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**CONTROL OF ANTIBIOTIC
PRESCRIBING IN UK NHS HOSPITALS**

VOL 1

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Doctor of Philosophy

ASTON UNIVERSITY

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ASTON UNIVERSITY
CONTROL OF ANTIBIOTIC PRESCRIBING IN UK NHS HOSPITALS

Eleanor Marcella Woodford

Submitted for the degree of Doctor of Philosophy, 2005

This thesis is an evaluation of practices to control antibiotic prescribing in UK NHS hospitals. Within the past ten years there has been increasing international concern about escalating antibiotic resistance, and the UK has issued several policy documents for prudent antibiotic prescribing.

Chief Pharmacists in 253 UK NHS hospitals were surveyed about the availability and nature of documents to control antibiotic prescribing (formularies, policies and guidelines), and the role of pharmacists and medical microbiologists in monitoring prescribers' compliance with the recommendations of such documents. Although 235 hospitals had at least one document, only 60% had both an antibiotic formulary and guidelines, and only about one-half planned an annual revision of document(s). Pharmacists were reported as mostly checking antibiotic prescribing on every ward whilst medical microbiologists mostly visited selected units only. Response to a similar questionnaire was obtained from the Chief Medical Microbiologists in 131 UK NHS hospitals. Comparisons of the questionnaires indicated areas of apparent disagreement about the roles of pharmacists and medical microbiologists. Eighty-three paired-responses received from pharmacists and medical microbiologists in the same hospital revealed poor agreement and awareness about controls.

A total of 205 institutional prescribing guidelines were analysed for recommendations for the empirical antibiotic prescribing of Community-Acquired Pneumonia (CAP). Variation was observed in recommendations and agreement with national guidance from the British Thoracic Society (BTS). A questionnaire was subsequently sent to 235 Chief Pharmacists to investigate their awareness of this new guidance from the BTS, and subsequent revision of institutional guidelines. Documents had been revised in only about one-half of hospitals where pharmacists were aware of the new guidance.

An audit of empirical antibiotic prescribing practices for CAP was performed at one hospital. Although problems were experienced with retrieval of medical records, diagnostic criteria were poorly recorded, and only 57% of prescribing for non-severe CAP was compliant with institutional guidelines. A survey of clinicians at the same hospital identified that almost one-half used the institutional guidelines and most found them useful. However, areas for improvement concerning awareness of the guidelines and ease of access were identified.

It is important that hospitals are equipped to react to changes in the hospital environment including frequent movement of junior doctors between institutions, the employment of specialist "infectious diseases pharmacists" and the increasing benefits offered by information technology. Recommendations for policy have been suggested.

Key words:

Antibiotics, pharmacists, medical microbiologists, guidelines, audit

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Copy of the LREC application form

Copy of the Research and Development application form

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**COPIES OF PUBLICATIONS AND CONFERENCE
DOCUMENTATION**

Antibiotic prescribing for lower respiratory tract infections within secondary care. International Journal of Pharmacy Practice 2001; 9 (supp): R39.

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Antibiotic prescribing control by pharmacists within UK NHS hospitals. International Journal of Pharmacy Practice 2004; 12 (2): 101-106.

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Copy of Certificate of Attendance at the Third Forum on Respiratory Tract Infections, 5th-7th February 2004, Monte-Carlo.

Copy of Certificate of Attendance at the 27th ESCMID Post-Graduate Education Course: Measuring, Auditing and Improving Antimicrobial Prescribing, 29th April-1st May 2004, Czech Republic.

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Chapter 1 Introduction to the research

This research is primarily an examination of the control of antibiotic prescribing in UK NHS hospitals.

There is increasing concern about the escalating antibiotic resistance of pathogenic micro-organisms, which has important implications for international antibiotic prescribing and the world-wide community. One important method of minimising such resistance is by prudent prescribing of antibiotics. Prescribing control documents for these drugs have been produced in UK secondary care but there is little up-to-date information about their existence and use. This thesis reviews the background to this subject, examines factors involved in antibiotic prescribing control, and suggests important aspects for present and future consideration.

At the start of this research a pilot study was performed on antibiotic prescribing control documents obtained from twelve hospitals in the West Midlands and six University hospitals. This was an initial exploration to identify if differences were apparent in the content of institutional antibiotic prescribing guidelines recommendations for lower-respiratory tract infections. Analysis of these guidelines identified that the examined recommendations were not included in all documents. These results are summarised in Table 1.1.

Table 1.1: Analysis of prescribing recommendations from West Midland hospitals (WM) and University hospitals (U).

Feature	WM (%)	U (%)
Guidance given on treating acute exacerbations of chronic bronchitis	67	100
Severity of community-acquired pneumonia graded	67	100
Community and hospital-acquired pneumonia treated separately	75	100
Guidance given on treatment of hospital-acquired pneumonia	92	50
Guidance included on drug dosage	75	67
Guidance on action for penicillin allergy (using example of bronchitis)	58	83

Subsequently, questionnaires were mailed to all UK NHS hospitals to investigate the prevalence, nature and application of control documents (formularies, policies and guidelines). The benefits of such documents will only be achieved when their recommendations are implemented into clinical practice. A Sub-Group of the Standing Medical Advisory Committee¹ identified pharmacists as having an important role in monitoring and encouraging prescribing compliance with these documents. There is a need to evaluate the contribution that pharmacists can make to this process.

Both pharmacists and medical microbiologists, either singularly or together, can be involved in antibiotic prescribing control, but they may not necessarily understand each other's role in this matter. Therefore the factors involved in prescribing monitoring by these two professional groups were examined in detail, including the methods used to communicate interventions to prescribers. The auditing of antibiotic prescribing is also necessary to verify compliance with established prescribing guidance, and the nature of this has been examined.

Based on institutional guidelines collected it was possible to analyse the recommendations in antibiotic prescribing control documents for the empirical

antibiotic treatment of an important model infection, Community Acquired Pneumonia (CAP). This is a common infection; there were 130,149 episodes of pneumonia in English NHS hospitals in 2002-2003, which translated into 1, 110, 658 bed days². CAP causes high morbidity and mortality, and the compliance of institutional guidelines with the recommendations of the national British Thoracic Society (BTS) guidance for the empirical antibiotic treatment of CAP is an important part of this thesis. That study suggested that problems exist with such agreement, and the failure of some hospitals to update their documents was examined.

An in-depth case study was carried out in one large Birmingham hospital to identify the factors involved at ward level in the diagnosis and treatment of CAP, specifically involving prescribing compliance with institutional guidelines for this infection. Such prescribing compliance averaged less than 50% for severe, non-severe and ill-defined disease; therefore the usefulness of these prescribing documents to clinicians was examined.

Thus, the overall aims of this study were to investigate the availability of institutional antibiotic prescribing control documents, their value to clinicians, the role of other health professionals (pharmacists and medical microbiologists) in monitoring prescribing control, and the analysis of a case-study in a large hospital using a model illness, CAP.

Chapter 2 Literature Search

2.1 Antibiotic Prescribing

Since the introduction of the sulphonamides in the 1930s³ and penicillin in 1940⁴, the development of antibiotics has been one of the great medical triumphs of the 20th century, dramatically reducing morbidity and mortality from infectious diseases⁵. Consequently many antibacterials have been developed in the last sixty years and parameters for their optimal use have been defined, dependent upon knowledge of both host and micro-organism factors⁶. The majority of antibiotic prescribing occurs in community practice, with only approximately 10 to 20% of antibiotics being prescribed for hospitalised patients⁷⁻¹¹. Several prevalence studies of antibiotic prescribing have been performed both in UK hospitals and overseas¹²⁻¹⁶, and antibiotics typically account for about 20% of the pharmacy drug budget in UK hospitals^{8, 17, 18}.

2.2 Antibiotic Resistance

Although a US surgeon infamously testified to the US congress in 1969 that the “book could be closed on infectious diseases”¹⁹, resistance to antibiotics has been observed since the production of penicillin⁴ and most bacteria are now resistant to at least one antibiotic²⁰. Resistance is an unavoidable consequence of antibiotic use due to Darwinian selection²¹ and natural diversity in the susceptibility of bacterial phenotypes²². However, the emergence of multiple-resistant pathogens is especially worrying^{5, 23-25} and antibiotic resistance already causes problems in most hospitals²⁶. Escalating antibiotic resistance has been of particular concern to the global medical community in recent years^{10, 27} as prior warnings about antibiotic

resistance have often been ignored²⁸, and there is concern about a possible return to a pre-antibiotic era characterised by untreatable infections^{4, 29}. Antibiotic resistance has implications for both individual patients and international healthcare¹³.

The European Union (EU) and the World Health Organisation (WHO)⁵ have advocated surveillance of trends in antibiotic resistance, important to inform antibiotic policy recommendations³⁰. International programmes for the surveillance of respiratory tract pathogens include the Alexander Project³¹ and PROTEKT³², whilst the British Society for Antimicrobial Chemotherapy (BSAC's) Respiratory Resistance Surveillance Programme examines the susceptibility of pneumonal pathogens in the UK and Eire³³. One of the key recommendations of the "Getting ahead of the curve" strategy³⁴ was increased surveillance of resistance, aided by the creation of the Health Protection Agency in 2003³⁵.

2.3 Resistance of Pneumonal Pathogens

The main pathogens that cause Community-Acquired Pneumonia (CAP) are *Streptococcus pneumoniae* (*S.pneumoniae*), *Moraxella catarrhalis* (*M.catarrhalis*) and *Haemophilus influenzae* (*H.influenzae*). This section describes the mode of action of, and resistance to, the main antibiotics used in the empirical therapy of CAP, a topic that has been thoroughly reviewed by Felmingham⁵.

2.3.1 B-lactams (e.g. penicillin, amoxicillin, ceftriaxone, cefotaxime)

Until clinical B-lactam resistance became increasingly apparent in the 1970s³⁶, penicillin was considered a "magic bullet" for the treatment of *S.pneumoniae*³⁷. The molecular targets of the B-lactam antibiotics are penicillin-binding proteins³⁸, which are required for peptidoglycan manufacture of the bacterial cell wall.

Penicillin-resistant *S.pneumoniae*, identified in the late 1960s, results from decreased affinity and/or binding capacity of the penicillins due to alterations in penicillin-binding proteins³⁹. It is subject to regional and international variability^{40, 41}, but is generally lower in Northern Europe⁵. The production of beta-lactamases, enzymes which hydrolyse the beta-lactam bond of a beta-lactam antibiotic in an inactivation mechanism⁵, are the most frequent resistance mechanisms of *H.influenzae* and *M.catarrhalis*²¹.

2.3.2 Fluroquinolones (e.g. ciprofloxacin, ofloxacin, levofloxacin)

Although the first quinolone antibiotic, nalidix acid, was introduced in 1967⁴², wide-spread development of the fluroquinolone antibiotics did not occur until the 1980s⁴³. Fluroquinolones inhibit enzymes (DNA gyrase and Topoisomerase IV) involved in maintaining coiled DNA⁴² and their main clinical use is the treatment of pneumonia⁴⁴, with ciprofloxacin being active against *M.catarrhalis* and *H.influenzae* and the newer agents (such as levofloxacin) having greater in-vitro activity against *S.pneumoniae*^{42, 45}. Microbial resistance occurs due to mutations in genes encoding for enzymes^{41, 46} and efflux mechanisms⁴¹.

2.3.3. Macrolides (e.g. erythromycin)

Macrolide antibiotics inhibit protein synthesis by binding to bacterial ribosomes²¹ and are of value in patients with B-lactam allergy⁴⁷. However, erythromycin-resistant *S.pneumoniae* has been apparent since the 1960s⁴¹ and macrolide resistance occurs through alteration of the ribosomal target site and/or efflux mechanisms^{40, 41}.

2.3.4 Vancomycin

There is grave concern about multiple resistant pneumococcus and genetic mosaicism of penicillin-binding proteins suggests that resistance is transferable through resistant clones^{5 24}. Until the late-1980s enterococci were sensitive to vancomycin. However, emerging resistance due to transferable plasmids (Van A and Van B) means that some bacteria are resistant to all antibiotics¹. Therefore there is compelling evidence that vancomycin remains the “last-resort” antibacterial and should be used cautiously in the absence of new antibiotic development to help preserve its efficacy^{1 24}.

2.4 Possible Future Strategies Against Antibiotic Resistance

Rapidly evolving antibiotic resistance to respiratory pathogens⁴⁸ has encouraged the development of antibiotics with new or extended modes of action against key bacterial pathogens, especially penicillin-susceptible pneumococci^{19,47}.

- Ketolides are macrolides derived from erythromycin A which target bacterial ribosomes⁴⁷. Telithromycin (launched in 2001) purportedly has high activity against respiratory pathogens⁴⁷, whilst cethromycin shows promising potential at the in-vitro stage⁴⁹.
- Ertrapanem, (registered in the EU in 2002) a new carbapenem, binds to penicillin-binding proteins and has a broad spectrum of antimicrobial activity. It is particularly suitable for serious community-acquired infections⁵⁰.
- Gemifloxacin⁵¹, moxifloxacin⁵¹ and grepafloxacin⁵² are newer “respiratory” fluoroquinolones⁵¹ with enhanced pneumococcal activity⁴⁰.

- The oxazolidinone antibiotic, linezolid, inhibits protein synthesis by ribosomal binding, and has high potency against penicillin resistant *S.pneumoniae*⁴⁸.
- There is interest in the development of glutamine analogues which inhibit an enzyme involved in cell wall synthesis⁵³, and genomic sequencing of pathogens enables the identification of essential genes for antibacterial targets¹⁹.
- A pneumococcal conjugate vaccine was licensed in the US in 2000³⁷ and a pneumococcal immunisation programme for the over-80s was introduced in the UK in 2003⁵⁴.

2.5 Need for Antibiotic Prescribing Control

Despite these advances, there is concern about a lack of antibiotics being developed by the pharmaceutical industry⁵⁵ (A White, ESCMID conference, 2004) and of a return to a pre-antibiotic era⁵⁶. Only six antibacterials are currently being researched by the pharmaceutical industry, and none has a novel mechanism of action⁵⁷. The introduction of new antibiotics is always accompanied by the threat of eventual bacterial resistance^{48, 50}, and Fleming devised a set of rules for preserving the use of penicillin in 1946 (I Gould, ESCMID conference, 2004). Therefore, there is a need for prudent prescribing of those agents already available. Concern has been expressed for several decades about the extensive hospital use of antibiotics⁵⁸⁻⁶⁰, and it has been estimated that 50-60% of hospital antimicrobial use is irrational^{61, 62}. The changing spectrum of pathogens and antibiotic resistance can make appropriate antibiotic prescribing difficult⁶³ and initial antibiotic prescribing is often delegated to inexperienced junior staff who require effective guidance^{64, 65}.

A culture of “fear medicine” can exist in some hospitals, whereby physicians inappropriately over-treat less severely ill patients⁶⁶, and physicians’ choice of antibiotics can also be affected by marketing from the pharmaceutical industry and drug prices⁶⁷. Addressing the problem of antibiotic misuse is an urgent healthcare priority⁶⁸, and the resultant consequences of escalating healthcare costs, clinical failure, drug toxicity, antibiotic resistance and supra-infection have been well documented^{26, 29, 68-71}. It has been difficult to establish a quantitative relationship between antibiotic use and resistance due to a paucity of longitudinal studies (R Polk, ESCMID conference 2004). However, a much-cited Finnish study showed that a reduced consumption of macrolide antibiotics in outpatient care resulted in a decreased incidence of erythromycin-resistant streptococci⁷², and a Slovenian study identified corresponding macrolide resistance with increased use of these antibiotics⁷³.

2.6 Antibiotic Prescribing Control Organisations

National strategies against antibiotic resistance exist for France⁷⁴, Spain⁷⁵, Sweden⁷⁶, Finland⁷⁷, Denmark⁷⁷, Belgium⁷⁷, the US⁷⁸ and the UK¹. A multi-faceted, global, approach to the crisis of antibiotic resistance has been advocated⁷⁹,⁸⁰ and several international meetings have been held. The EU Conference, “The Microbial Threat” (1998), included representatives of the EU member states and considered elements of antibiotic resistance and control⁷⁰. A follow-up meeting was subsequently held in 2001⁷⁷, and in the same year the World Health Organisation (WHO) launched its global strategy against antibiotic resistance⁸¹.

Organisations involved in encouraging prudent antibiotic prescribing include;

- The Alliance for the Prudent Use of Antibiotics (APUA) is an international organisation established in 1981⁸², which “conducts educational, research and international networking activities to promote more appropriate use of antibiotics around the world”⁸³. Programmes include developing a national antibiotic policy for Nepal and hosting international training events on antimicrobial agents (A Sosa, ESCMID conference, 2004).
- The European Society of Clinical Microbiology and Infectious Diseases (ESCMID) has formed a specialist group to investigate the optimum control measures for antibiotics; the European Study Group on Antibiotic Policies (ESGAP)^{84, 85}.
- The Specialist Advisory Committee on Antibiotic Resistance (SACAR) was established in 2001 and is an independent advisory group which advises the UK Government on issues associated with antibiotics and resistance^{86, 87}. A prescribing sub-group concentrates on aspects of prudent prescribing and its remit includes establishing a national database for the use of antimicrobials in hospitals⁸⁸.

2.7 Mechanisms of Antibiotic Prescribing Control

No simple method for controlling antibiotic prescribing exists⁸⁹, and few studies have effectively evaluated different control activities^{57, 90}. However, various mechanisms can be employed either singularly or in a collaborative approach to attempt to control prescribing.

2.7.1 Education

Educational interventions may take the form of newsletters, various written materials^{18 69, 91}, sticker-campaigns¹⁸, lectures⁶⁷, journal publications⁶⁷, and may include educational meetings and grand-rounds⁹².

2.7.2 Therapeutic Interchange/Substitution

Under organisational protocols, and with physician notification, pharmacists can be given authority to change an antibiotic to another specified agent⁹³⁻⁹⁶.

2.7.3 Automatic Stop Orders

Pharmacists can discontinue antibiotic regimens after a pre-determined length, to prevent open-ended prescriptions⁹⁷.

2.7.4 Antibiotic Order Sheets

These documents require prescribers to specify the indication for a prescribed antibiotic, thereby allowing pharmacists to screen for appropriateness prior to dispensing⁹⁸⁻¹⁰¹.

2.7.5 Documentation

Guidelines, formularies and policies provide comprehensive information at the point of prescribing¹⁰². These documents will be described below.

2.8 Antibiotic Prescribing Control Documents

2.8.1 Formularies

The American Society of Hospital Pharmacists defined a formulary as “a list of drugs (and associated information) that are considered by the professional staff in that setting to be the most useful in patient care”¹⁰³. This list should contain the optimal agents with regard to safety, quality and cost-effectiveness¹⁰⁴ according to an organisation’s specific patients, procedures and resistance patterns¹⁰⁵ and should

rationalise therapy by avoiding unnecessary duplication of therapeutic agents¹⁰⁶. Formulary documents outline the agents that can be routinely prescribed within the healthcare organisation and often contain different “classes” of use²³ with “non-formulary” drugs being reserved for certain situations¹⁰³. A further classification of “controlled status”, whereby a drug requires approval by a specific healthcare professional (e.g. an infectious diseases physician) may also be included¹⁰⁷. Hospitals’ formularies may vary greatly with regard to the restriction of agents and control of “non-formulary” drug use⁹². Elements of effective formularies and misconceptions have been reviewed¹⁰⁸, and their associated benefits include cost-containment and educational benefit⁹². A similar term is “limited drug list”¹⁰⁹.

2.8.2 Policies

The definition of a “policy” is obtuse, but a policy may be regarded as a general term for strategies aimed at controlling antibiotic prescribing. Possession of formulary and guidelines documents can constitute a policy^{110, 111} whilst other antibiotic policies include a formal infectious diseases consultation for restricted drugs¹⁰⁵ and limited reporting on antibiotic susceptibilities²³. Although antibiotic policies are believed to have a beneficial impact upon clinical practice, more research into their effectiveness is needed and a European study group (ESGAP) has been established for this endeavour⁸⁹.

2.8.3 Guidelines

The widely-accepted definition of guidelines is “systematically developed statements to assist practitioner and patient decisions about appropriate healthcare for a specific clinical condition”¹¹², and they represent attempts to summarise research into evidence-based recommendations¹¹³⁻¹¹⁵. The large volume of published medical papers is often incomprehensible and time-consuming for

clinicians to read^{116, 117} and guidelines streamline data in an attempt to improve the conformity, quality and cost-effectiveness of therapy¹¹⁸. A systematic review identified that the majority of guidelines result in significant improvements in the quality of care¹¹⁹, and such documents are used in many countries¹²⁰. Guidelines provide recommendations for the treatment and prophylaxis of specific clinical conditions whilst generally allowing the clinician some degree of flexibility for certain patients¹¹¹. Important considerations in the development, implementation and evaluation of guidelines have been extensively reviewed^{112, 121-123}. The Appraisal of Guidelines Research and Evaluation (AGREE) Collaboration is an international group of researchers, which investigates the development, reporting and assessment of guidelines¹²⁴. However, guidelines are not a treatment panacea and associated limitations can include a lack of emphasis upon quality of patient care^{120, 122}, a simplistic approach to medicine and a mandatory nature¹²⁵. Terminology for similar documents includes protocols and algorithms¹²¹.

2.9 International Recommendations for Antibiotic Prescribing Control

Documents

International symposia have emphasised the importance of documents for the control of antibiotic prescribing. One of the main Copenhagen recommendations following the meeting, "The Microbial Threat"⁷⁰, was that prescribing guidelines for appropriate antimicrobial usage should be utilised to ensure the rational use of antibiotics. A subsequent update meeting held in 2001 considered that progress had not been sufficiently rapid and emphasised the necessity of implementing the Copenhagen recommendations, including the implementation of guidelines for antimicrobial use⁷⁷. Emphasis upon developing and regularly updating prescribing

guidelines for appropriate antimicrobial therapy was also given high importance in the World Health Organisation's 2001 global strategy against antibiotic resistance⁸¹. One of the "action steps" highlighted by the US "Campaign to prevent antimicrobial resistance in healthcare settings" was the implementation of clinical guidelines⁷⁸.

2.10 UK Recommendations for Antibiotic Prescribing Control Documents

The provision of control documents in UK hospitals for the improvement of antibiotic prescribing has been advocated since 1950¹²⁶, and an editorial in the British Journal of Medicine published in 1975 recommended that every hospital should have an antibiotic policy¹²⁶.

Subsequently, several high-profile UK documents have been published with the aim of controlling antibiotic prescribing in the light of increasing resistance problems. The House of Lords Science and Technology Select Committee Report "Resistance to Antibiotics and other Antimicrobial agents", published in 1998 emphasised that antibiotic resistance should be recognised as a "major threat to public health"³. Its recommendations included the need for reviewing antibiotic prescribing by junior doctors, and the use of evidence-based prescribing recommendations³. A subsequent government response outlined areas of action for the NHS, including surveillance, prudent antibiotic prescribing (including the use of guidelines and audit) and the use of antibiotics in animals¹²⁷.

A specialist Sub-group on Antimicrobial Resistance of the Standing Medical Advisory Committee (SMAC) highlighted the importance of continual surveillance

and research regarding antibiotic prescribing and outlined recommendations for antibiotic prescribing control in its report, “The Path of Least Resistance” (1998)¹. That report identified that antibiotic prescribing control documents are often the first information source consulted by inexperienced prescribers and that they have an important role in therapy rationalisation¹. Following this publication, the Health Service Circular, “Resistance to Antibiotics and other Antimicrobial agents”(1999)¹²⁸, issued directives to be undertaken within the NHS with the aim of optimising antimicrobial prescribing, including the development and implementation of policies and guidelines on the rational use of antimicrobial drugs. The promotion of optimal antimicrobial prescribing by the provision of tailored information, guidelines and prescribing support was also recommended by the “UK Antimicrobial Resistance Strategy and Action Plan” (2000)¹²⁹. The House of Lords Select Committee reviewed the continuing problem of antibiotic resistance in 2001 and wondered whether slow progress meant that their original report had not conveyed the seriousness of the situation¹³⁰. The Audit Commission’s report (“A Spoonful of Sugar”) considered a formulary to be a stagnant document, which only becomes useful when its list of medicines is tied to a diagnosis¹³¹.

2.11 Antibiotic Prescribing Control Documents in the UK

Concern regarding a lack of knowledge about antibiotic prescribing and its control in UK hospitals led to the formation of An Antibiotic Usage Working Party of the BSAC⁹¹. That Party surveyed UK consultant medical microbiologists and senior pharmacists in 1990 in an attempt to identify the national prevalence of operational antibiotic prescribing controls (including prescribing documents) in secondary care⁹¹. A content analysis was performed on 41 antibiotic policies received from

hospital trusts and health authorities from the South-East region of the NHS Executive in 1999¹⁷ and antibiotic policies received in 1999 and 2000 from NHS hospital trusts and health authorities have been reviewed¹³².

2.12 International Prevalence of Antibiotic Prescribing Control Documents

The national prevalence of antibiotic prescribing control documents in hospitals has been the subject of previous studies in various countries. A study published in 1986 surveyed pharmacy directors at 112 Australian general hospitals with 150 or more beds to identify the use of quality improvement procedures for antibiotic prescribing¹³³. One hundred and nine Dutch hospitals were approached for their antibiotic formulary and data on antibiotic susceptibility patterns by researchers in 1991¹³⁴. Information on antibiotic control policies and antimicrobial-use programmes were the subject of three separate surveys of US hospitals performed in 1982¹³⁵, 1993⁹⁹ and 1998¹³⁶. An evaluation of the implementation of French guidelines on antimicrobial usage in 300 French hospitals was performed in 1999. More recently a survey of 535 Italian hospitals was conducted in 2000 to identify the existence of policies to reduce antibiotic resistance¹³⁷.

2.13 Compliance of Prescribers with Antibiotic Prescribing Control

Documents

It is essential that prescribers comply with the recommendations of antibiotic prescribing control documents so that rational antibiotic prescribing can be achieved¹³⁸. However, previous studies have identified inappropriate antibiotic prescribing even where these recommendations exist^{139, 140}. Active implementation and promotion of such documents by other healthcare professionals is essential⁶³.

^{141, 142} and the Deming-Shewhart cycle of “plan-do-check-act” emphasises that it is necessary to check compliance with a guideline following its implementation¹⁴³. The BSAC’s 1990 survey examined the degree of, and methods employed in, monitoring compliance with antibiotic prescribing control documents⁹¹.

2.14 Clinical Pharmacy

The Royal Pharmaceutical Society of Great Britain (RPSGB) considers pharmacists important members of the general hospital team who have a key clinical role in encouraging effective and economical drug therapy¹⁴⁴. Clinical/ward pharmacy is an important role for pharmacists in different countries^{145 146 147 148}, and this service has been provided within UK NHS hospitals since the late 1960s¹⁴⁹. Since the late 1980s, the UK Department of Health (DOH)¹⁵⁰ has recognised the potential for hospital pharmacists to improve the safety, quality and cost-effectiveness of drug therapy by performing prescribing reviews and providing advice to prescribers on quality improvement issues. “Clinical pharmacy” refers to the patient-centred involvement of pharmacists in drug-related decision making and drug-therapy monitoring¹⁵¹ whilst “pharmaceutical care” refers to pharmacists collaborating with professional colleagues to ensure optimum patient care with defined outcomes¹⁵². This mechanism of practising pharmacy in the immediate clinical environment¹⁵³ can also be called “ward pharmacy”. A comprehensive survey of clinical pharmacy services operating in UK NHS hospitals was performed by Cotter et al in 1992¹⁵⁴.

The clinical governance agenda has emphasised the importance of optimal prescribing through evidence-based medicine and risk reduction¹⁵⁵. Pharmacists have an important role in audit, risk management and evidence-based practice,

important components of clinical governance¹⁵⁶. “The NHS Plan” (2000)¹⁵⁷ aimed to improve the quality of NHS care by re-forming services around the patient. Since then both the DOH strategy for pharmacy, “Pharmacy in the Future” (2000)¹⁵⁸, and an Audit Commission report on medicines management (2001)¹³¹ have acknowledged the need for enhanced pharmacist involvement in the clinical care of patients. The Audit Commission considered that optimising the use of medicines is essential in improving hospital care and acknowledged the clinical expertise of pharmacists and their important contribution in decreasing clinical and financial risk¹³¹. The Audit Commission’s report of 2001¹³¹ identified that 50% of UK NHS hospitals surveyed were unable to provide all their intended pharmacy services owing to staff shortage. However, implementation of clinical pharmacy activities uses the expertise of clinical pharmacists most effectively and increased job satisfaction should encourage their retention within an organisation¹⁵⁹. One way of ensuring a greater emphasis on patient-centred care¹⁵⁰ is through re-engineering overall pharmacy services, e.g. by using automatic dispensing systems^{160 161}, and expanding the roles of technical staff^{162, 163} and residency services^{164 165}.

2.15 The Role of Professionals in Antibiotic Prescribing Control

Although the monitoring of antibiotic therapy by ward/clinical pharmacists was considered as one of their routine roles in American hospitals as early as 1978¹⁶⁶, the development of this role has been slower in the UK. There is an important role for pharmacists in the evaluation of antibiotic prescribing and in identifying adherence with antibiotic prescribing control documents¹⁴², although this requires further evaluation¹⁶⁷. This activity will henceforth be referred to as “antibiotic prescribing control”.

The SMAC report⁸ identified hospital pharmacists as performing an important role in promoting improved antibiotic prescribing by advising prescribers on antibiotic prescribing issues, enforcing prescribing policies and auditing adherence to prescribing guidelines. A Department of Health directive (PL/CMO/2003/3, PL/PhO/2003/3) sent to hospital Chief Pharmacists and Finance Directors in 2003 announced new funding for clinical pharmacy activity in promoting prudent antibiotic prescribing and Chief Pharmacists were asked to develop plans for these activities in individual hospitals¹⁶⁸. Pharmacists can also perform other activities for the improvement of antibiotic prescribing, including implementing sequential therapy (the change of parenteral to oral dosage forms)¹⁶⁹, performing a culture-antibiotic monitoring service¹⁷⁰, providing advice about drug-level monitoring⁶⁹ and producing data about antimicrobial usage data¹⁷¹.

In its 2002 report on infection services, the NHS described medical microbiologists as key members of the multidisciplinary infection team who have an important role in interpreting and applying the science of microbiology³⁴. Clinical roles include liaison with clinicians in the diagnosis and management of patients and providing advice on antibiotic policies, and the last 30 years have seen continued emphasis upon this consultative and educational role¹⁷². Their work on the ward enables more stringent monitoring of adherence with antibiotic prescribing policies¹⁷³, and medical microbiologists can also improve antibiotic prescribing by restricting the reporting of bacterial sensitivities to policy antibiotics¹⁷⁴.

UK government policy has advocated multidisciplinary working relationships and improved communication between healthcare professionals to improve the quality of care offered by UK NHS hospitals¹³¹. The recent Department of Health (DoH) paper “Agenda for Change” has developed this further and highlighted the importance of re-engineering professional roles to enable increased flexibility and collaboration between professional NHS staff¹⁷⁵. An important role for both pharmacists and medical microbiologists is the performance of antibiotic prescribing improvement activities¹ and there have been international recommendations for the establishment of multidisciplinary “antibiotics teams” in every hospital¹⁷⁶. These teams should evaluate compliance of antibiotic prescribing with established guidelines and alter inappropriate prescriptions⁷⁰, and should be comprised of clinical pharmacists, medical microbiologists and infectious diseases specialists¹⁷⁷. Collaboration between pharmacists and medical microbiologists in antibiotic prescribing control activities has been strongly advocated as an effective means of limiting the inappropriate use of antibiotics¹⁷⁸⁻¹⁸⁰, enforcing infection control policies and in decreasing antibiotic costs^{147, 181, 182}.

2.16 Auditing Antibiotic Prescribing

Audit can be defined as “the systematic examination and improvement of clinical activity”¹⁸³, and such a quality improvement approach is important in evaluating the success of prescribing policies in relationship to prescribing practices^{111, 184, 185}. Audits include drug-use evaluations and disease-condition evaluations¹⁸⁵ and are mostly performed retrospectively due to the feasibility of data collection⁹². Such drug-use evaluation programmes have evolved from addressing basic questions about drug use to analysing overall health care management and outcomes data¹⁸⁶

and should include well-defined and measurable criteria¹⁸⁷. Detailed feedback on drug prescribing patterns must be provided to prescribers and pharmacists are ideally suited for this role⁹². Audit is also an important component of “clinical governance”¹⁸⁸, a framework through which NHS organisations are accountable for the quality of clinical performance¹⁸⁹.

2.17 National Antibiotic Prescribing Control Documents

Several countries have national guidelines developed by professional organisations or specialist societies¹⁹⁰. National bodies for the development of antibiotic guidelines exist in Belgium (the infectious diseases advisory board)¹⁹¹, Sweden (Swedish strategic programme for the rational use of antimicrobial agents and surveillance of resistance)⁷⁶, the Netherlands (Dutch Working Party on Antibiotic Policy)¹⁹² and Central and Eastern Europe (Belarus, Czech Republic, Croatia, Hungary, Slovakia and Russia)¹⁹³.

The formation of the National Institute of Clinical Excellence (NICE) in the UK has led to an increasing tendency for the formulation and dissemination of national guidance throughout the NHS¹⁹⁴. Professional organisations play an essential role in maintaining clinical standards by issuing and retaining responsibility for guidelines, and the importance of this role has been emphasised by the National Health Services Executive¹⁹⁵. A series of 26 national guidelines has been developed by the Scottish Intercollegiate Guidelines Network (SIGN) since 1993, which have purportedly been widely disseminated within the Scottish NHS¹⁹⁶.

2.18 Community-Acquired Pneumonia

Community-Acquired Pneumonia (CAP) is a frequent and complex lower respiratory tract infection¹⁹⁷ characterised by inflammation of lung tissue by an infectious agent¹⁹⁸. It may be defined as “an acute illness acquired in the community with symptoms suggestive of a lower respiratory tract infection., together with the presence of intrapulmonary shadowing on a chest radiograph which is likely to be new with no alternative cause”¹⁹⁹. Symptoms typically include fever, cough, sputum production, pleuritic chest pain²⁰⁰ and dyspnoea²⁰¹. Although pneumonia is an important cause of morbidity, mortality and hospitalisation²⁰², it is not a reportable disease and documented statistics of its incidence may be incomplete²⁰³. However, pneumonia is purportedly the fourth-leading cause of death in Western countries²⁰³ and although only approximately one-third of UK patients are hospitalised with this condition, their treatment constitutes the majority of care costs²⁰¹. CAP is the infectious disease with the greatest mortality rate²⁰⁴ with 5-10% in hospitalised care increasing to 50% in severely ill patients admitted to the Intensive Care Unit¹⁹⁷. Factors indicating an increased risk of mortality include co-morbid conditions such as diabetes, advancing age, significant clinical findings of respiratory rate and blood pressure tests and laboratory results including white cell count and oxygen saturation rates²⁰¹. Severe CAP is considered a separate clinical syndrome which necessitates a different antibacterial approach²⁰⁵.

2.19 National Antibiotic Guidelines for the Empirical Treatment of CAP

Initial empirical antibiotic prescribing is the most common approach for the treatment of CAP^{206, 207} and often relies upon the use of broad-spectrum agents until the results of culture and sensitivity tests become available²⁰⁸. Pathogen-directed

therapy tends to occur less often^{202, 209} due to the frequent problem of poor identification of causative pathogens from routine laboratory tests²¹⁰. Differing CAP epidemiology, healthcare systems and antibiotic resistance rates have resulted in different countries developing their own recommendations for CAP therapy²¹¹²¹², and national CAP antibiotic prescribing guidelines exist in Europe²¹³⁻²¹⁵²¹⁶, Central/Eastern Europe²¹⁷, North America^{218, 219}, South Africa²²⁰, Japan²²¹, Slovenia¹⁹³, Poland¹⁹³ and the Middle East²²². A review of eight international guidelines identified differences in recommendations for chest radiography, sputum sampling and serological testing²²³.

2.20 The 1993 British Thoracic Society Guidance for the Empirical

Treatment of CAP

A Sub-Committee of the British Thoracic Society (BTS) first published guidance to improve the care of patients hospitalised with CAP in the UK in 1993²²⁴, with the impetus being the high mortality rate, especially for relatively young patients. That publication²²⁴ identified *S.pneumoniae* as the most common pneumonal pathogen, accounting for 60-75% of cases, and severity of infection was considered another important determinant for initial empirical treatment. Features associated with an increased risk of fatality were defined. Recommendations for investigation and assessment of intensive care admission were detailed and recommendations for empirical antibiotic therapy provided.

2.21 The 2001 British Thoracic Society Guidance for the Empirical

Treatment of CAP

There was subsequent criticism that the 1993 national guidance did not adequately differentiate between CAP and other lower respiratory tract infections, which had led to inappropriate increases in the use of intravenous broad-spectrum antibiotics with the resultant problems of increased cost and side-effects²⁰⁰. This criticism, combined with the increasing age of patients, restructuring of medical services, patient admission for non-medical reasons, increasing antibiotic resistance and diagnostic techniques, etc, necessitated a revision of the prescribing recommendations²⁰⁰. Revised BTS guidance for the empiric antibiotic therapy of uncomplicated and severe pneumonia of unknown aetiology was issued in 2001²⁰⁰. This guidance, at 64 pages, represents a more evidence-based approach to the formulation of antibiotic prescribing guidelines. *S.pneumoniae* was still considered the most common pneumonal pathogen in the UK and 85% of CAP cases were caused by a single pathogen. Recommendations for patient investigations and management were included, in conjunction with detailed criteria for the definition of “severe CAP”.

2.22 Institutional Antibiotic Guidelines

The SMAC report requested hospitals to base their institutional antibiotic prescribing guidelines upon official publications to ensure the use of the most current evidence-based prescribing¹. Adaptation of readily-available national guidelines prevents duplication of effort and spares local resources^{122, 133}, and the ultimate value of national guidelines is dependent upon their adoption at a local

level²²⁵. However, such national/speciality society guidelines have limitations and must be produced in an explicit, transparent way^{226 227 228 133}.

It is essential that institutional prescribing guidelines are regularly revised in response to advancing medical knowledge and changing clinical practice¹²², and the UK government has requested that hospital antibiotic prescribing guidelines are reviewed on at least an annual basis¹²⁸. Several studies have identified poor knowledge of prescribers about national guidelines^{225 229}. If institutional guidelines are not appropriately revised then a few prescribers, “early-adopters”²³⁰, may implement the recommendations of updated national guidance with the majority following the out-dated recommendations of the current institutional recommendations. “Turf-wars” can occur in deciding which category of healthcare professional is responsible for guideline development¹¹⁶ and therefore a multi-disciplinary approach is favourable.

2.23 Physician Adherence with Institutional CAP Guidelines

The use of institutional CAP antibiotic guidelines improves quality of patient care whilst decreasing treatment costs²³¹, and has been the subject of previous studies. Although the compliance rate was not reported, the introduction of an antibiotic prescribing algorithm for CAP and other lower-respiratory tract infections in a Northern Ireland hospital successfully resulted in decreased treatment failures, parenteral drug use and length and cost of hospitalisation²³². The introduction of a paediatric prescribing protocol for CAP in an English hospital resulted in increased prescription of rational antibiotics from 26% to 75% of cases²¹⁰.

As with any prescribing guideline, the success of institutional CAP guidelines is dependent upon the compliance of physicians with their recommendations. Various studies have been performed both in the UK and overseas to examine prescribers' adherence with institutional and national CAP guidelines. Overall prescriber compliance with a CAP antibiotic prescribing protocol in an Australian hospital was 60% but adherence with recommendations for penicillin-allergic patients was particularly poor²³³. Compliance with the American Thoracic Society (ATS) guidelines for patients with non-severe CAP admitted into 72 US non-teaching hospitals was 81%²³⁴ and average compliance with the ATS guidelines by physicians from 20 Canadian hospitals was 80% but was subject to inter-hospital variation²³⁵. A comprehensive audit of the management of 205 patients admitted to 2 Dundee hospitals has been described by Nathwani et al, and antibiotic regimens were compliant with the local protocol in 70% of cases²³⁶. Other parameters associated with CAP infection and management that have been investigated include mortality rates²³⁷, sequential regimens^{238, 239}, microbiological testing rates²⁴⁰⁻²⁴³ and readmission rates²⁰⁷.

2.24 Attitudes of Prescribers to Prescribing Control Documents

Prescribers' perception of antibiotic prescribing policies is likely to impact upon their use of such documents¹⁴², and possible attitudinal barriers to the use of guidance documents include a perception of limited clinical freedom and increased litigation^{113, 244}. Other factors may also negatively impact upon prescribers' use of such documents; lack of awareness, lack of familiarity, lack of agreement with specific guidelines, lack of self confidence with guidelines, an inability to change the inertia of previous prescribing practices, problems associated with guideline

presentation²⁴⁵ and poor availability²⁴⁶. Some physicians regard evidence-based guidelines with suspicion when they conflict with their own opinion or previous clinical practice²⁴⁷. It is vital that prescribers perceive guidelines as relevant and useful in everyday practice²¹² and obtaining prospective users' views is an integral part of the guideline development process²⁴⁶.

Two surveys have been performed in North America to identify physicians' views about clinical practice guidelines, and guidelines were seen as "good educational tools" by 67%²⁴⁸ and 51%²⁴⁹ of respondents, although 25%²⁴⁸ and 22%²⁴⁹ thought they oversimplified or led to "cook book medicine". The fear of the use of guidelines to discipline physicians was also apparent^{248 249}. Similar findings were identified by a systematic review of 30 studies concerning clinicians' views on clinical guidelines from different countries, with 71% of respondents considering them good educational tools although 34% thought they were oversimplified¹¹³. Evaluation of 268 UK hospital doctors' attitudes towards clinical guidelines in 1993/1994 identified that the major cause of guidelines not being used was poor awareness of them²⁴⁶. A study performed at a Swiss hospital investigated the effect of physicians' age and experience upon their attitude towards clinical guidelines¹²⁵, whilst an Italian study examined the effect of professional setting upon guidelines acceptance²⁵⁰. Accident and emergency medical staff in UK hospitals were surveyed to identify their views on a range of guidelines and to examine their experience of guidelines²⁴⁶. A survey of both physicians' and pharmacists' views on antibiotic policies has been performed in Australian hospitals, which identified that these staff had an overall positive attitude to these documents¹⁴². It was interesting that the Department physicians worked within affected their overall

attitude to this document and female physicians and those over 40 years were more likely to have a positive attitude about antibiotic policies¹⁴². Another interesting finding was that pharmacists in teaching hospitals were more likely to believe that antibiotic policies cause problems for practitioners than pharmacists in non-teaching hospitals¹⁴².

Chapter 3 Research Methodology

This chapter describes the methodologies employed in the research programme;

- Literature survey.
- Self-completion postal questionnaires.
- Analysis of institutional prescribing guidelines.
- Prescribing audit.

3.1 Literature Survey

A survey of the published literature identified the relevant research issues. Search terms were entered into the following electronic databases for the identification of primary research papers;

- Hosted by the US National Library of Medicine, PubMed²⁵¹ is the most prestigious database for published research in the biomedical sciences²⁵². It enables access to Medline bibliographic information covering over 12 million citations dating back to the mid-1960s and is used by most medical researchers²⁵³.
- A bibliographic database on pharmacy practice and the clinical use of drugs, Pharm-line²⁵⁴ includes citations from approximately 155,000 pharmaceutical and medical journals. It includes citations of pharmacy practice journals not cited in PubMed, e.g. "International Journal of Pharmacy Practice".

- A bibliographic searching tool, the Web of Science²⁵⁵ accesses citation databases. It was used to identify papers that had subsequently cited a specific paper.
- The Cochrane Library²⁵⁶ publishes systematic reviews of healthcare interventions²⁵⁷ prepared by the Cochrane Collaboration²⁵⁸.
- A website for the BMJ was launched in 1998²⁵⁹, and for the Journal of Antimicrobial Chemotherapy in 2000²⁶⁰, and databases provided a searching facility for articles published in their own and related journals.
- An electronic table of contents provided by the British Library Database, Zetoc²⁶¹ contains details of approximately 20,000 research journals and around 16,000 conference proceedings²⁶², 40% of which are health-related²⁶³. A current-awareness service (Zetoc Alert) forwards e-mail alerts to the researcher when new data matched predefined search criteria. The researcher was e-mailed the contents pages of four journals in the scope of antibiotic prescribing control and six journals in the field of CAP therapy.

Primary papers were sourced from the libraries of Aston University and the University of Birmingham and the researcher visited the British Library and obtained inter-library-loans. Official publications from the NHS and DoH were sourced from the internet. In an era of decreasing library journal subscriptions and proliferating journal titles²⁵², the increasing electronic availability of journals was particularly useful. "PubMed Central" has linked certain citations with free access to the full-text of articles²⁶⁴, and "ScienceDirect" was also helpful. Relevant literature was also identified from examination of references cited by the obtained papers.

This literature search identified that current, detailed research of the control of antibiotic prescribing in UK NHS hospitals was required to inform national policy.

3.2 Research Methodologies

Methodologies employed in this research programme included questionnaire surveys, a content analysis of prescribing guidelines and an audit of the appropriateness of prescribing. Health-services research frequently employs these methods, whilst other possible techniques include in-depth qualitative and observational studies²⁶⁵.

3.3 Self-Completion Postal Questionnaires

Surveys account for the largest proportion of pharmacy-practice research²⁶⁵, and include self-completion postal questionnaires and personal and telephone interviews²⁶⁶. Personal interviews confer the advantage of a high response rate and allow the researcher to probe respondents²⁶⁷, although are too expensive and time-consuming for large and widely distributed samples²⁶⁷. Telephone interviews are more appropriate for a geographically dispersed survey population²⁶⁶ but are not time or cost-effective. Self-completion postal questionnaires are widely employed in health-services research and are often the only viable questionnaire format owing to the necessity of obtaining information from a large cohort of respondents within a geographically dispersed population²⁶⁸. In the present research programme, self-completion questionnaires were employed to obtain data from respondents on issues relevant to the control of antibiotic prescribing in UK NHS hospitals. This method was chosen because of the large, geographically dispersed nature of the survey population.

Self-completion questionnaires also confer the following advantages;

- Standardisation of the wording of questions eliminates the possibility of interviewer bias²⁶⁹.
- Respondents are allowed to complete the questionnaire at their own convenience²⁶⁹.
- Administrative costs are generally lower than those incurred for interviews²⁶⁵.
- Respondents are able to locate information required for specific questions²⁷⁰.
- A greater degree of confidentiality is provided than in interviews²⁷¹.

However, as with any research instrument, self-completion postal questionnaires also have several disadvantages;

- Their impersonal nature means that poor response is common²⁶⁹, and a reduction of the effective sample size can introduce bias²⁶⁸. A response rate of approximately 50% suggests a successful survey instrument²⁶⁹.
- It is difficult to differentiate between genuine non-responders, and those recipients for whom the incorrect name or address has been used²⁷⁰, and the use of an accurate mailing list is essential²⁶⁶.
- Questions may remain uncompleted, without the possibility of explanation²⁷⁰.
- The design of the questionnaire is of vital importance in encouraging questionnaire recipients to participate²⁶⁶.

3.3.1 Design of Self-Completion Postal Questionnaires

The problem of poor response to self-completion postal questionnaires necessitates the provision of a well-designed questionnaire with a succinct purpose²⁶⁹. The questions should be easily understood²⁶⁷, brief, relevant, unambiguous and specific to the aims of the questionnaire²⁷². Two types of question may be included; open (which allow respondents to provide their own free-text response) and closed (which require the respondent to choose the appropriate response/s from a limited number of possible options). Open questions allow the respondent a greater freedom of response but demand more effort from them and may be difficult to analyse²⁶⁷. Although closed questions may elicit less detailed information, they are easier and quicker for respondents to answer and for the researcher to analyse²⁷². Important consideration must also be given to the content and format of an accompanying letter sent with the questionnaire with the aim of maximising the response rate²⁶⁷. It is also important that respondents are easily able to return their completed questionnaire, and for this purpose a pre-paid envelope is often included²⁶⁵. A poor response rate can introduce bias because it is not known if the answers from respondents accurately represent the total population²⁶⁵, and it is often necessary to follow-up non-responders with additional copies of the questionnaire²⁶⁵.

3.3.2 Piloting of Self-Completion Postal Questionnaires

It is essential that the questionnaire and accompanying letter are piloted with a small sample of similar participants prior to wide-scale distribution to the study recipients²⁷². This process evaluates the acceptability of the research instrument and

data collection techniques²⁶⁵, and facilitates modification of the questionnaire documents prior to the survey.

3.3.3 Self-Completion Postal Questionnaires Employed In This Research

The following sections describe the four self-completion postal questionnaires used in the research programme. Although the individual methodologies of these questionnaires are described in detail, certain common components are described below.

i). Design of Questionnaires

The questionnaires mostly contained closed questions that required the respondent to select the most appropriate response(s) from a list of options provided by ticking the relevant box. The respondent was only required to enter free-text if another, non-listed, reply was appropriate. This approach was taken because closed questions are perceived as being easier and less time-consuming for respondents to complete, and for researchers to analyse.

ii). Results Analysis

Data from the questionnaires were analysed following coding and entry into the “Statistical Package for the Social Sciences” Version 11. Valid response rates have been used throughout the results sections; these only account for questionnaires that have been answered for that particular question. Non-parametric statistical tests were applied to this nominal data. Where applicable, the continuity correction for Pearson’s chi-squared test (and Fisher’s exact test for low frequency cells) was employed to investigate whether there was a statistically significant association

between variables. A p value of ≤ 0.05 was regarded as having statistical significance. The validity of the results is dependent on the respondents providing valid responses, and it is possible that some respondents may provide falsely positive answers due to fear of retribution, even though confidentiality was assured.

3.3.4 “Antibiotic Prescribing Documents, Survey 2001”

i). Aims

This questionnaire was designed to identify issues in relation to antibiotic prescribing control in UK NHS hospitals. The aims were;

- To examine the prevalence and nature of antibiotic prescribing control documents in UK NHS hospitals; availability, format, and approval and revision processes.
- To examine the roles of pharmacists and medical microbiologists in antibiotic prescribing control at ward-level; whether performed on every ward or only in selected units, factors examined, frequency of review, communication of interventions and participation in audit.

ii). Design

The questionnaire was in 2 parts;

- The first section, “Your Hospital”, contained questions to identify hospital parameters; type, number of beds and speciality units.
- The second section, “Your Hospital’s Antibiotic Prescribing Documents”, contained 2 sub-sections;
 - a). The prevalence and nature of antibiotic prescribing control documents; availability, format, approval and revision processes. The phrase “antibiotic

prescribing control documents” is used as a summary term for antibiotic formularies, policies and guidelines. The following definitions of antibiotic prescribing documents were used in the questionnaire.

Formulary “a limited list of drugs available for prescription. It does not include guidance for use”, policy “a general statement of hospital strategy” and guidelines “a document offering guidance regarding what drug should be prescribed for a specific clinical condition”. A note was added that combinations of these might be contained within the same document.

- b). The performance of antibiotic prescribing control activities by pharmacists and medical microbiologists; occurrence, nature, frequency, communication and participation in antibiotic prescribing audits.

The phrase antibiotic prescribing control refers to a verification process of ward-based empirical antibiotic prescribing adherence with recommendations outlined in hospital antibiotic prescribing control documents (clinical review) performed by professional staff as part of their routine job. Audit was defined as “a systematic examination of compliance with prescribing guidance”.

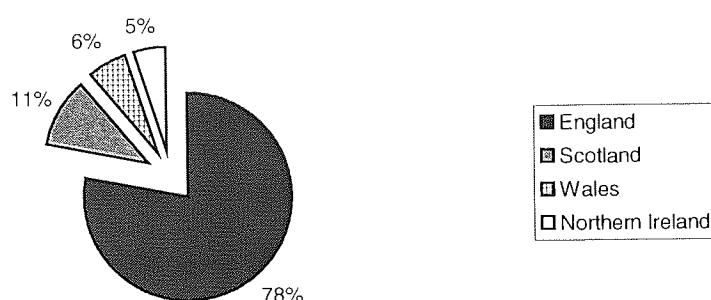
iii). Methodology

Survey Population

The questionnaire was mailed to pharmacists because they are healthcare professionals with a key role in improving prescribing. It was felt that the Chief Pharmacist should be aware of antibiotic prescribing controls operating in their hospital, or could pass the questionnaire on to another member of their staff if considered more appropriate. The questionnaire was sent to the Chief Pharmacist at all UK NHS hospitals in November 2001, with recipients identified from a mailing

list compiled by the Guild of Healthcare Pharmacists. That list contained the names and addresses of Chief Pharmacists employed by 465 hospitals in November 2001. Figure 3.1 depicts the employment of questionnaire recipients by hospitals located in the constituent countries of the UK.

Figure 3.1: The location of questionnaire recipients within the UK (n=465).



Pilot Study

Six secondary-care pharmacists from the West Midlands considered to have similar roles to Chief Pharmacists, and academic pharmacists and researchers within the Aston Pharmacy Practice Group, piloted the questionnaire prior to national send-out. Comments were invited on the composition of the accompanying letter and the layout and clarity of the questionnaire. Following the pilot sample's consideration of these documents, the following changes were made.

Accompanying letter;

- Greater emphasis was placed upon the importance of respondents completing the questionnaire.
- The questionnaire's return date was specified to enable recipients to prioritise completion.

Questionnaire;

- The inclusion of a coding number rather than a hospital's name was believed to be more effective in assuring confidentiality.
- Due to the substantial length of the questionnaire, the numbering of pages was felt to discourage response and was therefore removed.

The Survey

Following the pilot study, questionnaires were mailed to the Chief Pharmacist from 465 UK NHS hospitals on 7th November 2001, with a return-date of 28th November 2001. Two follow-up mailings of the questionnaire were subsequently sent with the objective of maximising the response rate; the second questionnaire was sent on 30th January 2002 with a return date of 28th February 2002 and the third questionnaire was sent on 30th June 2002 with a return date of 31st July 2002. The delay between the second and third mailings was due to illness. Questionnaires contained a form that allowed non-responders to indicate the reason for failure of completion, to account for as many questionnaires as possible. Appendix A contains a copy of the questionnaire.

Accompanying Letter

An accompanying letter explained the aims of the research and that the questionnaire had University sponsorship, and was sent to the named recipient. Making letters personal and outlining University sponsorship are strategies that have been defined as increasing the response rate to postal questionnaires²⁶⁸. The letter also contained an explanation of the importance of recipients participating in the research, and an assurance of the confidentiality of the results. All questionnaires contained a stamped-return envelope, and were mailed by first-class delivery because these are also effective strategies for increasing the response

rate²⁶⁸. Questionnaire respondents were also requested to enclose a copy of their hospital's antibiotic prescribing control document(s) with their completed questionnaire (these are described in Chapter 8). Appendix A contains a copy of the accompanying letter.

iv). Results

The results of this survey regarding response and nature of respondents and the prevalence and nature of antibiotic prescribing control documents are described and discussed in Chapter 4. Results about the control of antibiotic prescribing by professional healthcare staff are described and discussed in Chapter 5.

3.3.5 “Antibiotic Prescribing Documents, Survey 2002”

i). Aims

This survey used a similar self-completion questionnaire to the one described above, but was sent to Chief Medical Microbiologists. The aims were;

- To examine the prevalence and nature of antibiotic prescribing control documents in UK NHS hospitals and the performance of antibiotic prescribing control activities by medical microbiologists and pharmacists, as reported by medical microbiologists.
- To compare the questionnaire responses received from medical microbiologists with those received from pharmacists at the same hospital.

ii). Design

The design of the questionnaire has been described above. The only difference in the questionnaire format was that the order of pharmacists and medical microbiologists was reversed in questions that referred to these staff.

iii). Methodology

Survey Population

The questionnaire was sent in association with ESGAP (European Study Group on Antibiotic Policies). Recipients were identified from examination of a directory of UK Medical Microbiology Services compiled by the Association of Medical Microbiologists. In October 2002, this list contained the names and addresses of Chief Medical Microbiologists employed by 273 hospitals.

Pilot Study

The questionnaire and accompanying letter were piloted by two medical microbiologists. No changes were considered necessary prior to national send-out.

The Survey

Following the pilot study, questionnaires were mailed to the Chief Medical Microbiologist in 273 UK NHS hospitals on 25th October 2002 with a return-date of 15th November 2002. Two follow-up mailings of the questionnaire were subsequently sent with the objective of maximising the response rate; the second questionnaire was sent on 20th November 2002 with a return date of 10th December 2002 and the third questionnaire was sent on 9th January 2003 with a return date of 30th January 2003. Questionnaire respondents were also requested to enclose a copy of their hospital's antibiotic prescribing control document(s) with their completed questionnaire (these are described in Chapter 8). Appendix B contains a copy of the questionnaire and accompanying letter.

iv). Results

The results of this survey regarding response and nature of respondents and about the control of antibiotic prescribing by professional healthcare staff are described

and discussed in Chapter 6. Results referring to difference in responses compared to pharmacist respondents are described in Chapter 7.

3.3.6 “Antibiotic Guideline Modifications, Survey 2002”

i). Aims

This questionnaire was designed to identify issues in relation to the publication of new national antibiotic prescribing guidance, the “British Guidelines for the Management of Community-Acquired Pneumonia in Adults”²⁰⁰, in 2001. Analysis of hospitals’ institutional antibiotic prescribing guidelines for CAP had been performed and indicated a lack of proactive reaction to change (Chapter 8). It was considered important to examine the institutional reaction to new national antibiotic prescribing guidance. The aims were;

- To assess pharmacists’ awareness of this new national antibiotic prescribing guidance.
- To identify whether hospitals’ institutional antibiotic prescribing guidelines had been subsequently revised.
- To examine what roles different healthcare staff had performed in this revision process.

ii). Methodology

Survey Population

The questionnaire was sent to the 253 Chief Pharmacists (or their nominated staff) from UK NHS hospitals who had responded to the survey, “Antibiotic Prescribing Documents, Survey 2001”, described previously.

Pilot Study

The same six secondary-care pharmacists from the West Midlands considered to have similar roles to Chief Pharmacists, and academic pharmacists and researchers within the Aston Pharmacy Practice Group piloted the questionnaire prior to national send-out. Comments were invited on the composition of the accompanying letter and the layout and clarity of the questionnaire. The pilot sample considered that no changes were necessary before national send-out.

The Survey

Following the pilot study, questionnaires were mailed to the 253 Chief Pharmacists described above on 15th October 2002 with a return-date of 5th November 2002. Two follow-up mailings of the questionnaire were subsequently sent with the objective of maximising the response rate; the second questionnaire was sent on 7th November 2002 with a return date of 21st November 2002 and the third questionnaire was sent on 25th November 2002 with a return date of 11th December 2002. Questionnaire respondents were also requested to enclose a copy of their hospital's antibiotic guidelines with their completed questionnaire (these are described in Chapter 8). Appendix C contains a copy of the questionnaire and accompanying letter.

iii). Results

The results are described and discussed in Chapter 9.

3.3.7 “Antibiotic Guidelines, Survey 2003”

i). Aims

This questionnaire was designed to identify issues in relation to one hospital’s institutional antibiotic prescribing guidelines. The aims were;

- To identify the use of institutional antibiotic prescribing guidelines by medical staff.
- To identify the antibiotic regimen that staff would prescribe for a patient with CAP.

ii). Design

The questionnaire contained ten questions, most of which required the respondent to tick the appropriate box. One question required specification of a date and another required specification of an appropriate antibiotic regimen. There were three parts to the questionnaire;

- Demographic questions; date of joining the hospital and grade.
- Questions pertaining to the antibiotic prescribing guidelines used in the hospital; access, use, usefulness and frequency of access.
- The final question requested the respondent to specify the antibiotic(s) they would prescribe for a patient diagnosed with (non-severe) CAP.

iii). Methodology

Survey Population

The questionnaire was sent to the 412 medical staff with initial, surnames and grade obtained from a hospital “bleep list” in November 2003.

Pilot Study

Academic pharmacists and researchers within the Aston Pharmacy Practice Group, together with the Chief Pharmacist, specialist “infectious diseases pharmacist” and medical microbiologist from the hospital, piloted the questionnaire prior to send-out. No changes were considered necessary before national send-out.

Ethical Approval

Ethical approval was sought for the study from the West Birmingham Local Research Ethics Committee (LREC). The study was granted ethical approval and assigned the code LREC 03/10/704. A summary of the proposed study was also sent to the hospital’s Research and Development Department. Appendix D contains a copy of the LREC application form and of the Research and Development application form.

The Survey

Following the pilot study, questionnaires were personally delivered to the post-room of the hospital (from which they were delivered to recipients) on 6th November 2003 with a return date of 26th November 2003. A follow-up mailing was similarly delivered to the hospital on 28th November 2003 with a return date of 17th December 2003. It is important that questionnaire mailings do not coincide with holiday seasons²⁶⁵, and therefore it was felt that the approaching Christmas season should be avoided. The questionnaire was converted into an electronic document and the URL e-mailed to recipients on 5th March 2003. Recipients were asked to complete the questionnaire form on-line and to click the “submit” button when finished. The questionnaire is accessible at <http://www.lhs.aston.ac.uk/surveys/Anti-Biotic-Guidelines/>. The delay between the second postal mailing and the electronic mailing was due to difficulties in obtaining

the e-mail addresses of recipients. A list of specific e-mail addresses was unavailable and it was necessary to e-mail the recipients in the format of firstname.surname@swbh.nhs.uk. The firstname had to be obtained from the Workforce Department within Human Resources at the hospital. Appendix D contains a copy of the questionnaire and accompanying letter.

iv). Results

The results are described and discussed in Chapter 11.

3.4 Analysis of Institutional Antibiotic Prescribing Guidelines for CAP

i). Aims

Questionnaire recipients of the surveys, “Antibiotic Prescribing Documents, Survey 2001”, “Antibiotic Prescribing Documents, Survey 2002” and “Antibiotic Guideline Modifications, Survey 2002” were requested to return a copy of their hospital’s antibiotic prescribing control documents with their completed questionnaire.

The aims were;

- To analyse the recommendations of institutional prescribing guidelines for the empirical antibiotic treatment of CAP.
- To evaluate the recommendations of institutional prescribing guidelines for CAP in the context of the national antibiotic prescribing guidance published by the British Thoracic Society in 1993 (“Guidelines for the management of adults admitted to hospital”²²⁴) and 2001 (“BTS guidelines for the management of Community-Acquired Pneumonia in Adults”²⁰⁰).

ii). Methodology

The recommendations in the institutional antibiotic prescribing guidelines received were analysed for the following aspects of empirical therapy for non-severe and severe CAP;

- 1st-line empirical antibiotic regimen.
- Alternative/2nd-line antibiotic regimens.
- Definitions of severe CAP.
- Compliance with the appropriate BTS CAP guidance (“Guidelines for the management of adults admitted to hospital”²²⁴ for institutional guidelines received before Spring 2002 and “BTS guidelines for the management of Community-Acquired Pneumonia in Adults”²⁰⁰ for institutional guidelines received after Spring 2002).

iii). Results

The data were analysed after entry into Microsoft[®] Access and Excel programmes and the results are described and discussed in Chapter 8.

3.5 Prescribing Audits

Audits of prescribing practice are employed to investigate the extent of prescribing adherence with “expert views”, accepted recommendations or guidelines²⁶⁵, and can be performed prospectively or retrospectively. One advantage of using a retrospective design is that the “Hawthorne effect” (of biasing the results due to prescriber awareness of the study) is avoided^{273, 274}. The retrospective review of patient medical records for treatment details is an accepted research methodology, which has been employed in previous studies^{60, 275-282}. The first stage in such an audit process is the identification of appropriate patients from administrative

records²⁸³. Although it is inevitable that some patients' medical records will not be retrieved, a reduction in the sample may introduce bias, especially if poor retrieval is related to different clinical teams²⁸³. Extraction of data from medical records must be logical and avoid subjective analysis by the researcher. The NHS Central Office for Research Ethics Committees has advised that any research proposal involving NHS patients should be the subject of ethical approval by the appropriate NHS Research Ethics Committee.

3.5.1 Audit of Community-Acquired Pneumonia Treatment

i). Aims

The study was designed to investigate prescribing practices for the empirical antibiotic therapy of CAP at one hospital.

The aims were;

- To investigate what antibiotic regimens had been prescribed for CAP.
- To analyse how prescribing practice had correlated with the institutional and national CAP antibiotic prescribing guidelines.
- To investigate reasons for prescribing outside the guidelines and the consequent implications for guidelines applicability and improvement.

ii). Study Methodology

Study Location

This study was performed at a large hospital in the West Midlands.

Study Design

Although a prospective methodology would have enabled identification of current patients with CAP it was concluded that this method would be impractical and

overly time-consuming for data collection, and a retrospective methodology was followed. The antibiotic treatment of patients admitted to the hospital between November 2002 and March 2003 with an International Classification Diseases (ICD-10) primary admission code for CAP was examined. These codes were obtained from the tenth revision of the “International Statistical Classification of Diseases and Related Health Problems”, approved by the “International Conference for the 10th Revision of the International Classification of Diseases” in 1989 and adopted by the 43rd World Health Assembly²⁸⁴.

Ethical Approval

Ethical approval was sought and granted for this study, “A study of empirical antibiotic prescribing for community-acquired pneumonia and its relationship to Trust and national guidelines”, from the West Birmingham LREC. It was assigned the code LREC 03/05/634. A summary of the proposed research was also sent to the hospital’s Research and Development Department. Appendix E contains copies of the ethics application form and of the application form for the hospital’s Research and Development Department.

Sample Size

An examination of previous studies of prescriber compliance with CAP antibiotic prescribing guidelines identified that compliance tended to range from 60-80%²⁸⁵⁻²⁹¹. The number of patient records required in the study was approximately 250 based upon a detection rate for non-compliance with guidelines of 20%, a power level of 0.9 and statistical significance of 0.005. This figure of 250 was obtained using the above parameters from the appropriate table in a statistical text²⁹².

Patient Identification

The name and hospital ID number of patients admitted during the study-period with relevant primary admission diagnosis codes were obtained from a hospital database by the Information Services Department of the hospital. The ICD-10 codes used are summarised in Table 3.1.

Table 3.1: Primary admission diagnosis ICD-10 codes used for patient identification.

ICD-10 code	Definition
J11.0	Pneumonia with influenza
J12.0, J12.1, J12.2, J12.8, J12.9	Viral pneumonia, not elsewhere classified
J13	Pneumonia due to <i>Streptococcus pneumoniae</i>
J14	Pneumonia due to <i>Haemophilus influenzae</i>
J15.0, J15.1, J15.2, J15.3, J15.4, J15.5, J15.6, J15.7, J15.8, J15.9	Bacterial pneumonia, not elsewhere classified
J16.0, J16.8	Pneumonia due to other infectious organisms, not elsewhere classified
J17.0, J17.1, J17.2, J17.3, J17.8	Pneumonia in diseases classified elsewhere
J18.0, J18.1, J18.2, J18.8, J18.9	Pneumonia, organism unspecified
J69.0	Pneumonia, aspiration
J84.1	Pneumonia, chronic
J20.0, J20.1, J20.2, J20.3, J20.4, J20.5, J20.6, J20.7, J20.8, J20.9	Acute bronchitis
J21.0, J21.8, J21.9	Acute bronchiolitis
J22	Unspecified acute lower respiratory tract infection
J40	Bronchitis, not specified as acute or chronic
J41.0, J41.1, J41.8	Simple and mucopurulent chronic bronchitis
J42	Unspecified chronic bronchitis
J44.0, J44.1, J44.8, J44.9	Other chronic obstructive pulmonary disease

Record Retrieval

Patients' medical records were obtained from the Medical Records Library at the hospital.

Inclusion and Exclusion Criteria

Inclusion and exclusion criteria were derived from "BTS guidelines for the management of Community-Acquired Pneumonia in Adults"²⁰⁰. Patients were included in the study if they met the following criteria;

- Over 16 years of age.
- Positive diagnosis of community-acquired pneumonia.
- Community-acquired pneumonia was the primary indication for hospital admission.
- Community-acquired pneumonia was distinguished from other respiratory conditions by chest radiograph.

Patients were excluded from the study if they had the following;

- Pulmonary tuberculosis.
- Cystic fibrosis.
- Primary immune deficiency.
- Secondary immune deficiency related to HIV.
- Drug/systemic disease-induced immunosuppression (not including corticosteroids).

Data Collection

The following data were abstracted from the medical record and entered onto a structured data-form;

Patient Data (required for demographic characteristics);

- Name and hospital identification number
- Date of birth.
- Gender.
- Location the patient was admitted from (e.g. own home/nursing home).
- Previous hospital admissions within the past month.
- If antibiotic therapy was initiated prior to admission, and regimen details.
- Penicillin allergy.
- Recent influenza infection.

- Co-existing morbidity.

Physical and laboratory data (required for assessment of the severity of CAP);

- Temperature.
- Diastolic & systolic blood pressure.
- Altered mental state (confusion).
- Respiratory rate.
- Pulse.
- Chest x-ray.
- Oxygen saturation.
- Full blood count.
- Liver function tests.
- Serum albumin.
- Urea.
- White cell count.
- C-reactive protein.

Antibiotic Therapy (required for review of antibiotic regimens prescribed);

- Antibiotic course.
- Grade of prescribing physician (e.g. junior/registrar/consultant).
- Time of admission.
- Post-take ward round review.
- Explanation why following the guidelines was not considered appropriate.
- Interventions by, and involvement of, other health professionals (e.g. medical microbiologists and pharmacists).
- Change in antibiotic regimen following receipt of aetiology, culture and sensitivity reports.

Clinical Outcome;

- Transfer to the Intensive Care Unit (ICU).
- Mortality (at 30 days).
- Length of stay.
- Discharge with antibiotics on prescription.
- Readmission within 4 weeks.

iii). Results

The results are described and discussed in Chapter 10.

Chapter 4 The nature of documented antibiotic prescribing controls-as reported by pharmacists

The aim of this part of the study was to identify the prevalence and nature of antibiotic prescribing control documents in UK NHS hospitals. Recent policy drivers for the provision of such prescribing control documents have included the Copenhagen recommendations⁷⁷ and the SMAC report, “The Path of Least Resistance”¹.

The objectives of this part of the study were;

- To identify the availability of antibiotic formularies, policies and guidelines.
- To examine the ways of accessing documents.
- To identify who had approved documents.
- To examine if processes existed for the timely revision of documents.

The results were obtained from the first section of a self-completion questionnaire, “Antibiotic Prescribing Documents, Survey 2001”, which was mailed to the Chief Pharmacist at 465 UK NHS hospitals in 2001/2002. A copy of this questionnaire is included in Appendix A.

4.1 Results

4.1.1 Response Rate

Three successive mailings were sent to the 465 recipients and the number of questionnaires returned for each mailing is summarised in Table 4.1.

Table 4.1: The proportion of questionnaires returned by pharmacists after successive mailings.

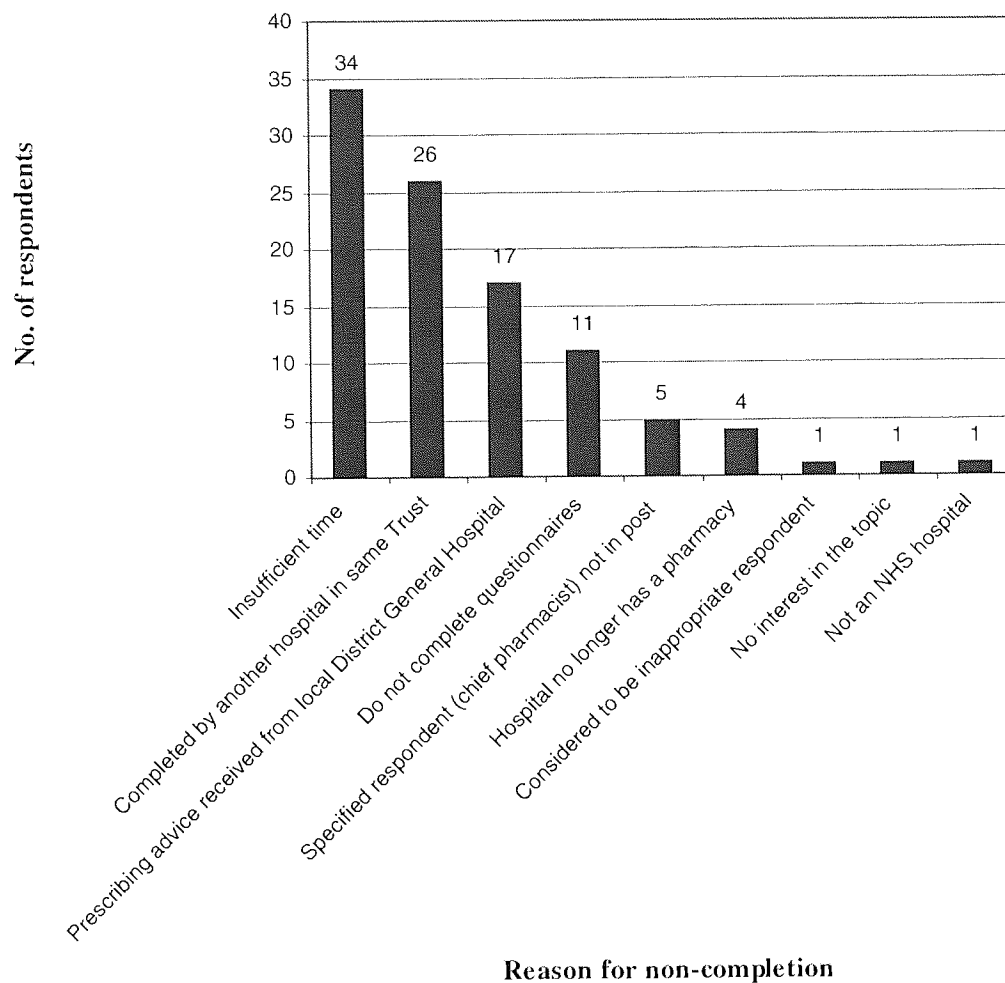
Questionnaire mailing	Number of questionnaires returned	Cumulative total of questionnaires returned	Returned questionnaire as a proportion of total sent (%)
1 st	202	202	43
2 nd	85	287	62
3 rd	71	358	77

Of the 465 questionnaires mailed, 77% (n=358) were returned and 253 of these were completed (a 54% response rate). The 465 recipient hospitals were from 293 NHS Trusts and the 253 respondent hospitals were from 209 of these Trusts; a Trust response rate of 71%.

4.1.2 Reasons for Non-Completion

Chief Pharmacists from 105 hospitals returned the questionnaire but had not completed it. Of these, 100 recipients specified a reason for non-completion, and these results are depicted in Figure 4.1

Figure 4.1: Reasons for non-completion of the questionnaire by pharmacists (n=100).



4.1.3 Geographical Nature of Respondents

A similar response rate was achieved from the four countries of the UK and this is summarised in Table 4.2.

Table 4.2: Response rates of pharmacists from hospitals from the UK countries.

Country	Number of hospitals replied	Number of hospitals surveyed	Response rate (%)
England	195	363	54
Scotland	31	53	58
Wales	14	26	54
Northern Ireland	13	23	57
Total	253	465	

4.1.4 Nature of Respondents

Although the questionnaire was addressed to the Chief Pharmacist, these recipients were asked to pass it on to a member of staff should they consider this to be appropriate. An optional question was included in the questionnaire for respondents to stipulate their contact details, including job position, if they were prepared to be contacted to participate in future research. One hundred and seventy-three (68%) of the 253 respondents specified their job title, whilst it is not known whether the questionnaire was subsequently passed on to another staff member for the other 80 (32%) respondents. The job titles specified by the 173 respondents are summarised in Table 4.3.

Table 4.3: Job titles of respondent pharmacists (n=173).

Job Title	Number of pharmacists
Chief Pharmacist (or similar)	64 (37%)
Clinical pharmacist	47 (27%)
Principal pharmacist	41 (24%)
Infectious diseases pharmacist	7 (4%)
Formulary pharmacist	7 (4%)
Clinical governance support pharmacist	6 (3%)
Procurement and IT pharmacist	1 (1%)

4.1.5 Parameters of Respondents' Hospitals

Twenty-three respondents classified their hospitals as "other" type, and these were re-classified to District General Hospital (DGH) (n=11) and specialist (n=12) following analysis of information about the hospital available on the internet. Of the 253 hospitals, 58% (n=147) were DGHs, 20% (n=50) were teaching hospitals and 22% (n=56) were specialist units. Five respondents did not know the size of their hospital, 47% (n=119) had less than 500 beds, 42% (n=105) had between 501 and 1000 beds and 9% (n=24) had more than 1000 beds. A specialist Infectious

Diseases Unit (ID) unit was present in 12% (n=30) of hospitals. Table 4.4 summarises the parameters of respondent hospitals.

Table 4.4: Analysis of respondent hospitals by type, bed size and ID unit, as reported by pharmacists (n=253).

Hospital Type (n=253)	0-500 beds (n=119)	501-1000 beds (n=105)	1000+ beds (n=24)	Missing/Don't Know (n=5)	Specialist ID Unit (n=30)
Specialist 56 (22%)	52	3	-	1	2 (7%)
District General 147 (58%)	59	80	4	4	3 (10%)
Teaching 50 (20%)	8	22	20	-	25 (83%)

Five type and size groups accounted for 92% of hospitals, and these categories are summarised in Table 4.5.

Table 4.5: The five most common hospital categories, as reported by pharmacists (n=233).

Hospital category	Number of hospitals
Small & Specialist	52 (22%)
Small & District General	59 (25%)
Medium & District General	80 (34%)
Medium & Teaching	22 (9%)
Large & Teaching	20 (9%)

4.1.6 Availability of Antibiotic Prescribing Control Documents

Respondents were asked whether their hospital had an antibiotic formulary, policy, and/or guidelines (defined on page 53, Chapter 3).

Seventy-six percent (n=168) of the hospitals had an antibiotic formulary (or other similar document), 56% (n=107) had an antibiotic policy and 87% (n=216) had antibiotic guidelines. Table 4.6 summarises these responses from pharmacists.

Table 4.6: The availability of antibiotic prescribing control documents, as reported by pharmacists.

Document Type	Valid response	Yes	Other Similar	No	Don't Know
Formulary	220	159 (72%)	9 (4%)	51 (23%)	1 (0.5%)
Policy	193	102 (53%)	5 (3%)	67 (35%)	19 (10%)
Guidelines	248	211 (85%)	5 (2%)	30 (12%)	2 (1%)

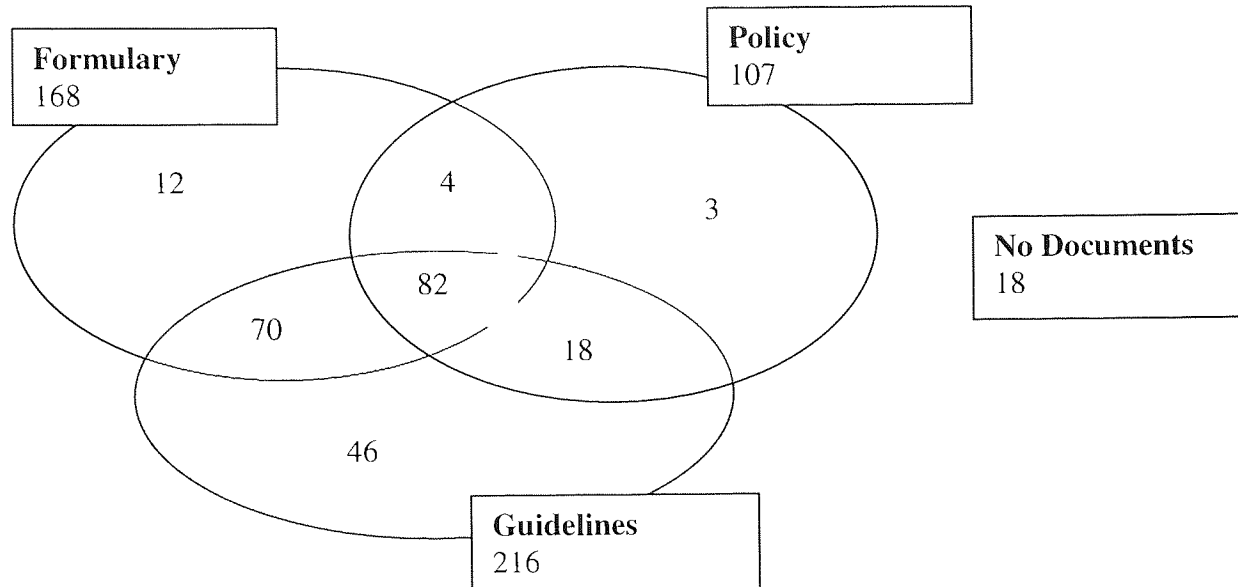
The continuity correction for Pearson's chi-squared test (page 51-52, Chapter 3) was employed to investigate whether the existence of an antibiotic prescribing control document was associated with the hospital's type, size, possession of specialist ID unit and country. Small specialist hospitals were less likely to have antibiotic formulary ($p=0.002$), policy ($p=0.017$) and guideline ($p=0.001$) documents whilst medium DGHs were more likely to have formularies ($p=0.002$) and guidelines ($p=0.053$) than would be expected by chance.

4.1.7 Combinations of Antibiotic Prescribing Control Documents

Of the 253 respondents, 82 (32%) hospitals had all three antibiotic prescribing control documents, 92 (36%) had two documents, 61 (24%) had one document and 18 (7%) did not have any documents.

Figure 4.2 is a Venn diagram showing the combinations of documents available in the respondent hospitals.

Figure 4.2: The availability of antibiotic prescribing control documents, as reported by pharmacists (n=253).



152 (60%) hospitals had both antibiotic formulary and guideline documents and small specialist hospitals were less likely to have both these documents ($p=0.022$).

4.1.8 Format of Antibiotic Prescribing Control Documents

Respondents were asked whether their hospital's antibiotic prescribing control document(s) were contained within a general hospital or Trust policy document, available as a separate document and/or accessible electronically. For ease of analysis, the results for availability as a general hospital and general Trust policy documents were combined.

The results regarding the format of antibiotic prescribing control documents are summarised in Table 4.7.

Table 4.7: The format of antibiotic prescribing control documents, as reported by pharmacists.

Document Type	Valid response	General document	Separate document	Electronic	Don't Know
<i>Formulary</i> (n=168)	156	68 (44%)	84 (54%)	68 (44%)	2 (1%)*
<i>Policy</i> (n=107)	96	41 (43%)	57 (59%)	43 (45%)	2 (2%)
<i>Guidelines</i> (n=216)	207	77 (37%)	133 (64%)	72 (35%)	3 (1%)

*Please Note: These figures do not total 100% because a document may have been available in more than one type of format.

Over one-third of hospitals had antibiotic prescribing control documents available in electronic form. In the majority of cases these documents were also available in a printed format; only 10 (15%, n=68) formularies, 6 (14%, n=43) policies and 7 (10%, n=72) guidelines were available in electronic format alone. Electronic access to antibiotic prescribing control documents was provided by a total of 89 hospitals, and small hospitals were less likely to provide this availability (p=0.004) whilst English hospitals were more likely to provide electronic availability (p=0.026).

4.1.9 Approval Processes for Antibiotic Prescribing Control Documents

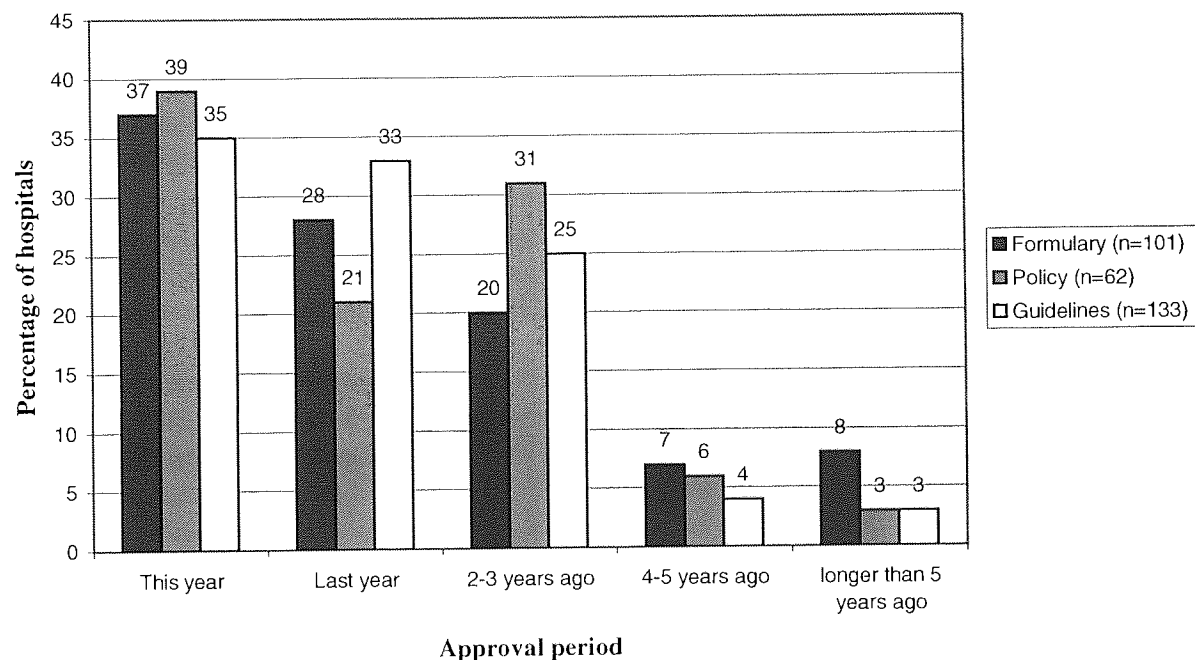
i). Approval Time-Frame

Respondents were asked when their hospital's antibiotic prescribing document(s) had been approved, and a space was provided for them to enter the date.

An approval year was provided for 101 formularies, 62 policies and 133 guidelines. Approval years for formularies ranged from 1994 to 2002, for policies ranged from 1995 to 2001 and for guidelines ranged from 1996 to 2002. Thirty-seven percent (n=37) of formularies, 39% (n=24) of policies and 35% (n=47) of guidelines were reported to have been approved within the current year at the time of the

questionnaire (2001 for the 1st mailing and 2002 for the 2nd and 3rd mailings). A total of 65% (n=66) of formularies, 60% (n=37) of policies and 68% (n=90) of guidelines had been approved either in the year of the questionnaire or in the previous year, and the approval period of the documents is depicted in Figure 4.3.

Figure 4.3: The approval period of antibiotic prescribing control documents, as reported by pharmacists.



Policies were more likely to have been approved in the current year in hospitals with a specialist ID unit (p=0.021) and teaching hospitals (p=0.011), although less likely in Scottish hospitals (p=0.037). It was more likely that guidelines had been approved within the current year in medium sized teaching hospitals (p=0.017) than in the other hospital types.

ii). Approval Bodies

Respondents were asked who had approved their hospital's document(s), and were provided with the options of the Drug and Therapeutics Committee (DTC),

Pharmacy Department Representation and Microbiology Department Representation. These results are summarised in Table 4.8.

Table 4.8: Approval bodies for antibiotic prescribing control documents, as reported by pharmacists.

Document Type	Valid Response	Drug and Therapeutics Committee	Pharmacy Department Representation	Microbiology Department Representation	Other	Don't Know
<i>Formulary</i> (n=168)	158	142 (90%)	97 (61%)	112 (71%)	16 (10%)	4 (3%)*
<i>Policy</i> (n=107)	100	78 (78%)	61 (61%)	77 (77%)	13 (13%)	1 (1%)
<i>Guidelines</i> (n=216)	203	161 (79%)	129 (64%)	162 (80%)	31 (15%)	4 (2%)

**Please Note: These percentages do not total 100% because more than one body may have approved a document.*

Approval by the triad combination of the DTC, Pharmacy Department Representation and Microbiology Department Representation was the most frequently cited combination and accounted for the approval of 73 hospitals' formularies, 44 hospitals' policies and 91 hospitals' guidelines.

The DTC had not been involved in the approval of 16 hospitals' formularies, 22 hospitals' policies and 42 hospitals' guidelines. Of these hospitals, the approval body was known for 12 hospitals' formularies, 19 hospitals' policies and 35 hospitals' guidelines. Of these, 6 hospitals' formularies, 7 hospitals' policies and 10 hospitals' guidelines had been approved by representation from both the Pharmacy and Microbiology Departments. A further 4 hospitals' formularies, 8 hospitals' policies and 14 hospitals' guidelines had been solely approved by Microbiology Department representation. No documents had been approved by the Pharmacy

Department in isolation, although it should be considered that the DTC would most likely contain a pharmacist member.

4.1.10 Revision Processes for Antibiotic Prescribing Control Documents

i). Revision

Respondents were asked whether a revision was planned for their hospital's document(s), and these results are summarised in Table 4.9.

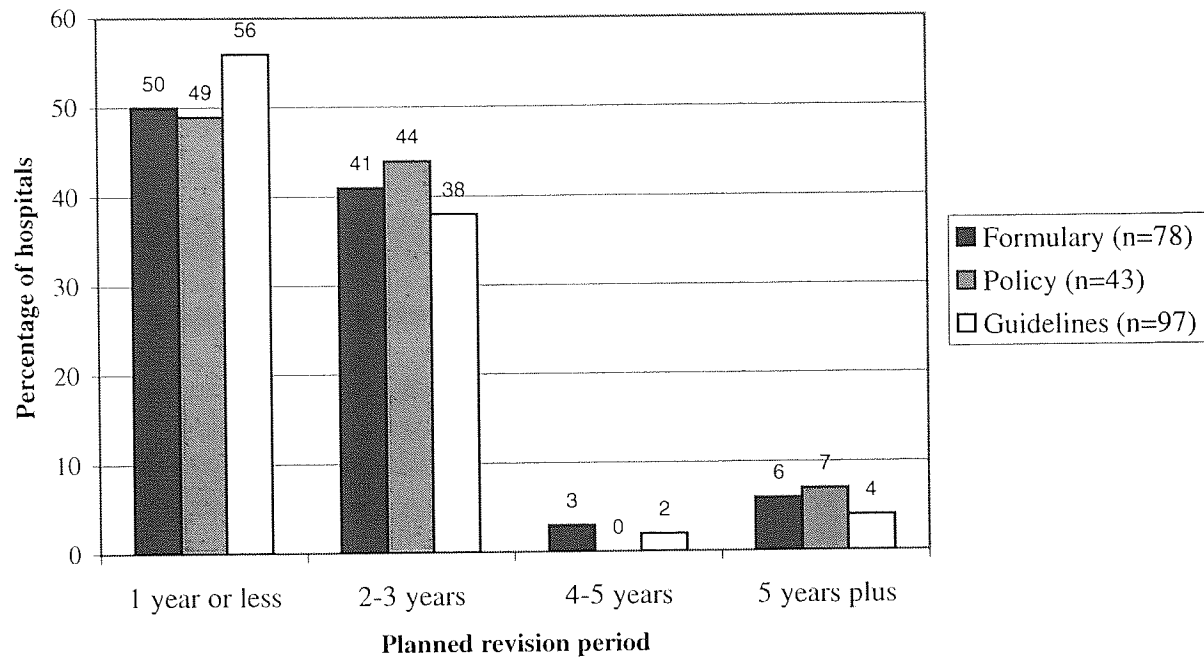
Table 4.9: Planned revision of antibiotic prescribing control documents, as reported by pharmacists.

Document Type	Valid Response	Planned Revision	No Planned Revision	Don't Know
<i>Formulary (n=168)</i>	156	129 (83%)	12 (8%)	15 (10%)
<i>Policy (n=107)</i>	93	71 (76%)	8 (9%)	14 (15%)
<i>Guidelines (n=216)</i>	205	157 (77%)	12 (6%)	36 (18%)

ii). Revision Period

If respondents had answered that there was a planned revision of their hospital's antibiotic prescribing document(s), they were asked when this would be, and were provided with a space to enter the date. Both the approval and planned revision dates were provided for 78 hospitals' formularies, 43 hospitals' policies and 97 hospitals' guidelines. The "revision period" was calculated for documents for which both dates were provided and formulary revision periods ranged from "on-going" to 7 years, policies ranged from annually to 6 years and guidelines ranged from "on-going" to 6 years. These results are depicted in Figure 4.4.

Figure 4.4: The planned revision period for antibiotic prescribing control documents, as reported by pharmacists.



It was significantly more likely that policies would be revised within 1 year in medium teaching hospitals ($p=0.021$) and in hospitals with a specialist ID unit ($p=0.046$) than in the other hospital types.

4.2 Discussion

This part of the study examined the prevalence, as reported by pharmacists, of antibiotic prescribing control documents in UK NHS hospitals; formularies, policies and guidelines. To impact upon antibiotic prescribing, such documents must be accessible to staff and appropriately revised, and therefore these aspects were also considered. A comprehensive survey of hospital antibiotic prescribing control activities, including document availability, was performed by a BSAC Working Party in 1990⁹¹. However, many high-profile policy documents recommending the use of antibiotic prescribing control documents have been

published since that survey (page 32, Chapter 2) and the context of antibiotic prescribing has changed.

4.2.1 Response Rate

The response rate of 54% was encouraging for an in-depth questionnaire. It has been suggested that a successful self-completion postal questionnaire results in a response rate of over 50%²⁶⁹, and when classified by NHS Trusts, the response rate of 71% was appreciably higher. The same mailing list of Chief Pharmacists was used by the Guild of Healthcare Pharmacists in 2001 to request information about hospitals' performance of pharmacy practice research and that survey's response rate of only 7% (n=34) was attributed to the time-pressures encountered by these staff²⁹³. The present study obtained a higher response rate from the same recipient cohort, which might reflect the importance of antibiotic prescribing improvement.

Chief pharmacists are not a homogenous group, with some having a more strategic role and some having a more operational function. It was suggested to Chief Pharmacist recipients of the questionnaire that they might want to pass it on to a member of their staff to complete it if they considered this appropriate. About three-fifths of the questionnaires were completed by a nominated staff member, predominantly by pharmacists with a clinical role and the principal pharmacist (who might be presumed to have both a managerial and clinical role). Therefore, the respondents were a heterogeneous group, although the questionnaire was presumably completed by staff with optimal knowledge about antibiotic prescribing control initiatives in the hospital. However, any questionnaire will provide data that is only as accurate as the respondents' knowledge and response.

A copy of the same questionnaire was later sent to Chief Medical Microbiologists at 273 UK NHS hospitals (described in Chapter 6). The 131 respondents were from a different sample of hospitals and so the data-set is not comparable.

4.2.2 Availability of Antibiotic Prescribing Control Documents

One of the objectives was to identify the prevalence of antibiotic formularies, policies and guidelines available in UK NHS hospitals.

i). Formulary

The majority of respondents reported that their hospital had an antibiotic formulary, the prevalence (76%) being comparable with that of the BSAC's 1990 study (79%)⁹¹. Despite high-profile recommendations for the use of antibiotic formularies, the availability of this document has not increased in over a decade and strategies need to be identified to encourage the use of this document.

The characteristics of the hospital were examined to identify whether there was any association between a hospital's size, type and presence of an ID unit and the availability of an antibiotic formulary. It was hypothesised that hospitals with a specialist ID unit would be more likely to have an antibiotic formulary due to the employment of a larger proportion of specialist infectious diseases staff. However, there was no association, which might suggest that such staff work within specialist units and don't impact upon wider hospital policy.

Studies have investigated the availability of antibiotic formularies in hospitals in other countries, and the prevalence of such documents has ranged from 78% in the

Netherlands to 100% in the USA^{99, 134, 136, 137}. It appears that the UK results are consistent with the international scene. However, most of these previous surveys were performed before the increasing emphasis upon control documents.

ii). Policy

Just over one-half (56%) of hospitals were reported to have an antibiotic policy, comparable with the results of the BSAC study (62%). However, there are problems in defining an antibiotic policy. The definition used by the BSAC, “the provision of guidelines for the use of specific antibiotics”, is confusing because it incorporates the use of guidelines, although the provision of an antibiotic formulary could also be classified as an antibiotic policy^{138, 193, 294}. Various international studies have used different terminology, and national availability of antibiotic policies in hospitals has ranged from 69% to 98%^{133, 295}.

This problem in defining antibiotic policies means that it is difficult to compare the results of availability from different studies, and future research is required to standardise the term. In the present study, approximately one-quarter of respondents failed to answer whether their hospital had an antibiotic policy, which suggests that respondents might have different perceptions of this document, although a definition was provided.

iii). Guidelines

Antibiotic prescribing guidelines are the most prevalent type of control document available in UK hospitals. It is encouraging that the majority of hospitals were reported to have antibiotic guidelines because official policy documents have

advocated the provision of guidelines to rationalise the antibiotic treatment of specified infections¹³¹.

The definition of “guidelines” is more universal, and that of the US Institute of Medicine (“a systematically developed statement to assist practitioner and patient decisions about appropriate health care for specific clinical circumstances”¹¹²) is often quoted, which should allow comparison between different studies. National results of availability of between 56% and 76% have been reported for different countries^{99, 133, 136, 296}.

The BSAC’s study did not include a separate definition for guidelines, but the availability of this document was incorporated into the definition of an antibiotic policy. When the results for the availability of antibiotic guidelines from the present study (87%) are compared with the BSAC’s availability of guidelines (62%), there has been a noticeable increase in the proportion of hospitals with this document (personal communication, IM Gould).

Institutional antibiotic prescribing guidelines might vary with regard to the level of information provided and for the types of infections considered^{17 132}. A content-analysis of recommendations for the empirical antibiotic treatment of CAP contained in institutional guidelines is the subject of Chapter 8.

This question about the availability of antibiotic prescribing control documents in UK NHS hospitals was only designed to identify the availability of formularies, policies and guidelines. No attempt was made to assess how widely these

documents are used in practice, whether recommendations are enforced and how beneficial hospital staff find the recommendations, although the last two points are addressed in Chapter 5 and Chapter 11 respectively.

4.2.3 Combinations of Antibiotic Prescribing Control Documents

It can be suggested that antibiotic formularies and guidelines have a greater impact upon antibiotic prescribing quality than an antibiotic policy, which is difficult to define and may refer to a specific activity such as the operation of “automatic stop orders”. Formularies and guidelines operate in tandem because guidelines recommend the antibiotic to be prescribed for a specific infection whilst a formulary identifies which antibiotics are suitable for use when the guidelines are not appropriate for a specific patient.

It is of concern that only three-fifths of hospitals reportedly had both an antibiotic formulary and antibiotic guidelines because a cornerstone of the medicines management strategy is that hospitals provide both these document types⁹. Although the present study was performed before the publication of the Audit Commission’s Report on medicines management⁹ it provides an insight into the availability of these medicines management tools before its release, and shows that progress is necessary before the Report’s aims can be met.

However, a further one-fifth of hospitals had either antibiotic guidelines or an antibiotic formulary, and efforts could be focussed upon those hospitals to encourage them to provide both document types. If hospitals will only provide one

control document, then guidelines which are disease-focussed might be suggested as being preferable to antibiotic formularies²⁷³.

It is of particular concern that 18 hospitals apparently did not have any of the antibiotic prescribing control documents considered. Two-thirds of these hospitals were small specialist hospitals and these types of hospitals had less chance of having either antibiotic formularies or antibiotic guidelines than the other types of hospitals examined. Such hospitals include psychiatric hospitals, which presumably obtain appropriate antibiotic prescribing guidance from their local DGH. However, it is preferable that all such hospitals have antibiotic prescribing control documents (which can be provided by another hospital within the Trust) because the treatment of concurrent medical problems is one of the problems of psychiatric medicine²⁷⁹. Indeed the second House of Lords' Select Committee's Science and Technology Report on antibiotic resistance urged the Department of Health to "pursue" hospitals that did not have a formal policy for antibiotic prescribing in 2001¹³⁰.

It is possible that where hospitals did not have antibiotic prescribing control documents, they used other forms of antibiotic prescribing control such as word-of-mouth, although prescribing is likely to be more erratic when documented controls do not exist.

4.2.4 Format of Antibiotic Prescribing Control Documents

One of the objectives was to assess the ways in which staff could access documents.

Although there is interest in the employment of information technology and the world wide web in antibiotic prescribing improvement efforts^{1, 78, 129, 131, 297, 298}, the present research is the first major study to have examined the provision of electronic antibiotic prescribing guidance to staff in the UK. Documents were reported to be accessible electronically in less than one-half of hospitals, although electronic prescribing guidance is considerably easier and cheaper to update than paper formats²⁹⁹, offers easier searching facilities²⁹⁹ and provides readily accessible information^{131 300}.

The limited electronic availability identified in the present study suggest that “Information for Health” targets²⁹⁸, including access to clinical guidance, will not be met, as has been previously suggested¹³¹. It would be interesting to investigate whether hospitals have electronic facilities available for purposes other than access to institutional guidelines. New initiatives include the pilot of the “National Electronic Library for Health”³⁰¹ which provides on-line access to resources including “Clinical Evidence” and the “Cochrane Library” to the whole NHS³⁰². “Computer-based decision support systems”¹ combine clinical data with an electronic knowledge base to generate patient-specific recommendations³⁰³ and can positively impact upon physician behaviour^{300, 303, 304, 305}. However, the lack of investment in information technology for antibiotic prescribing improvement implied by the present study suggests that adoption of such systems in the future may be limited.

4.2.5 Approval of Antibiotic Prescribing Control Documents

One of the objectives was to identify which staff were involved in the approval of documents.

The majority of antibiotic prescribing control documents were reported to have been approved by the DTC, either with or without contribution from the Pharmacy and Microbiology Departments. DTCs, in existence since the 1960s³⁰⁶, are multidisciplinary committees that aim to ensure effective and economic prescribing^{307 308}, and the absence of a DTC was a major reason for the failure of UK hospitals to implement a formulary³⁰⁹. The finding of the present study of DTC involvement is not surprising but provides clear evidence of multi-professional engagement as recommended by best practice and international trends^{103, 310, 311,128}. Within the UK, the medicines management strategy has recommended that DTCs be accountable for the introduction of evidence-based formularies linked to clinical guidelines in NHS hospitals¹³¹. Previous international studies have identified that antibiotic prescribing control documents have been approved by multidisciplinary committees in the majority of hospitals; in the USA⁹⁹, The Netherlands¹³⁴, and Ireland³¹².

A definitive model does not exist for the operation of a DTC^{132, 313}, although large diverse committees may be more effective than more narrowly-focused groups³¹⁴. It would have been interesting to investigate which professionals are represented on hospitals' DTCs because this would have identified whether pharmacists and medical microbiologists routinely sit on these committee although pharmacists have been traditionally seen as being represented^{312 306}. A survey of 97 DTCs

identified that all included a pharmacist and a representative of the consultant medical staff, with other possible members including senior nursing representatives and medical microbiologists³¹².

4.2.6 Revision of Antibiotic Prescribing Control Documents

One of the objectives was to identify whether processes exist for the timely revision of documents.

All antibiotic prescribing control documents should have an approval date so that staff know they are using the current version, and the inclusion of a revision date provides a visual reminder that should help to ensure that the document is revised at the correct time. Unfortunately, both the year of approval and the year of planned revision were only provided for a proportion of the antibiotic prescribing control documents in the present study, which may have biased the results. However, such failure to include a termination date appears to be a common problem, and a previous study identified that only 11% (n=30) of national/speciality guidelines published in peer-reviewed journals included a scheduled review date²²⁸.

It is possible that respondents were unable to specify both dates because they did not have immediate access to the documents (although such documents should be easily accessible) or that the dates were not easily identifiable on the document. On reflection, a question should have been included in the questionnaire to distinguish between these two possibilities.

Periodic revision of documents is important to ensure the use of the most current evidence-based medicine^{315, 316}. Although revision was planned for the majority of documents, there was great variation in the reported lifetime of the documents and some documents would be operational for more than 3 years without revision. The Government has requested NHS Trusts ensure that systems exist for the revision of documents on at least an annual basis³¹⁷. In light of this official recommendation, it is of grave concern that only approximately one-half of hospitals intended an annual revision of their antibiotic prescribing control document(s). However, the present study has identified an increase in the proportion of hospitals performing annual revision since the BSAC's 1990 study⁹¹, when only one-third of hospitals reviewed their formularies within one year. One of the recommendations for minimum antibiotic prescribing control measures from that study⁹¹ was that control documentation should be frequently updated and it appears that there has been some improvement in this activity.

None of the examined hospital parameters (type of hospital, number of beds and a speciality ID unit) were associated with annual revision of formularies and guidelines and other factors may be important, such as the organisational structure of the DTC, the commitment of individual members to this activity and a belief that a longer revision period is acceptable. However, the Health Circular recommending annual revision was published in 1999³¹⁷ and all hospitals should have been able to plan for annual revision. It would be interesting to investigate whose responsibility it was to identify and action this policy, and these aspects are considered in Chapter 9. Antibiotic policies were more likely to be revised annually in medium teaching hospitals and in those with a specialist ID unit, which suggests that these hospitals

may place greater emphasis on incorporating new evidence into practice. It should be considered that, although respondents had indicated an intention to revise a document annually, this might not actually occur in practice.

4.3 Conclusion

This part of the study has investigated the prevalence and nature of antibiotic prescribing control documents in UK NHS hospitals, with the objectives of identifying availability of antibiotic formularies, policies and guidelines, provision of electronic access and approval and revision processes.

Although policies are difficult to define, there appears to have been little improvement in the use of antibiotic formularies since the previous survey a decade ago. The present study has also provided evidence of incomplete compliance with a number of national recommendations regarding electronic accessibility, provision of both formulary and guidelines and annual revision of documents. An NHS strategy should be implemented to ensure hospitals' conformity regarding antibiotic prescribing control documentation.

The main findings of this study are;

- Questionnaires were returned completed by pharmacist respondents from 253 UK NHS hospitals (a 54% response rate).
- 76% (n=168) of hospitals had an antibiotic formulary (or other similar document), 56% (n=107) had an antibiotic policy and 87% (n=216) had antibiotic guidelines. It is disappointing that formulary availability had not appreciably increased since the BSAC's 1990 survey.

- Although “formulary” and “guidelines” are generally acceptable terms, the same does not appear to be true for “policy”, which causes difficulties in comparing the results of prevalence studies.
- 82 (32%) respondents’ hospitals had all three antibiotic prescribing control documents, 92 (36%) had two documents, 61 (24%) had one document and 18 (7%) did not have any documents. Small specialist hospitals were less likely to have formularies and guidelines than the other hospital types.
- Only 60% of hospitals had both an antibiotic formulary and antibiotic guidelines, which the medicines management strategy has emphasised as important for prescribing control.
- Less than one-half of antibiotic prescribing control documents were available electronically and these results add credence to the theory that it is unlikely that national policy targets for the use of information technology will be attained.
- The Drug and Therapeutics Committee (DTC) was the most frequently appointed approval body for all documents, and most documents had been approved following multidisciplinary collaboration.
- Both a document’s approval and planned revision date were provided for less than one-half of antibiotic prescribing control documents, and less than one-half of those hospitals intended an annual revision of such documents, despite Government recommendations.

Chapter 5 Antibiotic prescribing control by pharmacists and medical microbiologists-as reported by pharmacists

The prevalence and nature of antibiotic prescribing control documents in UK NHS hospitals was examined in the previous chapter (Chapter 4). However, the benefits of documents will only be achieved when their recommendations are implemented in clinical practice. Pharmacists and medical microbiologists can play an important role in enforcing such recommendations, and the aim of this part of the study was to identify the involvement of these staff in encouraging prescribing adherence with antibiotic prescribing control documents in UK NHS hospitals.

The objectives of the study were;

- To identify whether pharmacists and medical microbiologists monitor prescribing adherence with institutional prescribing recommendations.
- To identify what factors are reviewed in this control process.
- To identify how often this control process is performed.
- To examine the methods used for communicating resultant interventions to prescribers.
- To examine the prevalence and nature of audits of antibiotic prescribing.

This chapter describes the results of the second section of the questionnaire, “Antibiotic Prescribing Documents, Survey 2001” sent to the Chief Pharmacist at 465 UK NHS hospitals in 2001/2002. A copy of this questionnaire is included in Appendix A.

5.1 Results

5.1.1 Performance of Antibiotic Prescribing Control

The 235 respondents who had indicated that their hospital had antibiotic control document(s) were asked whether their hospital’s pharmacists and medical microbiologists performed antibiotic prescribing control (defined on page 53, Chapter 3).

Responses were received from 228 (97%) hospitals about pharmacists’ performance of antibiotic prescribing control and from 217 (92%) hospitals about medical microbiologists’ involvement. Almost two-fifths of pharmacist respondents (39%, n=85) did not know the role of medical microbiologists, whilst 4% (n=8) did not know the role of pharmacists. The results for the roles of pharmacists and of medical microbiologists reported by pharmacists who purportedly knew this information are summarised in Table 5.1.

Table 5.1: Antibiotic prescribing control performed by pharmacists and medical microbiologists in UK NHS hospitals, as reported by pharmacists.

Staff	Response	Yes Every ward	Yes Selected units	No
<i>Pharmacists</i>	220	146 (66%)	43 (20%)	31 (14%)
<i>Medical Microbiologists</i>	132	19 (14%)	63 (48%)	50 (38%)

Pharmacists were reported to perform antibiotic prescribing control in a total of 86% (n=189) of hospitals and medical microbiologists were reported to perform this role in a total of 62% (n=82) of hospitals.

Responses were analysed according to hospital type and size, and whether hospitals had a specialist ID unit. Pharmacist performance of antibiotic prescribing control was not associated with these hospital parameters ($p > 0.05$ in all cases). However, hospitals were less likely to have medical microbiologists performing this role if they were small ($p = 0.018$), specialist ($p = 0.041$) or based in Scotland ($p = 0.046$). More large hospitals ($p = 0.034$), teaching hospitals ($p = 0.010$) and those that contained a specialist ID unit ($p = 0.025$) had medical microbiologists undertaking an antibiotic prescribing control role. Hospitals situated in England were more likely to have antibiotic prescribing control performed by medical microbiologists ($p = 0.001$).

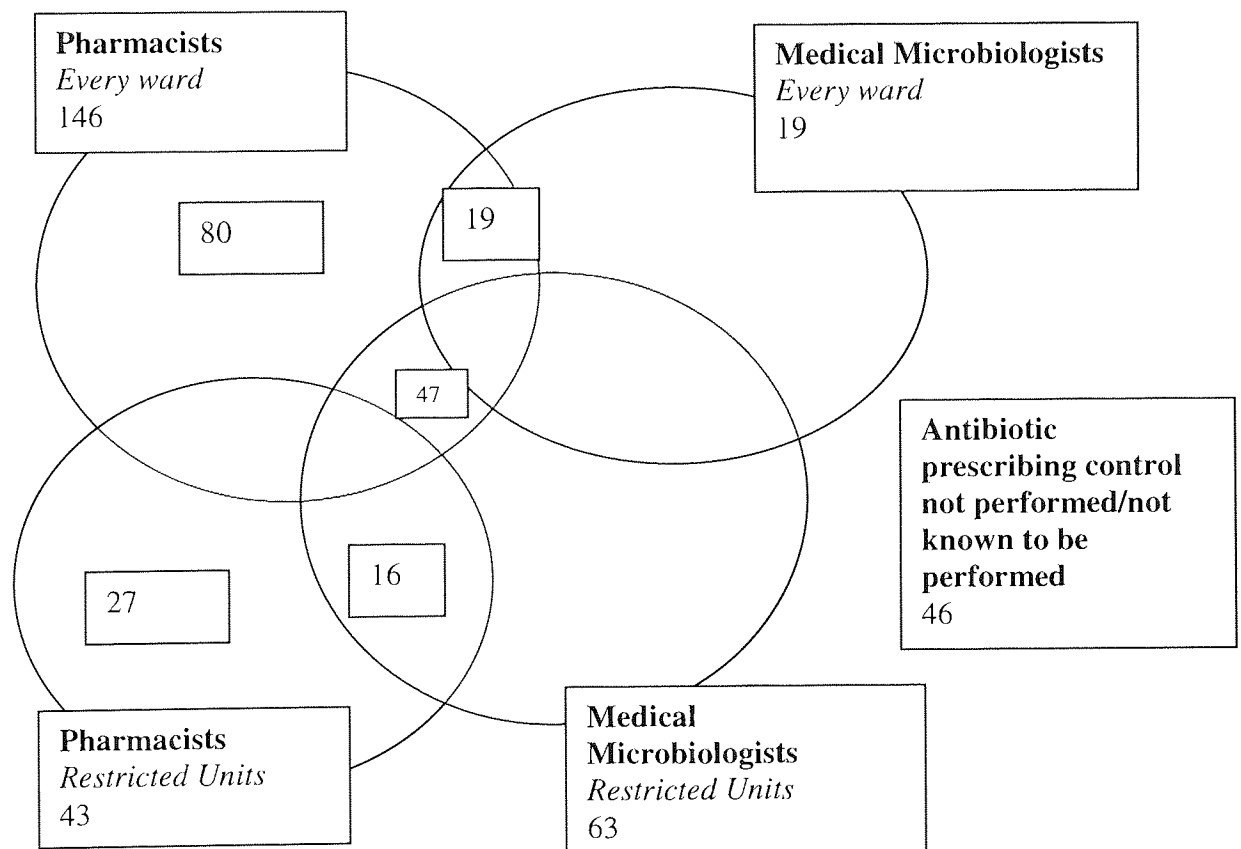
There was no association between the hospital parameters and the reported incidence of pharmacists performing an antibiotic prescribing control function on every ward rather than in selected units only ($p > 0.05$ in all cases). There were significant differences when the results were analysed by country of location; hospitals located in England were more likely to have control performed on every ward ($p = 0.001$), whilst hospitals located in Scotland ($p = 0.001$) and Northern Ireland ($p = 0.025$) were less likely. Whether medical microbiologists performed control on every ward or only in selected units was not related to the hospital parameters examined or country of location ($p > 0.05$ in all cases).

5.1.2 Combinations of Staff Performing Antibiotic Prescribing Control

Antibiotic prescribing control was purportedly performed in 80% (n=189) of the 235 hospitals that had antibiotic prescribing control documents. Of the 189 hospitals, only pharmacists were reported to perform this role in 107 hospitals, whilst both pharmacists and medical microbiologists were reported to perform antibiotic prescribing control in 82 hospitals.

Figure 5.1 is a Venn diagram showing the location of antibiotic prescribing control undertaken by pharmacists and medical microbiologists, and shows that in no hospital did medical microbiologists alone perform control.

Figure 5.1: Performance of antibiotic prescribing control by pharmacists and medical microbiologists in UK NHS hospitals, as reported by pharmacists (n=235).



5.1.3 Factors Reviewed during Antibiotic Prescribing Control

Respondents were asked what factors were reviewed during antibiotic prescribing control by pharmacists and medical microbiologists, and were provided with several answer options. Pharmacist respondents had reported that pharmacists performed antibiotic prescribing control in 189 hospitals, and that medical microbiologists performed this role in 82 hospitals (Table 5.1). Responses were received from 188 (99%) hospitals about the nature of antibiotic prescribing control by pharmacists and from 68 (83%) hospitals about the nature of medical microbiologists' antibiotic prescribing control. These results are summarised in Table 5.2.

Table 5.2: Factors reviewed during antibiotic prescribing control by pharmacists and medical microbiologists, as reported by pharmacists.

Factor Definition	Number of hospitals where pharmacists reviewed this factor (n=188)	Number of hospitals where medical microbiologists reviewed this factor (n=68)
<i>Drug/s in accordance with prescribing document recommendations</i>	179 (95%)	44 (65%)*
<i>Drug/s Dosage in accordance with prescribing document recommendations</i>	177 (94%)	29 (43%)
<i>Drug Regimen Length(s) in accordance with prescribing document recommendations</i>	161 (86%)	28 (41%)
<i>Drug/Drug Interactions exist between empirical regimen and other therapy which justify deviation from prescribing document recommendations</i>	182 (97%)	15 (22%)
<i>Patient Factors exist which justify deviation from empirical regimen recommended (e.g. penicillin allergy)</i>	180 (96%)	40 (59%)
<i>Other</i>	15 (8%)	6 (9%)
<i>Don't Know</i>	0	9 (13%)

**Please Note: These percentages do not total 100% because more than one factor may have been reviewed.*

Pharmacists were reported to review the length of the antibiotic regimen in slightly fewer hospitals than the other factors (86%, n=161), although whether this factor was checked was not associated with any of the hospital parameters. The most frequent combination of factors reportedly reviewed by pharmacists was drug, drug dosage, regimen length, drug-drug interactions and patient factors, and this combination was reviewed in 74% (n=139) of hospitals. The possibility of this combination of factors being employed was not associated with hospital parameters.

Pharmacists thought that pharmacists reviewed more factors than medical microbiologists, and this is summarised in Table 5.3.

Table 5.3: The number of factors reviewed by pharmacists and medical microbiologists in the antibiotic prescribing control process, as reported by pharmacists.

Number of review factors considered in the control process	Number of hospitals where pharmacists reviewed this number of factors (n=188)	Number of hospitals where medical microbiologists reviewed this number of factors (n=68)
1	3 (2%)	22 (32%)
2	3 (2%)	15 (22%)
3	5 (3%)	12 (18%)
4	24 (13%)	11 (16%)
5	144 (77%)	8 (12%)
6	9 (5%)	0

5.1.4 Frequency of Antibiotic Prescribing Control

Pharmacist respondents had reported that pharmacists performed antibiotic prescribing control in 189 hospitals, and that medical microbiologists performed this role in 82 hospitals (Table 5.1). Respondents were asked how often antibiotic prescribing control was performed by pharmacists and medical microbiologists, and

were offered several answer options. Responses were received from 188 (99%) hospitals about pharmacists' frequency of antibiotic prescribing control and from 76 (93%) hospitals where medical microbiologists performed this role. These results are summarised in Table 5.4.

Table 5.4: The frequency of antibiotic prescribing control performed by pharmacists and medical microbiologists, as reported by pharmacists.

Frequency	Number of hospitals where pharmacists performed this frequency (n=188)	Number of hospitals where medical microbiologists performed this frequency (n=76)
<i>Daily as part of a routine clinical ward service</i>	160 (85%)	19 (25%)*
<i>Weekly as part of a routine clinical ward service</i>	25 (13%)	14 (18%)
<i>During participation in a routine Consultant ward round</i>	56 (30%)	22 (29%)
<i>When requested by the prescriber</i>	43 (23%)	38 (50%)
<i>Other</i>	22 (12%)	8 (11%)
<i>Don't Know</i>	2 (1%)	15 (20%)

**Please Note: These percentages do not total 100% because more than one frequency may have been employed.*

Daily antibiotic prescribing control by pharmacists was associated with the type of hospital and pharmacists in small, specialist hospitals were less likely to perform daily antibiotic prescribing control ($p=0.047$). Daily control by medical microbiologists was not associated with any of the hospital parameters examined.

5.1.5 Communication of Interventions with the Prescriber

Respondents were asked about the ways in which pharmacists and medical microbiologists communicated interventions arising from the antibiotic prescribing control process to the prescriber. Annotation within the medical records was not included in the list of response options provided, but it was often cited by

respondents in the free response option and therefore it has been included as a response in the data analysis. Pharmacist respondents had reported that pharmacists performed antibiotic prescribing control in 189 hospitals, and that medical microbiologists performed this role in 82 hospitals (Table 5.1). Responses were received from 187 (99%) hospitals about pharmacists' communication and from 66 (80%) hospitals about medical microbiologists' communication. These results are summarised in Table 5.5.

Table 5.5: Methods employed by pharmacists and medical microbiologists for the communication of interventions to prescribers, as reported by pharmacists.

Communication method	Number of hospitals where pharmacists used this method (n=187)	Number of hospitals where medical microbiologists used this method (n=66)
<i>Annotation on the prescription</i>	141 (75%)	10 (15%)*
<i>Annotation in the medical record</i>	25 (13%)	28 (42%)
<i>Verbally</i>	175 (94%)	50 (76%)
<i>During participation in a routine Consultant ward-round</i>	107 (57%)	35 (53%)
<i>Other</i>	20 (11%)	8 (12%)
<i>Don't Know</i>	1 (1%)	10 (15%)

**Please Note: These percentages do not total 100% because more than one communication method may have been employed.*

In 35 (19%) hospitals pharmacists were reported to only communicate verbally, with no written documentation of the intervention being recorded on the prescription or in the medical record. This was more likely to happen in Scottish hospitals ($p=0.001$), whilst it was less likely in English hospitals ($p=0.001$). Verbal communication in isolation was reported for medical microbiologists in 17 (26%) hospitals and was not associated with the hospital parameters examined.

In 45% of hospitals (n=84) where antibiotic prescribing control was performed, pharmacists were reported to communicate interventions verbally, annotate prescriptions and attend ward rounds. It was more likely that this combination of communication methods would be employed in English hospitals (p=0.010) than Scottish hospitals (p=0.034), but was not associated with the other hospital parameters. Medical microbiologists seldom annotated the prescription, although they communicated verbally in adjunct to participation on ward rounds in 12 (18%) hospitals and in a further 8 hospitals documented interventions in the medical record in addition to these communication methods.

5.1.6 Antibiotic Prescribing Audits

i). Audit Performance

Respondents were asked if their hospital undertakes audits of antibiotic prescribing (defined on page 53, Chapter 3). Valid responses were received from 231 of the 235 respondents whose hospitals had antibiotic prescribing control document(s). Of these respondents, 71% (n=164) of hospitals purportedly performed such an audit and similar numbers either did not perform audits (14%, n=32) or did not know whether audits were performed (15%, n=35).

Audits of antibiotic prescribing were less likely to be undertaken in small specialist hospitals (p=0.002). It was more likely that audits were performed in large teaching hospitals (p=0.034) and where pharmacists (p=0.001) and medical microbiologists (p=0.001) undertook antibiotic prescribing control.

ii). Most Recent Audit Performance

Respondents (n=164) were asked when the last audit of antibiotic prescribing had been undertaken, and were provided with several review periods. Responses were provided by 163 respondents, and these results are summarised in Table 5.6.

Table 5.6: The timing of the most recent audit of antibiotic prescribing, as reported by pharmacists (n=163).

Most Recent Audit Performance	Number of hospitals
During the last year	97 (60%)
1-2 years ago	44 (27%)
2-3 years ago	15 (9%)
Other	2 (1%)
Don't Know	5 (3%)

It was less likely that audits had been performed within the last year in small DGHs (p=0.045) than in the other hospital types. However, hospitals where medical microbiologists performed antibiotic prescribing control had a greater chance of having had an antibiotic prescribing audit performed within the last year (p=0.009).

iii). Staff Involvement in Audit Performance

The 164 respondents whose hospitals perform audits of antibiotic prescribing were asked which staff were involved, and were provided a list of staff types. Responses were received from 158 (96%) hospitals, and these results are summarised in Table 5.7.

Table 5.7: Staff involved in audits of antibiotic prescribing, as reported by pharmacists (n=158).

Staff involved	Number of hospitals
Clinicians	35 (22%)*
Pharmacists	146 (92%)
Medical Microbiologists	79 (50%)
Auditing Department	43 (27%)
Other	10 (6%)

*Please Note: These percentages do not total 100% because more than one staff type might have been involved.

Pharmacists purportedly performed antibiotic prescribing audits alone in 45 hospitals, whilst other professionals were also involved in the other 101 hospitals. None of the hospital parameters examined affected whether pharmacists performed audits alone or if other professionals contributed ($p > 0.05$ in all cases). Medical microbiologists were more likely to be involved in audits of antibiotic prescribing in large teaching hospitals ($p = 0.016$), hospitals with a specialist ID unit ($p = 0.029$) and in hospitals where they were involved in antibiotic prescribing control ($p = 0.012$).

5.2 Discussion

The aim of this part of the study was to identify the roles of pharmacists and medical microbiologists in antibiotic prescribing control activities, as reported by pharmacists. The first section of this questionnaire identified that 93% of UK NHS hospitals had at least one antibiotic prescribing control document (Chapter 4). However, previous studies have identified prescriber compliance with institutional document recommendations of between 38% and 92%^{318, 18, 275, 278, 294, 319-321}, and interventions by other healthcare staff are often necessary to improve prescriber compliance with institutional documents²⁹⁴.

Although the roles of pharmacists and medical microbiologists in antibiotic prescribing improvement activities were considered in the BSAC's 1990 survey⁹¹, the present study has investigated their involvement in greater depth. Also, since 1990 pharmacists have developed an increased role in antibiotic prescribing improvement⁹¹, including the establishment of specialist "infectious diseases pharmacists"³²², who were employed by approximately one-third of NHS Trusts in 2000³²³.

Although the present questionnaire was addressed to Chief Pharmacists, the respondents were not a homogenous group (chief pharmacists 37%, clinical pharmacists 31%, principal pharmacists 24%) and their answers may reflect this.

5.2.1 Performance of Antibiotic Prescribing Control

One of the objectives was to analyse whether pharmacists and medical microbiologists purportedly performed an antibiotic prescribing control role, and if such activity was performed on every ward or only in selected units.

Pharmacists were reported to perform antibiotic prescribing control in 86% of hospitals. This result is of the same order as that identified by a 1992 survey of pharmacy services provided in UK NHS Hospitals, where pharmacists monitored general drug therapy in 93% of hospitals²⁷. It is encouraging that such a clinical pharmacy service was provided by the majority of UK NHS hospitals in the present study because it offers the benefits of reduced prescribing errors, prescriber education¹ and cost-effective drug choice³²⁴⁻³²⁶. Clinical pharmacists are ideally placed to intervene in the prescribing process to ensure compliance with

institutional documents containing prescribing recommendations^{327 328 111 329 88 330,}
³³¹ and formulary enforcement has become an increasingly important aspect of their
job^{167, 332-334}. The SMAC report identified pharmacists' responsibilities in
promoting improved antibiotic prescribing by advising prescribers on antibiotic
prescribing issues, enforcing prescribing policies and auditing adherence with
prescribing guidelines¹.

Pharmacists were reported to only visit selected units in one-fifth of the hospitals
where antibiotic prescribing control was performed. Unfortunately, in most cases,
the respondent failed to specify the nature of this unit, but the Intensive Care Unit
(ICU) was the unit most often cited. However, patients on any ward may contract
an infection and it is therefore of concern that prescribing was only controlled on
every ward in about two-thirds of the responding hospitals. It would be interesting
to investigate why only some units had been visited in certain hospitals and this
should be put into the context of a well-reported recruitment and retention problem
within the UK hospital pharmacy service. Although respondents were not requested
to state the reasons for pharmacists failing to provide an antibiotic prescribing
control service, several respondents annotated this question to indicate that a lack of
staff had prevented this service. The announcements that Chief Pharmacists had
responsibility for developing clinical pharmacy activities to promote prudent
antimicrobial prescribing¹⁶⁸, and that NHS hospital pharmacists would receive £12
million over the next three years to monitor and control the use of antibiotics³³⁵,
should facilitate this. It is also essential that prescribers co-operate with such a
prescribing improvement service¹⁷⁴ and that pharmacists have a consultative rather
than a restrictive approach⁶¹.

Pharmacists may also check prescribing compliance at the supply stage in the dispensary, although it is preferable for pharmacists to review patients' therapy at the ward-level because this prevents the prescription chart from leaving the patient. Tulip and Campbell identified that pharmacists based on ward teams have a greater likelihood of interventions being accepted than those based in a "standard pharmacy-based service"¹⁵². Relationships and "facilitative" communication may be improved by the clinical pharmacy service^{336, 337} and pharmacy-based antimicrobial monitoring systems result in a constructive educational relationship between prescribers and pharmacists in combination with a positive impact upon prescribing patterns^{331, 338}.

The BSAC's 1990 study⁹¹ indicated that pharmacists controlled prescribers' compliance with institutional documents in 65% of hospitals, and therefore the result of their involvement of the present study (86%), show increased performance of this activity.

Responses on the role of medical microbiologists were received from fewer pharmacist respondents, and many pharmacists did not know about the role of their colleague. Where medical microbiologists checked antibiotic prescribing, in most cases this was reportedly only done on selected units. This may reflect the former's traditionally reactive approach³³⁹, although there has been recent emphasis on their direct input into clinical care¹⁷², but other factors may contribute to this finding. Considerably fewer medical microbiologists are employed in a hospital than pharmacists and there is a reported lack of medical microbiologists^{340, 341}, coupled with increased duties³⁴⁰. Non-compliance was controlled by medical

microbiologists in a similar proportion of hospitals in the BSAC study (56%) and the present study (62%).

Medical microbiologists were significantly less likely to perform an antibiotic prescribing control service in smaller and specialist hospitals, presumably because these hospitals are less likely to employ a full-time medical microbiologist who may divide their time between several sites. It is interesting that medical microbiologists in English hospitals were more likely to perform this role than their Scottish colleagues, which may reflect different case-loads and staff duties.

In contrast to pharmacists, the majority of medical microbiologists were reported to perform antibiotic prescribing control only in selected units. In most cases this was the ICU and this might reflect that medical microbiologists tend to routinely visit severely ill patients with complicated infections on the ICU but are also contactable for advice on any other patient in the hospital⁶⁵. Similarly, a survey of Consultants in the Public Health Laboratory Service South West region identified that the unit most often visited by medical microbiologists was the ICU¹⁷².

The present study has investigated the individual role of pharmacists and medical microbiologists in antibiotic prescribing control. In hospitals where both pharmacists and medical microbiologists performed this role, it is not possible to speculate whether these individuals performed this activity in isolation, or in collaboration with the other professional.

In hospitals where antibiotic prescribing control was not performed by either staff, it does not necessarily mean that there is no enforcement activity because antibiotic prescribing may be improved by other methods (e.g. clinical audits). Education has also been shown to have a positive effect in encouraging rational antibiotic prescribing³⁴²⁻³⁴⁶, and pharmacists based in Medicine Information services can provide an important source of advice for prescribers¹⁵³.

5.2.2 Factors Reviewed During Antibiotic Prescribing Control

In hospitals where pharmacists performed antibiotic prescribing control they were reported to review most of the stipulated factors in the majority of cases. This indicates that where antibiotic prescribing was checked, it was done thoroughly.

However, there was some indication that pharmacists considered the drug regimen length in somewhat fewer hospitals than the other factors. This is of some concern because the correct length of an antibiotic course is vital in ensuring elimination of the infection without promoting the development of antibiotic resistance³¹⁸. However, there have been reports of antibiotics being prescribed for excessively long durations³⁴⁷ and pharmacists are ideally placed to prevent such inappropriate use²⁷⁹. The DoH has identified an important role for pharmacists in the provision of advice regarding suitable durations of antibiotic regimens⁸.

Medical microbiologists were reported to review fewer factors in their control process than pharmacists. This emphasises that a review role accounts for a larger proportion of clinical pharmacists' workload than that of their medical

microbiologist colleagues, who may be requested by a prescriber to look at only one specific review factor³⁴⁸.

Unfortunately a substantial number of the pharmacist respondents failed to answer the question for factors reviewed by medical microbiologists. It is possible that although pharmacists were aware that medical microbiologists performed such a role, they were not conversant with the nature of the process, and this is a limitation of depending on indirect reporting of one healthcare professional on the other's role.

5.2.3 Frequency of Antibiotic Prescribing Control

The present study has shown that hospital pharmacists have a routine role in the performance of antibiotic prescribing control. Although pharmacists reportedly carried out antibiotic prescribing control in response to a prescriber's request, in all but one hospital this was combined with other prescribing review functions driven by the Pharmacy Department. It was encouraging that daily control was reportedly performed in the majority of hospitals because a Special Interest Group of the Regional Pharmaceutical Officers agreed a standard in 1991 that all prescriptions should be reviewed by a pharmacist before the first dose is administered³¹⁰. This is a similar result to that identified by a survey performed in 1992¹⁵⁴, where pharmacists purportedly reviewed general therapy daily on weekdays for short-term patients in 90% of 392 hospitals examined. However most hospitals offer a limited service on weekends and Bank Holidays¹⁵⁴, which can result in a significantly longer time between prescription writing and review¹⁴⁵ and there have been calls for extended Pharmacy Department opening¹⁴⁵. On reflection, this

question may have been a little ambiguous because some hospitals may operate a service only on weekdays, whilst others may also cover weekends, and the wording of the question did not allow differentiation between these frequencies.

Almost one-quarter of pharmacist respondents who stated that medical microbiologists perform antibiotic prescribing control in their hospital did not know how often their colleagues performed this function. This is of concern, because it would be hoped that the Chief Pharmacist (or their representative, such as an “infectious diseases pharmacist”) and medical microbiologists would collaborate on antibiotic prescribing improvement.

Medical microbiologists were reportedly more than twice as likely as pharmacists to check antibiotic prescribing when specifically requested by the prescriber, which emphasises the consultative nature of their service^{339, 348}. However, if antibiotic prescribing control is only performed when requested by the prescriber then problems with other regimens for which the medical microbiologist is not consulted will remain unnoticed.

5.2.4 Communication of Interventions with the Prescriber

An objective was to identify which methods were employed in the communication process between the reviewer and the prescriber.

Although the uptake by prescribers of prescribing improvement interventions from other staff has been the subject of various studies^{349, 279, 350, 351, 352}, there has been little consideration of the use of inter-professional communication methods. It is

necessary that staff communicate problems professionally³⁵³ because their efficacy in promoting rational drug use is dependent upon physicians' willingness to accept their interventions³⁵⁴.

The majority of pharmacists and medical microbiologists were reported to discuss problems directly with the prescriber. Direct communication ensures that the prescriber acknowledges a problem with an antibiotic prescription, whilst enabling the reviewer to suggest a solution. In a study of physician acceptance of pharmacist interventions, direct verbal communication meant that the physician was more likely to accept the recommendation than when it was recorded in writing ($p < 0.001$)³⁴⁹. It was not possible to classify how many verbal interactions were performed face-to-face or via the telephone in the present study (an important communication medium, especially for medical microbiologists^{173, 348}), and this would make an interesting future study.

In a number of hospitals where verbal communication was used, the intervention was purportedly not also documented on the prescription or in the medical record. Verbal communication employed in isolation, i.e. during a ward round, may have important consequences for risk management because advice may be misunderstood³³⁹. Written records of interventions, in combination with verbal communication, should be encouraged because they enable the prescriber to refer to the problem at a later date, ensure all professional staff involved in the patient's care are aware of the problem, fulfil the requirement of clinical governance regarding "paper trails" and in an increasingly litigious culture provide evidence of action upon perceiving a problem with drug therapy³⁵⁵.

Pharmacists were more likely to annotate the prescription chart than were medical microbiologists, and three-quarters of pharmacists performed this activity. A possible advantage of annotating the prescription chart is that it may provide a trigger for nurses to double-check a perceived problem with the prescriber.

Although annotation within the medical record was not included in the list of answer options provided by the questionnaire, it was often cited by respondents in the free response section and was subsequently included in the data analysis of the study. The patient's medical record should contain detailed information relevant to their hospital stay and should enable all healthcare professionals access to up-to-date information³⁰. The General Medical Council has recognised that record-keeping is essential for documenting the interaction between physicians and patients and the record functions as a permanent on-going statement of care and may be useful in medicolegal disputes³⁵⁶. Medical microbiologists were more likely than pharmacists to document information in the patient's medical record, perhaps due to their medical background. There is a need to encourage pharmacists to use this communication method¹⁵² and a 1995 survey identified that 27% (n=100) of pharmacist interventions required entry into the patient record. This was beneficial to pharmacists in emphasising their important professional contribution to the multidisciplinary patient team³⁵⁷. However, the results of the present study about documentation in medical records should be interpreted with some caution, because this answer option was not included in the questionnaire.

Pharmacists and medical microbiologists were reported to participate in ward rounds in approximately one-half of hospitals. The inclusion of pharmacists in this

activity promotes their role as advisors on drug use³⁵⁸, has been associated with decreased mortality³⁵⁹, and 58% (n=449) of US physicians surveyed in 1998 expected pharmacists to be available for consultation at the point of seeing patients³⁵⁴. The medicines management strategy has emphasised the importance of pharmacist participation on ward rounds²⁰ because this decreases adverse drug effects by avoidance of prescribing errors and contributes to prescriber education^{31,32 20}. Such participation can also decrease costs³²⁷ and increase prescribers' knowledge of antibiotics³⁶⁰. It is interesting to note, however, that in a 1992 survey of 414 UK hospital pharmacy services, pharmacists were found to participate in medical ward rounds in 78% of hospitals¹⁵⁴ compared to 57% in the present study. There is, therefore, a suggestion that clinical pharmacy services provision in UK hospitals may be contracting and this warrants further study. The inclusion of a medical microbiologist on ward rounds is a key component of the continuing education of those specialists and other physicians, as well as attracting junior staff into the speciality¹⁷³. Two questions addressed whether pharmacists and medical microbiologists attended ward rounds; frequency of control and communication of interventions. Different frequencies were reported for the two questions. It is not clear why pharmacists were reported to attend ward rounds in more hospitals in the latter question, although some may specifically join the round to communicate problems with drug therapy.

In almost one-half (45%) of hospitals where antibiotic prescribing control was performed, pharmacists were reported to communicate interventions verbally, annotate prescriptions and attend ward rounds. This combination of methods appears to constitute best practice and it is recommended that this combination be

employed in all hospitals. A previous study identified that medical microbiologists documented clinical advice in a variety of formats and standardisation was important³³⁹. Prescribers frequently move between hospitals and standardisation of communication methods should improve their awareness of problems. In the future, the use of electronic Personal Digital Assistants (pdas) could also enable quicker data-entry and information transfer between colleagues³⁶¹.

This study has investigated the use of different methods to communicate interventions, but not the efficacy of such methods, which would make an interesting study.

5.2.5 Antibiotic Prescribing Audits

One of the objectives of the present study was to identify the prevalence and nature of audits of antibiotic prescribing.

Audits of antibiotic prescribing were reported to be performed in the majority of hospitals. The prevalence of audits was much greater in the present study (71%) than in the BSAC's study of 1990 (11%), which suggests effective implementation of key components of the clinical governance and effectiveness agenda. Clinical audit assesses the quality of clinical care against hospital standards³³, and it has become an integral part of NHS policy³⁴. Whilst prescription review by pharmacists and medical microbiologists offers an ongoing type of feedback³⁶², clinical audits are important components of any antibiotic prescribing improvement programme in a continuous-improvement strategy^{184, 185, 363}. Audits provide an analysis of prescribing patterns over a period of time and enable the comparison of

antibiotic prescribing by different teams, and individual prescribers within those teams³⁶³. The House of Lords' Select Committee Report recommended that development of doctors' prescribing should be aided by audit and feedback (Recommendation 11.7)³.

Audits of antibiotic prescribing were less likely to be performed in small hospitals, possibly because such hospitals tend to care for fewer patients. Audit performance was associated with the performance of antibiotic prescribing control by pharmacists and medical microbiologists, which suggests that such hospitals place greater importance on antibiotic prescribing improvement activities. Audits were also more likely to have been performed in large teaching hospitals, possibly because such hospitals may employ specific research staff.

Audits can be time-consuming, and this may have prevented their performance in some hospitals, although the process could be helped by the availability of electronic records²⁷⁶. Some respondents did not know if an antibiotic prescribing audit had been performed, possibly because they thought that an audit had been performed but had not been informed of its results. However, the Pharmacy Department has an important role in monitoring and improving prescribing throughout the hospital, and should be made aware of any such audits performed by members of other departments. An audit of the empirical antibiotic treatment of CAP according to institutional antibiotic prescribing guidelines has been included in this research programme (Chapter 10).

A positive finding was that the majority of antibiotic prescribing audits were reported as having been performed within the past 2 years. Prescribers often move between different hospitals, especially junior physicians, and it is necessary to identify whether such staff are compliant with institutional recommendations. Regular auditing complies with the requirements of a “feedback loop”, because re-auditing is essential for analysing whether feedback has resulted in consequent improvement of prescribing patterns. Studies have identified beneficial effects of audit on practice lasting over a year^{363 364}, which can be attributed to a close working relationship between clinical pharmacists and their attachment wards³⁶⁴. In the present study, antibiotic prescribing audits were more likely to have been performed within the last year in hospitals where antibiotic prescribing control was performed by medical microbiologists and it is possible that they drive the auditing process, whilst pharmacists actually undertake this activity.

Pharmacists were reportedly involved in audits of antibiotic prescribing in almost all hospitals and this appears to show an expansion of the pharmacist’s role in this area compared to Cotter et al’s 1992 study, when pharmacists contributed to medical audit in only one-half of the 410 hospitals examined¹⁵⁴, although it is difficult to compare these studies’ results due to differences in question wording. This indicates that pharmacists are participating in regular auditing of prescribing as recommended by UK policy^{8, 20} and one of the recommendations of the SACAR “pharmacy initiative” was that pharmacists analyse antimicrobial use and provide feedback to prescribers⁸⁸. Leadership and continuous co-ordination of drug-use evaluation programmes by pharmacists has often been necessary in the performance of such an activity³⁶⁵ and a survey indicated that 79% (n=33) of

doctors were amenable to the involvement of pharmacists in medical audits³⁶⁶. A survey of 323 American hospitals in 1992 identified that pharmacists participated in five related activities in 67% (n=215) of hospitals; prepared criteria, gathered quantitative data, interpreted and reported findings, performed interventions and educational programmes, and co-ordinated the day-to-day aspects of the programme³⁶⁵. It would be interesting to investigate whether UK staff collaborate on such audits, as collaboration has been advocated by the multidisciplinary clinical directorate³⁶⁷.

Although beyond the scope of the present study, appropriate feedback is vital for resultant prescribing improvement¹¹, and it is essential that drug-use data is linked to patient data to evaluate whether drugs were prescribed according to institutional recommendations¹⁸⁶.

5.3 Conclusion

This part of the study has investigated the role of pharmacists and medical microbiologists in checking whether prescribing complies with the recommendations of antibiotic prescribing control documents in UK NHS hospitals, as reported by pharmacists. The objectives were to identify the nature and location of such a control process, frequency of performance, communication of interventions with prescribers and the performance of audits of antibiotic prescribing.

Pharmacists apparently thought that they offered a proactive service, compared to the more reactive nature of the involvement of medical microbiologists. However,

antibiotic prescribing was not controlled by pharmacists on all wards every day, and there is a need for service expansion. Hopefully the announcement of increased funding will be helpful in this respect. Variation was seen in the methods used to communicate interventions, and a national strategy for standardisation would be helpful. A positive finding was that most hospitals perform audits of antibiotic prescribing, the majority of which had been performed within the past two years.

The main findings of this study are;

- There was poor awareness about the other professionals' role in antibiotic prescribing control; 39% of pharmacist respondents did not know the role of medical microbiologists.
- Pharmacists were reported to perform antibiotic prescribing control in 86% (n=189) of hospitals and where this function was performed, the majority of pharmacists (77%, n=149) reportedly visited every ward. Antibiotic prescribing control was reportedly performed in 189 hospitals in total; only by pharmacists in 107 hospitals, and medical microbiologists also performed this role in 82 hospitals.
- Pharmacists were reported to consider more review factors than medical microbiologists, and the combination of factors most often reviewed by pharmacists was drug, drug dosage, drug regimen length, drug-drug interactions and patient factors (74%, n=139).
- Pharmacists were reported to perform antibiotic prescribing control most often on a daily basis (85%, n=160).

- Verbal communication was reportedly the most frequent communication method employed by pharmacists to inform prescribers of a problem with a prescribed empirical antibiotic regimen (94%, n=175).
- Medical microbiologists were reported to perform antibiotic prescribing control in 62% (n=82) of hospitals, where pharmacists purportedly knew the role of staff in antibiotic prescribing control. Medical microbiologists tended to only visit a selected unit (77%, n=63) rather than every ward.
- In no hospitals did medical microbiologists, but not pharmacists, perform antibiotic prescribing control.
- Almost one-third of medical microbiologists were reported as only checking one factor (32%, n=22) in their control process.
- Antibiotic prescribing audits had been performed in the majority of hospitals (71%, n=164) and had mostly been performed within two years (87%, n=141).
- Both pharmacists and medical microbiologists had been involved in antibiotic prescribing audits, although pharmacists had undertaken this activity in the vast majority of hospitals (92%, n=146) whilst medical microbiologists had only been involved in one-half of hospitals (50%, n=79).
- Medical microbiologists were reported as being more often specifically requested to perform antibiotic prescribing control by the prescriber (50%, n=38) than were pharmacists.
- Verbal communication was the most frequent communication method used by medical microbiologists (76%, n=50). However, a considerable

proportion of these staff did not also provide written documentation of the intervention.

Chapter 6 Comparison of the roles of pharmacists and medical microbiologists in antibiotic prescribing control-as reported by pharmacists and medical microbiologists

Chapter 5 examined the results of a questionnaire completed by pharmacists about the role of pharmacists and medical microbiologists in enforcing adherence with document recommendations for antibiotic prescribing. This chapter describes and discusses the responses of medical microbiologists to a similar questionnaire. There was no overlap in time between the questionnaires mailed to pharmacists and those mailed to medical microbiologists and it was considered that there would be negligible collusion between these staff in completing the questionnaires. The objectives of the study were the same as Chapter 5;

- To identify whether pharmacists and medical microbiologists monitor prescribing adherence with institutional prescribing recommendations.
- To identify what factors are reviewed in this control process.
- To identify how often this control process is performed.
- To examine the methods used for communicating resultant interventions to prescribers.
- To examine the prevalence and nature of audits of antibiotic prescribing.

This chapter describes the results of the second section of the questionnaire, “Antibiotic Prescribing Documents, Survey 2002”, sent to the Chief Medical Microbiologist at 273 UK NHS hospitals in 2002. A copy of this questionnaire is included in Appendix B. Summary tables of responses from pharmacists and medical microbiologists have been included to identify trends of major disagreement between this study and the pharmacist survey. The results of the two surveys can not be directly compared because the respondents are from different hospital groups. However, apparent areas of disagreement will then be examined in the paired-respondent sample in Chapter 7. The results for the involvement of pharmacists and medical microbiologists as reported by pharmacists are taken from Chapter 5.

6.1 Results

6.1.1 Response Rate

Three successive mailings were sent to the 273 Chief Medical Microbiologist recipients and the number of questionnaires returned for each mailing is summarised in Table 6.1.

Table 6.1: The proportion of questionnaires returned by medical microbiologists after successive mailings.

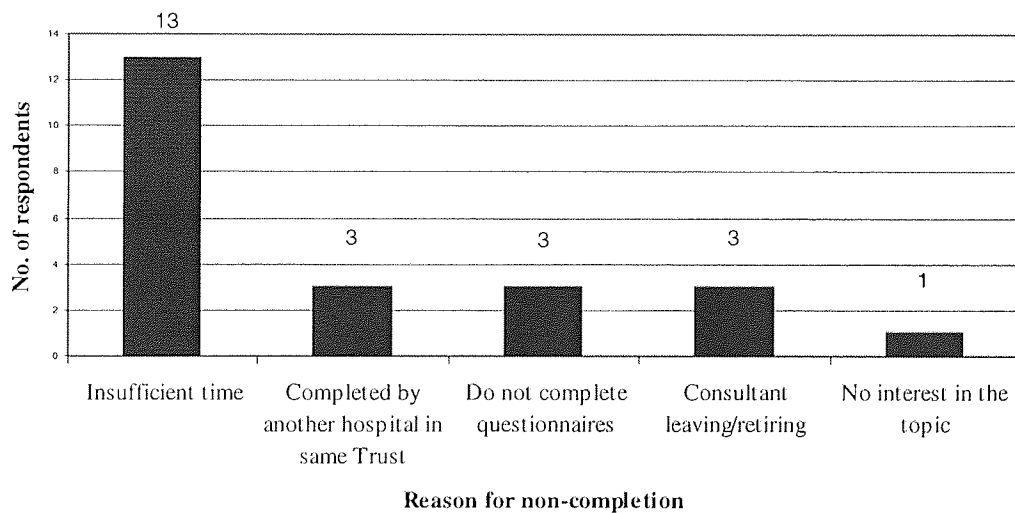
Questionnaire mailing	Number of questionnaires returned	Cumulative total of questionnaires returned	Returned questionnaire as a proportion of total sent (%)
1 st	67	67	25
2 nd	59	126	46
3 rd	28	154	56

Of the 273 questionnaires mailed, 56% (n=154) were returned and of these 131 were completed (a 48% response rate).

6.1.2 Reasons for Non-Completion

Chief Medical Microbiologists from 23 hospitals returned the questionnaire but had not completed it. These recipients all specified a reason for non-completion, and these results are depicted in Figure 6.1

Figure 6.1: Reasons for non-completion of the questionnaire by medical microbiologists (n=23).



6.1.3 Parameters of Respondents' Hospitals

A valid response about the nature of the hospital was provided by 130 of the 131 hospitals; 75% (n=98) were DGHs, 20% (n=26) were teaching hospitals and 5% (n=6) were specialist units. A specialist ID unit was present in 11% (n=15) of hospitals. When classified by bed numbers, 30% (n=39) of hospitals had less than 500 beds, 57% (n=73) had between 501 and 1000 beds and 13% (n=16) had more

than 1000 beds. Three respondents failed to specify the size of their hospital. These hospital parameters are summarised in Table 6.2.

Table 6.2: Analysis of respondent hospitals by type, bed size and ID unit, as reported by medical microbiologists (n=130).

Hospital Type (n=130)	0-500 beds (n=39)	501-1000 beds (n=73)	1000+ beds (n=16)	Missing/Don't Know (n=3)	Specialist ID Unit (n=15)
Specialist 6 (5%)	5	0	0	1	1 (7%)
District General 98 (75%)	30	62	4	2	4 (27%)
Teaching 26 (20%)	4	10	12	0	10 (67%)

6.1.4 Availability of Antibiotic Prescribing Control Documents

Respondents were asked whether their hospital had an antibiotic formulary, policy, and/or guidelines (defined on page 53, Chapter 3). Eighty-four percent (n=91) of the hospitals had an antibiotic formulary (or other similar document), 65% (n=62) had an antibiotic policy and 97% (n=124) had antibiotic guidelines. Table 6.3 summarises these responses, which are broadly similar to those of the pharmacist survey (Table 4.6).

Table 6.3: The availability of antibiotic prescribing control documents, as reported by medical microbiologists.

Document Type	Valid response	Yes	Other Similar	No	Don't Know
Formulary	109	90 (83%)	1 (1%)	13 (12%)	5 (5%)
Policy	95	56 (59%)	6 (6%)	30 (32%)	3 (3%)
Guidelines	128	122 (95%)	2 (2%)	4 (3%)	0 (0%)

6.1.5 Performance of Antibiotic Prescribing Control

One hundred and twenty-eight respondents' hospitals had antibiotic prescribing control documents, and these respondents were asked whether their hospital's pharmacists and medical microbiologists performed antibiotic prescribing control. Responses were received from 123 (96%) hospitals about medical microbiologists' performance of antibiotic prescribing control and from 125 (98%) hospitals about pharmacists' control. One-fifth of these medical microbiologist respondents (20%, n=25) did not know the role of pharmacists, whilst 2% (n=3) did not know the role of medical microbiologists. The results for the roles of pharmacists and medical microbiologists as reported by medical microbiologists are summarised in Table 6.4.

Table 6.4: Antibiotic prescribing control performed by pharmacists and medical microbiologists in UK NHS hospitals, as reported by medical microbiologists.

Staff	Response	Yes Every ward	Yes Selected units	No
<i>Pharmacists</i>	100	57 (57%)	23 (23%)	20 (20%)
<i>Medical Microbiologists</i>	120	19 (16%)	49 (41%)	52 (43%)

The results were broadly similar to those from the pharmacist study (Table 6.5 and Table 6.6).

Table 6.5: A summary of the results for performance of antibiotic prescribing control by pharmacists, as reported by pharmacists and medical microbiologists.

Performance of antibiotic prescribing control	As reported by pharmacists (%)	As reported by medical microbiologists (%)	Difference (%)
<i>Yes-Every ward</i>	66	57	9
<i>Yes-Selected units</i>	20	23	3
<i>No</i>	14	20	6

Table 6.6: A summary of the results for performance of antibiotic prescribing control by medical microbiologists, as reported by pharmacists and medical microbiologists.

Performance of antibiotic prescribing control	As reported by pharmacists (%)	As reported by medical microbiologists (%)	Difference (%)
<i>Yes-Every ward</i>	14	16	2
<i>Yes-Selected units</i>	48	41	7
<i>No</i>	38	43	5

6.1.6 Factors Reviewed during Antibiotic Prescribing Control

In this questionnaire study, medical microbiologists had previously reported that pharmacists performed antibiotic prescribing control in 80 hospitals and that medical microbiologists performed antibiotic prescribing control in 68 hospitals (Table 6.4). Responses were received from medical microbiologists from 76 (95%) hospitals about the nature of antibiotic prescribing control performed by pharmacists and from 65 (96%) hospitals about medical microbiologists' performance of this role. These results are summarised in Table 6.7.

Major areas of apparent disagreement between pharmacists and medical microbiologists concerned whether pharmacists checked patient factors in their control process (Table 6.8), and whether medical microbiologists checked the drug, drug dosage, drug regimen length and drug-drug interactions (Table 6.9).

Table 6.7: Factors reviewed during antibiotic prescribing control by pharmacists and medical microbiologists, as reported by medical microbiologists.

Factor Definition	Number of hospitals where pharmacists reviewed this factor (n=76)	Number of hospitals where medical microbiologists reviewed this factor (n=65)
<i>Drug/s in accordance with prescribing document recommendations</i>	62 (82%)	61 (94%)*
<i>Drug/s Dosage in accordance with prescribing document recommendations</i>	66 (87%)	50 (77%)
<i>Drug Regimen Lengths in accordance with prescribing document recommendations</i>	58 (76%)	49 (75%)
<i>Drug/Drug Interactions exist between empirical regimen and other therapy which justify deviation from recommendation</i>	62 (82%)	36 (55%)
<i>Patient Factors exist which justify deviation from empirical regimen recommended (e.g. penicillin allergy/poor renal function)</i>	53 (70%)	53 (82%)
<i>Other</i>	1 (1%)	3 (5%)
<i>Don't Know</i>	6 (8%)	1 (2%)

*Please Note: These percentages do not total 100% because more than one factor may have been reviewed.

Table 6.8: A summary of the results for factors reviewed by pharmacists in antibiotic prescribing control, as reported by pharmacists and medical microbiologists.

Factor Definition	As reported by pharmacists (%)	As reported by medical microbiologists (%)	Difference (%)
<i>Drug/s in accordance with prescribing document recommendations</i>	95	82	13
<i>Drug/s Dosage in accordance with prescribing document recommendations</i>	94	87	7
<i>Drug Regimen Lengths in accordance with prescribing document recommendations</i>	86	76	10
<i>Drug/Drug Interactions exist between empirical regimen and other therapy which justify deviation from recommendation</i>	97	82	15
<i>Patient Factors exist which justify deviation from empirical regimen recommended (e.g. penicillin allergy/poor renal function)</i>	96	70	26

Table 6.9: A summary of the results for factors reviewed by medical microbiologists in antibiotic prescribing control, as reported by pharmacists and medical microbiologists.

Factor Definition	As reported by pharmacists (%)	As reported by medical microbiologists (%)	Difference (%)
<i>Drug/s in accordance with prescribing document recommendations</i>	65	94	29
<i>Drug/s Dosage in accordance with prescribing document recommendations</i>	43	77	34
<i>Drug Regimen Lengths in accordance with prescribing document recommendations</i>	41	75	34
<i>Drug/Drug Interactions exist between empirical regimen and other therapy which justify deviation from recommendation</i>	22	55	33
<i>Patient Factors exist which justify deviation from empirical regimen recommended</i>	59	70	11

Table 6.10 summarises the number of factors reviewed by pharmacists and medical microbiologists.

Table 6.10: The number of factors reviewed by pharmacists and medical microbiologists in the antibiotic prescribing control process, as reported by medical microbiologists.

Number of review factors considered in the control process	Number of hospitals where pharmacists reviewed this number of factors (n=76)	Number of hospitals where medical microbiologists reviewed this number of factors (n=65)
1	5 (7%)	3 (5%)
2	7 (9%)	11 (17%)
3	9 (12%)	6 (9%)
4	15 (20%)	20 (31%)
5	40 (53%)	23 (35%)
6	0	2 (3%)

The results trends were broadly similar for the number of factors checked by pharmacists, although medical microbiologists thought that pharmacists checked 5 factors in less hospitals than pharmacists reported (Table 6.11).

Table 6.11: A summary of the results for number of factors reviewed by pharmacists in antibiotic prescribing control, as reported by pharmacists and medical microbiologists.

Number of review factors considered in the control process	As reported by pharmacists (%)	As reported by medical microbiologists (%)	Difference (%)
1	2	7	5
2	2	9	7
3	3	12	9
4	13	20	7
5	77	53	24
6	5	0	5

Noticeable variation was apparently seen in the results for how many factors medical microbiologists checked in their antibiotic prescribing control process, with pharmacists apparently under-estimating the number of factors that medical microbiologists reportedly checked.

Table 6.12: A summary of the results for number of factors reviewed by medical microbiologists in antibiotic prescribing control, as reported by pharmacists and medical microbiologists.

Number of review factors considered in the control process	As reported by pharmacists (%)	As reported by medical microbiologists (%)	Difference (%)
1	32	5	27
2	22	17	5
3	18	9	9
4	16	31	15
5	12	35	23
6	0	3	3

6.1.7 Frequency of Antibiotic Prescribing Control

Medical microbiologists had previously reported that pharmacists performed antibiotic prescribing control in 80 hospitals and that medical microbiologists performed antibiotic prescribing control in 68 hospitals (Table 6.4). Responses were received from medical microbiologists from 73 (91%) hospitals about the frequency of pharmacists' antibiotic prescribing control and from 66 (97%) hospitals about medical microbiologists' control. These results are summarised in Table 6.13.

Table 6.13: The frequency of antibiotic prescribing control performed by pharmacists and medical microbiologists, as reported by medical microbiologists.

Frequency	Number of hospitals where pharmacists performed this frequency (n=73)	Number of hospitals where medical microbiologists performed this frequency (n=66)
<i>Daily as part of a routine clinical ward service</i>	59 (81%)	38 (58%)*
<i>Weekly as part of a routine clinical ward service</i>	6 (11%)	8 (12%)
<i>During participation in a routine Consultant ward</i>	7 (10%)	28 (42%)
<i>When requested by the prescriber</i>	12 (16%)	34 (52%)
<i>Other</i>	5 (7%)	15 (23%)
<i>Don't Know</i>	10 (14%)	0
<i>Never</i>	0	0

*Please Note: These percentages do not total 100% because more than one frequency may have been employed.

Major areas of apparent disagreement between the medical microbiologist and pharmacists respondents concerned whether pharmacists participated in Consultant ward rounds (Table 6.14) and whether medical microbiologists performed daily control (Table 6.15).

Table 6.14: A summary of the results for frequency of antibiotic prescribing control by pharmacists, as reported by pharmacists and medical microbiologists.

Frequency of review	As reported by pharmacists (%)	As reported by medical microbiologists (%)	Difference (%)
<i>Daily as part of a routine clinical ward service</i>	85	81	4
<i>Weekly as part of a routine clinical ward service</i>	13	11	2
<i>During participation in a routine Consultant ward round</i>	30	10	20
<i>When requested by the prescriber</i>	23	16	9

Table 6.15: A summary of the results for frequency of antibiotic prescribing control by medical microbiologists, as reported by pharmacists and medical microbiologists.

Frequency of review	As reported by pharmacists (%)	As reported by medical microbiologists (%)	Difference (%)
<i>Daily as part of a routine clinical ward service</i>	25	58	33
<i>Weekly as part of a routine clinical ward service</i>	18	12	6
<i>During participation in a routine Consultant ward round</i>	29	42	13
<i>When requested by the prescriber</i>	50	52	2

6.1.8 Communication of Interventions with the Prescriber

Medical microbiologists had previously reported that pharmacists performed antibiotic prescribing control in 80 hospitals and that medical microbiologists performed antibiotic prescribing control in 68 hospitals (Table 6.4). Responses were received from 64 (80%) hospitals about the methods used by pharmacists to communicate interventions to prescribers and from 66 (97%) hospitals about medical microbiologists' communication methods. These results are summarised in Table 6.16.

Table 6.16: Methods employed by pharmacists and medical microbiologists to communicate interventions to prescribers, as reported by medical microbiologists.

Communication method	Number of hospitals where pharmacists used this method (n=64)	Number of hospitals where medical microbiologists used this method (n=66)
<i>Annotation on the prescription</i>	49 (77%)	10 (15%)*
<i>Annotation in the medical record</i>	9 (14%)	30 (45%)
<i>Verbally</i>	9 (14%)	43 (65%)
<i>During participation in a routine Consultant ward-round</i>	46 (72%)	57 (86%)
<i>Other</i>	6 (9%)	8 (12%)
<i>Don't Know</i>	0	0

A major apparent difference between the pharmacist and medical microbiologist respondents concerned whether pharmacists communicated resultant interventions from the antibiotic prescribing control process verbally with the prescriber (Table 6.17).

Table 6.17: A summary of the results for methods of communication used by pharmacists in antibiotic prescribing control, as reported by pharmacists and medical microbiologists.

Communication method	As reported by pharmacists (%)	As reported by medical microbiologists (%)	Difference (%)
<i>Annotation on the prescription</i>	75	77	2
<i>Annotation in the medical record</i>	13	14	1
<i>Verbally</i>	94	14	80
<i>During participation in a routine Consultant ward-round</i>	57	72	15

Table 6.18: A summary of the results for methods of communication used by medical microbiologists in antibiotic prescribing control, as reported by pharmacists and medical microbiologists.

Communication method	As reported by pharmacists (%)	As reported by medical microbiologists (%)	Difference (%)
<i>Annotation on the prescription</i>	15	15	0
<i>Annotation in the medical record</i>	42	45	3
<i>Verbally</i>	76	65	11
<i>During participation in a routine Consultant ward-round</i>	53	86	33

6.1.9 Antibiotic Prescribing Audits

i). Audit Performance

Valid responses were received from 126 of the 128 respondents whose hospitals had antibiotic prescribing control document(s) about whether their hospital undertook audits of antibiotic prescribing. Of these respondents, 79% (n=100) of hospitals purportedly undertook such audits and similar numbers either did not perform audits (12%, n=15) or did not know whether an audit had been performed (9%, n=11).

ii). Most Recent Audit Performance

Responses were provided by 99 respondents of the 100 hospitals where audits of antibiotic prescribing were undertaken to a question about when the last such audit had been performed. These results are summarised in Table 6.19.

Table 6.19: The timing of the most recent audit of antibiotic prescribing, as reported by medical microbiologists (n=99).

Most Recent Audit Performance	Number of hospitals
During the last year	48 (48%)
1-2 years ago	22 (22%)
2-3 years ago	16 (16%)
Other	9 (9%)
Don't Know	4 (4%)

A summary of the results about the timing of the most recent audit, as reported by pharmacists and medical microbiologists is presented in Table 6.20.

Table 6.20: A summary of the results for timing of the most recent audit of antibiotic prescribing, as reported by pharmacists and medical microbiologists.

Most Recent Audit Performance	As reported by pharmacists (%)	As reported by medical microbiologists (%)	Difference (%)
During the last year	60	48	12
1-2 years ago	27	22	5
2-3 years ago	9	16	7

iii). Staff Involvement in Audit Performance

Of the 100 hospitals that performed audits of antibiotic prescribing, responses were received from 95 (95%) hospitals about the staff involved. These results are summarised in Table 6.21.

Table 6.21: Staff involved in audits of antibiotic prescribing, as reported by medical microbiologists (n=95).

Staff involved	Number of hospitals
Clinicians	31 (33%)*
Pharmacists	73 (77%)
Medical Microbiologists	68 (72%)
Auditing Department	30 (32%)
Other	4 (4%)

*Please Note: These percentages do not total 100% because more than one staff type might have been involved.

A summary of the results about the timing of the most recent audit, as reported by pharmacists and medical microbiologists, are summarised in Table 6.22.

Table 6.22: A summary of the results for staff involved in audits of antibiotic prescribing, as reported by pharmacists and medical microbiologists.

Staff involved	As reported by pharmacists (%)	As reported by medical microbiologists (%)	Difference (%)
<i>Clinicians</i>	22	33	11
<i>Pharmacists</i>	92	77	15
<i>Medical Microbiologists</i>	50	72	22
<i>Auditing Department</i>	27	32	5

6.2 Discussion

The aim of this part of the study was to identify the roles of pharmacists and medical microbiologists in antibiotic prescribing control activities, as reported by medical microbiologists. The same questionnaire was also sent to pharmacists, and their responses have been described and discussed in Chapter 5. Although these surveys were drawn from the same sample-frame and included common respondent hospitals, not all the hospitals had a Medical Microbiology Department and not all recipients responded. This means that the collective results from pharmacists and medical microbiologists cannot be directly compared because they come from different hospital cohorts. However, comparison of the trends in results can identify major areas of apparent disagreement between the two respondent groups. These aspects of disagreement were then tested in paired-respondents from the same hospital, described in Chapter 7.

In cases where the trends reported by the medical microbiologists were similar to those reported by pharmacists these aspects have been discussed in Chapter 5 to avoid repetition.

6.2.1 Performance of Antibiotic Prescribing Control

Approximately two-fifths of the respondent pharmacists did not know whether medical microbiologists performed an antibiotic prescribing control function (reported in Chapter 5) and one-fifth of respondent medical microbiologists did not know about the role of pharmacists. This lack of awareness of job roles is a matter of concern because pharmacists and medical microbiologists are healthcare professionals who share an antibiotic prescribing improvement role. This subject of poor inter-disciplinary awareness in relation to antibiotic prescribing control will be discussed further in Chapter 7.

However, where pharmacists and medical microbiologists purportedly knew the role of pharmacists and medical microbiologists in antibiotic prescribing control, their responses were very similar. Where pharmacists were reported to perform antibiotic prescribing control, they apparently mostly visited every ward, whilst medical microbiologists were reported as mostly visiting selected units only. The pharmacist and medical microbiologist respondents also reported similar proportions of staff not performing an antibiotic prescribing control function.

6.2.2 Factors Reviewed During Antibiotic Prescribing Control

Two major areas of disagreement were identified between the pharmacist and medical microbiologist respondents regarding what factors these staff reviewed

during their antibiotic prescribing control process. Medical microbiologists reported pharmacists as checking patient factors in a smaller proportion of hospitals than pharmacists reported (a difference of 26%). In cases where there is a large percentage difference in the responses of pharmacists and medical microbiologists, it is suggested that this might not be solely due to differences in the hospital cohorts. It is possible that medical microbiologists thought that pharmacists' control process was solely based upon checking the drug regimen prescribed but pharmacists actually performed a more holistic review process.

Greater difference between responses from pharmacists and medical microbiologists was apparent when their responses about the nature of the medical microbiologist's antibiotic prescribing control were compared. For four of the stipulated review factors (drug, dosage, regimen length and drug-drug interactions), a difference of about 33% was apparent, with pharmacists apparently underestimating whether medical microbiologists checked these factors compared to the responses of medical microbiologists. This finding was also reflected in the fact that about one-third of pharmacist respondents (the modal group) thought that medical microbiologists checked only one factor in their antibiotic prescribing control process, whilst about one-third of medical microbiologist respondents (the modal group) reported that they considered five of the stated factors in their antibiotic prescribing control.

These noticeable differences in responses could be due to other factors than the difference in the cohorts of hospitals. Possibly it could be due to pharmacists not being fully conversant with the nature of the medical microbiologist's control

process. It should be considered that the questionnaire was addressed to the Chief Pharmacist, who might have been aware that medical microbiologists checked antibiotic prescribing, but were not fully conversant with the nature of their role. It is also possible that medical microbiologists over-estimated the nature of their control role, because the consideration of a professional's job role is a highly sensitive subject²⁶⁵. Agreement between paired-respondents from the same hospital about the factors checked by medical microbiologists in their control process will be further considered in Chapter 7.

6.2.3 Frequency of Antibiotic Prescribing Control

Medical microbiologists reported pharmacists as participating in routine Consultant ward rounds in a smaller proportion of hospitals than that reported by pharmacists (a 20% difference). It is possible that a different clinical style operated in the different hospital cohort. However, such apparent disagreement might have been caused by medical microbiologists not attending the ward round and consequently being unsure about its members, or possibly because pharmacists had over-estimated their involvement in this activity.

The greatest discrepancy for the frequency of medical microbiologists' antibiotic prescribing control was whether it was performed daily, with medical microbiologists reporting a higher frequency than pharmacists (a 33% difference). This finding again suggests poor awareness of the nature of the medical microbiologists' control role, or possibly an over-estimation of activity by medical microbiologists.

6.2.4 Communication of Interventions with the Prescriber

There was great apparent difference between pharmacists and medical microbiologists about whether pharmacists communicated interventions arising from the antibiotic prescribing control process verbally with the prescriber (a 80% difference, with medical microbiologists apparently under-estimating pharmacists' use of this method). This could suggest that medical microbiologists have a limited view of pharmacists communicating only by annotating the prescription chart, or that pharmacists had over-estimated the use of this communication method.

There was disagreement about whether medical microbiologists communicated interventions during participation in a routine Consultant ward round between the pharmacist and medical microbiologist respondents (a 33% difference, with pharmacists apparently under-estimating medical microbiologists' participation in this activity).

Comparing these results, it seems that medical microbiologists thought that pharmacists were more likely to communicate interventions on a ward round, but pharmacists reported that these would be communicated verbally (at another time). There was broad agreement about whether pharmacists and medical microbiologists communicated resultant interventions to the prescriber on prescriptions and in patients' medical records.

6.2.5 Antibiotic Prescribing Audits

Audits of antibiotic prescribing were performed in a similar proportion of hospitals; 71% of the hospitals where a response from a pharmacist was received and 79% of the hospitals where a response from a medical microbiologist was received. There

was more variation about whether an audit had been performed in the past 2 years (87% reported by pharmacists and 70% reported by medical microbiologists).

However, the greatest disagreement between the two respondent groups concerned the role of different staff in performing audits of antibiotic prescribing. It was interesting that more of the medical microbiologist respondents thought that medical microbiologists had been involved in audits of antibiotic prescribing than did pharmacist respondents (72% and 50% respectively). Similarly, more of the pharmacist respondents thought that pharmacists had been involved in audits of antibiotic prescribing than did medical microbiologist respondents (92% and 77% respectively). This could suggest that pharmacists and medical microbiologists had a poor awareness about the role of each other in audit activity. It is also possible that each group had over-estimated their own involvement in this sphere of activity.

6.3 Conclusion

This part of the study has investigated the role of pharmacists and medical microbiologists in antibiotic prescribing control, as reported by medical microbiologists. These medical microbiologist responses cannot be directly compared with the pharmacist responses described and discussed in Chapter 5 because they came from different hospital cohorts. However, the surveys were both large and comparison of the data has identified apparent differences that can be tested in the common element of paired-responses from pharmacists and medical microbiologists from the same hospital (discussed in Chapter 7).

In cases of apparent disagreement between the professional groups, it is not possible to state which group's response is correct, but simply that there is disagreement between the groups. Self-reporting of a professional's job activity is a highly sensitive area, and some respondents might therefore have over-estimated their involvement in control.

There was broad agreement between pharmacists and medical microbiologists about whether these staff groups performed antibiotic prescribing control, and the location of such a control process. However, disagreement was apparent concerning whether pharmacists participated on routine Consultant ward rounds and communicated resultant interventions verbally with the prescriber. There was also disagreement about the factors considered by medical microbiologists in control, whether they performed antibiotic prescribing control daily and whether they participated on routine Consultant ward rounds.

The main findings of this study are;

- Questionnaire responses were returned completed by medical microbiologists from 131 UK NHS hospitals (a 48% response rate).
- The responses of the medical microbiologists cannot be directly compared with the pharmacists (reported in Chapter 5) because of difference in the respondent cohorts. However, apparent differences may indicate aspects of disagreement, which can be tested in the common sample of paired-respondents from the same hospital (described in Chapter 7).
- 20% (n=25) of medical microbiologists did not know whether pharmacists performed antibiotic prescribing control.

- There was broad agreement between the pharmacist and medical microbiologist respondents about whether pharmacists performed antibiotic prescribing control, and the location of this process. There was also broad agreement about whether medical microbiologists performed antibiotic prescribing control and where it was undertaken.
- However there were apparent differences in perceptions. There was noticeable difference in the responses from pharmacists and medical microbiologists about the nature of the antibiotic control process performed by medical microbiologists. It appeared that pharmacists had underestimated the factors included by medical microbiologists in their antibiotic prescribing control process.
- Medical microbiologists appeared to considerably underestimate pharmacists' stated participation in routine Consultant ward rounds, and pharmacists tended to underestimate medical microbiologists' similar involvement. While four-fifths of both professionals thought that pharmacists visited wards daily, pharmacists believed that fewer medical microbiologists visited daily than the latter claimed.
- Medical microbiologists appeared to considerably underestimate pharmacists' reported use of verbal communication with the prescriber.
- These aspects of disagreement will be tested in the paired-respondents employed in the same hospital.

Chapter 7 Comparison of responses from paired-respondent pharmacists and medical microbiologists about the roles of these staff groups in antibiotic prescribing control

Chapters 5 and 6 examined the views of pharmacists and medical microbiologists respectively about the roles of pharmacists and medical microbiologists in enforcing antibiotic prescribing control document recommendations in UK NHS hospitals. These surveys are not directly comparable because the respondents were from two cohorts of hospitals, but identify major areas of possible disagreement. The paired-sample was then tested to explore whether these areas of disagreement were apparent.

This chapter compares the paired-responses from pharmacists and medical microbiologists from the same hospital. The objectives were to compare responses about;

- The availability of an antibiotic formulary.
- The availability of antibiotic guidelines.
- The performance of audits of antibiotic prescribing.
- The role of pharmacists in antibiotic prescribing control.

- The role of medical microbiologists in antibiotic prescribing control.

This chapter compares the responses received from pharmacists to the questionnaire, “Antibiotic Prescribing Documents, Survey 2001” and the responses received from medical microbiologists to the questionnaire, “Antibiotic Prescribing Documents, Survey 2002” from staff employed at the same hospital.

7.1 Results

Responses were received from a total of 253 hospitals from pharmacists and 131 hospitals from medical microbiologists to a questionnaire about antibiotic prescribing control documents, and the role of pharmacists and medical microbiologists in antibiotic prescribing control (described in Chapter 4, Chapter 5 and Chapter 6).

Although these pharmacist and medical microbiologist respondents came from different hospital cohorts, it was possible to identify differences in trends of responses (described in Chapter 6). In 83 hospitals a response was received from both a pharmacist and a medical microbiologist from the same hospital. These paired-respondents were compared to identify whether professionals agreed in their response about antibiotic prescribing controls operating in their hospital.

7.1.1. Response Rate

Although a Chief Pharmacist was employed in 465 UK NHS hospitals, medical microbiologists were not employed by all these hospitals; only 273 UK NHS hospitals employed a Chief Medical Microbiologist.

Responses were received from the Chief Medical Microbiologist in 131 of the 273 hospitals, a response rate of 48%. Of these 131 responses, 83 (63%) were from hospitals in which the Chief Pharmacist had also completed a questionnaire. The response-rate of paired respondents was 30% (n=83), from the total possible cohort of 273 hospitals.

7.1.2 Hospital Parameters

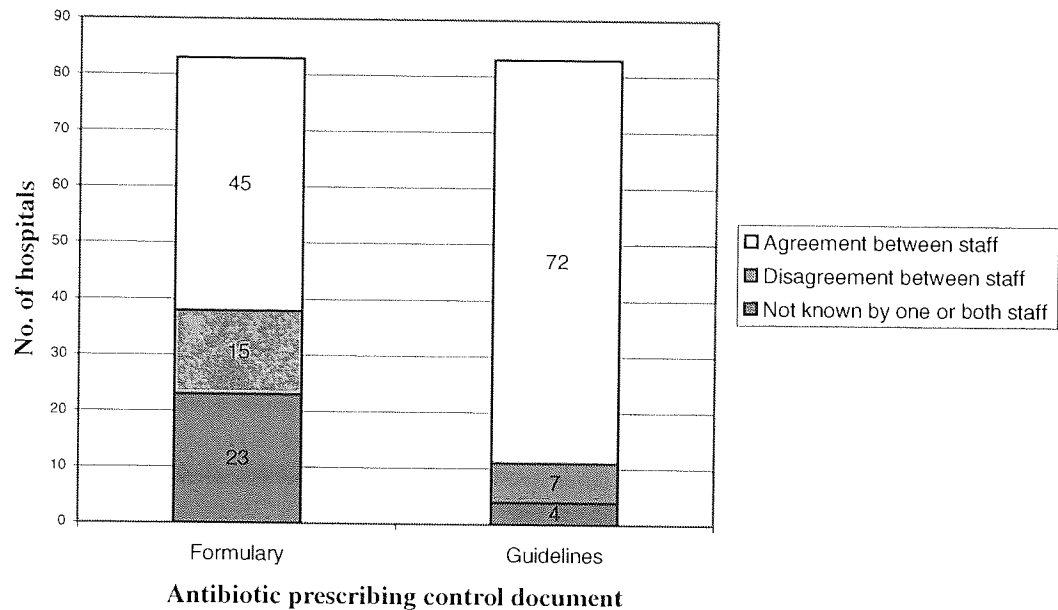
Of the sub-set of 83 hospitals, the majority were DGHs (78%, n=65) and the remainder were either teaching hospitals (16%, n=13) or specialist units (6%, n=5). When classified by bed number, 37 (45%) hospitals had up to 500 beds, 40 (48%) had between 501 and 1000 beds whilst only 6 hospitals (7%) had more than 1000 beds. Eight (10%) hospitals had a specialist ID unit.

7.1.3 Availability of Antibiotic Prescribing Control Documents

Respondents were asked whether their hospital had an antibiotic formulary and/or antibiotic guidelines. Definitions of these antibiotic prescribing control documents were provided (page 53, Chapter 3).

Both pharmacists and medical microbiologists agreed about the availability of an antibiotic formulary in 54% (n=45) of hospitals but agreement was much greater about the availability of antibiotic guidelines (87%, n=72). These results are depicted in Figure 7.1.

Figure 7.1: The views of paired-respondents about the availability of antibiotic prescribing control documents (paired samples, n=83).



Of the 45 hospitals where staff agreed about the availability of an antibiotic formulary, the majority (91%, n=41) did have an antibiotic formulary. Also, most (97%, n=70) hospitals in which staff agreed about the availability of antibiotic guidelines did have that document.

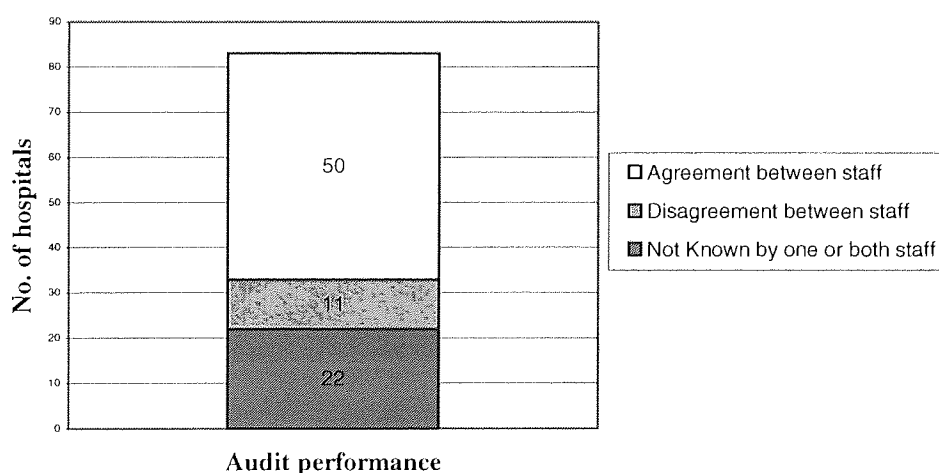
The type and size of a hospital had no impact upon whether its Chief Pharmacist and Chief Medical Microbiologist agreed about the availability of antibiotic prescribing control documents ($p > 0.05$ in all cases). Only in about one-half (54%) of the 72 hospitals where staff agreed on guidelines availability did they also agree about the availability of a formulary. There was no association between staff agreement about the availability of an antibiotic formulary and staff agreement about the availability of antibiotic guidelines ($p = 1.000$).

Staff disagreed about the availability of an antibiotic formulary in 15 hospitals. In 8 of these hospitals medical microbiologists thought an antibiotic formulary was available but pharmacists did not, whilst the reverse was true for 7 hospitals.

7.1.4 Antibiotic Prescribing Audits

Respondents were asked whether their hospital undertook audits of antibiotic prescribing (defined on page 53, Chapter 3). Staff agreed about whether antibiotic prescribing audits were performed in 60% (n=50) of the hospitals examined and Figure 7.2 depicts the results for this question.

Figure 7.2: The views of paired-respondents on the performance of antibiotic prescribing audits (paired samples, n=83).



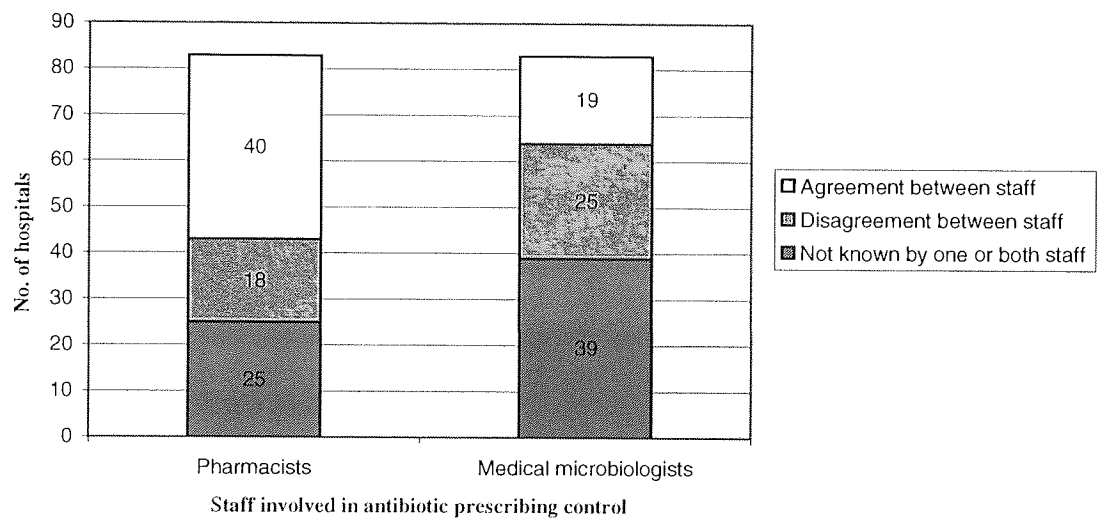
Of the 50 hospitals where there was agreement between staff regarding audit performance, 49 (98%) hospitals undertook audits of antibiotic prescribing.

Staff disagreed about the performance of audits of antibiotic prescribing in 11 hospitals; in 5 of these hospitals medical microbiologists thought audits were undertaken but pharmacists did not, whilst the reverse was true for 6 hospitals.

7.1.5 Involvement of Pharmacists and Medical Microbiologists in Antibiotic Prescribing Control

Respondents were asked whether pharmacists and medical microbiologists performed antibiotic prescribing control (defined on page 53, Chapter 3), and these results are depicted in Figure 7.3.

Figure 7.3: The views of paired-respondents on the involvement of pharmacists and medical microbiologists in antibiotic prescribing control (paired samples, n=83).



i). Pharmacists

In 48% (n=40) of the hospitals there was agreement between the medical microbiologist and pharmacist respondents about the role of pharmacists in antibiotic prescribing control. Pharmacists performed this role in the majority (95%, n=38) of these hospitals; on every ward in 30 and only in selected units in 8 of these hospitals.

Staff disagreed about whether pharmacists performed antibiotic prescribing control in 22% (n=18) of the hospitals; in 8 there was disagreement about whether the role

was performed and in 10 about where this function was performed (on every ward or only in selected units). Of the 8 hospitals where staff disagreed about performance of this role, in 7 hospitals medical microbiologists did not think pharmacists performed this role but pharmacists responded that they did, whilst the reverse was true in the other hospital. In half of the 10 hospitals where staff disagreed on the location of performance of this role, medical microbiologists thought pharmacists performed this role on every ward but pharmacists responded that they performed this role only in selected units, whilst the reverse was for the other 5 hospitals.

As might be expected, the majority (68%, n=17) of the 25 respondents that did not know the role of pharmacists were medical microbiologists.

ii). Medical Microbiologists

In 23% (n=19) of the hospitals pharmacists and medical microbiologists agreed about the medical microbiologist's role. In the majority of these cases medical microbiologists did perform an antibiotic prescribing control function (63%, n=12) and this function was performed only in selected units in 92% (n=11) of these hospitals.

Respondents in 30% (n=25) of the hospitals disagreed about the medical microbiologist's role in antibiotic prescribing control; in 17 about whether medical microbiologists controlled antibiotic prescribing and in the other 8 about the location of this control. Of the 17 hospitals where staff disagreed about whether medical microbiologists performed this role, medical microbiologists said they

performed this role but pharmacists thought they did not in 8 hospitals, whilst the reverse was true for the other 9 hospitals. Of the 8 hospitals where there was disagreement about the location of the medical microbiologist's antibiotic prescribing control, in 7 of these hospitals medical microbiologists said that they visited every ward but pharmacists thought this role was only performed in selected units. The reverse was true for the other hospital.

As might be expected, the majority (82%, n=32) of the 39 respondents who did not know the role of the medical microbiologists were pharmacists.

The type and size of a hospital had no impact upon whether its staff agreed about whether pharmacists and medical microbiologists performed antibiotic prescribing control ($p>0.05$ in all cases). Only in about one-half (53%) of the 19 hospitals where staff agreed about the medical microbiologist's role did they also agree on the pharmacist's role and there was no association between paired-staff's agreement about the pharmacist's role and agreement about the role of the medical microbiologist ($p=0.858$).

7.1.6 Overview of Agreement About Antibiotic Prescribing Controls

A summary of the responses to the detailed data about existence of antibiotic prescribing controls in sections 7.1 to 7.1.5 is presented in Table 7.1.

Table 7.1: Summary of responses about operational antibiotic prescribing controls (n=83).

Comparison of paired responses	Formulary availability	Guidelines availability	Performance of audits	Antibiotic prescribing control performed by pharmacists	Antibiotic prescribing control performed by medical microbiologists
Agreement	45 (54%)	72 (87%)	50 (60%)	40 (48%)	19 (23%)
Disagreement	15 (18%)	7 (8%)	11 (13%)	18 (22%)	25 (30%)
Don't Know	23 (28%)	4 (5%)	22 (27%)	25 (30%)	39 (47%)

A major reason for paired-respondents disagreeing about an antibiotic prescribing control was due to one or both respondents being unaware of the existence of the control. This poor awareness (don't know) was omitted from the results in Table 7.1 to produce Table 7.2.

Table 7.2: Agreement about operational antibiotic prescribing controls (n=83).

Comparison of paired responses	Formulary availability	Guidelines availability	Performance of audits	Antibiotic prescribing control performed by pharmacists	Antibiotic prescribing control performed by medical microbiologists
Agreement	45 (75%)	72 (91%)	50 (82%)	40 (69%)	19 (43%)
Disagreement	15 (25%)	7 (9%)	11 (18%)	18 (31%)	25 (57%)

7.1.7 Nature of The Antibiotic Prescribing Control Process Performed by Pharmacists

Table 7.2 identified that major areas of disagreement between pharmacists and medical microbiologists were about the roles of pharmacists and medical microbiologists in antibiotic prescribing control. There was greatest disagreement between respondents about the role of medical microbiologists (57%). The views of paired-respondents about the nature of antibiotic prescribing control performed by pharmacists and medical microbiologists were examined in detail; factors reviewed,

frequency of control and methods used to communicate resultant interventions with the prescriber.

In 40 hospitals, pharmacists and medical microbiologists agreed about whether pharmacists performed antibiotic prescribing control, which was reportedly performed in 38 hospitals. In a further 10 hospitals, pharmacists and medical microbiologists agreed that pharmacists performed antibiotic prescribing control, but disagreed about where prescribing was controlled. Responses from pharmacists and medical microbiologists from these 48 hospitals were compared for the different parameters of the antibiotic prescribing control process.

i). Factors Reviewed During Antibiotic Prescribing Control

Responses from pharmacists and medical microbiologists about whether pharmacists reviewed stipulated factors during antibiotic prescribing control were compared to identify agreement. These results are summarised in Table 7.3.

Table 7.3: The views of paired-respondents on the factors reviewed by pharmacists in antibiotic prescribing control (paired samples, n=48).

Factor Definition	Agreement about whether pharmacists check this factor	Disagreement about whether pharmacists check this factor
<i>Drug/s in accordance with prescribing document recommendations</i>	41 (85%) 40-do check 1-don't check	7 (15%) 6-pharms yes but med micros no 1-pharms no but med micros yes
<i>Drug/s Dosage in accordance with prescribing document recommendations</i>	36 (75%) 35-do check 1-don't check	12 (25%) 8-pharms yes but med micros no 4-pharms no but med micros yes
<i>Drug Regimen Length(s) in accordance with prescribing document recommendations</i>	36 (75%) 32-do check 4-don't check	12 (25%) 9-pharms yes but med micros no 3-pharms no but med micros yes
<i>Drug/Drug Interactions exist between empirical regimen and other therapy which justify deviation from prescribing document recommendations</i>	38 (79%) 37-do check 1-don't check	10 (21%) 9-pharms yes but med micros no 1-pharms no but med micros yes
<i>Patient Factors exist which justify deviation from empirical regimen recommended</i>	34 (71%) 32-do check 2-don't check	14 (29%) 14-pharms yes but med micros no 0-pharms no but med micros yes

ii). Frequency of Antibiotic Prescribing Control

The results of the paired sample about how often pharmacists reviewed antibiotic prescribing control are summarised in Table 7.4.

Table 7.4: The views of paired-respondents on the frequency that pharmacists perform antibiotic prescribing control (paired samples, n=48).

Frequency	Agreement about whether pharmacists check this frequency	Disagreement about whether pharmacists check this frequency
<i>Daily as part of a routine clinical ward service</i>	35 (73%) 31-check daily 4-do not check daily	13 (27%) 7-pharms yes but med micros no 6-pharms no but med micros yes
<i>During participation in a routine Consultant ward round</i>	35 (73%) 1-participate 34-don't participate	13 (27%) 10-pharms yes but med micros no 3-pharms no but med micros yes
<i>When requested by the prescriber</i>	33 (69%) 1-check when requested 32-don't	15 (31%) 10-pharms yes but med micros no 5-pharms no but med micros yes

iii).Communication of Interventions With the Prescriber

The results of the paired samples' views on communication techniques employed by pharmacists are summarised in Table 7.5.

Table 7.5: The views of paired-respondents on the methods used by pharmacists to communicate interventions to the prescriber (paired samples, n=48).

Communication method	Agreement about whether pharmacists use this communication method	Disagreement about whether pharmacists use this communication method
<i>Annotation on the prescription</i>	32 (67%) 27-annotate the prescription 5-don't annotate the prescription	16 (33%) 11-pharms yes but med micros no 5-pharms no but med micros yes
<i>Annotation in the medical record</i>	40 (83%) 40-don't annotate the prescription	8 (17%) 5-pharms yes but med micros no 3-pharms no but med micros yes
<i>Verbally</i>	29 (60%) 26-verbally communicate 3-don't verbally communicate	19 (40%) 18-pharms yes but med micros no 1-pharms no but med micros yes

7.1.8 Nature of The Antibiotic Prescribing Control Process Performed by Medical Microbiologists

In 19 hospitals, pharmacists and medical microbiologists agreed about whether medical microbiologists performed antibiotic prescribing control, which was reportedly performed in 12 hospitals. In a further 8 hospitals, pharmacists and medical microbiologists agreed that medical microbiologists performed antibiotic prescribing control, but disagreed about where prescribing was controlled. Responses from pharmacists and medical microbiologists from these 20 hospitals were compared for the different parameters of the antibiotic prescribing control process.

i). Factors Reviewed During Antibiotic Prescribing Control

Responses from pharmacists and medical microbiologists about whether medical microbiologists reviewed stipulated factors during antibiotic prescribing control were compared to identify agreement. These results are summarised in Table 7.6.

Table 7.6: The views of paired-respondents on the factors reviewed by medical microbiologists in antibiotic prescribing control (paired samples, n=20).

Factor Definition	Agreement about whether medical microbiologists check this factor	Disagreement about whether medical microbiologists check this factor
<i>Drug/s in accordance with prescribing document recommendations</i>	10 (50%) 7-do check 3 – don't check	10 (50%) 10-mms yes but pharms no
<i>Drug/s Dosage in accordance with prescribing document recommendations</i>	5 (25%) 1-do check 4-don't check	15 (75%) 10-mms yes but pharms no 5-mms no but pharms yes
<i>Drug Regimen Length(s) in accordance with prescribing document recommendations</i>	7 (35%) 3-do check 4-don't check	13 (65%) 11-mms yes but pharms no 2-mms no but pharms yes
<i>Drug/Drug Interactions exist between empirical regimen and other therapy which justify deviation from prescribing document recommendations</i>	13 (65%) 0-do check 13-don't check	7 (35%) 5-mms yes but pharms no 2-mms no but pharms yes
<i>Patient Factors exist which justify deviation from empirical regimen recommended (e.g. penicillin allergy)</i>	11 (55%) 8-do check 3-don't check	9(45%) 7-mms yes but pharms no 2-mms no but pharms yes

ii). Frequency of Antibiotic Prescribing Control

The results of the paired-respondents about how often medical microbiologists reviewed antibiotic prescribing are summarised in Table 7.7.

Table 7.7: The views of paired-respondents on the frequency that medical microbiologists perform antibiotic prescribing control (paired samples, n=20).

Frequency	Agreement about whether medical microbiologists check this frequency	Disagreement about whether medical microbiologists check this frequency
<i>Daily as part of a routine clinical ward service</i>	8 (40%) 1-do check 7-don't check	12 (60%) 9-mms yes but pharms no 3-mms no but pharms yes
<i>During participation in a routine Consultant ward round</i>	17 (85%) 4-do check 13-don't check	3 (15%) 2-mms yes but pharms no 1-mms no but pharms yes
<i>When requested by the prescriber</i>	14 (70%) 4-do check 10-don't check	6 (30%) 1-mms yes but pharms no 5-mms no but pharms yes

iii).Communication of Interventions with the Prescriber

The results of the paired-respondents' views about the communication techniques employed by medical microbiologists are summarised in Table 7.8.

Table 7.8: The views of paired-respondents on the methods used by medical microbiologists to communicate interventions to the prescriber (paired samples, n=20).

Communication method	Agreement about whether medical microbiologists use this communication method	Disagreement about whether medical microbiologists use this communication method
<i>Annotation on the prescription</i>	15 (75%) 1-annotate 14-don't annotate	5 (25%) 2-mms yes but pharms no 3-mms no but pharms yes
<i>Verbally</i>	12 (60%) 10- verbally communicate 2-don't verbally communicate	8 (40%) 4-mms yes but pharms no 4-mms no but pharms yes

7.1.9 Agreement About Antibiotic Prescribing Control Mechanisms

Both staff agreed about the existence of all five of the antibiotic prescribing controls considered (formulary, guidelines, audit, pharmacist control and medical microbiologist control) in only 2 hospitals.

7.2 Discussion

This part of the study has examined agreement between pharmacists and medical microbiologists employed in the same hospital about the existence of antibiotic prescribing controls in their institution. The BSAC's 1990 survey⁹¹ considered this subject of inter-professional awareness by comparing the results received from pharmacists and medical microbiologists from 73 hospitals, including the availability of an antibiotic formulary and the performance of audits of antibiotic prescribing. Although the BSAC survey included other facets of antibiotic prescribing, it did not examine professionals' awareness about whether their colleague performed antibiotic prescribing control. Also, it did not identify in how many cases were one or both respondents unaware of the existence of an antibiotic prescribing control.

Such a study of interdisciplinary awareness is an important component of health services research because there is a move towards a more collaborative and fluid healthcare system¹⁷⁵ and the BSAC's study advocated closer working relationships and better inter-professional communication between hospital pharmacists and medical microbiologists⁹¹. The continued interest in antibiotic resistance and prescribing issues in the intervening decade, together with the increased emphasis on flexible working patterns coupled with non-inclusion of the consideration of job roles by the BSAC survey⁹¹, means that a study of pharmacist and medical microbiologist agreement upon control measures is particularly timely.

The parameters of the availability of antibiotic prescribing control documents, the role of pharmacists and medical microbiologists in antibiotic prescribing control

and the performance of audits of antibiotic prescribing were chosen because they were considered to be major indicators of antibiotic prescribing control activity in an institution. It was also considered that pharmacists and medical microbiologists should be aware of such operational controls due to their key role in antibiotic prescribing improvement. Comparison of the independent pharmacists' responses (described in Chapter 5) and the medical microbiologists' responses (described in Chapter 6) indicated that the nature of the antibiotic prescribing control role performed by pharmacists and medical microbiologists was a major area of apparent disagreement (Chapter 6). Therefore the nature of the antibiotic prescribing control processes was examined in detail.

7.2.1 Response Rate

Respectable response rates were achieved for both questionnaires; 54% for the Chief Pharmacist survey and 48% for the Chief Medical Microbiologist survey. Although every effort was made to maximise questionnaire responses according to a systematic review of effective methods to increase response rates to postal questionnaires²⁶⁸, the problem of a low response rate (30%) for the sub-set of paired responses was inherent in the methodological design of two independent surveys. However, a key aspect of the research was that the studies were independent to ensure that staff did not collaborate in their responses.

7.2.2 Availability of Antibiotic Prescribing Control Documents

One of the objectives was to identify whether staff agreed about the availability of antibiotic prescribing control documents in their hospital.

Formularies and guidelines are basic antibiotic prescribing control mechanisms and the importance of hospitals having both document-types was emphasised by the medicines management agenda¹³¹. As such it would be reasonable to expect that those health care professionals involved in antibiotic prescribing improvement should be aware of, and therefore agree, about their existence. As discussed in Chapter 4 (page 79), pharmacists and medical microbiologists are often involved in approving antibiotic prescribing control documents and it is reasonable to presume that, through membership of the DTC and/or their routine work, both Chief Pharmacists and Medical Microbiologists should be aware of the availability of these documents within their hospital.

However, when responses were compared from the pharmacist and medical microbiologist from the 83-paired hospitals, disagreement was identified. There was much greater agreement between staff about whether their hospital had antibiotic prescribing guidelines than whether they had antibiotic formularies, although both terms were defined in the questionnaire. This high level of agreement about guidelines availability might indicate that this is a more recognised document-type and that it is possibly used more commonly in practice than antibiotic formularies. This finding could also suggest that the recommendations contained within antibiotic prescribing guidelines are more achievable in practice due to their specific nature.

In approximately one-half of the responding hospitals pharmacists and medical microbiologists disagreed, or at least one of the respondents did not know, whether an antibiotic formulary existed within their organisation. Such poor awareness

might have occurred because formularies may contain less specific recommendations than guidelines³⁶⁸. However, in almost one-third of hospitals one or both staff did not know if their hospital had an antibiotic formulary (Table 7.1). In cases where paired-respondents purportedly knew about the existence of a control, the level of agreement between them was high (Table 7.2). It could be argued that a lack of knowledge is better than the wrong knowledge, but indicates that a key area for action is education of staff about antibiotic prescribing controls operating in their hospital.

The results of the present study suggest that there has been no improvement in medical microbiologists' and pharmacists' agreement regarding the existence of antibiotic formularies since the BSAC's 1990 survey⁹¹, with the level of disagreement being approximately one-eighth of hospitals in both surveys. This is of concern, because pharmacists and medical microbiologists should work together to maintain the standards of a hospital policy³⁶⁹. However, the BSAC's study did not identify cases where one or both respondents did not know whether a formulary existed. The present study shows the advantage of probing the aggregated data to this level.

Disagreement might have occurred because of confusion about a document-type (although a definition had been provided), or as a result of a basic lack of knowledge about antibiotic prescribing controls. This finding highlights apparent differences in the perception of antibiotic prescribing controls by pharmacists and medical microbiologists, and therefore reflects weaknesses in inter-professional communication.

Pharmacists and medical microbiologists are healthcare professionals with a key role in enforcing the recommendations of antibiotic prescribing control documents, as discussed in Chapter 5. However, if they are unaware of these documents then their recommendations will not be appropriately enforced. Such enforcement should be shared between dispensary pharmacists, formulary pharmacists and clinical pharmacists, and it is important that all such staff are aware of a document's existence. The new specialist "infectious diseases pharmacists" could have a key input into this area if this was defined as one of the job roles, and consequently the research findings of the present study can inform policy.

It was hypothesised that there would be greater agreement between staff in small hospitals because such a smaller organisation may facilitate greater informal communication. However, it is interesting that none of the hospital parameters influenced whether staff agreed about the availability of the antibiotic prescribing control documents and it is possible that other factors have an effect, e.g. "personality traits" of individual staff. It would be interesting to investigate the impact of the characteristics of staff (e.g. age, period of employment and specific interest in antibiotic prescribing improvement strategies) upon their knowledge of the antibiotic prescribing control documents available within their hospital. There was no correlation between agreement about formulary availability with agreement about guidelines availability, which indicates that in no hospitals was agreement optimal.

In cases where both professionals agreed about whether antibiotic formularies and guidelines were available, the majority of hospitals did have these documents. A

comparison of views about the availability of antibiotic policies was not included because of the difficulties in defining an antibiotic policy (see page 84, Chapter 4).

If the results for disagreement about availability of an antibiotic formulary from the present study (18%, n=15) are compared with the results from the BSAC study⁹¹ (15%, n=11) there has been no noticeable improvement. However, when the results for disagreement about availability of antibiotic guidelines from the present study (8%, n=7) are compared with the results from the BSAC study about the availability of a policy for therapy (27%, n=20), then there has been a noticeable improvement in the level of agreement.

7.2.3 Antibiotic Prescribing Audits

One of the objectives was to identify whether staff agreed about whether audits of antibiotic prescribing are performed in their hospital.

The finding that staff in two-fifths of hospitals did not know, or disagreed, about whether antibiotic prescribing audits were performed again raises questions about inter-professional communication in a significant proportion of the hospitals. Although the BSAC study⁹¹ gave no indication about the proportion of hospitals in which staff did not know about audit performance, a similar level of disagreement about the performance of audits was identified in the present survey (13%) and the 1990 survey⁹¹ (14%). It appears that the increasing emphasis upon antibiotic prescribing improvement in the intervening decade has done little to improve staff awareness of this activity. However, in the present study almost one-third of respondents did not know if audits of antibiotic prescribing were performed (Table

7.1). Where respondents purportedly knew about whether such an activity had been performed, the level of agreement was high (Table 7.2).

An essential component of audits is feedback of results³⁷⁰ but this was beyond the scope of the present study. Limited publication of results, or a failure to circulate such results because considered insignificant, could have contributed to staff disagreeing or not knowing whether an audit had been performed. It is also possible that an audit of antibiotic prescribing had been performed by a specific department (e.g. the Pharmacy Department) and the subsequent results only circulated to prescribers and pharmacists, but not to medical microbiologists. However, it is important that all professionals involved in antibiotic prescribing control are informed of improvement activities, so that control can be performed in a cohesive, multidisciplinary manner. Failing to publicise the results of audits of antibiotic prescribing might make it difficult to evaluate the efficacy of an antibiotic prescribing control document in routine clinical practice. It would be expected that the Chief Pharmacist and Chief Medical Microbiologist would be members of the DTC and consequently made aware of the performance of audit activities within their hospital.

Even though an audit programme might be established in a hospital, individual audits tend to be “static activities” which are undertaken for a finite period of time, whilst the availability of antibiotic prescribing control documents and antibiotic prescribing control by pharmacists and medical microbiologists should be continuing activities. It is therefore possible that the results of an antibiotic

prescribing audit had been reported, but that one of the respondents had forgotten about it.

A positive finding was that in the vast majority of the three-fifths of hospitals where there was agreement, audit had been performed. This is an encouraging finding, because Nathwani has indicated the importance of the evaluation of the effect of prescribing control documents through standards of care, including audit³⁷¹. This complies with the developing clinical governance agenda, with its emphasis upon evaluation of outcomes through the performance of audit¹⁵⁵. The involvement of both pharmacists and medical microbiologists in multi-disciplinary antibiotic prescribing audits is an ideal activity for enriching interprofessional relations^{336, 372-374}.

7.2.4 Involvement of Pharmacists and Medical Microbiologists in Antibiotic Prescribing Control

One of the objectives was to identify pharmacists' and medical microbiologists' awareness of the other professional's role in antibiotic prescribing control.

In Chapter 6, the total questionnaire responses completed by pharmacists were compared with the total questionnaire responses completed by a medical microbiologist to identify possible markers of disagreement. The trends concerning the performance of antibiotic prescribing control by pharmacists and medical microbiologists were similar in cases where staff purportedly knew their roles. However, almost two-fifths of the total pharmacist respondents did not know the

role of medical microbiologists, and one-fifth of the total medical microbiologist respondents did not know the role of pharmacists.

When the results were compared for the 83-paired hospitals, the majority of staff did not know, or did not agree, whether the other healthcare professional performed antibiotic prescribing control. A negative finding was that pharmacists and medical microbiologists were not fully conversant with the other professional's antibiotic prescribing control role in the majority of hospitals. It is especially disappointing that in approximately two-fifths of the responding hospitals Chief Pharmacists did not know about the medical microbiologist's role in antibiotic prescribing control. This provides further evidence of poor internal communication between the Pharmacy and Medical Microbiology Departments. It is possible that the Pharmacy Department could employ a specialist "infectious diseases pharmacist", or another pharmacist who is more conversant with the role of medical microbiologists. However, it is reasonable to expect that the Chief Pharmacist would be aware of the role of professionals working in related Departments in such a key area as prescribing improvement.

A healthcare professional may be unsure about their colleagues' role in antibiotic prescribing control because, although historically performed, a lack of staff might now have limited their activity. Communication about job roles increases staff awareness about when it might be appropriate to consult the other professional, and this could be facilitated by participation in joint ward-rounds. It should be considered that the consideration of a professional's job role is more personally

motivated than other control mechanisms, for which responsibility is often shared between different disciplines.

It was a matter of concern that the Chief Pharmacist did not know whether pharmacists performed antibiotic prescribing control in eight hospitals, whilst the Chief Medical Microbiologist was not aware of the role of medical microbiologists in seven hospitals. This indicates that senior staff need to become more familiar with the roles of staff in their own Department in these hospitals.

Other studies that have considered the roles of both pharmacists and medical microbiologists have mostly focussed upon their collaboration with other relevant professionals as part of an “antimicrobial management team”^{87, 375, 376}. Reports from professional organisations and consensus experts have emphasised the importance of such multidisciplinary collaboration between professionals in achieving effective antibiotic prescribing control^{70, 171, 341, 377, 378}. Pharmacists and medical microbiologist colleagues can also collaborate in the interpretation of microbiological culture and sensitivity results^{62, 166, 170, 350, 351, 379-381}, design of local guidelines⁸⁸ and in the development of electronic prescribing systems³⁸². However, it would seem that a necessary precursor to such collaborative work would be an awareness of the role of the other professional in antibiotic control activities, which has been disappointing in the present study.

There was no association between a hospital’s type, size and specialist ID unit and whether staff agreed about the role of pharmacists and medical microbiologists in antibiotic prescribing control. Awareness of colleagues’ roles may be influenced by

other factors such as a special interest in antibiotic prescribing improvement for pharmacists and a clinically-orientated, rather than laboratory-based, outlook for medical microbiologists. There is a need to restructure the traditional “dispensary based” pharmacist role and the traditional “laboratory based” medical microbiologist role.

Limited financial resources may be one of the major barriers to the implementation of proposals in the “Agenda for Change”¹⁷⁵ for increased multidisciplinary working. However, it is hoped that this concern will be less relevant for antibiotic prescribing control in the future, following the recent announcement that hospital pharmacists are to receive £12 million to enable an enhanced clinical role in this area³³⁵. The findings of the present study suggest that a key area for increased pharmacist activity is in engagement with medical microbiologists.

The present study was performed prior to the Department of Health’s publication of recommendations for reformed professional roles, “Agenda for Change”, which aims to modernise the pay system and structure of the NHS¹⁷⁵. However, the study provides some insight into the progress that must be achieved before these goals of increased collaborative working can be met.

7.2.5 The Nature of Antibiotic Prescribing Control Performed by Pharmacists and Medical Microbiologists

Although a number of respondents did not know about the role of pharmacists in antibiotic prescribing control, in cases where they purportedly knew, there was a high level of disagreement between the pharmacists and medical microbiologists.

The same was true concerning the role of medical microbiologists in antibiotic prescribing control.

Chapter 5 and Chapter 6 examined the views of pharmacists and medical microbiologists about the role of these staff in antibiotic prescribing control, and identified areas of possible disagreement. These aspects have been tested in the paired-respondents and disagreement was often apparent, but less extreme. This emphasises the importance of testing these hypotheses with the paired-respondents.

i). Pharmacists

Agreement between pharmacist and medical microbiologist respondents about whether pharmacists considered the five stipulated factors during their antibiotic prescribing control process; drug, drug dosage, regimen length, drug-drug interactions and patient factors, ranged from 71% to 85%. Comparison of the medical microbiologist responses (described in Chapter 6) with the pharmacists responses (described in Chapter 5) indicated that whether pharmacists checked patient factors in their review process might be an aspect of disagreement. Although the agreement level for the paired-respondents was 71% for whether pharmacists checked patient factors, in 14 hospitals pharmacists reported that they checked this factor but their medical microbiologist colleague did not report them considering this factor.

Agreement between pharmacist and medical microbiologist respondents about whether pharmacists performed certain frequencies of control; daily, when requested by the prescriber and during a routine Consultant ward round ranged from 69% to 73%. In cases where the paired-respondents disagreed about whether

the pharmacist performed control when requested and during a ward round, mostly the medical microbiologists reported that pharmacists did not perform this role, whilst pharmacists reported that they did. A potential aspect of disagreement (identified in Chapter 6) was concerning whether pharmacists participated on routine Consultant ward rounds. The level of agreement of 73% between the paired-respondents was not noticeably different for this frequency when compared to the other review frequencies examined.

Agreement between paired-respondents about the methods used by pharmacists to communicate resultant interventions with the prescriber ranged from 63% to 87%. A key area of disagreement was whether pharmacists communicated verbally with the prescriber, as identified in Chapter 6. This was also reflected in the responses of the paired-respondents, because staff from only 60% of hospitals agreed about whether pharmacists communicated interventions verbally with the prescriber. In 19 hospitals pharmacists reported that they used this method of communication but their medical microbiologist colleague did not report that the pharmacist used verbal communication.

Medical microbiologists appeared to be generally conversant with the nature of the antibiotic prescribing control process performed by pharmacists, although they apparently under-estimated the employment of verbal communication by pharmacists.

ii). Medical Microbiologists

Agreement between pharmacist and medical microbiologist respondents about whether medical microbiologists considered five factors during their antibiotic prescribing control process; drug, drug dosage, regimen length, drug-drug interactions and patient factors ranged from 25% to 65%. There was particularly poor agreement about whether medical microbiologists checked drug dosage (25%) and regimen length (35%). The level of agreement was noticeably lower than that reported by the paired-respondents about the factors checked by pharmacists. In most of the cases of disagreement, pharmacists reported that the medical microbiologist did not check a factor, whilst the medical microbiologist reported that they did verify it. This emphasises that pharmacists seem to under-estimate the number of factors reviewed by medical microbiologists, as was indicated in Chapter 6.

Comparing the beliefs of pharmacist and medical microbiologist respondents about whether medical microbiologists performed certain frequencies of control; daily, when requested by the prescriber and during a routine Consultant ward round, agreement ranged from 40% to 85%. A key indication of disagreement identified in Chapter 6 was whether medical microbiologists performed control daily, and four-fifths of the paired-respondents also disagreed about whether medical microbiologists performed this control frequency. However, disagreement was equally split between medical microbiologists apparently over-estimating daily control and pharmacists apparently over-estimating this control frequency.

Pharmacists seemed to be poorly aware of the role of medical microbiologists in antibiotic prescribing control. However, medical microbiologists seemed to be generally conversant with the role of pharmacists in antibiotic prescribing control. This suggests that pharmacists are operating in isolation and would benefit from better liaison with medical microbiologists, and is a key area for improvement. Encouraging such inter-disciplinary communication could be one of the roles of the new specialist “infectious diseases pharmacists”.

7.3 Conclusion

This part of the study has examined professionals’ agreement about the existence of antibiotic prescribing controls within their hospital; antibiotic formularies, antibiotic guidelines, audits of antibiotic prescribing, and the role of pharmacists and medical microbiologists in antibiotic prescribing control. Although there have been recommendations for close liaison between pharmacists and medical microbiologists in hospital practice, this study indicates that this does not occur in a significant number of hospitals. The level of disagreement and poor awareness regarding the performance of basic antibiotic prescribing controls in many hospitals was a matter for concern, and indicates that there is a need to publicise the existence of these basic controls. A negative finding was that pharmacists and medical microbiologists agreed about the availability of all five antibiotic prescribing control measures in only two hospitals. There was no association between hospital parameters and staff agreement about control efforts, and awareness may have been related to other factors such as an interest in antibiotic prescribing improvement and personal motivation. More positive findings were that in the majority of hospitals where staff agreed about antibiotic formulary and

guidelines availability and audit performance, these control mechanisms were in operation.

Paired-respondents' beliefs about the roles of pharmacists and medical microbiologists in antibiotic prescribing control were examined in detail. Apparent differences in trends were identified in Chapter 6 and tested in the paired-sample. Key areas of disagreement included whether pharmacists checked patient factors, participated in Consultant ward rounds and communicated interventions verbally to prescribers. Disagreement about the involvement of medical microbiologists in antibiotic prescribing control concerned how many factors they considered and whether they performed this function on a daily basis. Medical microbiologists seemed to be better aware of the role of pharmacists in antibiotic prescribing control, with pharmacists apparently unaware about several components of the control process performed by medical microbiologists.

The main findings of this study are;

- Although professionals agreed about whether antibiotic prescribing guidelines were available in most hospitals (87%, n=72), staff agreed about the availability of an antibiotic formulary in only 54% (n=45) of hospitals.
- There was disagreement, or a poor knowledge, about whether an audit of antibiotic prescribing had been undertaken in 40% (n=33) of hospitals. However, audit had been performed in most (98%, n=49) of the hospitals where staff agreed about whether or not this activity had been performed.
- A large number of respondents did not know whether their hospital had an antibiotic formulary, and in cases where staff purportedly agreed about

whether such a document existed, there was a high level of agreement. The same scenario was true concerning whether audits of antibiotic prescribing were performed.

- There was agreement between the two health professionals about the role of the pharmacist in antibiotic prescribing control in 48% (n=40) of hospitals. There was disagreement in 18 hospitals (22%) about the pharmacist's role; whether they performed this role (n=8) and whether they visited every ward or only selected units (n=10). Of the 25 hospitals where one or both staff did not know the role of pharmacists, medical microbiologists from 17 hospitals did not know whether their colleague performed such a role.
- There was agreement about the role of the medical microbiologist in antibiotic prescribing control in 23% (n=19) of hospitals. There was disagreement in 25 hospitals (30%) about the medical microbiologist's role; whether they performed this role (n=17) and whether they visited every ward or only selected units (n=8). Of the 39 hospitals where one or both staff did not know the role of medical microbiologists, pharmacists from 32 hospitals did not know whether their colleague performed such a role.
- A key area for disagreement about the role of pharmacists in antibiotic prescribing control concerned whether they communicated resultant interventions from the control process with the prescriber verbally.
- Key areas for disagreement about the role of medical microbiologists in antibiotic prescribing control concerned what factors they reviewed, whether they performed daily control and whether they communicated verbally with prescribers.

- A key area for improvement is education of pharmacists about the role of medical microbiologists in antibiotic prescribing control.

Chapter 8 Recommendations of local antibiotic guidelines for the empirical antibiotic treatment of community-acquired pneumonia

The majority of surveyed hospitals had institutional antibiotic prescribing guidelines (Chapter 4). It therefore appeared relevant to undertake an in-depth study of guideline recommendations for the empirical antibiotic treatment of a specific infection. An analysis of recommendations for the treatment of Community-Acquired Pneumonia (CAP) was chosen because it is a prevalent infection causing high morbidity and mortality, and national British Thoracic Society Guidelines exist with which institutional guidelines can be compared.

Pharmacist recipients of the questionnaire, “Antibiotic Prescribing Documents, Survey 2001” and medical microbiologist recipients of the questionnaire, “Antibiotic Prescribing Documents, Survey 2002” were asked to enclose a copy of their hospital’s antibiotic prescribing document(s) with their completed questionnaire. Pharmacist recipients of the questionnaire, “Antibiotic Guideline Modifications, Survey 2002”, were asked to enclose a copy of their documents if they had not already sent them, or, where appropriate, to enclose a copy of updated documents.

The following recommendations for the empirical antibiotic treatment of CAP were analysed;

- First-line antibiotic regimens for non-severe and severe infection.
- Reasons for alternative regimens for non-severe infection.
- Definition of severe infection.
- Agreement with the national British Thoracic Society guidance.

8.1 Results

8.1.1 Response Rate

A total of 205 institutional antibiotic prescribing guidelines were received from 171 hospitals and the number of documents returned with questionnaire mailings is summarised in Table 8.1.

Table 8.1: Institutional antibiotic prescribing guidelines for CAP returned with self-completion postal questionnaires.

Questionnaire	Number of guidelines received from different hospitals	Cumulative total of guidelines received from different hospitals
<i>“Antibiotic Prescribing Documents, Survey 2001” to pharmacists</i>	104	104
<i>“Antibiotic Prescribing Documents, Survey 2002” to medical microbiologists</i>	64	168
<i>“Antibiotic Guideline Modifications, Survey 2002” to pharmacists</i>	37	205

8.1.2 Institutional Guidelines Comparable with the 1993 BTS CAP Guidance

In 1993 the British Thoracic Society published their first set of guidance for CAP, “Guidelines for the management of community-acquired pneumonia in adults

admitted to hospital”²²⁴. Of the institutional documents received, 71 were returned with the questionnaire “Antibiotic Prescribing Documents, Survey 2001” in November 2001. A further 24 were returned after the second February 2002 posting. It was considered that these institutional guidelines should be compared with the 1993 BTS CAP guidance because although these hospitals might intend to update the guidelines it was likely that such documents would not yet have been revised following the publication of new guidance in December 2001. A total of 95 institutional guidelines were compared with the 1993 BTS CAP guidance.

i). Non-Severe CAP

1993 BTS CAP Guidance

The 1993 BTS CAP guidance contained recommendations for the antibiotic treatment of “uncomplicated pneumonia of unknown origin without features indicating severe or non-pneumococcal disease”.

“An aminopenicillin (e.g. amoxicillin 500mg tds po/ampicillin 500mg qds iv) or benzylpenicillin 1.2g qds iv”. It was recommended that sulphonamides and tetracyclines be avoided due to pneumococcal resistance, quinolones should not be used as single agents due to poor activity and oral cephalosporins were considered to have limited activity against CAP pathogens. The place of new macrolides (e.g. clarithromycin and azithromycin) awaited further experience.

Institutional Document Recommendations

Of the 95 institutional documents, 91 (96%) contained recommendations for the empirical antibiotic regimen for a patient with CAP. Twenty-two different regimens

were recommended, and these were compared with the 1993 BTS CAP guidance to evaluate whether institutional guidelines allowed agreement with the national recommendations.

Three categories of comparison were used;

- Agreement-the institutional document recommended an antibiotic(s) that was included in the recommendations of the national guidance.
- Could allow agreement-several antibiotics were recommended and, depending on the agent chosen, it could allow agreement with the recommendations of the national guidance.
- Disagreement-the antibiotic(s) recommended was not included in the national guidance.

The empirical antibiotic regimen recommended by 46 (51%) institutional documents was in agreement with the 1993 BTS CAP guidance and these regimens are summarised in Table 8.2.

Table 8.2: Empirical antibiotic regimens recommended by institutional prescribing documents for non-severe CAP that were in agreement with the 1993 BTS CAP guidance (n=46).

Empirical antibiotic regimen	Number of institutional guidelines	
<i>Amoxicillin</i>	31	(67%)
<i>Amoxicillin or ampicillin</i>	6	(13%)
<i>Amoxicillin or benzylpenicillin</i>	4	(9%)
<i>Benzylpenicillin</i>	2	(4%)
<i>Ampicillin</i>	1	(2%)
<i>Ampicillin then amoxicillin</i>	1	(2%)
<i>Benzylpenicillin then amoxicillin</i>	1	(2%)

Of these recommendations, 31 suggested initial oral therapy, 9 suggested initial parenteral therapy whilst the recommendations of 6 guidelines allowed either oral or parenteral therapy.

The empirical antibiotic regimen recommended by 15 (16%) institutional guidelines was broader than the 1993 BTS CAP guidance and, depending on the antibiotic(s) chosen, allowed agreement with national guidance. These regimens are summarised in Table 8.3.

Table 8.3: Empirical antibiotic regimens recommended by institutional prescribing documents for non-severe CAP that allowed possible agreement with the 1993 BTS CAP guidance (n=15).

Empirical antibiotic regimen	Number of institutional guidelines
<i>Amoxicillin or erythromycin</i>	3 (20%)
<i>Amoxicillin +/- macrolide</i>	3 (20%)
<i>Amoxicillin or macrolide or 2nd-generation cephalosporin</i>	2 (13%)
<i>Amoxicillin or macrolide or 2nd-generation cephalosporin or penicillin</i>	2 (13%)
<i>Amoxicillin or 2nd-generation cephalosporin or penicillin</i>	1 (7%)
<i>Amoxicillin or macrolide or tetracycline</i>	1 (7%)
<i>Benzylpenicillin or macrolide</i>	1 (7%)
<i>Amoxicillin or doxycycline</i>	1 (7%)
<i>Amoxicillin or cefaclor</i>	1 (7%)

The empirical antibiotic regimen recommended by 30 (33%) institutional guidelines disagreed with the recommendations of the 1993 BTS CAP guidance and these regimens are summarised in Table 8.4.

Table 8.4: Empirical antibiotic regimens recommended by institutional prescribing documents for non-severe CAP that disagreed with the 1993 BTS CAP guidance (n=30).

Empirical antibiotic regimen	Number of institutional guidelines
<i>Amoxicillin and a macrolide</i>	20 (67%)
<i>Fluroquinolone</i>	2 (7%)
<i>Benzylpenicillin and a quinolone</i>	2 (7%)
<i>Benzylpenicillin and a fluroquinolone</i>	2 (7%)
<i>Co-amoxiclav</i>	2 (7%)
<i>Macrolide</i>	2 (7%)

Twenty guidelines recommended amoxicillin and a macrolide and of these, 4 were received in February 2002. Of the total 91 institutional guidelines, 64 (70%) recommended monotherapy, 24 (26%) recommended dual therapy and either one or two agents could be used from 3 (3%) guidelines.

ii). Second-line Alternatives for Non-Severe Pneumonia

1993 BTS CAP Guidance

Penicillin allergy was the only condition included in the 1993 BTS CAP guidance that necessitated an alternative regimen from the recommended empirical regimen.

“Alternatives in penicillin-allergic patients include erythromycin (e.g. 500mg orally or intravenous four times daily) or a second- or third- generation cephalosporin (e.g. cefuroxime or cefotaxime intravenously).”

Institutional Document Recommendations

Of the 91 prescribing documents that contained recommendations for the empirical antibiotic treatment of (non severe) CAP, 14 (15%) did not contain any guidance for 2nd-line/alternative states. The other 77 (85%) guidelines contained up to five

2nd-line/alternative recommendations, and these results are summarised in Table 8.5.

Table 8.5: The number of 2nd-line/alternative recommendations for non-severe CAP contained in institutional prescribing documents comparable with the 1993 BTS CAP guidance (n=77).

Number of 2 nd -line/alternative recommendations	Number of institutional guidelines
1	29 (38%)
2	23 (30%)
3	15 (19%)
4	9 (12%)
5	1 (1%)

iii). Severe CAP– Definition

1993 BTS CAP Guidance

The national guidance indicated that a patient had severe CAP if they had 2 or more of the following;

- Respiratory rate ≥ 30 /minute.
- Diastolic blood pressure ≤ 60 mmHg.
- Serum urea >7 mmol/litre.

Institutional Document Recommendations

Of the 91 institutional documents that contained guidelines for the empirical antibiotic therapy of non-severe CAP, 77 (85%) also contained recommendations for severe CAP. However, only 30 (39%) of these 77 documents contained guidance about how severe CAP should be defined.

Of the 30 documents that contained guidance about defining “severe CAP”, 25 (83%) provided a set of parameters associated with increased severity of infection and these are summarised in Table 8.6.

Table 8.6: Number of parameters included for the definition of “severe CAP” by institutional documents (n=25).

Severity definition	Number of institutional documents
<i>2+ of a defined set of parameters</i>	16 (64%)
<i>Any of a defined set of parameters</i>	7 (28%)
<i>3-6 of a defined set of parameters</i>	1 (4%)
<i>Consolidation & 2 of a defined set of parameters</i>	1 (4%)

In addition, two documents stated that “radiological consolidation” indicated severe CAP and 3 documents contained definitions of severe CAP that were immeasurable; “life-threatening”, “lobar pneumonia” and “causing significant hypoxia”.

iv). Severe CAP– Empirical Antibiotic Therapy

1993 BTS CAP Guidance

The 1993 BTS CAP guidance included a recommendation for the antibiotic treatment of “severe pneumonia of unknown aetiology”.

“Erythromycin 1g four times daily can be used with a second- or third- generation cephalosporin (e.g. cefuroxime 1.5g or cefotaxime 2g three times daily iv)”.

Institutional Document Recommendations

Of the 91 institutional documents that contained guidelines for the empirical antibiotic therapy of non-severe CAP, 77 (85%) also contained recommendations for severe CAP.

The empirical antibiotic regimen recommended by 20 (26%) of the 77 institutional documents was in agreement with the 1993 BTS CAP guidance and these regimens are summarised in Table 8.7.

Table 8.7: Empirical antibiotic regimens recommended by institutional prescribing documents for severe CAP that were in agreement with the 1993 BTS CAP guidance (n=20).

Empirical antibiotic regimen	Number of institutional guidelines
<i>Erythromycin and cefuroxime</i>	17 (85%)
<i>Erythromycin and cefotaxime</i>	3 (15%)

The empirical antibiotic regimen recommended by 57 (74%) institutional guidelines disagreed with the recommendations of the 1993 BTS CAP guidance and these regimens are summarised in Table 8.8.

Table 8.8: Empirical antibiotic regimens recommended by institutional prescribing documents for severe CAP that disagreed with the 1993 BTS CAP guidance (n=57).

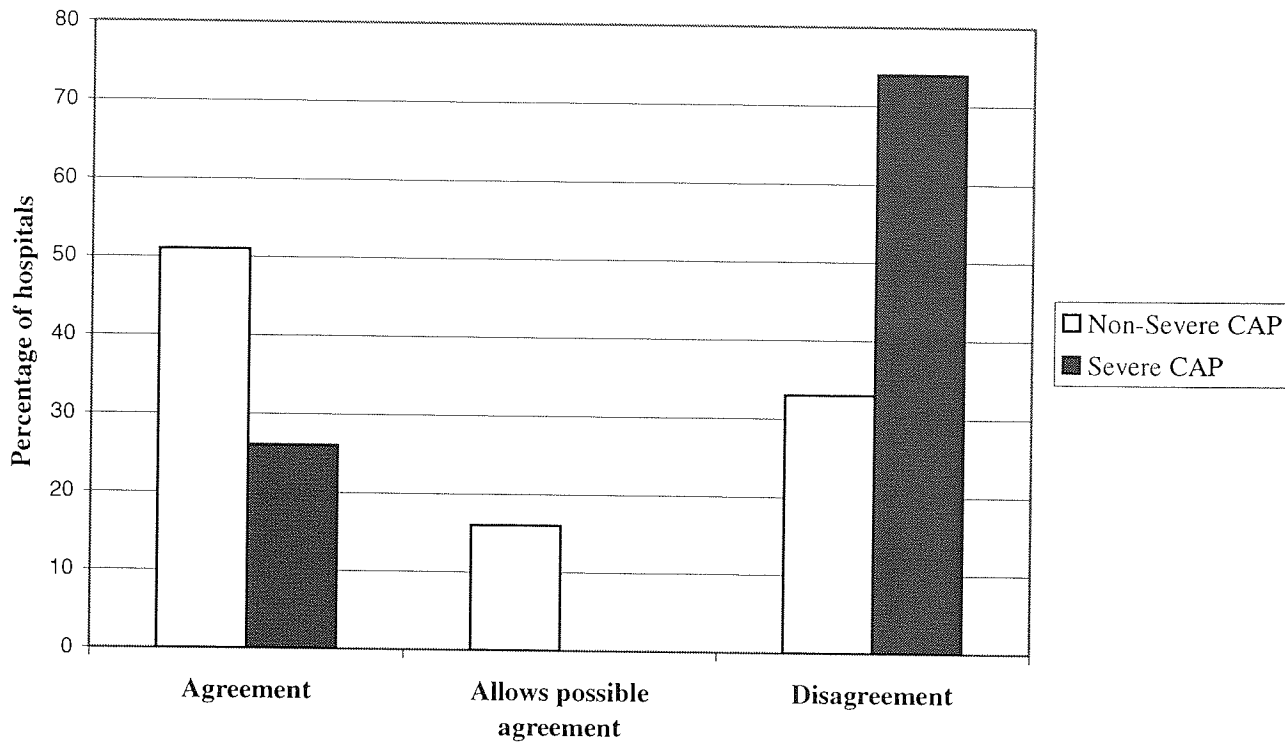
Empirical antibiotic regimen	Number of institutional guidelines
<i>Cefuroxime and clarithromycin</i>	11 (19%)
<i>Amoxicillin and a macrolide</i>	7 (12%)
<i>Ceftriaxone and clarithromycin</i>	5 (9%)
<i>Co-amoxiclav</i>	4 (7%)
<i>Cefotaxime and clarithromycin</i>	4 (7%)
<i>Clarithromycin and co-amoxiclav</i>	3 (5%)
<i>Cefuroxime</i>	2 (4%)
<i>Cefuroxime or clarithromycin</i>	2 (4%)
<i>Cefotaxime</i>	2 (4%)
<i>Ceftriaxone</i>	1 (2%)

Empirical antibiotic regimen	Number of institutional guidelines
<i>Cefuroxime or cefotaxime and clarithromycin</i>	1 (2%)
<i>Erythromycin and ceftriaxone and penicillin</i>	1 (2%)
<i>Clarithromycin and (cefotaxime or co-amoxiclav)</i>	1 (2%)
<i>(Penicillin V or benzylpenicillin) and (erythromycin or clarithromycin)</i>	1 (2%)
<i>Amoxicillin and levofloxacin</i>	1 (2%)
<i>Benzylpenicillin and clarithromycin</i>	1 (2%)
<i>Benzylpenicillin and levofloxacin</i>	1 (2%)
<i>Penicillin G and ofloxacin</i>	1 (2%)
<i>Levofloxacin</i>	1 (2%)
<i>Clarithromycin</i>	1 (2%)
<i>Benzylpenicillin and ciprofloxacin and gentamicin</i>	1 (2%)
<i>Ciprofloxacin and clarithromycin and penicillin</i>	1 (2%)
<i>Cefuroxime +/- clarithromycin</i>	1 (2%)
<i>Amoxicillin</i>	1 (2%)
<i>Amoxicillin and erythromycin and flucloxacillin +/- fusidic acid</i>	1 (2%)
<i>Amoxicillin and (erythromycin or doxycycline) and (flucloxacillin or co-amoxiclav)</i>	1 (2%)

Of the total 77 institutional guidelines, 14 (18%) recommended monotherapy, 57 (74%) recommended dual therapy, 5 (6%) recommended triple therapy and either one or two agents could be used from 1 (1%) institutional guideline.

The compliance of institutional document recommendations with the 1993 BTS CAP guidance is depicted in Figure 8.1.

Figure 8.1: The compliance of recommendations contained in institutional antibiotic prescribing documents with the 1993 BTS CAP guidance.



8.1.3 Institutional Guidelines Comparable with the 2001 BTS CAP Guidance

Of the institutional documents received, 9 were returned with the questionnaire, “Antibiotic Prescribing Documents, Survey 2001” in July 2002 (the third mailing). The recommendations contained in these documents were compared with the 2001 BTS CAP guidance, because these hospitals should have had enough time to update their institutional guidelines following the publication of the updated national guidance in December 2001. In addition, 64 guidelines were returned by medical microbiologists with the questionnaire, “Antibiotic Prescribing Documents, Survey 2002” in Winter 2002 and 37 guidelines were returned with the questionnaire, “Antibiotic Guideline Modifications, Survey 2002” also in Winter 2002. In total, 110 of the institutional guidelines received were compared with the 2001 BTS CAP guidance.

i). Non-Severe CAP

2001 BTS CAP Guidance

The 2001 BTS CAP guidance identified *S.pneumoniae* as the predominant pathogen for “hospital treated, not severe” CAP. However, Legionella species account for approximately 20% of infections and, for this reason, a combined β -lactam/macrolide regimen was recommended

“Oral amoxicillin 500mg-1.0g tds po plus erythromycin 500mg qds po or clarithromycin 500mg bd po is the preferred regimen.” The regimen recommendation for patients for whom oral therapy is inappropriate was “ampicillin 500mg qds iv or benzylpenicillin 1.2g qds iv plus erythromycin 500mg qds iv or clarithromycin 500mg bd iv”.

Institutional Document Recommendations

Of the 110 institutional documents, 106 (96%) contained a recommendation for the empirical antibiotic treatment of non-severe CAP. The empirical antibiotic regimen recommended by 32 (30%) institutional documents was in agreement with the 2001 BTS CAP guidance and these regimens are summarised in Table 8.9.

Table 8.9: Empirical antibiotic regimens recommended by institutional prescribing documents for non-severe CAP that were in agreement with the 2001 BTS CAP guidance (n=32).

Empirical antibiotic regimen	Number of institutional guidelines
<i>Amoxicillin and erythromycin</i>	18 (56%)
<i>Amoxicillin and clarithromycin</i>	11 (34%)
<i>Amoxicillin and (clarithromycin or erythromycin)</i>	3 (9%)

The empirical antibiotic regimen recommended by 7 (7%) institutional guidelines allowed for possible agreement with the 2001 BTS CAP guidance, depending on the antibiotic(s) selected. These regimens are summarised in Table 8.10.

Table 8.10: Empirical antibiotic regimens recommended by institutional prescribing documents for non-severe CAP that allowed possible agreement with the 2001 BTS CAP guidance (n=7).

Empirical antibiotic regimen	Number of institutional guidelines
<i>(Amoxicillin or cefuroxime) and erythromycin</i>	3 (43%)
<i>Amoxicillin +/- erythromycin</i>	3 (43%)
<i>Amoxicillin +/- (erythromycin or clarithromycin)</i>	1 (14%)

The empirical antibiotic regimen recommended by 67 (63%) institutional guidelines disagreed with the recommendations of the 2001 BTS CAP guidance and these regimens are summarised in Table 8.11.

Table 8.11: Empirical antibiotic regimens recommended by institutional prescribing documents for non-severe CAP that disagreed with the 2001 BTS CAP guidance (n=67).

Empirical antibiotic regimen	Number of institutional guidelines
<i>Amoxicillin</i>	39 (58%)
<i>Benzylpenicillin</i>	5 (7%)
<i>Ampicillin or amoxicillin</i>	3 (4%)
<i>Levofloxacin</i>	3 (4%)
<i>Amoxicillin or benzylpenicillin</i>	2 (3%)
<i>Doxycycline</i>	2 (3%)
<i>Amoxicillin and doxycycline</i>	1 (1%)
<i>Penicillin or a macrolide</i>	1 (1%)
<i>Amoxicillin or erythromycin</i>	1 (1%)
<i>Amoxicillin or benzylpenicillin or clarithromycin or erythromycin</i>	1 (1%)
<i>Amoxicillin or benzylpenicillin or cefuroxime</i>	1 (1%)
<i>Ampicillin or benzylpenicillin</i>	1 (1%)
<i>Ampicillin</i>	1 (1%)
<i>Benzylpenicillin and ciprofloxacin</i>	1 (1%)
<i>Doxycycline or amoxicillin or</i>	1 (1%)

<i>erythromycin</i>	
Empirical antibiotic regimen	Number of institutional guidelines
<i>Amoxicillin or clarithromycin</i>	1 (1%)
<i>Cefotaxime and erythromycin</i>	1 (1%)
<i>Benzympenicillin and erythromycin</i>	1 (1%)
<i>Benzympenicillin and clarithromycin</i>	1 (1%)

Of the 106 guidelines, 62 (58%) recommended monotherapy, 40 (38%) recommended dual therapy and either one or two agents could be used from 4 (4%) institutional guidelines.

ii). Second-line Alternatives for Non-Severe Pneumonia

2001 BTS CAP Guidance

The option of a fluroquinolone with enhanced pneumococcal activity was provided as an alternative regimen for specific patients. The only licensed fluroquinolone antibiotic was levofloxacin when the 2001 BTS CAP guidance was compiled and the recommended regimen was levofloxacin 500mg od po/iv.

Institutional Document Recommendations

Of the 106 prescribing documents that contained recommendations for the empirical antibiotic treatment of CAP, 9 (8%) did not include any guidance for 2nd-line/alternative states. The other 97 guidelines contained up to five 2nd-line/alternative recommendations, and these results are summarised in Table 8.12.

Table 8.12: The number of 2nd-line/alternative recommendations for non-severe CAP contained in institutional prescribing documents (n=97).

Number of 2 nd -line/alternative recommendations	Number of institutional guidelines
1	24 (25%)
2	27 (28%)
3	19 (20%)
4	22 (23%)
5	5 (5%)

iii). Severe CAP– Definition

2001 BTS CAP Guidance

The 2001 CAP guidance introduced the CURB criteria (see below) for diagnosing severe CAP. These four “core” features should be assessed for all patients, and patients should be classified as having “severe CAP” if they present with 2 or more of these features;

- Confusion: new mental confusion defined as an Abbreviated Mental Test score of 8 or less.
- Urea: raised >7 mmol/l.
- Respiratory rate: raised \geq 30/min.
- Blood pressure: low blood pressure (systolic <90mmHg and/or diastolic \leq 60mmHg).

If a patient has one of the above features, then “additional” adverse prognostic features should be considered;

- PaO₂ <8 kPa/SaO₂ <92% (any FiO₂).
- CXR: bilateral/multilobar shadowing.

Whether a patient is treated as having “severe CAP” is then at the discretion of the physician, based upon clinical judgement.

Institutional Document Recommendations

Of the 106 institutional documents that contained recommendations for the empirical antibiotic therapy of non-severe CAP, 86 (81%) also contained recommendations for the treatment of severe CAP. Fifty-four (63%) of these 86 documents contained guidance about the diagnosis of “severe CAP”, and of these, 44 included a set of measurable parameters. These results are summarised in Table 8.13.

Table 8.13: Number of parameters included for the definition of severe CAP by institutional documents (n=44).

Severity definition	Number of institutional guidelines
<i>2+ a defined set of parameters</i>	18 (41%)
<i>2 out of 4 defined parameters (defined specifically as CURB)</i>	11 (25%)
<i>List of adverse prognostic factors</i>	10 (23%)
<i>1+ of a defined set of parameters</i>	3 (7%)
<i>3+ of a defined set of parameters</i>	2 (5%)

Ten guidelines provided statements that did not include measurable parameters e.g. “high risk”.

iv). Severe CAP – Empirical Antibiotic Therapy

2001 BTS CAP Guidance

The guidance indicated that, although *S.pneumoniae* remained the predominant pathogen for patients with severe infection, *S.aureus* and Gram-negative enteric bacilli carry a high mortality rate and therefore broad-spectrum β -lactam regimens were recommended.

“Co-amoxiclav 1.2g tds or cefuroxime 1.5g tds or ceftriaxone 2g od (all iv) plus erythromycin 500mg qds iv or clarithromycin 500mg bd iv (with or without rifampicin 600mg od or bd iv)”. An alternative regimen was provided for patients intolerant of, or hypersensitive to, the preferred regimen; “fluroquinolone with some enhanced pneumococcal activity e.g. levofloxacin 500mg bd iv plus benzylpenicillin 1.2g qds iv”.

Institutional Document Recommendations

Of the 106 institutional documents that contained a recommended regimen for non-severe CAP, 86 (81%) also contained an empirical antibiotic regimen for the treatment of severe CAP.

The empirical antibiotic regimen recommended by 44 (51%) hospitals' institutional guidelines were in agreement with the 2001 BTS CAP guidance, and these regimens are summarised in Table 8.14.

Table 8.14: Empirical antibiotic regimens recommended by institutional prescribing documents for severe CAP that were in agreement with the 2001 BTS CAP guidance (n=44).

Empirical Antibiotic Regimen	Number of institutional guidelines
<i>Cefuroxime and erythromycin</i>	14 (32%)
<i>Cefuroxime and clarithromycin</i>	13 (30%)
<i>Co-amoxiclav and clarithromycin</i>	7 (16%)
<i>Ceftriaxone and clarithromycin</i>	5 (11%)
<i>Co-amoxiclav and erythromycin</i>	2 (5%)
<i>Cefuroxime and clarithromycin +/- rifampicin</i>	1 (2%)
<i>(Co-amoxiclav or cefuroxime) and clarithromycin</i>	1 (2%)
<i>Co-amoxiclav and erythromycin</i>	1 (2%)

The regimens of ten institutional guidelines could allow for possible agreement with the 2001 BTS CAP guidance, depending on the antibiotic(s) chosen. These regimens are summarised in Table 8.15.

Table 8.15: Empirical antibiotic regimens recommended by institutional prescribing documents for severe CAP that allowed possible agreement with the 2001 BTS CAP guidance (n=10).

Empirical Antibiotic Regimen	Number of institutional guidelines
<i>(Co-amoxiclav or cefuroxime or cefotaxime) and clarithromycin</i>	3 (30%)
<i>(Cefuroxime or cefotaxime) and erythromycin</i>	2 (20%)
<i>(Co-amoxiclav or cefotaxime) and clarithromycin</i>	1 (10%)
<i>(Co-amoxiclav or cefuroxime or cefotaxime or ceftriaxone) and (clarithromycin or erythromycin)</i>	1 (10%)
<i>Cefuroxime +/- clarithromycin</i>	1 (10%)
<i>(Cefuroxime or amoxicillin) and erythromycin</i>	1 (10%)
<i>Ceftriaxone and a macrolide +/- (flucloxacillin or vancomycin)</i>	1 (10%)

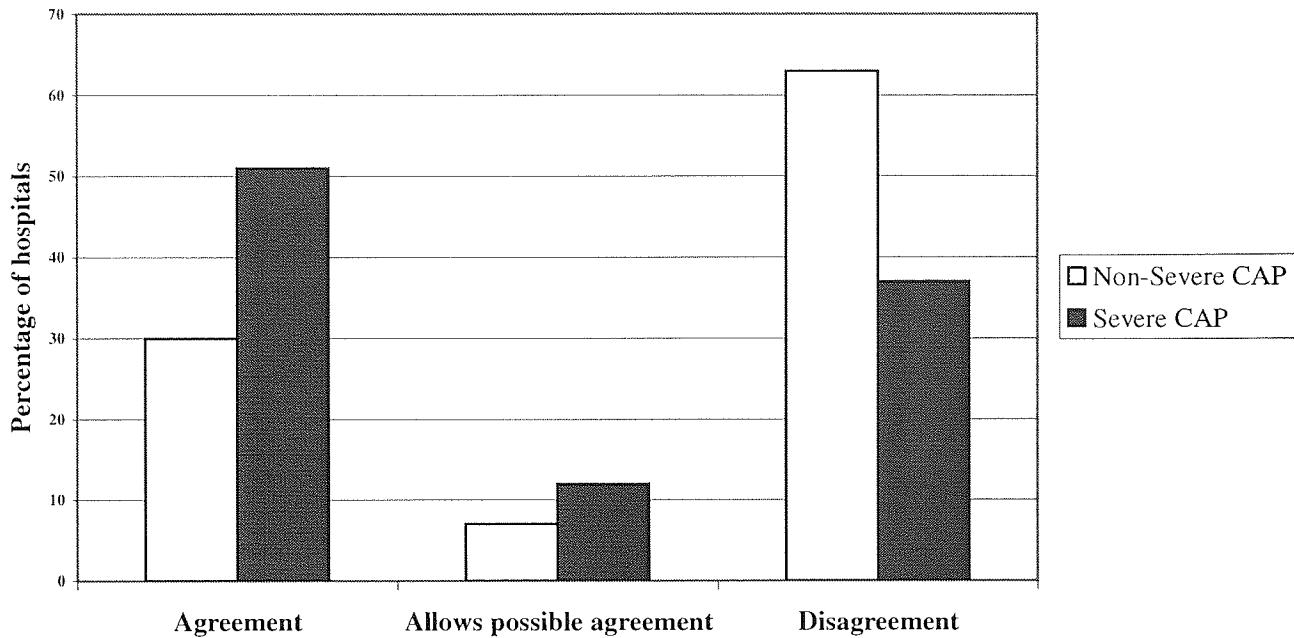
The empirical antibiotic regimen recommended by 32 (37%) hospitals' institutional guidelines disagreed with the 2001 BTS CAP guidance, and these regimens are summarised in Table 8.16.

Table 8.16: Empirical antibiotic regimens recommended by institutional prescribing documents for severe CAP that disagreed with the 2001 BTS CAP guidance (n=32).

Empirical Antibiotic Regimen	Number of institutional guidelines
<i>Benzylpenicillin and levofloxacin</i>	5 (16%)
<i>Cefuroxime</i>	3 (9%)
<i>Benzylpenicillin and erythromycin</i>	2 (6%)
<i>Levofloxacin</i>	2 (6%)
<i>Ampicillin and clarithromycin</i>	2 (6%)
<i>Cefotaxime and clarithromycin</i>	2 (6%)
<i>Co-amoxiclav or cefotaxime</i>	1 (3%)
<i>Ampicillin and ciprofloxacin</i>	1 (3%)
<i>Amoxicillin and levofloxacin</i>	1 (3%)
<i>Ampicillin or amoxicillin and erythromycin or clarithromycin</i>	1 (3%)
<i>Benzylpenicillin +/- clarithromycin</i>	1 (3%)
<i>Ampicillin and clarithromycin</i>	1 (3%)
<i>Benzylpenicillin or cefotaxime</i>	1 (3%)
<i>Clarithromycin</i>	1 (3%)
<i>Benzylpenicillin and ciprofloxacin</i>	1 (3%)
<i>Penicillin G and levofloxacin</i>	1 (3%)
<i>Co-amoxiclav</i>	1 (3%)
<i>Ceftriaxone</i>	1 (3%)
<i>Cefotaxime or benzylpenicillin</i>	1 (3%)
<i>Amoxicillin and erythromycin and flucloxacillin +/- fusidic acid</i>	1 (3%)
<i>A single antibacterial agent from a list</i>	1 (3%)
<i>Cefotaxime and erythromycin</i>	1 (3%)

The compliance of institutional document recommendations with the 2001 BTS CAP guidance is depicted in Figure 8.2.

Figure 8.2: The compliance of recommendations contained in institutional antibiotic prescribing documents with the 2001 BTS CAP guidance.



v). Additional Classification

2001 BTS CAP Guidance

The 2001 BTS CAP guidance introduced an additional classification of CAP, “hospital treated, not severe (admitted for non-clinical reasons or previously untreated in the community)”. This category was added in recognition of the fact that a significant number of patients with non-severe pneumonia are admitted to hospital for non-clinical reasons; advanced age, personal or family preference, inadequate home care or adverse social circumstances. Other patients are admitted who have not received therapy in the community and therefore have not failed previous therapy.

The guidelines recommended the antibiotic regimen of amoxicillin 500mg-1.0g tds po for the treatment of these patients. The choice of erythromycin 500mg qds po or clarithromycin 500mg bd po was provided for patients intolerant of, or hypersensitive to, the preferred regimen or where there was local concern regarding *C. difficile* associated diarrhoea related to β -lactam use.

Institutional Document Recommendations

Of the 106 guidelines that recommended an antibiotic regimen for mild CAP, 10 (9%) documents included a variation of this new category. Six of these documents recommended amoxicillin and a macrolide for 1st-line therapy and included a 2nd-line/alternative regimen of amoxicillin; 4 recommended monotherapy for patients who had not been previously treated in the community or who were admitted for non-clinical reasons and 2 recommended monotherapy for patients who had not been previously treated in the community. Four documents recommended amoxicillin monotherapy for 1st-line therapy and included a 2nd-line/alternative regimen for patients who had been previously treated in the community; amoxicillin and a macrolide for 3 documents, whilst 1 document recommended doxycycline or levofloxacin.

8.1.4 Two Editions of Institutional Guidelines

Two editions of guidelines were returned by 34 hospitals. One guideline edition was returned with the questionnaire, "Antibiotic Prescribing Documents, Survey 2001" for all these hospitals. For 18 hospitals a second edition was returned with the questionnaire, "Antibiotic Prescribing Documents, Survey 2002" and for 16

hospitals a second edition was returned with the survey “Antibiotic Modifications, Survey 2002”.

This provided an ideal opportunity to evaluate whether an institution’s CAP antibiotic guidelines had been updated following the publication of the 2001 BTS CAP guidance. The empirical antibiotic regimen contained in the 1st document received (comparable with the 1993 BTS CAP guidance) was compared with the regimen in the 2nd document (comparable with the 2001 BTS CAP guidance) to identify if changes had been made.

i). Non-Severe CAP

No recommendation in guidelines

Four (12%) of the guidelines received before publication of the 2001 BTS CAP guidance did not include any recommendation for the empirical antibiotic treatment of CAP. Of these 2 had also failed to include this infection in their updated guidelines, 1 had recommended amoxicillin or cefuroxime and erythromycin and 1 had recommended one agent from a list provided.

Recommendation not changed

The recommendations in 12 (35%) institutions’ guidelines had not been changed in their updated document. Of these, 4 already contained a regimen that agreed with the 2001 BTS CAP guidance (2 recommended amoxicillin and erythromycin and 2 recommended amoxicillin and clarithromycin) and therefore did not require changing. The remaining 8 guidelines had not been updated and the regimen

recommended did not agree with the BTS 2001 CAP guidance; 4 recommended amoxicillin, 1 recommended amoxicillin or benzylpenicillin, 1 recommended benzylpenicillin, 1 recommended amoxicillin or ampicillin and 1 benzylpenicillin plus ciprofloxacin.

Recommendation changed

Eighteen institutions (53%) had changed their guideline recommendations, of which 6 documents agreed with the 2001 BTS CAP guidance (4 recommended amoxicillin and erythromycin and 2 recommended amoxicillin and clarithromycin). One regimen allowed for possible agreement (amoxicillin +/- erythromycin) and 11 regimens did not agree with the BTS 2001 CAP guidance (5 recommended amoxicillin, 2 recommended levofloxacin, 1 recommended doxycycline, 1 recommended amoxicillin or clarithromycin, 1 recommended amoxicillin or cefuroxime or benzylpenicillin and 1 recommended cefotaxime and erythromycin).

ii). Severe CAP

No recommendation in guidelines

Seven (21%) of the guidelines received before the publication of the 2001 BTS CAP guidance did not include any recommendation for the empirical antibiotic treatment of severe CAP. Of these, 6 had also failed to include this infection in their updated guidelines and 1 had recommended cefotaxime or benzylpenicillin, which was not in agreement with the national guidance. Three (9%) guidelines had provided a regimen for severe CAP in the pre-2001 BTS CAP institutional document but did not provide a recommendation post-2001 BTS CAP guidance.

Recommendation not changed

The recommendations of 13 (38%) institutions' guidelines had not been changed in the updated document. Of these, 7 already contained a regimen that agreed with the 2001 BTS CAP guidance (4 recommended cefuroxime and erythromycin and 3 recommended cefuroxime and clarithromycin). Two guidelines could allow agreement with the 2001 BTS CAP guidance (1 recommended cefuroxime +/- clarithromycin and 1 recommended cefotaxime and erythromycin). The remaining 4 guidelines had not been updated and their regimen did not agree with the BTS 2001 CAP guidance (1 recommended ceftriaxone, 1 recommended amoxicillin and erythromycin and flucloxacillin +/-fusidic acid, 1 recommended clarithromycin and 1 recommended co-amoxiclav).

Recommendation changed

Eleven institutions (32%) had changed their guideline recommendations, of which 3 now agreed with the 2001 BTS CAP guidance (1 recommended co-amoxiclav and erythromycin, 1 recommended cefuroxime and clarithromycin and 1 recommended cefuroxime or ceftriaxone and erythromycin). Two allowed possible compliance (1 recommended cefotaxime and clarithromycin and 1 recommended cefuroxime or amoxicillin and erythromycin). Six of the changed regimens did not agree with the BTS 2001 CAP guidance (3 recommended a penicillin and levofloxacin, 1 recommended ampicillin and clarithromycin, 1 recommended an agent from a list of choices and 1 recommended benzylpenicillin and ciprofloxacin).

8.2 Discussion

This part of the study examined the recommendations contained in institutional antibiotic prescribing guidelines for the empirical antibiotic treatment of CAP and whether regimens agreed with national guidance from the British Thoracic Society. Recommendations of new national antibiotic prescribing guidance should be incorporated into institutional guidelines¹²² and whether guidelines had been appropriately revised in response to publication of the 2001 BTS CAP guidance was also investigated. This research programme also included a study to investigate pharmacists' awareness of the updated BTS guidance and subsequent revision of institutional guidelines (Chapter 9).

Recommendations contained within Dutch antibiotic policies for the treatment of CAP have been analysed³⁸³. In 1999, representatives of the BTS CAP Guidelines Committee analysed the recommendations for CAP contained in local hospital antibiotic guidelines and their relationship to the 1993 BTS CAP guidance³⁸⁴. Wiffen and White¹⁷ analysed recommendations for the empirical antibiotic treatment of CAP in their examination of antibiotic prescribing guidelines. The present study has updated these previous studies by examining the agreement of recommendations in institutional guidelines with the 2001 BTS CAP guidance and update of guidelines.

8.2.1 Response Rate

The 205 antibiotic prescribing guidelines were sufficient to allow a detailed analysis, which should ensure identification of the major trends. Fewer documents

were analysed by the BSAC CAP Committee (n=123)³⁸⁴ and by Wiffen and White (n=39)¹⁷.

8.2.2 Institutional Guidelines Comparable with the 1993 BTS CAP Guidance

i). Non-Severe CAP

The vast majority of guidelines contained recommendations for the empirical antibiotic treatment of non-severe CAP. However, 4 did not, although they contained recommendations for the antibiotic treatment of other infections, and there was no reason to exclude consideration of CAP. Antibiotic prescribing might be erratic and depend on prescriber and team preference in hospitals where guidelines are not available, and these hospitals could be encouraged to include recommendations for the treatment of CAP in future documentation.

The number of different regimens suggests that a large degree of variation occurs in prescribing for CAP in the UK. Approximately one-half of the documents recommended regimens that agreed with the 1993 BTS CAP guidance. Amoxicillin monotherapy was frequently recommended (34% of the documents received), less than the 54% identified by the BTS CAP Guideline Committee's study³⁸⁴. This difference might be due to the earlier performance of the BTS CAP Guideline Committee's study (2 years before the present work began) or the obtaining of guidelines from different hospitals in the two studies.

The majority of complying guidelines in the present study recommended initial oral therapy, as per the BTS document and the BTS 1999 study³⁸⁴. Such an approach is

preferred to parenteral therapy because of decreased treatment costs and absence of problems at the injection site³⁸⁵. Where an initial parenteral approach, followed by later transfer to oral therapy, was recommended it is possible that prescribers will forget to change the route of administration, and pharmacists can play an important role in enforcing sequential switch policies^{386 387}.

The regimens recommended by 15 institutional guidelines were broader than the 1993 BTS CAP guidance and could allow agreement with national guidance depending on the antibiotic(s) selected. However, the inclusion of choice could be confusing for prescribers and might lead to selection of inappropriate therapy e.g. due to influence of pharmaceutical representatives³⁸⁸ (D Monnet, ESCMID conference, 2004), and apparently comply with guidelines. It is also worrying that several regimens permitted the use of cephalosporins, which should be reserved for the treatment of severe infections due to resistance problems.

Two-thirds of the 30 guidelines that disagreed with the BTS guidance recommended dual therapy of amoxicillin and a macrolide. The 1993 BTS CAP guidance recommended amoxicillin alone, whilst the 2001 BTS CAP guidance recommended the addition of a macrolide. The inclusion of the latter regimen in these institutional guidelines might indicate that those hospitals were “forward-looking” and had anticipated a change in national guidance, or might employ members of the CAP Guidelines Committee. In the BTS 1999 study the main reason for hospitals not complying with the 1993 BTS guidance was also due to the recommendation of a B-lactam agent with a macrolide (24% of 29 documents

received), which prompted the Committee to change to this recommendation in the 2001 BTS CAP guidance.

Four institutions recommended a fluroquinolone antibiotic, and this category of drug did not exist when the 1993 BTS CAP guidance was written. However, the BTS guidance had been available for 8 years at the time of the present study, and a revision was overdue. The 2001 BTS CAP guidance recommended that such antibiotics be reserved for 2nd-line use due to concerns about antibiotic resistance³⁸⁹, and therefore the recommendation for 1st-line use has to be considered non-compliant. The recommendations of six (7%) institutional documents included a cephalosporin option, which is of concern because of resistance concerns associated with the use of these antibiotics. However, recommendation of these antibiotics was noticeably less than in the 30% (n=10) of documents reported by Wiffen and White¹⁷.

Reasons for institutional document regimens failing to comply with national guidance might include hospital staff being unaware of the BTS guidance, a distrust of national guidance¹²² and legitimate reasons for providing alternative advice, e.g. concerns about local antibiotic resistance or *Cl.difficile* associated diarrhoea³⁹⁰.

An empirical antibiotic prescribing recommendation will often not be appropriate for all patients and it may be necessary to provide a 2nd-line or alternative regimen for some patients. Fifteen percent of institutional guidelines did not include any 2nd-line/alternative regimens, which may lead to confusion about the appropriate

treatment of a patient for whom the 1st-line regimen is inappropriate, and to variation in prescribing.

Although some institutional prescribing guidelines contained up to six 2nd-line/alternative regimens, the majority included one or two such treatment-options. Balance must be achieved between including advice for the treatment of the main possible 2nd-line alternatives and providing the prescriber with excessive information, which could be confusing and make the document bulky. Excessive information can reduce rather than increase prescribers' compliance with guideline recommendations, and careful consideration needs to be given to the number and type of 2nd-line/alternative options included.

ii). Severe CAP

Different degrees of infection are associated with different mortality rates and require different treatment approaches. It is therefore important that CAP is classified as “non-severe” or “severe”³⁹¹. One of the criticisms of the 1993 BTS CAP guidance was that some patients could have been treated successfully with a milder approach²⁰⁰. Several of the institutional guidelines analysed in the present study did not contain any recommendation for the treatment of severe infection, and recommendation of one antibiotic regimen for all patients with CAP leads to the possibility of both under- and over-treatment.

Almost two-fifths of guidelines recommended a different antibiotic regimen for non-severe and severe CAP. However, they did not provide measurable parameters for the classification of severe CAP, which may be dependent upon prescribers'

interpretation (with the more cautious treating as “severe” and the more cavalier treating as “non-severe”). Less experienced (junior) prescribers may be less competent in their classification of infection severity and the 2001 BTS CAP guidance suggests that clinical judgement has resulted in an apparent underestimation of severity²⁰⁰.

Approximately three-quarters of institutional guidelines recommended a regimen for severe CAP that incorporated two agents, in accordance with the 1993 BTS CAP guidance²²⁴. However, 15 of the institutional documents disagreed with the 1993 BTS CAP guidance due to the recommendation of clarithromycin rather than erythromycin. Although often associated with greater acquisition costs, clarithromycin causes less gastrointestinal side-effects and needs to be administered less frequently than erythromycin. The 1993 BTS CAP guidance considered that the use of clarithromycin awaited further experience, whilst the updated 2001 BTS CAP guidance recommended either erythromycin or clarithromycin as a macrolide choice²⁰⁰. A further five documents disagreed due to the recommendation of ceftriaxone. Although a 3rd-generation cephalosporin, it was not listed in the 1993 BTS CAP guidance (although licensed in 1988), but was recommended in the 2001 BTS CAP guidance.

Eight institutional guidelines recommended a regimen for the treatment of severe infection that was included in either the 1993 or 2001 BTS CAP guidance for the treatment of non-severe CAP, possibly leading to treatment failure and an increased mortality rate.

The level of disagreement with national guidance was greater for severe CAP (74%) than non-severe infection (33%). However, it could be argued that there is a greater need for therapy rationalisation for a more severe condition.

8.2.3 Institutional Guidelines Comparable with the 2001 BTS CAP Guidance

i). Non-Severe CAP

Institutional recommendations for the treatment of non-severe CAP agreed with the 2001 BTS CAP guidance in only approximately one-third of hospitals, which is a lower level of agreement than observed with the 1st cohort documents (comparable with the 1993 BTS CAP guidance). Recommendations in 51% of the institutional guidelines agreed with the 1993 BTS CAP guidance, but the level of agreement decreased with the publication of the 2001 BTS CAP guidance, because only 32% of guidelines agreed with the latter guidance. This suggests that hospitals had not responded to new national guidance, possibly due to a time-dependent effect. This is considered further in Chapter 9.

Approximately one-third of guidelines recommended dual therapy in line with national guidance. However, two guidelines recommended initial treatment with benzylpenicillin, which should be reserved for patients with absorption problems or for whom the oral route is contra-indicated²⁰⁰.

Thirty-nine institutional guidelines recommended amoxicillin monotherapy, and a further 12 documents recommended ampicillin and/or benzylpenicillin, as recommended by the 1993 BTS CAP guidance but outdated with the publication of

the 2001 BTS CAP guidance. However, the institutional guidelines were all received at least 7 months after the 2001 BTS CAP guidance had been published, and hospitals should have had sufficient time to respond to change in national guidance.

There was a noticeable increase in the number of 2nd-line/ alternative options provided in these 2nd cohort documents, with almost one-half of documents providing three or more 2nd-line/alternative options. It is not clear why an increased number of 2nd-line/alternative options was provided in response to the updated national guidance, because that document only contained two of these options; oral therapy and intolerance of the preferred regimen. It appears that as an additional 2nd line/alternative has been added in the national guidance, the number of 2nd line/alternatives contained in institutional guidelines has also increased.

ii). Severe CAP

Almost two-thirds of the guidelines provided guidance for the classification of “severe CAP”. A noticeable increase in the proportion of guidelines containing such advice suggests that the emphasis in the 2001 BTS CAP guidance about the importance of differentiation between CAP and severe CAP has been somewhat successful.

Approximately one-half of hospitals recommended a regimen for severe CAP that agreed with the 2001 BTS CAP guidance. This represents a noticeable increase in the proportion of institutional guidelines agreeing with national guidance for the treatment of severe CAP, compared to the guidelines comparable with the 1993

BTS CAP guidance. This suggests that the greater emphasis placed upon the definition and treatment of severe CAP by the updated national guidance has achieved some success. However, there is still a need to emphasise the importance of local uptake of national guidance, because about 50% of hospitals had not complied.

Regimens contained in thirteen institutional guidelines recommended the use of cefotaxime, but although this antibiotic is a 2nd-generation cephalosporin, it was not listed in the 2001 BTS CAP guidance. A further nine hospitals recommended levofloxacin as a 1st-line empirical regimen. However, such a regimen should be reserved for the alternative treatment of certain patients, because fluoroquinolones should be used sparingly to prevent problems with resistance in the future. Twenty-four different regimens were recommended by only one hospital each, which indicates wide variation in recommendations.

The level of disagreement with national guidance was greater for non-severe CAP (63%) than severe infection (37%). This represents a change in trend following the publication of the 2001 BTS CAP guidance because disagreement was greatest for the recommendation of severe infection in documents comparable with the 1993 BTS CAP guidance.

An additional category of CAP treatment was introduced in the 2001 BTS CAP guidance, “hospital treated, not severe (admitted for non-clinical reasons or previously untreated in the community)”. However, this category was seldom included in institutional guidelines, which indicates a lack of appropriate response

mechanisms to the updated national guidance. It is possible that this new category has caused confusion for guideline reviewers about whether the regimen should be recommended for 1st-line therapy or as a 2nd-line/alternative option, and such variation was identified in the guidelines reviewed.

8.2.4 Two Editions of Institutional Guidelines

Less than one-fifth of hospitals had appropriately revised the recommendation of their hospital's institutional document for the treatment of non-severe CAP, and only about one-tenth had appropriately revised their recommendations for severe CAP. This again suggests that proactive mechanisms for response to new national guidance do not exist in some hospitals. It is also of concern that three guidelines included a recommendation for severe CAP pre-2001 BTS CAP guidance but no recommendation was provided in the subsequent edition of the institutional document.

8.3 Conclusion

This part of the study examined the antibiotic prescribing recommendations provided in institutional guidelines for the empirical antibiotic treatment of non-severe and severe CAP.

Disagreement with national guidance was greatest for severe CAP in guidelines comparable with the 1993 BTS CAP guidance, but greatest for non-severe CAP in guidelines comparable with the 2001 BTS CAP guidance. Provision of the definition of the term "severe CAP" is essential for the appropriate treatment of patients, and more of the documents received after the publication of the 2001 BTS

CAP guidance included such a definition. The time-period of the study provided an excellent opportunity to assess hospitals' response to updated national guidance. There is a need for the improvement of institutional recommendations to allow agreement with national guidance, although it should be considered that individual factors in some hospitals may necessitate disagreement with national guidance due to factors such as local resistance patterns.

The main findings of this study are;

Institutional guidelines comparable with the 1993 BTS CAP guidance.

- 51% (n=46) of guidelines provided a recommendation for non severe CAP that agreed with the 1993 BTS CAP guidance. The main reason for disagreement with the national guidance was due to the recommendation of amoxicillin and a macrolide, as per the 2001 BTS CAP guidance (n=20).
- 85% (n=77) of guidelines contained at least one 2nd-line/alternative option and 68% (n=52) of guidelines provided one or two alternatives.
- 85% (n=77) of the institutional guidelines recommended a regimen for the empirical antibiotic treatment of severe CAP, although only 39% (n=30) provided a definition of severe CAP.
- 26% (n=20) of the guidelines recommended a regimen for severe CAP that agreed with the recommendations of the 1993 BTS CAP guidance. The main reason for non-agreement was due to the recommendation of clarithromycin rather than erythromycin.
- Agreement of the institutional document recommendations with the 1993 BTS CAP guidance was noticeably higher for the treatment of non-severe CAP (51%, n=46) than severe CAP (26%, n=20).

Institutional guidelines comparable with the 2001 BTS CAP guidance.

- 30% (n=32) of guidelines recommended a regimen for non-severe CAP that was in agreement with the 2001 BTS CAP guidance. The main reason for disagreement was due to the recommendation of amoxicillin monotherapy, as per the 1993 BTS CAP guidance (n=39).
- 92% (n=97) of guidelines contained up to 5 regimens and 76% (n=73) contained 2 or more 2nd-line/alternative.
- 81% (n=86) of guidelines contained a recommendation for the empirical antibiotic treatment of severe CAP and 63% (n=54) of these contained a definition that included measurable criteria.
- 51% (n=44) of the institutional guidelines contained a regimen for severe CAP that agreed with the recommendations of the 2001 BTS CAP guidance. The main reasons for disagreement were the recommendation of cefotaxime or clarithromycin.
- The 2001 BTS CAP guidance introduced an additional classification for CAP, “hospital treated, not severe (admitted for non-clinical reasons or previously untreated in the community)”. Of the 106 institutional guidelines that recommended an antibiotic regimen for mild CAP, 10 (9%) included a variation of this new category of treatment.
- Two editions of institutional guidelines were received from 34 hospitals; one set comparable with the 1993 BTS CAP guidance and the other comparable with the 2001 BTS CAP guidance. Less than one-fifth of hospitals had appropriately revised the recommendation of their hospital’s institutional document for the treatment of non-severe CAP, and only 9% had appropriately revised their recommendation for severe CAP.

Chapter 9 Local hospital uptake of a new national antibiotic guideline for the empirical antibiotic treatment of community-acquired pneumonia

The recommendations of institutional antibiotic prescribing guidelines for the empirical treatment of CAP have been examined (Chapter 8). It is important that these recommendations are based upon national prescribing guidance and pharmacists have been identified as performing a key role in approving antibiotic prescribing control guidelines (Chapter 4). The publication of the updated British Thoracic Society guidance, “BTS Guidelines for the Management of Community Acquired Pneumonia in Adults”, in 2001 provided an ideal opportunity to examine pharmacists’ awareness and response to a new national antibiotic prescribing guideline at an institutional level.

A self-completion postal questionnaire was designed to identify the following objectives; Chief Pharmacists’ awareness of the new national antibiotic prescribing guidance, whether institutional guidelines had been revised following this publication and which professional staff had initiated and been involved in this revision process.

This questionnaire, “Antibiotic Guideline Modifications, Survey 2002” was sent to the 253 Chief Pharmacists (or their nominated staff, which included pharmacists with clinical, formulary and infectious diseases responsibilities) who had completed the previous questionnaire, “Antibiotic Prescribing Documents, Survey 2001”. A copy of the questionnaire is included in Appendix C.

9.1 Results

9.1.1 Response Rate

Three successive mailings were sent to the 253 recipients and a total of 188 questionnaires were completed (a response rate of 74%). The number of questionnaires completed for each mailing is summarised in Table 9.1.

Table 9.1: The proportion of questionnaires returned after successive mailings.

Questionnaire mailing	Number of questionnaires completed	Cumulative total of questionnaires completed	Completed questionnaires as a proportion of the total sent (%)
1 st	131	131	52
2 nd	42	173	68
3 rd	15	188	74

9.1.2 Nature of Pharmacist Respondents

The job title was specified by 128 (68%) of the 188 pharmacist respondents. Although the questionnaire was addressed to the Chief Pharmacist, it is not known whether it was subsequently passed onto another staff member for the other 60 (32%) respondents. The job titles specified by the 128 respondents are summarised in Table 9.2.

Table 9.2: The job titles of respondent pharmacists (n=128).

Job Title	Number of pharmacists
<i>Chief Pharmacist (or similar)</i>	49 (38%)
<i>Clinical pharmacist</i>	37 (29%)
<i>Principal pharmacist</i>	27 (21%)
<i>Formulary pharmacist</i>	5 (4%)
<i>Clinical governance support pharmacist</i>	5 (4%)
<i>Infectious diseases pharmacist</i>	4 (3%)
<i>Procurement and IT pharmacist</i>	1 (1%)

Data on the type of hospital, size, country of location in the UK and antibiotic prescribing control activities were derived from the previous questionnaire (“Antibiotic Prescribing Documents, Survey 2001”) for the same sample of hospitals. These are summarised below.

9.1.3 Data from the Previous Questionnaire (“Antibiotic Prescribing Documents, Survey 2001”)

i). Geographical Nature of Respondents

Generally, a similar response rate was achieved from the four constituent countries of the UK and these results are summarised in Table 9.3.

Table 9.3: Response rate from hospitals of the four UK constituent countries.

Country of location	Number of respondents	Number surveyed	Response rate (%)
England	143	195	73
Scotland	22	31	71
Wales	11	14	79
Northern Ireland	12	13	92
Total	188	253	

ii). Parameters of Responding Hospitals

The majority of the 188 respondents were from DGHs (55%, n=103) with the remainder from either teaching hospitals (24%, n=45) or specialist units (21%, n=40). One hundred and eighty-six respondents had answered a question about

their hospital's size. When classified by size, 84 (45%) hospitals had 500 beds or less, 78 (42%) had between 501 and 1000 beds whilst 22 hospitals (12%) had more than 1000 beds. Two respondents (1%) did not know how many beds their hospital contained.

iii). Availability of Institutional Guidelines

A total of 185 respondents had provided a valid response about whether their hospital had institutional antibiotic prescribing guidelines; 164 (89%) hospitals had antibiotic prescribing guidelines whilst 19 (10%) hospitals did not. Two respondents (1%) did not know whether their hospital had guidelines or not.

9.1.4 Data from the Present Questionnaire (“Antibiotic Guideline Modifications, Survey 2002”)

i). Awareness of the New BTS CAP Guidance

Respondents were asked if they were aware of the 2001 publication, “British Thoracic Society Guidelines for the Management of Community Acquired Pneumonia in Adults”²⁰⁰. A valid response was provided by 185 of the respondents.

The majority of pharmacists (71%, n=117) from the 164 hospitals that had antibiotic prescribing guidelines were aware of the publication of the 2001 BTS CAP guidance. However, almost one-third (29%, n=47) of the pharmacists were unaware of the publication of this new guidance. Pharmacists employed in small hospitals ($p=0.045$) and those located in England ($p=0.021$) were significantly less likely to be aware of the BTS guidance. Respondents were more likely to be aware

of the new BTS guidance in hospitals that undertook audits of antibiotic prescribing (p=0.002).

Respondents from a total of 24 hospitals either knew their hospital did not have institutional antibiotic prescribing guidelines, did not know if their hospital had this document or not, or failed to answer the question. Of these respondents, 21 provided a valid response about their awareness of the new guideline; 9 Chief Pharmacists were aware of the publication of the 2001 BTS CAP guidance whilst 12 respondents were not aware of this publication.

ii). Revision of Institutional Antibiotic Prescribing Guidelines

Respondents were asked if there had been a revision of their hospital's antibiotic prescribing guidelines for CAP following the publication of the 2001 BTS CAP guidance (i.e. since December 2001). A total of 66 of the 164 hospitals (40%) with institutional antibiotic prescribing guidelines had revised their document following the publication of the 2001 BTS guidance, whereas about half had not (49%, n=80). Eighteen respondents (11%) did not know whether their hospital's guidelines had been revised or not.

Revision of institutional guidelines was less likely to have been performed in small hospitals (p=0.019), hospitals in England (p=0.011) or where medical microbiologists participated in antibiotic prescribing control (p=0.034). It was more likely that revision had been performed in teaching hospitals (p=0.045) and hospitals with a specialist ID unit (p=0.030).

iii). Awareness of BTS Guidance & Review of Institutional Guidelines

Pharmacists in 71% (n=117) of the 164 hospitals with institutional antibiotic prescribing guidelines were aware of the new BTS guidance. Analysis of this subgroup revealed that revision of institutional guidelines had been performed in only 51% (n=60) of these hospitals following the publication of the new 2001 BTS CAP guidance. Revision had not been performed in 45% (n=53) hospitals, and the remaining respondents (3%, n=4) did not know whether revision had been performed or not. Guidelines were less likely to have been revised in small specialist hospitals (p=0.046) than in any other type of hospital but were more likely to have been revised in teaching hospitals (p=0.005) and in those with a specialist ID unit (p=0.012).

iv). Proactive Review of Institutional Guidelines following BTS 2001 Guidance

In 60 hospitals the pharmacist was aware of the 2001 BTS guidance and institutional antibiotic prescribing guidelines had been revised. These respondents were asked whether this revision process had been planned prior to the BTS publication; the majority of these hospitals (63%, n=38) had a previously planned revision. In 18 (30%) hospitals revision had not been planned prior to publication of the new national guidance and respondents from 4 (7%) hospitals did not know whether revision had been previously planned or not.

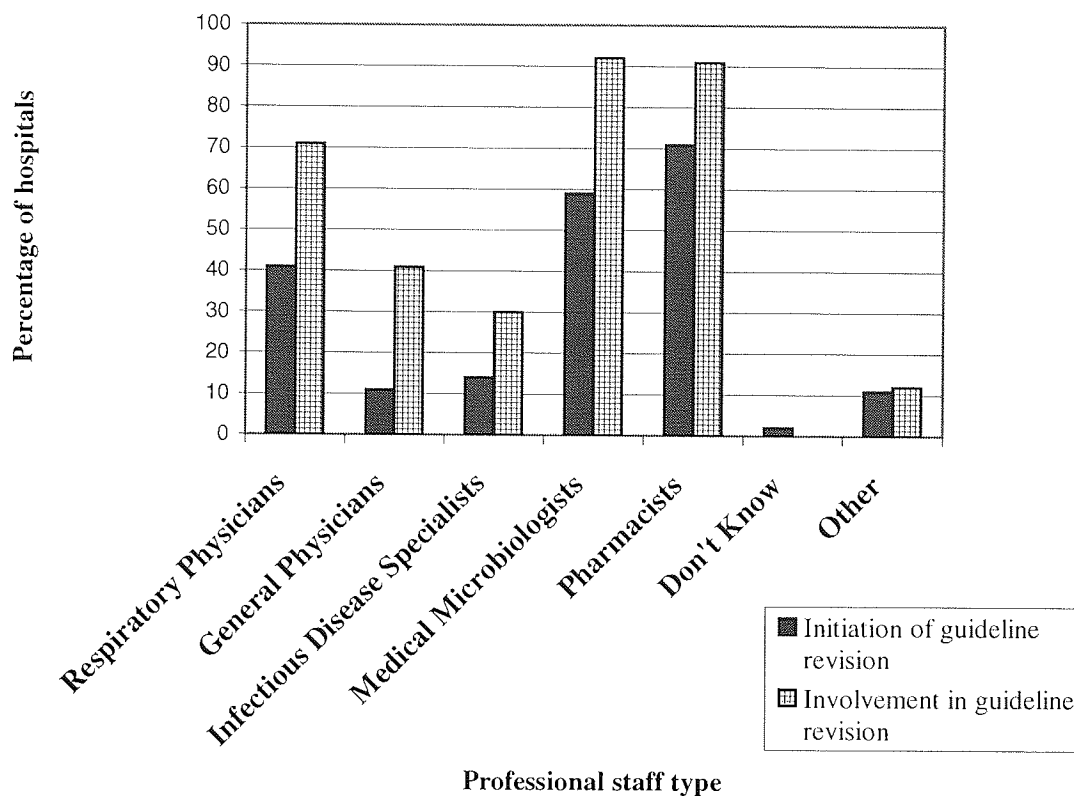
In a further attempt to identify if proactive revision of institutional guidelines had been instigated, these same 60 respondents were asked if the revision of their hospital's guidelines had been especially implemented in response to the publication of the new BTS guidance. Revision of institutional guidelines had been

in direct response to the publication of new national guidance in approximately one-quarter (28%, n=17) of these hospitals. However, in the majority (65%, n=39) of hospitals this revision had not been especially implemented following updated national guidance. Four (7%) respondents did not know whether this review had been especially implemented or not. The decision to undertake a revision in response to publication of the BTS 2001 CAP guidance was not linked to any of the hospital parameters examined.

v). Guidelines Revision

The 66 respondents from the total hospitals that had revised their antibiotic prescribing guidelines were asked to identify, from a list of alternatives, the professional staff groups that had initiated and been involved in this revision process. Figure 9.1 depicts the responses to these questions.

Figure 9.1: Initiation of, and involvement in, guidelines revision by professional staff, as reported by pharmacists (n=66).



Initiation of Guidelines Revision

Pharmacists had been involved in initiating the revision of guidelines in the majority of hospitals (71%, n=47). The revision process had been initiated by either one (38%, n=25) or two (36%, n=24) different professional staff groups in the majority of hospitals. Joint initiation by pharmacists and medical microbiologists was the most frequent combination of staff and accounted for revision in 20% (n=13) of hospitals. Pharmacist initiation alone accounted for revision in 14% (n=9) of hospitals.

Involvement in Guidelines Revision

Pharmacists had been involved in the revision of local guidelines in 91% (n=60) of the hospitals examined. In the majority of hospitals, either three (35%, n=23) or

four (27%, n=18) different professional staff groups had been involved in the guideline revision process. The most frequently cited combination of staff involved in revision was respiratory physicians, medical microbiologists and pharmacists (these staff were involved in 18 hospitals).

9.2 Discussion

This part of the study examined the awareness of the 2001 BTS CAP guidance by Chief Pharmacists (or their nominated staff). It also identified whether institutional antibiotic prescribing guidelines had been subsequently revised.

The new national guidance, “BTS Guidelines for the Management of Community Acquired Pneumonia in Adults”,²⁰⁰ was published in 2001 and replaced the earlier 1993 BTS guidance, “Guidelines for the management of community-acquired pneumonia in adults admitted to hospital”²²⁴. However, an analysis of recommendations in institutional antibiotic prescribing guidelines for the empirical antibiotic treatment of CAP indicated that many recommendations had not been updated in response to the publication of the new national guidance (Chapter 8).

Literature searches identified a paucity of studies examining staff awareness of a new antibiotic guideline and consequent revision of institutional guideline documents. Such a study is useful in informing policy makers about the efficacy of the implementation of national guidance at a local level. Previous studies that have investigated a local hospital response to the publication of new national prescribing guidance have mostly evaluated physicians’ compliance with new prescribing recommendations^{225,229,92,93}.

However, pharmacists have an important role in the update of institutional guidelines³⁹³ and often sit on the DTC. It is therefore essential that pharmacists are aware of relevant new national guidance so that they can lead pro-active revision of local recommendations. The publication of the updated BTS CAP guidance provided an ideal opportunity for an in-depth investigation of the processes operating in hospitals for the revision of institutional guidelines following change of national policy, and the role of different professional staff in this process.

9.2.1 Response Rate

The questionnaire was completed by almost three-quarters of recipients, an excellent result for a self-completion postal questionnaire. The survey population consisted of pharmacists who had already replied to a previous survey about antibiotic prescribing control documents and their enforcement (the subjects of Chapter 4 and Chapter 5 respectively), and it is likely that the targeting of interested and motivated recipients contributed to this high response rate. The questionnaire was presented in a folded A-5 booklet format, was coloured and only contained 7 questions, and these factors also presumably encouraged a high response rate. The respondent group was not homogeneous, which might have impacted upon the responses.

9.2.2 Awareness of the 2001 BTS CAP Guidance

One of the objectives was to identify the proportion of pharmacist respondents who were aware of the publication of the 2001 BTS CAP guidance.

Chief Pharmacists (or their nominated staff) were purportedly unaware of the publication of this national guidance in almost one-third of the hospitals examined. The multidisciplinary DTC is commonly involved in approving antibiotic prescribing guidelines (page 79, Chapter 4), and pharmacists traditionally have an important position on such committees. Therefore Chief Pharmacists would be expected to be aware of the new BTS guidance, even if they had not themselves raised this issue to the DTC. If members of such a committee are unaware of the publication of new national guidance, it is likely that local institutional guidelines will not be appropriately revised. This highlights the need for the proactive identification of new national antibiotic prescribing guidance by a specific member of the DTC.

However, this finding should be set in a global context of poor compliance with national antibiotic prescribing guidelines³⁹⁴⁻³⁹⁶. Previous studies have also identified poor prescriber compliance with recommendations for CAP therapy³⁹⁷⁻³⁹⁹, and this finding was the impetus for a case-study of prescriber compliance with an institutional antibiotic prescribing guideline for the empirical treatment of CAP in a large hospital (Chapter 10). Previous BTS guidance for other respiratory conditions has also had limited impact; variations from national recommendations have been identified for the assessment and management of acute asthma⁴⁰⁰, spontaneous pneumothorax⁴⁰¹ and chronic obstructive pulmonary disease⁴⁰².

It is possible that the Chief Pharmacist might have delegated the role of identifying national guidance, and/or membership of the DTC, to another member of staff, e.g. the formulary pharmacist. However, it would be expected that such a member of

staff would subsequently report back to the Chief Pharmacist. The new breed of specialist “infectious diseases pharmacists”, with their responsibility for improving antibiotic prescribing within a hospital, are ideally suited to undertake the role of identifying updated national guidance.

It is interesting that Chief Pharmacists (or their nominees) employed in English hospitals were less likely to be aware of the publication of the BTS 2001 CAP guidance than those based in hospitals located in the other UK countries. The reason for this difference is unclear, but it is possible that hospitals in other countries have placed greater importance upon the adoption of national guidelines and, for instance, may have been influenced by the publication of the SIGN guidelines¹⁹⁶ in Scotland. Pharmacists in small, specialist hospitals (e.g. psychiatric units) were also less likely to be aware of the updated guidance. Although these hospitals would probably treat fewer patients with CAP, it is still important that they have updated guidelines for therapy so that the occasional patients with this infection are treated according to the best available evidence.

Pharmacists were more likely to be aware of the publication of the new national guidance in hospitals that undertook audits of antibiotic prescribing. It is possible that such hospitals place greater emphasis on antibiotic prescribing control initiatives than do those that do not audit, and such an organisational culture has influenced Chief Pharmacists’ overall awareness of prescribing guidelines. It was not surprising that Chief Pharmacists were more likely to be aware of new national guidance in hospitals that had institutional antibiotic prescribing guidelines available than those that did not, because in the latter case there would be no need

for efforts to identify updated recommendations. Staff who were aware of the guidelines in those hospitals might have identified them due to a specific interest in the treatment of CAP.

In a consideration of pharmacists' awareness of the publication of new national guidance, it is important to consider the efficacy of the method by which such guidance was disseminated, because this might have impacted upon how easily staff could identify a change in practice. Although the BTS 2001 CAP guidance was published in the prestigious journal "Thorax", passively disseminated national guidance has been identified as generally having a poor uptake by professional staff³⁹². The journal publication of national guidelines has been reported to have a limited effect on local uptake¹¹⁹ and in a survey of Canadian physicians, only 50% of respondents found a journal article a useful format for the presentation of new guidelines²⁴⁹. The authors of a study on the use of a new national guideline for acute pancreatitis concluded that publication of the guideline alone had been insufficient to modify the practice of certain surgeons²²⁵. Commercial support for the dissemination and implementation of national guidelines may explain differences in the effective use of some guidelines⁴⁰³, and such support can help maximise dissemination of guidance (Mandell, Third Forum on Respiratory Tract Infections, 2004). The 2001 BTS CAP guidance is also available on the internet from the British Thoracic Society website⁴⁰⁴, but access to guidelines in this format is dependent upon professionals' access to, and competence with, this technology.

Although the relationship between hospital parameters and staff awareness has been considered, it would be interesting to identify other factors that might have

impacted upon pharmacists' awareness of this new national guidance, e.g. poor staffing levels, lack of time and disinterest in antibiotic prescribing improvement issues. Medical microbiologists also have an important role in the approval of a hospital's antibiotic prescribing control documents (Chapter 4) and it would be interesting to compare the awareness of the 2001 BTS CAP guidance by this professional group compared with that reported by pharmacists.

9.2.3 Revision of Institutional Antibiotic Prescribing Guidelines

One of the objectives was to identify whether institutional antibiotic prescribing guidelines had been revised as a direct result of the publication of new national guidance.

Institutional CAP guidelines had reportedly been revised in only about one-half of the hospitals where the Chief Pharmacist had purported to be aware of the 2001 BTS CAP guidance. This suggests that there is a lack of effective proactive mechanisms for the revision of institutional guidelines in a large proportion of hospitals. This finding has to be considered against a background of emphasis upon evidence-based medicine and quality of clinical care^{155, 195}, and raises concerns about clinical governance arrangements in some hospitals. This result complies with the principle that there tends to be a lag between the publication of clinical research and the incorporation of this information into practice, which has important consequences for healthcare improvement²³⁰.

The questionnaire did not allow for the identification of the reason(s) that guidelines had not been revised, but several possibilities can be suggested. It is

possible that revision is performed in an ad-hoc manner rather than by a formalised system, and this theory is reflected in the finding that only about one-half of UK NHS hospitals planned an annual revision of antibiotic prescribing control documents (page 81, Chapter 4). A strategy should be documented for the revision process to ensure that failure of communication does not prevent the performance of this activity. The multidisciplinary DTC is usually involved in approving antibiotic prescribing control documents (page 79, Chapter 4), and this committee would presumably also approve revised editions, although these may have been compiled by a sub-group (e.g. a “Specialist Antibiotic Committee”). The Chairman of the DTC should ensure that all members are aware of the revision process for antibiotic prescribing guidelines¹²¹, and the Chief Pharmacist (or their representative) should sit on such a committee^{109, 333, 405}, which is an organisational line of communication between the medical staff and the Pharmacy Department³⁰⁸. It is also possible that poor perception of the new national guidance resulted in some hospitals failing to revise their institutional guidelines, and the 2001 BTS CAP guidance has been criticised because one reviewer only selected relevant papers for the evidence base from title and abstract lists⁴⁰⁶. In his comprehensive review of the design, use, implementation and evaluation of antibiotic prescribing guidelines, Brown¹²² emphasised that clinicians may distrust or disagree with the recommendations of national guidance because they regard them as having being written by “remote experts”. However, prescribers may have differing levels of confidence regarding such guidelines because a survey of Canadian physicians in 1994 identified that most respondents had moderate or high confidence in the majority of guidelines produced by official physician organisations²⁴⁹.

It is possible that, although the role of initiating a local response to new national guidance is the responsibility of the Pharmacy Department, revision could not be performed due to staff shortage. Only about one-half of UK hospitals were able to provide all their intended pharmacy services in 2001 due to staff shortage¹³¹, and the present study was performed before the recent financial investment in antibiotic prescribing improvement³³⁵ and wide-spread employment of specialist “infectious diseases pharmacists”³²². Respondents might have misunderstood the question, and thought that it asked whether specific antibiotic recommendations had been revised, when such a revision may not have been needed if the regimen suggested was compliant.

It is interesting that there was a greater likelihood of guidelines having been revised in teaching hospitals and in those with a specialist ID unit. It is possible that teaching hospitals place greater emphasis upon evidence-based medicine due to their educational role, and that hospitals with an ID unit place greater emphasis upon antibiotic prescribing and improvement activities because they employ more staff with a specialist interest in infectious diseases issues.

In about three-fifths of hospitals where institutional guidelines had been revised, such a revision process had been planned before the publication of the 2001 BTS CAP guidance. In these cases it is impossible to conjecture whether a proactive revision would have been performed if such a process had not been due at that time anyway.

9.2.4 Professionals' Roles in Institutional Guidelines Revision

Different healthcare professionals may initiate, and be involved in, the guidelines revision process, and one of the objectives was to identify which staff had participated in these processes.

Pharmacists were reportedly involved in initiating the revision of institutional guidelines in the majority of hospitals where such a process had been performed, and this finding makes the consideration of the role of Pharmacy Department staff in local response to new national guidance particularly relevant. However, due to the questionnaire design, it was not possible to identify which healthcare professional(s) had the responsibility for initiating the revision of guidelines in hospitals where this had not occurred. Although it is possible that pharmacists were not responsible for initiating revision in those hospitals lacking updated documents, it is suggested that this would not be the case for all hospitals.

In their comprehensive review of the efficacy of clinical guidelines, Grimshaw and Russell¹¹⁹ identified that internally-developed guidelines are more effective than externally-developed recommendations, and key staff can play different roles in such a development process²³⁰. A key issue raised is the locus of responsibility for the initiation of guideline revision. A positive finding was that, in the majority of hospitals, only one or two professionals initiated guidelines revision, because the involvement of many professionals may make the process unwieldy. A delayed response may occur when a group is involved due to divided responsibilities, and the initiation of the revision process should lie with a specific post holder. It is interesting that the initiation of guidelines revision was the joint responsibility of

pharmacists and medical microbiologists in some hospitals. Both these professionals have an interest in improving antibiotic prescribing and have been identified as having an important role in the approval of antibiotic prescribing control documents (page 79, Chapter 4).

The present research findings on multidisciplinary participation in local guidelines development were positive, with three or four different groups of professional staff being involved in the revision process for the majority of guidelines. Such a multidisciplinary approach has been strongly recommended¹³¹ because adaptation of national guidance for local use should involve institutional healthcare staff who will consequently feel included in the guideline development process¹⁹⁴. Guidelines developed in this way are more likely to be successfully implemented due to perceived credibility^{121, 143 407}. Such involvement should lead to “local ownership” and increased compliance¹⁹⁵, and the NHS Executive has emphasised the importance of clinicians adapting national guidelines for local use in a multi-professional setting¹⁹⁵. It is also important that “opinion leader” representatives of medical staff are involved in the guideline revision process because these individuals have authority and/or influence over other prescribers and have important knowledge about the realities of everyday working practice and colleagues’ concerns^{408, 409}. Canadian physicians indicated that the endorsement of a set of guidelines by a respected colleague was the most important factor in deciding whether they would adopt a set of guidelines²⁴⁹.

The most common combination of staff involved in the revision of guidelines in the present study was pharmacists, medical microbiologists and respiratory physicians.

This would appear to represent an ideal combination of staff, with respiratory physicians having a key knowledge of pneumonal disease, medical microbiologists having knowledge of local bacterial resistance patterns and pharmacists having expertise in the clinical use of antibiotics. Another important addition to this team could be the infectious diseases specialist, although it should be considered that such healthcare professionals tend to be only employed by large regional units³¹⁸. Their role is seen as especially important in assisting physicians in the management of severely-ill patients¹⁴¹ and their training makes them well-equipped to educate prescribers on the importance of the rational use of antibiotics⁴¹⁰.

9.3 Conclusion

The response of local hospitals to new national antibiotic prescribing guidance has seldom been considered in the medical literature. This part of the study investigated pharmacists' awareness of the new BTS CAP guidance and consequent revision of institutional antibiotic prescribing guidelines.

Although this study has identified some good practice, it provides evidence of the need for proactive local response to the publication of new national guidelines in some hospitals. In an era of evidence-based medicine and continual recommendations from the National Institute of Clinical Excellence (NICE), this study has implications for the incorporation of national recommendations at a local level for other aspects of clinical care. Pharmacists initiated, and were involved in, revision of institutional guidelines in the majority of hospitals. Therefore a key role for pharmacists is the identification of, and response to, new national prescribing guidelines. It was of particular concern that subsequent revision of institutional

prescribing guidelines had not been performed in a large proportion of hospitals whose Chief Pharmacist had purported to be aware of the publication of the BTS 2001 CAP guidance, and reasons for this have been suggested.

The main findings of this study are;

- Chief Pharmacists (or their nominated staff) were unaware of the publication of the BTS 2001 CAP guidance in 29% (n=47) of hospitals examined.
- Even where these respondents had purported to be aware of the 2001 BTS CAP guidance, subsequent revision of institutional guidelines had not been performed in about one-half of hospitals (45%, n=53). This raises doubt in the efficacy of systems to respond to such a new national guideline in a large number of hospitals.
- Although institutional antibiotic prescribing guidelines had been revised in 60 hospitals where the Chief Pharmacist was aware of the new BTS guidance, this review process had occurred as a direct response to publication of the new national guideline in only a small proportion of these hospitals (28%, n=17).
- Guidelines had been revised in 66 hospitals in total. One (38%, n=25) or two (36%, n=24) professionals initiated institutional guidelines review in the majority of hospitals, with pharmacists and medical microbiologists mostly fulfilling this role. Both pharmacists and medical microbiologists initiated revision in one-fifth of hospitals (20%, n=13), which emphasises the link between these two staff in antibiotic prescribing control efforts.

- The revision of guidelines was a multidisciplinary activity in the majority of hospitals examined, with three (35%, n=23) or four (27%, n=18) staff types typically being involved in the review process. The most common combination of staff types involved in the revision process was respiratory physicians, medical microbiologists and pharmacists, and this combination accounted for revision in 27% (n=18) of hospitals examined.

Chapter 10 Case Study 1: Prescribers' compliance with an institutional antibiotic guideline for the empirical antibiotic treatment of community-acquired pneumonia

Audit of prescribers' compliance with document recommendations is one method of investigating the efficacy of antibiotic prescribing control documents in clinical practice (Chapter 5).

This chapter describes an audit of prescribers' compliance with institutional antibiotic prescribing guidelines for the empirical antibiotic treatment of CAP in one large hospital in Birmingham. It is a case-study, which was undertaken to probe the mechanics of guidelines use in one institution in the context of antibiotic prescribing.

The objectives of the study were to identify the following aspects of CAP therapy;

- Diagnostic criteria.
- Prescribed empirical antibiotic therapy, including compliance with recommendations of the institutional antibiotic prescribing guidelines.
- Clinical outcomes; mortality and discharge.

However, the recommendations of guidelines will not be incorporated into clinical practice unless prescribers are aware of them, use them and have confidence in them. A further case-study was performed in the same institution to explore these issues, and is the subject of Chapter 11.

10.1 Results

10.1.1 Number of Patients with Specified ICD-10 Admission Codes

Patients admitted with lower respiratory-tract infections with relevant ICD-10 primary diagnosis admission codes (page 66, Chapter 3) between November 2002 and March 2003 were identified from a hospital database. The number of patients admitted during this period with relevant ICD-10 codes is summarised in Table 10.1.

Table 10.1: Admissions classified by relevant ICD-10 codes for patients admitted between November 2002 and March 2003 (n=713).

ICD-10 Code	Definition of code	Number of patients
J11	Pneumonia with influenza	0
J12	Viral pneumonia, not elsewhere classified	0
J13	Pneumonia due to <i>S.pneumoniae</i>	3
J14	Pneumonia due to <i>H.influenzae</i>	3
J15	Bacterial pneumonia, not elsewhere classified	9
J16	Pneumonia due to infectious organisms, not elsewhere classified	0
J17	Pneumonia in diseases classified elsewhere	0
J18	Pneumonia, organism unspecified	234
J69	Pneumonia, aspiration	15
J841	Pneumonia, chronic	8
J20	Acute bronchitis	1
J21	Acute bronchiolitis	90
J22	Unspecified acute lower respiratory tract infection	168
J40	Bronchitis, not specified as acute or chronic	3
J41	Simple and mucopurulent chronic bronchitis	0
J42	Unspecified chronic bronchitis	1
J44	Other chronic obstructive pulmonary disease	178

There were 713 patient admissions for the specific ICD-10 primary admission diagnosis codes; 38% (n=272) were for a pneumonia infection and 62% (n=441) were for another lower-respiratory tract infection.

10.1.2 Location of Medical Records

A total of 272 patients were admitted with ICD-10 primary admission diagnosis codes for pneumonia. The data-analysis period was from August 2003 to May 2004 during which time the medical record could only be obtained for analysis for 112 (41%) patients. The medical records of the other 160 patients were unavailable for several reasons, as summarised in Table 10.2.

Table 10.2: Unavailability of medical records (n=160).

Location of medical record	Number of patients	
<i>Missing-unaccountable</i>	62	(39%)
<i>Patient deceased & record unobtainable</i>	61	(38%)
<i>Record in use due to readmission or by one of the clinical team or secretary</i>	37	(23%)

10.1.3 Data Capture

The medical records of 112 patients were available, but 31 (28%) patients were children (under 16 years of age) and consequently excluded from the data analysis, as per the 2001 BTS CAP guidance²⁰⁰. Of the remaining 81 patients (72%), three had been admitted twice during the study period and consequently there were 84 episodes of CAP.

10.1.4 Patient Demographics

i). Gender and Age

Fifty-six percent (n=45) of the patients were male and the patients' age ranged from 17 to 100 years, with a mean age of 66 years. Sixty-three percent (n=51) of patients were aged 65 years or more and 74% (n=60) were aged 50 years or more.

ii). Residence of Admission

The residence of the patient at the time of admission was included for 83 of the 84 CAP episodes, and these results are summarised in Table 10.3.

Table 10.3: Patient residence upon admission (n=83 CAP episodes).

Admission Location	Number of CAP episodes
<i>Own home</i>	64 (77%)
<i>Nursing-home</i>	11 (13%)
<i>Warden-controlled flat</i>	5 (6%)
<i>Residential home</i>	1 (1%)
<i>Residential psychiatric home</i>	1 (1%)
<i>No fixed abode</i>	1 (1%)

iii). Category of Admission

Data about the admission category had been documented for 83 of the 84 CAP episodes, and these results are summarised in Table 10.4.

Table 10.4: Category of patient admission (n=83 CAP episodes).

Category of admission	Number of CAP episodes
<i>Via the Accident & Emergency Department</i>	54 (65%)
<i>GP emergency</i>	25 (30%)
<i>Planned elective</i>	3 (4%)
<i>Transfer from another healthcare provider</i>	1 (1%)

The majority of patients admitted to the Accident and Emergency Department were transferred to the Medical Assessment Unit and then onto a ward.

iv). Penicillin Allergy

The records of 50 (62%) patients indicated that they had “nil known allergies”, the allergic status of 28 (35%) patients was not recorded and 3 (4%) patients were identified as being allergic to penicillin (1 reported a rash, 1 reported anaphylaxis and 1 did not state the severity of the reaction).

v). Recent Influenza Infection

The records of 8 (10%) patients indicated that they had had influenza prior to the CAP episode. However, these episodes were poorly documented with regard to the symptoms and length of influenza infection. The influenza infection had been contracted five days before the CAP episode for one patient and two patients had contracted the illness one week prior to CAP infection.

vi). Antibiotic Therapy Prior to Admission

A total of 32 (38%) patients had taken antibiotic(s) prior to hospital admission with CAP. Unfortunately the nature of the antibiotic(s) was not documented in the medical records of seven patients. Ten patients had taken amoxicillin alone, while 2 patients took it in combination with another antibiotic. Two patients had been taken separate courses of amoxicillin followed by another antibiotic; clarithromycin and ciprofloxacin had respectively been prescribed for these patients; cefuroxime for 1 of these patients and cefuroxime & ciprofloxacin for the other. A further patient had taken co-amoxiclav. A macrolide had been prescribed for 3 patients; 2 had received erythromycin whilst 1 had taken clarithromycin. A cephalosporin had been prescribed for 3 patients; cefuroxime for 2 and cefalexin for the other, and the quinolone ciprofloxacin had been given to a further 3 patients.

vii). Previous Hospital Admission

Seventeen patients had been admitted to hospital for another illness prior to the CAP infection, and the nature of these admissions is summarised in Table 10.5

Table 10.5: Hospital admissions prior to CAP infection (n=17 patients).

Time Period of Admission	Number of patients	Reasons for Admission
<i>Within the past week</i>	7	Hypothermia, CCF, pneumonia (3 patients), LRTI, PEG fitting
<i>Within the past fortnight</i>	3	Pneumonia, CAT scan, cellulitis
<i>Within the past month</i>	5	Similar symptoms (2 patients), collapse, sickness and diarrhoea
<i>Longer than 1 month ago</i>	2	Similar symptoms (1 patient), gastrectomy

viii). Time of Admission

The time that the patient had been admitted to hospital was recorded for 73 (n=87%) of the 84 CAP admissions; 21 (29%) patients with CAP episodes were admitted between 08:00 and 15:59, 38 (52%) were admitted between 16:00 and 00:00 and 14 (19%) were admitted between 00:01 and 07:59.

ix). Consultant Team

Patients were admitted under the care of 20 Consultant teams.

10.1.5 Diagnostic Criteria

i). Symptoms upon Admission

Patients reported 27 different symptoms upon admission with CAP, and these results are summarised in Table 10.6.

Table 10.6: Symptoms reported by patients upon admission (n=84 CAP episodes).

Symptom	Number of CAP episodes	
<i>Shortness of breath</i>	49	(58%)*
<i>Cough (productive)</i>	41	(49%)
<i>Chest pain</i>	29	(35%)
<i>Fevers</i>	10	(12%)
<i>Cough (not stated if productive or non productive)</i>	8	(10%)
<i>Haemoptysis</i>	8	(10%)
<i>Cough (non productive)</i>	7	(8%)
<i>Confusion</i>	6	(7%)
<i>Diminished appetite</i>	5	(6%)
<i>General malaise</i>	5	(6%)
<i>Sweats</i>	4	(5%)
<i>Rigors</i>	3	(4%)
<i>Decreased consciousness</i>	3	(4%)
<i>Abdominal pain</i>	3	(4%)
<i>Disorientation and drowsiness</i>	3	(4%)
<i>Weakness/lethargy</i>	2	(2%)
<i>Wheeze</i>	2	(2%)
<i>Diarrhoea</i>	2	(2%)
<i>Vomiting</i>	2	(2%)
<i>Chest pain worsening on coughing</i>	2	(2%)
<i>Night sweats</i>	2	(2%)
<i>Agitation</i>	2	(2%)
<i>Sore throat</i>	1	(1%)
<i>Collapse</i>	1	(1%)
<i>Constipation</i>	1	(1%)
<i>Back pain</i>	1	(1%)
<i>Incontinence</i>	1	(1%)

**Please Note: These do not total 100% because more than 1 symptom might have been reported by a patient.*

ii). Confusion

Of the 84 CAP episodes, the assessment of confusion was prevented by a pre-existing condition for three (due to Alzheimer's, psychiatric problems and MS) and a further patient was uncooperative. A further 2 patients were diagnosed as

confused because they scored 8 or less in the Abbreviated Mental Test (1 scored 7 and 1 scored 8). Two further patients were classified as being confused following the use of other tests (one scored 14 in the GCS test and one scored 27 in the long test).

iii). Urea

In 86% (n=72) of the CAP episodes the patient's urea level had been measured on admission and recorded; it was 7mmol/l or less for 38 (53%) episodes, but below this value for 34 (47%) episodes.

iv). Respiratory Rate

The patient's respiratory rate was recorded on admission for 62% (n=52) of the 84 CAP episodes; 38 (73%) patients' respiratory rate was below 30/min whilst it was above this value for 14 (27%) patients. The time of admission was investigated in relation to whether the patient's respiratory rate, and the admission time was recorded for 73 episodes. In 6 cases the time of admission was not recorded and therefore both respiratory rate and time of admission had been recorded for 46 episodes. These results are summarised in Table 10.7.

Table 10.7: Respiratory rate documentation and time of admission (n=73 CAP episodes).

Time of Admission	Respiratory rate recorded (n=46)	Respiratory rate not recorded (n=27)
08:00-15:59	15 (33%)	6 (22%)
16:00-00:00	21 (46%)	17 (63%)
00:01 – 07:59	10 (22%)	4 (15%)

Documentation of respiratory rate was not associated with the time of admission (p>0.05 in all cases).

v). Blood Pressure

Systolic Blood Pressure

The patient's systolic blood pressure was recorded on admission for 94% (n=79) of the 84 CAP episodes; it was above 90mmHg for 75 (95%) CAP episodes, and below this value for 4 (5%) CAP episodes.

Diastolic Blood Pressure

The patient's diastolic blood pressure was recorded on admission for the same 79 CAP episodes described above; it was above 60mmHg for 69 (87%) episodes, and equal to or below this value for 10 (13%) episodes.

vi). Oxygen Saturation

The patient's oxygen saturation level was recorded on admission for 86% (n=72) of the CAP episodes; it was 92% or above for 57 (79%) episodes, but less than this value for 15 (21%) episodes.

vii). Chest X-Ray

The results of chest x-rays were documented for 85% (n=71) of CAP episodes; shadowing was documented in 65 (92%) episodes but was not apparent, or the film was unclear, for 6 (8%) episodes.

viii). Temperature

The patient's temperature was recorded upon admission for 71% (n=60) of the CAP episodes, and these results are summarised in Table 10.8.

Table 10.8: Patients' temperature upon admission (n=60 CAP episodes).

Temperature	Number of CAP episodes
Between 35 and 35.9°	2 (3%)
Between 36 and 36.9°	17 (28%)
Between 37 and 37.9°	22 (37%)
Between 38 and 38.9°	11 (18%)
Between 39 and 39.9°	6 (10%)
Between 40 and 40.9°	2 (3%)

ix). White Cell Count

The white cell count was recorded on admission for 85% (n=71) of the CAP episodes; it was $>20 \times 10^9/l$ for 11 (15%) episodes and between 4 and $20 \times 10^9/l$ for 60 (85%) episodes.

x). C-Reactive Protein

The C-reactive protein value was recorded on admission for 98% (n=82) of the CAP episodes; it was >50 for 52 (62%) episodes and >100 for 30 (36%) episodes.

xi). Microbiology Results

Samples of blood, urine, serum, faeces and sputum were sent to the microbiology laboratory, and at least one type of sample was tested in 31 (37%) of the CAP episodes. These results are summarised in Table 10.9.

Table 10.9: Microbiology sample results (n=46 CAP episodes).

Type of sample	Number of CAP episodes in which the sample was taken	Results
Sputum	16 (19%)	Normal respiratory flora (n=13), <i>H.influenzae</i> (n=2), <i>Serratia</i> species(n=1)
Blood	11 (13%)	No growth (n=7), <i>S.aureus</i> (n=2), <i>S.pneumoniae</i> (n=2)
Urine	9 (11%)	No significant growth (n=5), moderate growth of mixed organisms (n=2), Legionella not detected (n=2)
Serum	7 (8%)	Antibodies to <i>M.pneumoniae</i> not detected (n=6), antibodies to <i>M.pneumoniae</i> detected (n=1)
Faeces	3 (4%)	No growth (n=2) <i>Cl.difficile</i> (n=1)

Of the 16 sputum samples sent to the microbiology laboratory, 3 were sent the day of admission (19%), 6 (38%) were sent the next day, 4 (25%) were sent after two days, 2 (13%) were sent after three days and 1 (6%) was apparently sent after eleven days. In a further 7 (8%) CAP episodes, an intention to take a sputum sample was documented in the medical record, but no results could be identified.

Two antibiotic sensitivity reports were sent by the microbiology laboratory, which both suggested using amoxicillin, tetracycline, co-amoxiclav, trimethoprim or cefuroxime for the two episodes where *H.influenzae* had been detected.

10.1.6 Empirical Antibiotic Therapy

i). No Antibiotics Prescribed

No antibiotic regimen had been prescribed for four CAP episodes; there was no record of therapy for one patients, one patient had been moved to the ICU and records for that time were unavailable, one had discharged themselves before therapy could be prescribed and one died before therapy could be prescribed.

ii). Initial Empirical Antibiotic Regimen

The initial empirical antibiotic therapy prescribed had been documented in the records for 80 CAP episodes, and these results are summarised in Table 10.10.

Table 10.10: The initial empirical antibiotic regimens (n=80 CAP episodes).

Empirical antibiotic regimen	Number of CAP episodes
<i>Amoxicillin</i>	20 (25%)
<i>Cefuroxime</i>	20 (25%)
<i>Amoxicillin and erythromycin</i>	17 (21%)
<i>Cefuroxime and metronidazole</i>	3 (4%)
<i>Erythromycin</i>	3 (4%)
<i>Ciprofloxacin</i>	2 (3%)
<i>Cefuroxime and erythromycin</i>	2 (3%)
<i>Amoxicillin and erythromycin and cefuroxime</i>	2 (3%)
<i>Amoxicillin and erythromycin and flucloxacillin</i>	1 (1%)
<i>Co-amoxiclav</i>	1 (1%)
<i>Amoxicillin and clarithromycin</i>	1 (1%)
<i>Benzylpenicillin and clarithromycin</i>	1 (1%)
<i>Cefuroxime and clarithromycin</i>	1 (1%)
<i>Benzylpenicillin and erythromycin</i>	1 (1%)
<i>Cefuroxime and flucloxacillin</i>	1 (1%)
<i>Oxytetracycline</i>	1 (1%)
<i>Vancomycin</i>	1 (1%)
<i>Amoxicillin and flucloxacillin</i>	1 (1%)
<i>Cefuroxime and amoxicillin</i>	1 (1%)

For 33 CAP episodes (41%), a change in initial regimen was recommended after a couple of doses; at the post-take ward round (n=20), by the Consultant (n=2), by the Registrar (n=2), by the medical microbiologist (n=1), by the ROM (n=1) and due to 1 patient self-discharging. It was not possible to identify who had changed the other 6 regimens. The subsequent main regimens for the 80 CAP episodes are summarised in Table 10.11.

Table 10.11: The subsequent main empirical antibiotic regimens (n=80 CAP episodes).

Empirical antibiotic regimen	Number of CAP episodes
<i>Amoxicillin and erythromycin</i>	28 (35%)
<i>Cefuroxime</i>	14 (18%)
<i>Amoxicillin</i>	11 (14%)
<i>Cefuroxime and erythromycin</i>	5 (6%)
<i>Ciprofloxacin</i>	4 (5%)
<i>Amoxicillin and clarithromycin</i>	4 (5%)
<i>Cefuroxime and metronidazole</i>	3 (4%)
<i>Cefuroxime and clarithromycin</i>	3 (4%)
<i>Erythromycin</i>	2 (3%)
<i>Amoxicillin and erythromycin and flucloxacillin</i>	1 (1%)
<i>Ceftazidime and erythromycin</i>	1 (1%)
<i>Cefuroxime and erythromycin and flucloxacillin</i>	1 (1%)
<i>Co-amoxiclav</i>	1 (1%)
<i>Amoxicillin and flucloxacillin</i>	1 (1%)
<i>Vancomycin</i>	1 (1%)

iii). Severe CAP

The institutional guidelines did not contain any guidance about when an infection should be classified as “severe CAP”. However, the 2001 BTS CAP guidance introduced the CURB criteria (see below) for diagnosis of severe CAP, and an infection should be classified as severe CAP if the patient presents with 2 or more of these features;

- Confusion: new mental confusion, defined as an Abbreviated Mental Test score of 8 or less.
- Urea: raised >7 mmol/l.
- Respiratory rate: raised ≥ 30 /min.
- Blood pressure: low blood pressure (systolic <90mmHg and/or diastolic ≤ 60 mmHg).

If a patient has one of the above features, then “additional” adverse prognostic features should be considered;

- PaO₂ < 8 kPa / SaO₂ < 92% (any FiO₂).
- CXR: bilateral/multilobar shadowing.

Classification of the severity of the CAP episode is then at the discretion of the physician.

The CAP episodes were analysed to identify the number of associated CURB factors. In the majority of cases the result(s) of at least one of the CURB severity parameters had not been documented. These results are summarised in Table 10.12.

Table 10.12: The number of CURB factors associated with the CAP episodes (n=84 CAP episodes).

Number of CURB factors	Number of CAP episodes	
None;	38	(45%);
None missing none		4
None missing one		15
None missing two		16
None missing three		3
One;	36	(43%);
One missing none		3
One missing one		17
One missing two		15
One missing three		1
Two;	6	(7%);
Two missing none		1
Two missing one		4
Two missing two		1
Three;	4	(5%);
Three missing one		4

iv). Empirical Antibiotic Therapy Compared with the Recommendations of Institutional Antibiotic Prescribing Guidelines

Non-Severe CAP

The institutional antibiotic prescribing guidelines recommended the use of amoxicillin +/- erythromycin for the treatment of non severe CAP, and cefpodoxime +/- erythromycin as a second-choice regimen for the treatment of patients with a penicillin allergy. The 2001 BTS CAP guidance recommended the use of amoxicillin and erythromycin or clarithromycin for the treatment of non severe CAP²⁰⁰.

A total of 38 patients did not have any of the CURB parameters, and therefore had non-severe CAP. Regimens were prescribed for 35 episodes, and these were analysed for compliance with institutional and national guidelines. These results are summarised in Table 10.13.

Table 10.13: Empirical antibiotic regimens prescribed for CAP episodes with none of the CURB severity parameters, which should have been treated as non-severe (n=35).

Initial regimen	Main subsequent regimen	Compliance of main with institutional guidance	Compliance of main with national guidance	Number of episodes
Amoxicillin and erythromycin	Amoxicillin and erythromycin	Compliant	Compliant	9
Amoxicillin	Amoxicillin	Compliant	Non-compliant	5
Amoxicillin	Amoxicillin and erythromycin	Compliant	Compliant	3
Cefuroxime	Cefuroxime	Non-compliant	Non-compliant	3
Cefuroxime	Amoxicillin and erythromycin	Compliant	Compliant	2
Cefuroxime	Erythromycin	Non-compliant	Non-compliant	1
Cefuroxime	Amoxicillin and clarithromycin	Non-compliant	Compliant	1

Initial regimen	Main subsequent regimen	Compliance of main with institutional guidance	Compliance of main with national guidance	Number of episodes
Amoxicillin	Erythromycin	Non-compliant	Non-compliant	1
Cefuroxime and erythromycin and amoxicillin	Cefuroxime and erythromycin	Non-compliant	Non-compliant	1
Erythromycin	Ceftazidime and erythromycin	Non-compliant	Non-compliant	1
Amoxicillin	Amoxicillin and clarithromycin	Non-compliant	Compliant	1
Cefuroxime	Cefuroxime and clarithromycin	Non-compliant	Non-compliant	1
Amoxicillin and clarithromycin	Amoxicillin and clarithromycin	Non-compliant	Compliant	1
Benzylpenicillin and clarithromycin	Amoxicillin and clarithromycin	Non-compliant	Compliant	1
Cefuroxime and clarithromycin	Cefuroxime and clarithromycin	Non-compliant	Non-compliant	1
Benzylpenicillin and erythromycin	Amoxicillin and erythromycin	Compliant	Compliant	1
Cefuroxime and flucloxacillin	Cefuroxime and flucloxacillin and erythromycin	Non-compliant	Non-compliant	1
Vancomycin	Vancomycin	Non-compliant	Non-compliant	1

The main regimen was compliant with the recommendations of the institutional antibiotic guidelines in 57% of cases and compliant with the national guidelines in 54% of cases.

Severe CAP

The institutional antibiotic prescribing guidelines recommended the use of amoxicillin and erythromycin for the treatment of severe CAP, and provided a 2nd-choice regimen of cefuroxime and erythromycin. However, no information was provided concerning when the 2nd-choice regimen should be prescribed. The 2001 BTS CAP guidance recommended the use of co-amoxiclav or cefuroxime or ceftriaxone and erythromycin or clarithromycin (with or without rifampicin 600mg od or bd iv)²⁰⁰.

A total of 10 (12%) episodes were classified as severe CAP because the patient had 2 or more CURB parameters. Nine of these patients were aged over 65 (range 66-96 years) and one was 35 years but had a pre-existing terminal condition (pontine astrocytoma, a type of brain tumour). One patient died before therapy could be prescribed, and the other 9 regimens are summarised in Table 10.14.

Table 10.14: Empirical antibiotic regimens prescribed for patients with two or more CURB severity parameters, which should have been treated as severe CAP (n=9 CAP episodes).

Initial regimen	Main regimen	Compliance of main with institutional guidance	Compliance of main with national guidance	Number of episodes
Amoxicillin and erythromycin	Amoxicillin and erythromycin	Compliant	Non-compliant	2
Cefuroxime and erythromycin and amoxicillin	Cefuroxime and erythromycin	Compliant	Compliant	1
Cefuroxime and metronidazole	Cefuroxime and metronidazole	Non-compliant	Non-compliant	1
Cefuroxime	Cefuroxime	Non-compliant	Non-compliant	1
Amoxicillin and flucloxacillin	Amoxicillin and flucloxacillin	Non-compliant	Non-compliant	1
Cefuroxime and amoxicillin	Cefuroxime and amoxicillin	Non-compliant	Non-compliant	1
Cefuroxime	Cefuroxime and clarithromycin	Non-compliant	Compliant	1
Cefuroxime	Ciprofloxacin	Non-compliant	Non-compliant	1

The main regimen was compliant with the recommendations of the institutional antibiotic guidelines in 33% of cases and compliant with the national guidelines in 22% of cases.

One CURB Factor

Thirty-six CAP episodes were associated with one of the CURB severity parameters, necessitating the consideration of “additional features”. Of these episodes, both the results from oxygen saturation tests and chest x-ray results (to

identify multilobar pneumonia) were documented for 24 (67%) episodes. Only the results for oxygen saturation were documented for 3 (8%) episodes, whilst only the results for chest x-ray were documented for 6 (17%) episodes and the result of neither test was documented for 3 (8%) episodes.

Of these 36 CAP episodes, 27 (75%) had neither “additional feature” (or the results of neither test had been documented), 8 (22%) had one additional feature and 1 (3%) had both additional features.

Twenty-seven episodes were not associated with “additional features”, and these episodes should be classified as non-severe CAP or severe CAP based on the physician’s judgement. The empirical antibiotic regimens prescribed for these 27 episodes are summarised in Table 10.15. The empirical antibiotic regimens prescribed for the 9 episodes associated with one or both additional features are summarised in Table 10.16.

Table 10.15: Empirical antibiotic regimens prescribed for patients with one CURB severity parameter and no additional severity parameters, indicating assessment based upon clinical judgement (n=27 CAP episodes).

Initial Regimen	Main Subsequent Regimen	Compliance of main with institutional guidance	Compliance of main with national guidance	Number of CAP episodes
Amoxicillin	Amoxicillin	Compliant (non-severe)	Non-compliant	5
Amoxicillin and erythromycin	Amoxicillin and erythromycin	Compliant (severe)	Compliant (non-severe)	5
Cefuroxime	Cefuroxime	Non-compliant	Non-compliant	5
Cefuroxime and erythromycin	Cefuroxime and erythromycin	Non-compliant	Compliant (severe)	2
Amoxicillin	Cefuroxime and metronidazole	Non-compliant	Non-compliant	1
Amoxicillin and erythromycin and flucloxacillin	Amoxicillin and erythromycin and flucloxacillin	Non-compliant	Non-compliant	1

Initial Regimen	Main Subsequent Regimen	Compliance of main with institutional guidance	Compliance of main with national guidance	Number of CAP episodes
Cefuroxime	Amoxicillin	Compliant (non-severe)	Non-Compliant	1
Amoxicillin	Amoxicillin and erythromycin	Compliant (severe)	Compliant (non-severe)	1
Amoxicillin	Cefuroxime and metronidazole	Non-compliant	Non-compliant	1
Cefuroxime and metronidazole	Amoxicillin and erythromycin	Compliant (severe)	Compliant (non-severe)	1
Cefuroxime and metronidazole	Cefuroxime	Non-compliant	Non-compliant	1
Ciprofloxacin	Ciprofloxacin	Non-compliant	Non-compliant	1
Oxytetracycline	Ciprofloxacin	Non-compliant	Non-compliant	1
Erythromycin	Cefuroxime	Non-compliant	Non-compliant	1

The main regimen was compliant with the recommendations of the institutional antibiotic guidelines in 50% of cases and compliant with the national guidelines in 35% of cases.

Table 10.16: Empirical antibiotic regimens prescribed for patients with one CURB severity parameter and one or two additional severity parameter, indicating assessment based upon clinical judgement (n=9 CAP episodes).

Initial regimen	Main subsequent regimen	Compliance with institutional guidance	Compliance with national guidance	Number of CAP episodes
Amoxicillin	Amoxicillin and erythromycin	Compliant (severe)	Compliant (non-severe)	3
Cefuroxime	Cefuroxime	Non-compliant	Non-compliant	3
Erythromycin	Amoxicillin and erythromycin	Compliant (severe)	Compliant (non-severe)	1
Co-amoxiclav	Co-amoxiclav	Non-compliant	Non-compliant	1
Ciprofloxacin	Ciprofloxacin	Non-compliant	Non-compliant	1

The main regimen was compliant with the recommendations of the institutional antibiotic guidelines in 44% of cases and compliant with the national guidelines in 44% of cases.

Penicillin Allergy

Three patients were documented as having an allergy to penicillin. Two patients were treated with erythromycin, with cefpodoxime added at a later date, and one patient was treated with cefuroxime.

Recent Influenza Infection

The records of 8 (10%) patients indicated that they had had influenza prior to the CAP infection. Of these, 7 patients were treated with erythromycin; in combination with amoxicillin for 3 patients, in combination with cefuroxime for 3 patients and with ciprofloxacin for the other patient. One patient was treated with cefuroxime as monotherapy. All of these patients survived.

Previous Hospital Admission

Fifteen patients had been previously admitted to hospital within the last month. Of these patients, 4 patients were prescribed amoxicillin and erythromycin, 2 patients cefuroxime, 1 amoxicillin, 1 with cefuroxime and erythromycin, 1 with ciprofloxacin, 1 with ceftazidime and erythromycin and 1 with cefuroxime and metronidazole. The empirical antibiotic regimen was not documented for 2 patients. Thirteen of these patients were discharged whilst 2 died. The institutional guidelines describe nosocomial pneumonia as “the onset of infection ≥ 72 hours after admission”, and they recommend treatment with cefuroxime.

v). Input from Medical Microbiologists

Advice was documented in the medical records by medical microbiologists for 8 (10%) of the CAP episodes. These recommendations were for therapy following a positive result (n=5), termination of an antibiotic course (n=2) and to send another blood culture, depending on the CRP (n=1).

vi). Input from Pharmacists

Advice was documented in the medical records/on the prescription chart from pharmacists for 8 (10%) of the CAP episodes. These recommendations were for oral rather than parenteral therapy (n=3), to verify that the course had finished and crossed it off the prescription chart (n=2), to confirm the strength of the antibiotic (n=1), to highlight the interaction between an antibiotic and another drug (n=1) and to emphasise the correct frequency of dosing for an antibiotic (n=1).

10.1.7 Clinical Outcomes

i). Transfer to the ICU

Three patients were transferred from the ward to the ICU during their stay, all of whom survived.

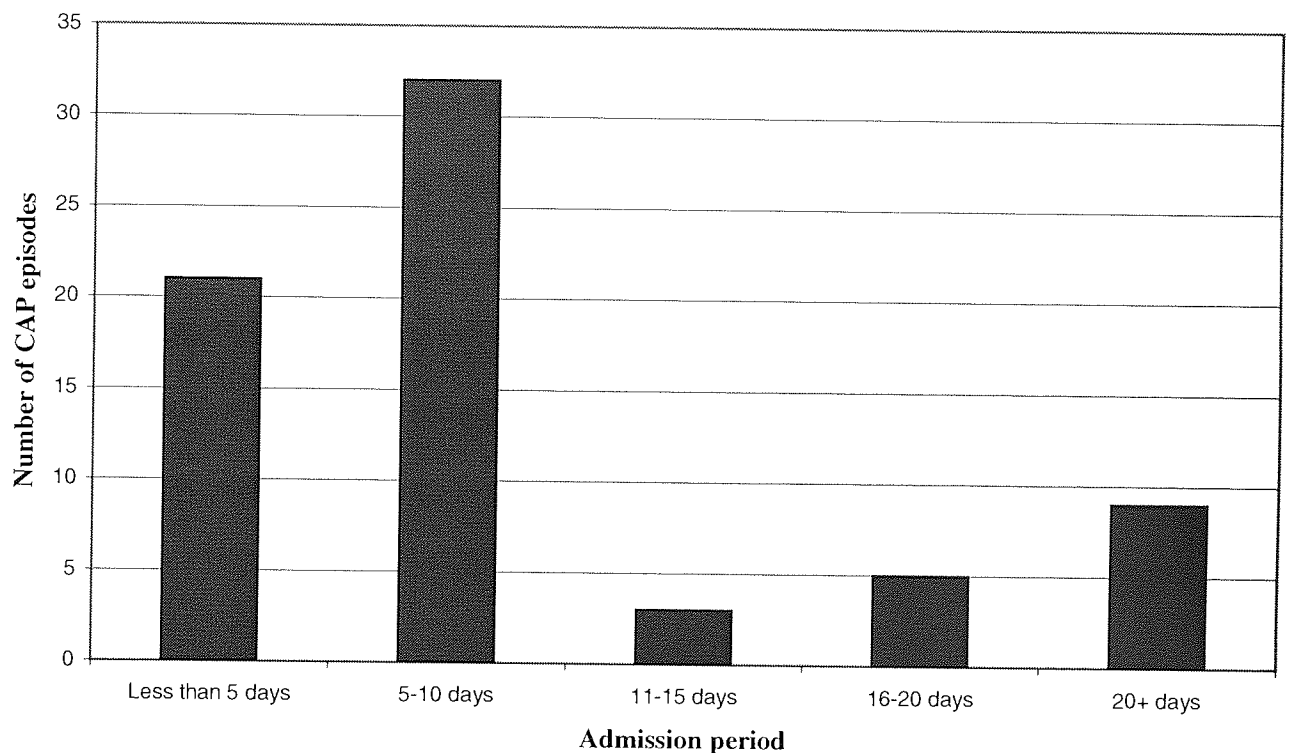
ii). Mortality

Patients died after 12 CAP episodes, giving a 14% mortality rate. Three (27%) of the 11 patients admitted from a nursing-home died.

iii). Length of Stay

Patients were discharged after 72 (86%) CAP episodes, and the length of stay could be calculated from the admission and discharge dates for 70 of these CAP episodes. The length of hospital admission varied from 1 day (due to the patient self-discharging) to 68 days. Most patients stayed between 5 and 10 days, and these results are depicted in Figure 10.1.

Figure 10.1: The admission period for CAP episodes (n=84).



iv). Planned Follow-Up

Whether patients were invited for follow-up after discharge was documented in the medical record for 58 (81%) CAP episodes. However, one patient self-discharged and one refused follow-up, and the results for the remaining 56 patients are summarised in Table 10.17.

Table 10.17: Proposed follow-up after discharge (n=56 CAP episodes).

Proposed follow-up	Number of CAP episodes
<i>Next week</i>	1 (2%)
<i>In 2 weeks</i>	2 (4%)
<i>In 3 weeks</i>	2 (4%)
<i>In 3 weeks at the GP</i>	1 (2%)
<i>In 4 weeks</i>	3 (5%)
<i>In 6 weeks</i>	13 (23%)
<i>In 6-8 weeks</i>	1 (2%)
<i>No time period denoted</i>	2 (4%)
<i>None</i>	31 (55%)

v). Readmission

Within the study period, 3 patients were admitted for 2 episodes of CAP. A total of 11 patients were re-admitted to hospital following the CAP episode.

10.2 Discussion

This case-study examined the treatment of patients diagnosed with CAP in one hospital, with the aim of identifying whether patients were treated according to the recommendations contained within the institutional antibiotic prescribing guidelines. The study also identified patient demographics, diagnostic criteria and the clinical outcome of patients with CAP. It is a case-study, which enabled in-depth investigation about whether the recommendations of antibiotic prescribing guidelines were followed by prescribers for one infection in one institution. Although case-studies are not generalisable, they allow the researcher to investigate the dynamics operating in the prescribing process in one hospital.

Several studies have assessed prescribers' adherence with the recommendations of institutional antibiotic prescribing guidelines for the treatment of CAP by audit of prescribing practices compared to institutional recommendations; in the UK^{285, 289,}

^{290, 411}, North America^{287, 288, 291} and Australia²⁸⁶. Such studies have identified levels of compliance ranging from 60% to 91%²⁸⁵⁻²⁹¹. The previous UK studies were performed before 2001, and consequently no UK studies have considered the treatment of patients with CAP since the publication of the 2001 BTS CAP guidance²⁰⁰.

10.2.1 Retrieval of Medical Records

This study was considerably delayed because staff at the hospital were unsure about the place of retrospective audits involving patients' medical records in the new research governance agenda (2nd edition of the framework). The research proposal had been approved by the LREC, but the data controller was then reticent about granting access to the patient-identifiable data. One of the key areas of the new research governance framework is the requirement for freely given and informed patient consent, and LREC staff viewed the proposed research as being a "grey area" about patient confidentiality. This had resulted from the increasing emphasis upon the privacy of patients' medical information, and about when it can be divulged^{412, 413}. There was confusion about policy changes necessary with the publication of the "Confidentiality NHS Code of Practice"⁴¹⁴. There was a preliminary suggestion that permission would need to be granted by every individual patient for access to their medical record before the research could begin. However, the necessity of gaining every patients' permission would have caused great delay and made the study impractical. Such restriction has implications for the employment of this audit methodology in health services research, and especially upon the practicality of performing undergraduate student projects in the sphere of pharmacy practice. However, eventually the LREC chairman granted ethical

approval without the need for obtaining patients' permission for access, by defining the research as a "service audit".

Medical records were only available for approximately two-fifths of patients in the study, despite every attempt to maximise response. Although it is never possible to retrieve all records, bias may be introduced if difference in the availability of records is related to efficiency among clinical firms²⁸³. Approximately one-fifth of the records could not be obtained because the patient had died, and the records were irretrievable from storage in an off-site location. Unfortunately this biases the results because it was not possible to assess whether patients died due to patient factors (e.g. advanced age), infection factors (e.g. severe infection) and/or therapy factors (e.g. inappropriate antibiotic treatment). It is possible that a large proportion of the patients who died had severe CAP, which is associated with a higher mortality rate than non-severe CAP²⁸⁹. Therefore, assessment of whether patients with severe CAP had been appropriately treated was limited. However, inability to retrieve all required records is common, and 30% (n=132) of medical records were unavailable for review in a study of institutional venous thromboembolism guidelines, although the authors provided no reasons why the records were unavailable⁴¹⁵. It is suggested that the provision of electronic records would be of great help in performing such audit research in the future^{416, 417}.

10.2.2 Patient Demographics

The majority (63%) of patients were over the age of 65 years, which shows that there is a greater incidence of CAP in elderly patients, as suggested by previous studies and the 2001 BTS CAP guidance²⁰⁰. The patient was admitted from a

nursing home in approximately one-tenth of cases, of whom 27% (n=3) died. Admission from a nursing home has been identified as a potential prognostic factor for mortality, but requires future research for UK patients²⁰⁰.

Although several patients had had influenza, or had taken antibiotics, prior to admission with CAP, documentation of these incidents was frequently incomplete. Concurrent influenza infection is typically observed in 39% of patients with CAP and in 50% of patients admitted to an ICU²⁰⁰. Although the 1993 BTS CAP guidance emphasised the importance of concurrent influenza, the 2001 BTS CAP guidance considered that such infection is only important for patients with severe CAP²⁰⁰. However, the nature of recent antibacterial therapy is more important because macrolide monotherapy may be appropriate for patients who have failed a previous course of amoxicillin²⁰⁰.

A total of ten patients had been previously admitted to hospital within the fortnight before their admission for CAP, and it is possible that these patients had contracted nosocomial pneumonia upon their previous admission.

10.2.3 Diagnostic Criteria

One of the objectives was to examine whether tests had been performed to confirm diagnosis, and enable classification of the severity of the CAP episode.

The 2001 BTS CAP guidance defined CAP in patients admitted to hospital, “symptoms and signs consistent with an acute lower respiratory tract infection associated with new radiographic shadowing for which there is no other

explanation, (e.g. not oedema or infarction) and the illness is the primary reason for hospital and is managed as pneumonia”²⁰⁰. The main symptoms reported by patients were shortness of breath (58%), productive cough (49%) and chest pain (35%), which are commonly reported symptoms of CAP^{200, 224}.

The performance of a chest x-ray is an important component in the differential diagnosis of CAP from other lower respiratory-tract infections, and the 2001 BTS CAP guidance emphasised that diagnosis based on history and physical findings is unreliable without a chest radiograph²⁰⁰. It was therefore encouraging that a chest x-ray had been performed for the majority of patients in the present study, and was undertaken more often than in a previous UK study, when only one-half of patients with CAP had had such an x-ray⁴¹⁸.

CAP should be managed differently depending on its severity, and patients with severe CAP should be treated more aggressively. The early identification of patients at high risk of death is important because it allows initiation of appropriate antibiotic therapy and admission to an ICU²⁰⁰. The 2001 BTS CAP guidance emphasised the importance of assessing and recording “core” adverse prognostic features²⁰⁰. Non-microbiological tests are performed for several reasons; to assess the impact on, or detect the presence of, any co-morbid disease, to provide a pointer to aetiological pathogens, to identify complications, to monitor progress and to assess severity²⁰⁰.

It is therefore of concern that all four CURB severity parameters were only recorded for a minority of patients, and consequently it was difficult to

retrospectively assess whether some episodes should have been classified and treated as non-severe or severe CAP. In cases where the medical record did not contain the result of a test, it is impossible to conjecture whether such a test had been performed and recorded but the result subsequently lost from the record (e.g. a paper printout), performed but not recorded or not performed at all. It is preferable that results are always documented in the bulk of the record because attached scraps of paper might subsequently be lost from the record.

There was particularly poor documentation for the results of respiratory rate and confusion tests, and there is a need to educate prescribers both about the importance of performing and recording the results of these tests. However, prescribers in a previous study reported a lack of confidence in documenting respiratory-tract infections, and the indication for antibiotic prescription was recorded in only 64% of cases in that study⁴¹⁸. The 2001 BTS CAP guidance indicated that a raised respiratory rate is one of the most reliable indicators of disease severity and there is a need for increased awareness, and better documentation, of this valuable clinical sign²⁰⁰. It was interesting that there was no association between the time of admission of the patient and whether the respiratory rate had been recorded because the hypothesis was that the respiratory rate would be less likely to be recorded at night. One of the recommendations of the present study is that the importance of this test is emphasised to clinicians, and in this way research can inform policy.

It is possible that prescribers are less familiar with assessing patients for confusion, and they may require education in the use of the AMT test. The BTS CAP guidance emphasised the importance of this test in helping future validation of the

importance of this clinical sign as part of the severity prediction rule²⁰⁰. However, it is also possible that prescribers had assessed a patient as not being confused and that non-documentation related to absence of the symptom²⁸⁹, although it is preferable that a statement is included to this effect, e.g. “patient not confused”.

It should be considered that these CURB severity parameters are presumably not associated with an absolute cut-off point, and that patients with borderline results might be treated as having severe CAP depending on assessment of their overall condition.

Sputum samples were only taken from patients in 16 episodes, this low prevalence possibly being associated with difficulties in expectoration, or clinicians not recognising the importance of this test. The 2001 BTS CAP guidance recommended that sputum samples should be sent for culture from patients who are able to expectorate purulent samples and who have not received prior antibiotic treatment²⁰⁰. The CAP guidance also recognised diagnostic problems arising from prior exposure to antibiotics, delays in transporting and processing samples and difficulty in interpretation due to contamination by upper respiratory tract flora²⁰⁰. In the present study, only 3 sputum samples were taken on the day of admission, and there is a need for education about the requirement of taking such samples before antibiotics are administered.

There was an intention documented in the clinical therapeutic plan to take a sputum sample for 7 patients, but no result was subsequently documented. However, it is possible that the test had been performed, but the results not documented, and in a

previous study, results from positive blood cultures were only documented for 54% (n=21) of cases⁴¹⁹. Medical microbiologists have an important role in interpreting the results of laboratory tests in “directed therapy”⁴²⁰, and in only reporting sensitivities to antibiotics contained in the hospital’s policy¹⁷⁴. The production of a “combined sensitivity profile and antibiotic prescribing aid” has been useful in this respect¹⁰². The optimum use of microbiology laboratories can contribute towards rational antibiotic prescribing, provided that there is good communication between the microbiologist and the clinician^{420, 421}.

10.2.4 Empirical Antibiotic Therapy

One of the objectives was to identify which empirical antibiotic regimens had been prescribed for patients with CAP, and whether prescribers had complied with the recommendations of institutional and national antibiotic prescribing guidelines.

Few pneumonias are defined microbiologically at initial assessment and consequently most prescribing is empirical²⁰⁰. It is therefore important that hospitals have institutional guidelines based upon current national recommendations (Chapter 8 and Chapter 9). However, the institutional antibiotic prescribing guidelines for the hospital in the present study can be criticised for recommending the same regimen for the treatment of non-severe and severe CAP; amoxicillin +/- erythromycin. In retrospect, it would have been better to have performed the audit at a hospital where the guideline recommendations were different for non-severe and severe CAP. The problem of recommending the same regimen for both CAP severities has been previously discussed (page 206, Chapter 8). It is surprising that the regimen of cefuroxime and erythromycin was reserved as

a 2nd-line alternative regimen for patients with severe CAP in the institutional guidelines because this regimen was recommended as 1st-line therapy by the 2001 BTS CAP guidance. It was possibly reserved in the hospital because of local concerns about cephalosporin resistance and cost issues.

There was poor compliance with the recommendations of the institutional antibiotic guidelines for the empirical antibiotic treatment of CAP. Compliance was 57% for non-severe CAP, 33% for severe CAP and 50% for CAP episodes that could be classified as either severe or non-severe.

Thirty-five episodes in the study were not associated with any of the CURB severity parameters, and according to the 2001 BTS CAP guidance should have been treated as non-severe CAP. The compliance rate with the institutional guideline recommendations for the main prescribed regimen for non-severe CAP was 57%. Non-compliance was mainly due to recommendation of a regimen including a cephalosporin (n=8) or of amoxicillin and clarithromycin (n=4). Although clarithromycin was not recommended in the institutional guidelines at the time of the audit, it was subsequently recommended as the macrolide choice instead of erythromycin. However, the recommendation of regimens containing cephalosporins is of greater concern because these should be reserved for patients with more severe infection⁵⁷. It is possible that prescribers over-estimated the severity of some CAP episodes, and would benefit from education.

A change in regimen was made for 43% (n=15) of the non severe CAP episodes, most often by the Consultant at the post-take ward round. The most common

change was to a main regimen of amoxicillin and macrolide (n=9); from an initial regimen of amoxicillin monotherapy for 4 episodes, and from a regimen containing cefuroxime for 3 episodes. A possible reason for the addition of a macrolide antibiotic is the suspicion of “atypical pathogens”⁴²². Of the 11 initial regimens including cefuroxime, 3 were subsequently “down-graded” to a regimen for non-severe CAP.

Nine episodes should have been treated as severe CAP due to the association of two or more CURB severity parameters. The antibiotic regimen prescribed for only 3 (33%) of these regimens complied with the institutional guidelines. Of these 9 episodes, therapy was changed from the initial regimen for 3 episodes, although the changes meant that the regimens were still non-compliant with institutional document recommendations. Unfortunately, the assessment of the appropriateness of regimens for severe CAP is hindered by the poor availability of medical records for patients who had died.

Thirty-six CAP episodes were associated with one CURB severity factor. The 2001 BTS CAP guidance recommended that whether such episodes were treated as non-severe or severe depended on the judgement of the clinician. Of these episodes, 17 (49%) were treated in accordance with the BTS CAP guidance; 6 as non severe CAP and 11 as severe CAP.

The content of the institutional antibiotic guidelines was poor, e.g. they did not comply with the national guidance, and this might have explained in part the high level of non-compliance. It was decided to investigate the general attitude of

prescribers to, and their use of, the institutional guidelines to identify if these were reasons for poor compliance. That case-study is described in Chapter 11.

10.2.5 Clinical Outcomes

The mortality rate of 14%, was similar to that reported by the 2001 BTS CAP guidance of between 5.7% and 12%²⁰⁰. It was slightly higher for patients admitted from a nursing home, although the small sample size prevents analysis of statistical association. However, it should be considered that the records of 61 patients were unavailable because they had died, and the mortality rate might be under-estimated, because a mortality rate of over 50% has been reported for patients with severe CAP²⁰⁰. Although mortality and length-of-stay have traditionally been used as end-points in assessing the quality of CAP care, they have not been subjected to robust validation techniques⁴²³.

Documentation of planned follow-up was only documented in the medical record for 45% (n=25) of episodes. A more positive finding was that where proposed follow-up was documented, in all but 1 case patients should have been seen within 6 weeks, as recommended by the 2001 BTS CAP guidance²⁰⁰.

10.3 Conclusion

This case-study has investigated the prescribing practices for the empirical antibiotic treatment of patients with CAP in one hospital. The objectives were to identify patient demographics and diagnostic criteria, and to evaluate whether prescribing was compliant with the recommendations of institutional guidelines and national BTS guidance.

Poor recording of diagnostic criteria, especially concerning the respiratory rate and whether patients were confused, hindered retrospective assessment of the severity of the CAP episode in some cases. There is a need for further education of clinicians about the importance of documenting the results of such tests. Less than three-fifths of patients were treated in accordance with institutional guideline recommendations, and there is a need for education of prescribers about the importance of these guidelines. These findings were the impetus for another case-study performed at the same institution, which investigated the general use of antibiotic guidelines and prescribers' attitudes towards them by self-completion questionnaire.

Unfortunately, the performance of this study was severely hindered by delay in granting ethical approval by the LREC because of confusion about the impact of the research governance framework upon access to patient identifiable data. Poor availability of patients' medical records also severely hindered this study and it is hoped that wide-scale implementation of electronic records would aid performance of this research methodology in the future.

The main findings of the study are;

- Medical records were only available for 41% (n=112) of patients in the study. Medical records were available for 112 patients, but 30 were aged under 16 years and were excluded from the analysis. The remaining 81 patients were admitted for 84 episodes of CAP.
- In the majority (85%, n=71) of CAP episodes, a chest x-ray had been performed to confirm diagnosis.

- Sputum samples were taken for 16 episodes, but only 3 of these were taken on the day of admission.
- Of the 84 episodes, 38 (45%) were not associated with any of the CURB severity parameters, 36 (43%) had one factor, 6 (7%) had two factors and 4 (5%) had 3 factors.
- Antibiotics were prescribed for 79 CAP episodes. Of these, 44% (n=35) of episodes should have been classified as non severe CAP, 11% (n=9) of episodes should have been classified as severe CAP, and 44% (n=35) of episodes should have been classified at the discretion of the clinician.
- Prescribing was compliant with the institutional guidelines for 57% of non severe CAP episodes, for 33% of severe CAP episodes and for 49% of episodes which could have been treated as either non-severe CAP or severe CAP.
- Documentation of intention to follow-up the patient following discharge was included in the medical record of 81% of CAP episodes. Of these, 45% (n=25) had a planned follow-up, the majority of which were after 4-6 weeks.

Chapter 11 Case Study 2: The views of prescribers about institutional antibiotic prescribing guidelines, and their use of this document

Chapter 10 described a case-study performed in one institution to investigate prescribers' compliance with recommendations for the empirical antibiotic therapy of CAP. Less than three-fifths of CAP episodes had been treated with appropriate antibiotic(s) according to the institutional antibiotic prescribing guidelines. It is possible that this poor compliance was related to guideline parameters including their availability, awareness of their existence and ease of access.

The aim of this part of the study was to perform a case-study to investigate the views of medical staff about the institutional guidelines. It was performed at the same institution as the prescribing compliance case-study described in Chapter 10.

The objectives of the study were to identify;

- How many clinicians use the institutional guidelines.
- How the guidelines are accessed.
- How often clinicians refer to the guidelines.
- How useful clinicians find the guidelines.

A self-completion questionnaire, "Antibiotic Guidelines, Survey 2003", was sent and e-mailed in 2003/2004 to 412 medical staff from the same hospital where the

retrospective audit of compliance with empirical antibiotic prescribing guidelines had been performed (Chapter 10). A question about the choice of antibiotic(s) for a patient diagnosed with non-severe CAP was included to identify whether staff were aware of the recommended antibiotic regimen, and to link with the prescribing compliance audit (Chapter 10). Appendix D contains a copy of the questionnaire.

11.1 Results

11.1.1 Response Rate

Two successive mailings of the questionnaire were delivered to the 412 recipients and a total of 214 were returned (a response rate of 52%). The number of questionnaires returned for each of the mailings is summarised in Table 11.1.

Table 11.1: The number of questionnaires returned after successive mailings.

Questionnaire mailing	Number of questionnaires returned	Questionnaires returned uncompleted
1 st	131	4
2 nd	83	5

A total of 205 questionnaires were returned completed (a completion rate of 50%) and nine questionnaires were returned unanswered because the recipient had left the hospital.

11.1.2 Electronic Mail for Questionnaire Distribution

A total of 214 questionnaires had been returned after two deliveries. It was planned to e-mail the questionnaire to the remaining 198 medical staff in a further attempt to increase the valid response rate, and to investigate the application of e-mail technology in questionnaire research methodology. The Trust could not provide a

list of e-mail addresses for staff and it was necessary to compose the e-mail addresses in the format of firstname.surname@swbh.nhs.uk. Although the original bleep list provided the initial and surname of clinicians, it was necessary to identify their first name. Examination of the Workforce Database revealed that 152 of the 198 previous non-respondents should be contactable by e-mail (excluding 20 staff who had left and 26 who were not listed on the database). However, e-mail could only be successfully delivered to 67 (44%) of these potential e-mail recipients and the fate of e-mails is summarised in Table 11.2.

Table 11.2: Fate of e-mails sent to hospital staff (n=152).

Fate of e-mail	Number of questionnaire recipients
<i>Successfully delivered to recipient</i>	67 (44%)
<i>“Undeliverable” due to full e-mail system or e-mail not used by recipient</i>	61 (40%)
<i>E-mail address not recognised</i>	24 (16%)

E-mails were successfully delivered to 67 staff, of whom 8 (12%) completed the electronic questionnaire.

11.1.3 Corrected Response Rate for Valid Recipients

Examination of the Workforce Department’s name list revealed that 26 medical staff were not listed and 20 had left the hospital. In addition, 9 questionnaires had been returned unanswered from postal mailings because the recipient had left the hospital. Therefore, of the original 412 recipients, the total possible survey cohort was 357. Completed questionnaires were received from 213 of these recipients, giving a corrected response rate of 60%.

11.1.4 Demographics of Respondents

i). Grade of Practice

Respondents were asked to state their grade of practice and were provided with the options of Consultant, Registrar, Senior House Officer (SHO) and Pre Registration House Officer (PRHO). Of the 213 respondents, 209 (98%) answered this question and 54% (n=112) were Consultants. A further 25% (n=53) were Registrars, 18% (n=37) were SHOs and 3% (n=6) were PRHOs. One respondent annotated the questionnaire that they were a clinical fellow.

ii). Length of Employment

A total of 205 (96%) of the 213 respondents specified the month that they had joined the hospital, which ranged from September 1972 to October 2003. The modal length of practice was 1 year or less, which accounted for 81 respondents. Sixty-three percent of staff (n=129) had been employed for 3 or less years, 17% (n=34) for between 4 and 9 years, 10% (n=20) for between 10 and 19 years and 11% (n=22) for over 20 years.

iii). Speciality

Although respondents were not asked to state their area of practice, this information was available from the original bleep list for the 205 respondents who had completed a postal questionnaire. Information was not available for the 8 respondents who had completed the internet-based questionnaire. The 205 respondents worked in 34 of the 37 specialities, and the response rate for each speciality is summarised in Table 11.3.

Table 11.3: Response rate of staff completing a postal questionnaire by speciality (n=205).

Speciality	Number of potential respondents	Number of respondents	Percentage of respondents
<i>Anaesthetics</i>	44	31	70
<i>Ophthalmology</i>	35	21	60
<i>Cardiology</i>	18	12	67
<i>Paediatrics</i>	24	12	50
<i>Dermatology</i>	19	11	58
<i>A & E</i>	25	11	44
<i>Geriatrics</i>	11	10	91
<i>Obstetrics & Gynaecology</i>	17	9	53
<i>ENT</i>	11	8	73
<i>Trauma and Orthopaedics</i>	16	7	44
<i>Radiology</i>	8	6	75
<i>ITU</i>	8	6	75
<i>Gastroenterology</i>	11	6	55
<i>Vascular surgery</i>	8	5	63
<i>Upper gastrointestinal surgery</i>	7	5	71
<i>Rheumatology</i>	8	5	63
<i>Community paediatrics</i>	5	4	80
<i>Colorectal surgery</i>	7	4	57
<i>Haematology</i>	4	3	75
<i>Urology</i>	6	3	50
<i>General medicine/Diabetes</i>	8	3	38
<i>Microbiology</i>	4	2	50
<i>Physics & Nuclear Medicine</i>	2	2	100
<i>Breast surgery</i>	5	2	40
<i>Plastic surgery</i>	6	2	33
<i>Pathology</i>	7	2	29
<i>Pharmacology</i>	3	2	67
<i>Cardiology/Hypertensive/Pharmacology</i>	6	2	33
<i>General medicine/Respiratory</i>	7	2	29
<i>Neurology</i>	6	2	33
<i>Poisons</i>	3	2	67
<i>Oral surgery</i>	1	1	100
<i>Immunology</i>	1	1	100
<i>Oncology</i>	1	1	100
<i>Medical assessment unit</i>	3	0	0
<i>Neurophysiology</i>	1	0	0
<i>Toxicology</i>	1	0	0
Total	357	205	57

11.1.5 Use of the Institutional Antibiotic Prescribing Guidelines

Respondents were asked if they used the hospital's antibiotic prescribing guidelines in their routine practice. All 213 respondents provided a valid response. Of these, 47% (n=101) used the antibiotic guidelines, whilst 53% (n=112) did not use the document. Staff in 32 specialities use the guidelines, and these results are summarised in Table 11.4.

Table 11.4: Use of the institutional antibiotic prescribing guidelines by speciality of respondents completing a postal questionnaire (n=205).

Speciality	Number of respondents	Number of respondents who use guidelines	Percentage of respondents that use guidelines
<i>Anaesthetics</i>	31	7	23
<i>Ophthalmology</i>	21	7	33
<i>Cardiology</i>	12	6	50
<i>Paediatrics</i>	12	5	42
<i>Dermatology</i>	11	1	9
<i>A & E</i>	11	8	73
<i>Geriatrics</i>	10	8	80
<i>Obstetrics & Gynaecology</i>	9	4	44
<i>ENT</i>	8	2	25
<i>Trauma and orthopaedics</i>	7	3	43
<i>Radiology</i>	6	2	33
<i>ITU</i>	6	1	17
<i>Gastroenterology</i>	6	3	50
<i>Vascular surgery</i>	5	4	80
<i>Upper gastrointestinal surgery</i>	5	4	80
<i>Rheumatology</i>	5	3	60
<i>Community paediatrics</i>	4	2	50
<i>Colorectal surgery</i>	4	1	25
<i>Haematology</i>	3	2	67
<i>Urology</i>	3	1	33
<i>General medicine/Diabetes</i>	3	3	100
<i>Microbiology</i>	2	2	100
<i>Physics & Nuclear Medicine</i>	2	1	50
<i>Breast surgery</i>	2	0	0
<i>Plastic surgery</i>	2	1	50
<i>Pathology</i>	2	1	50
<i>Pharmacology</i>	2	2	100

Speciality	Number of respondents	Number of respondents who use guidelines	Percentage of respondents that use guidelines
<i>Cardiology/Hypertensive/Pharmacology</i>	2	2	100
<i>General medicine/respiratory</i>	2	2	100
<i>Neurology</i>	2	0	0
<i>Poisons</i>	2	2	100
<i>Oral surgery</i>	1	1	100
<i>Immunology</i>	1	1	100
<i>Oncology</i>	1	1	100
Total	205	93	45

At least one staff respondent working in all specialities, except breast surgery and neurology, used the institutional antibiotic prescribing guidelines. Staff who had been employed at the hospital for more than 3 years were more likely to use the guidelines than those who had been at the hospital for a shorter period ($p=0.027$). However, whether staff were Consultant grade was not associated with whether they used the guidelines ($p=0.867$). Staff working within the Dermatology Department were less likely to use guidelines than those in other departments ($p=0.029$).

11.1.6 Reasons for Not Using the Institutional Antibiotic Prescribing Guidelines

The 112 respondents who had replied that they did not use the institutional antibiotic prescribing guidelines were asked to specify the reason(s) for this, and were provided with six answer options. All 112 respondents answered this question. One of the options provided was “no need to refer to the guidelines in my routine practice”, and 53 respondents ticked this box. The specialities of these respondents are summarised in Table 11.5.

Table 11.5: The speciality of respondents with no need to refer to the institutional antibiotic prescribing guidelines in their routine practice (n=53).

Speciality	Number of respondents
Anaesthetics	13
Ophthalmology	8
Radiology	5
Paediatrics	4
Dermatology	4
ENT	3
Intensive care	3
Community paediatrics	2
Neurology	2
Cardiology	2
Colorectal surgery	1
Physics and Nuclear medicine	1
Gastroenterology	1
Rheumatology	1
Urology	1
Vascular surgery	1
Trauma and Orthopaedics	1

The results for the reasons the other 59 respondents do not routinely use the institutional antibiotic guidelines are summarised in Table 11.6.

Table 11.6: Other reasons for not using the institutional antibiotic prescribing guidelines in routine practice (n=59).

Reasons for not using guidelines	Number of respondents
Unaware	38 (64%)*
Poor access	21 (36%)
Believe guidelines have been poorly developed	0
Disagree with guideline recommendations	0
Don't Know	1 (2%)
Other	7 (12%)

*Please Note: These frequencies do not total 100% because more than one reason may have been chosen.

Thirty-eight staff were unaware of the hospital's antibiotic prescribing guidelines, which was more likely if the respondent was a Specialist Registrar (0.001) and if the respondent had been employed at the hospital for less than three years (0.003). Poor access to the antibiotic prescribing guidelines was not associated with whether

staff had been employed for three years or less ($p>0.05$ in all cases) and with their grade ($p>0.05$ in all cases).

11.1.7 Corrected Results for the Use of Institutional Antibiotic Prescribing Guidelines

Fifty-three of the 213 respondents reported that they had no need to refer to the institutional antibiotic prescribing guidelines in their routine practice. Therefore, of the 160 respondents who could potentially use the guidelines in their practice, 63% ($n=101$) did use the document.

11.1.8 Access to the Institutional Antibiotic Prescribing Guidelines

The 101 respondents (93 postal and 8 e-mail) who use the hospital's antibiotic prescribing guidelines were asked how they access the document, and were provided with several answer options. A valid response was provided by 97 (96%) respondents, and these results are summarised in Table 11.7.

Table 11.7: Method of accessing the institutional antibiotic prescribing guidelines (n=97).

Method of access	Number of respondents
<i>Personal copy</i>	37 (38%)*
<i>Ward copy</i>	24 (25%)
<i>On Hospital intranet</i>	48 (49%)
<i>Don't Know</i>	3 (3%)
<i>Other</i>	21 (22%)

**Please Note: These frequencies do not total 100% because more than one method of accessing the antibiotic prescribing guidelines may have been used.*

The most commonly used methods were access via the intranet alone ($n=25$), reference to a personal copy alone ($n=15$) and use of a personal copy in conjunction with access via the intranet ($n=14$). The type of grade was not associated with

whether staff referred to a personal copy of the guidelines or accessed the guidelines on the intranet ($p>0.05$ in all cases). Staff who had been at the hospital more than 3 years were more likely to have a personal copy of the guidelines ($p=0.047$), but the length of employment was not associated with access via the intranet ($p=0.113$).

11.1.9 Frequency of Reference to the Institutional Antibiotic Prescribing Guidelines

These same 101 respondents who use the institutional antibiotic prescribing guidelines were asked how often they referred to this document, and were provided with the options of daily, weekly, rarely and never. A valid response was provided by 91 (90%) respondents, and these results are summarised in Table 11.8.

Table 11.8: Frequency of referral to the institutional antibiotic prescribing guidelines (n=91).

Frequency of referral to guidelines	Number of respondents
<i>Daily</i>	7 (8%)
<i>Weekly</i>	25 (27%)
<i>Rarely</i>	51 (56%)
<i>Never</i>	1 (1%)
<i>Don't Know</i>	2 (2%)
<i>Other</i>	5 (5%)

Thirty-two respondents referred to the antibiotic prescribing guidelines either daily or weekly, and these staff were more likely to be SHOs ($p=0.001$) and less likely to be Consultants ($p=0.001$). Staff who had been employed at the hospital less than 3 years were more likely to refer to the guidelines daily or weekly ($p=0.001$).

11.1.10 Perceived Usefulness of the Institutional Antibiotic Prescribing Guidelines

The 101 respondents who use the institutional antibiotic guidelines were asked how useful they found this document and were provided with the options of very useful, useful, ambivalent and not useful. Ninety-five respondents (94%) answered this question, and the results are summarised in Table 11.9.

Table 11.9: Perceived usefulness of the institutional antibiotic prescribing guidelines (n=95).

Usefulness of guidelines	Number of respondents
<i>Very useful</i>	18 (19%)
<i>Useful</i>	51 (54%)
<i>Ambivalent</i>	18 (19%)
<i>Not useful</i>	3 (3%)
<i>Don't Know</i>	2 (2%)
<i>Other</i>	3 (3%)

The perception that guidelines were “useful” or “very useful” was not associated with the length of employment ($p=0.898$), or whether staff were Consultant grade ($p=0.477$).

11.1.11 Antibiotic(s) Recommended for CAP

Respondents were asked what antibiotic(s) they would prescribe for a patient diagnosed with non-severe CAP, and a space was provided for them to write their answer. They were also asked if they had specifically looked in the institutional antibiotic prescribing guidelines for their answer. Amoxicillin +/- erythromycin was the regimen recommended in the institutional antibiotic prescribing guidelines for the treatment of (mild/moderate) CAP until February 2003. It was subsequently changed to amoxicillin +/- clarithromycin on the advice of the specialist “infectious diseases pharmacist” who stated that clarithromycin was preferable to erythromycin

for several reasons e.g. it can be given twice daily rather than four times a day and is associated with a lower incidence of side-effects.

i). Regimens Recommended by Respondents who Use the Institutional Antibiotic Prescribing Guidelines

Of the 101 respondents who use the antibiotic prescribing guidelines in their routine practice, 16 (16%) did not specify the antibiotic(s) they would prescribe for a patient with (non-severe) CAP. Of these respondents, 8 said that they would not encounter such an infection in their routine practice, 2 would discuss the case with a chest physician or medical microbiologist, 2 would refer to the guidelines and 4 failed to respond. Eighty-five respondents (84%) specified the empirical antibiotic regimen they would prescribe for a patient with CAP, and these results are summarised in Table 11.10.

Table 11.10: Empirical antibiotic regimens suggested for (non severe) CAP by prescribers who use the institutional antibiotic prescribing guidelines (n=85).

Empirical Antibiotic Regimen	Number of Respondents	Compliance with guidelines
<i>Amoxicillin</i>	46 (54%)	Compliant (new/old)
<i>Amoxicillin +/- erythromycin</i>	10 (12%)	Non-compliant (old)
<i>Amoxicillin and erythromycin</i>	4 (5%)	Non-compliant (old)
<i>Clarithromycin</i>	4 (5%)	Non-compliant
<i>Amoxicillin and clarithromycin</i>	3 (4%)	Compliant (new)
<i>Erythromycin</i>	2 (2%)	Non-compliant
<i>Amoxicillin or erythromycin</i>	2 (2%)	Non-compliant
<i>Amoxicillin +/- clarithromycin</i>	2 (2%)	Compliant (new)
<i>Co-amoxiclav</i>	2 (2%)	Non-compliant
<i>Amoxicillin and clarithromycin/ciprofloxacin</i>	1 (1%)	Allows possible compliance
<i>Amoxicillin +/- azithromycin</i>	1 (1%)	Allows possible compliance
<i>Amoxicillin or clarithromycin</i>	1 (1%)	Allows possible compliance
<i>Ampicillin</i>	1 (1%)	Non-compliant
<i>Benzympenicillin</i>	1 (1%)	Non-compliant
<i>Benzympenicillin and erythromycin</i>	1 (1%)	Non-compliant
<i>Cefuroxime and clarithromycin</i>	1 (1%)	Non-compliant

Empirical Antibiotic Regimen	Number of Respondents	Compliance with guidelines
<i>Ciprofloxacin</i>	1 (1%)	Non-compliant
<i>Penicillin class</i>	1 (1%)	Non-compliant
<i>Cefpodoxime and clarithromycin</i>	1 (1%)	Non-compliant

Prescribers recommended a compliant regimen in 60% of cases, and recommended a regimen that could allow compliance in 4% of cases.

ii). Regimens Recommended by Respondents Who Do Not Use the Institutional Antibiotic Prescribing Guidelines

Of the 112 respondents who do not use the antibiotic prescribing guidelines, 40 (36%) did not denote what antibiotic regimen they would prescribe for a patient with CAP. Seventy-two (64%) respondents specified the empirical regimen they would prescribe for a patient with this infection, and these results are summarised in Table 11.11.

Table 11.11: Empirical antibiotic regimens suggested for (non severe) CAP by prescribers who do not use the institutional antibiotic prescribing guidelines (n=72).

Empirical Antibiotic Regimen	Number of respondents	Compliance with Guidelines
<i>Amoxicillin</i>	35 (49%)	Compliant (new/old)
<i>Erythromycin</i>	8 (11%)	Non-compliant
<i>Amoxicillin or erythromycin</i>	6 (8%)	Non-compliant
<i>Amoxicillin and clarithromycin</i>	2 (3%)	Compliant (new)
<i>Amoxicillin and erythromycin</i>	2 (3%)	Non-complaint (old)
<i>Cefuroxime</i>	2 (3%)	Non-compliant
<i>Amoxicillin +/- erythromycin or clarithromycin</i>	1 (1%)	Allows possible compliance
<i>Amoxicillin or trimethoprim</i>	1 (1%)	Non-compliant
<i>Amoxicillin +/- erythromycin</i>	1 (1%)	Non-compliant (old)
<i>Co-amoxiclav</i>	1 (1%)	Non-compliant
<i>Co-amoxiclav +/- clarithromycin</i>	1 (1%)	Non-compliant
<i>Amoxicillin or co-amoxiclav</i>	1 (1%)	Non-compliant
<i>Benzylpenicillin and clarithromycin</i>	1 (1%)	Non-compliant
<i>Cefuroxime or clarithromycin</i>	1 (1%)	Non-compliant
<i>Clarithromycin</i>	1 (1%)	Non-compliant
<i>Cephalosporin</i>	1 (1%)	Non-compliant

Empirical Antibiotic Regimen	Number of respondents	Compliance with Guidelines
<i>Clarithromycin or cefuroxime</i>	1 (1%)	Non-compliant
<i>Clarithromycin or co-amoxiclav</i>	1 (1%)	Non-compliant
<i>Erythromycin or clarithromycin</i>	1 (1%)	Non-compliant
<i>Erythromycin or ofloxacin</i>	1 (1%)	Non-compliant
<i>Levofloxacin</i>	1 (1%)	Non-compliant
<i>Penicillin</i>	1 (1%)	Non-compliant
<i>Erythromycin or penicillin</i>	1 (1%)	Non-compliant

Prescribers recommended a compliant regimen in 60% of cases, and recommended a regimen that could allow compliance in 4% of cases.

11.1.12 Agreement with Institutional Antibiotic Prescribing Guidelines

At the time of the study, the recommended regimen for the empirical antibiotic treatment of non-severe CAP was amoxicillin +/- clarithromycin. Therefore if a respondent recommended amoxicillin, amoxicillin and clarithromycin or amoxicillin +/- clarithromycin, this was considered compliant with the institutional guidelines.

This regimen had recently replaced the recommendation of amoxicillin +/- erythromycin. If respondents had recommended amoxicillin and erythromycin or amoxicillin +/- erythromycin, this was classified as being non-compliant due to being consistent with the old regimen. Compliance with the institutional antibiotic prescribing guidelines for all 157 respondents (both those who use the guidelines and those who do not use this document) is summarised in Table 11.12.

Table 11.12: Overall compliance with the recommended antibiotic regimen for non-severe CAP contained in the institutional antibiotic prescribing guidelines (n=157).

Compliance with institutional antibiotic prescribing guidelines	Number of respondents
Compliant;	88 (56%);
<i>Amoxicillin</i>	81
<i>Amoxicillin and clarithromycin</i>	5
<i>Amoxicillin +/- clarithromycin</i>	2
Non-Compliant (old regimen);	18 (11%);
<i>Amoxicillin +/- erythromycin</i>	11
<i>Amoxicillin and erythromycin</i>	6
<i>Amoxicillin +/- erythromycin/clarithromycin</i>	1
Non-compliant (other regimens)	51 (32%)

11.1.13 Regimens Recommended Following Reference to the Institutional Antibiotic Prescribing Guidelines

Respondents were asked if they had specifically referred to the institutional antibiotic prescribing guidelines before specifying the empirical antibiotic regimen that they would prescribe for a patient with CAP. Of the 157 respondents who had recommended an empirical regimen, only 13 (8%) had specifically referred to the guidelines. The regimens recommended by these 13 respondents are summarised in Table 11.13.

Table 11.13: Empirical antibiotic regimens recommended for non-severe CAP after referral to the institutional antibiotic prescribing guidelines (n=13).

Regimen	Number of respondents
<i>Amoxicillin +/- erythromycin</i>	4 (old regimen)
<i>Amoxicillin</i>	4 (new regimen)
<i>Amoxicillin +/- clarithromycin</i>	1 (new regimen)
<i>Amoxicillin and erythromycin</i>	1 (old regimen)
<i>Cefuroxime</i>	1
<i>Benzylpenicillin and erythromycin</i>	1
<i>Amoxicillin or erythromycin</i>	1

11.2 Discussion

This case-study examined the use of institutional antibiotic prescribing guidelines by staff in a large hospital in Birmingham (the same institution where the audit of CAP therapy was performed, described in Chapter 10). It also identified the methods used to access the guidelines and staff perception about their usefulness. The prescribers who had not complied with the institutional antibiotic prescribing guidelines for the empirical treatment of CAP (study described in Chapter 10) might have left the hospital or not responded to the questionnaire. However, such a case-study identifies the general perception of the institutional antibiotic prescribing guidelines within the same hospital.

Previous studies have investigated the attitudes of prescribers towards general clinical guidelines^{125, 246, 248-250}, but most studies have investigated the impact of antibiotic prescribing guidelines upon antibiotic use and resistance^{320, 321, 424-431}, rather than their acceptance by prescribers.

Two previous UK studies have investigated the use and access of antibiotic guidelines; in England in 1982¹²⁶ and in Scotland (published in 1999)¹⁸. The present study has expanded this research by providing a thorough examination of the topic in one study and examining why guidelines were not used.

In the present study the questionnaire was delivered to all medical staff, so that the wider scenario of use of antibiotic prescribing guidelines could be analysed. Requesting prescribers to stipulate what antibiotic regimen they would prescribe for

CAP, and subsequent investigation of compliance with institutional guidelines, appears to represent a novel research methodology.

11.2.1 Response Rate

The overall response rate of 60% (n=213) was acceptable for a questionnaire distributed to medical staff. Surveys of physicians tend to attract lower response rates than those of the general population⁴³², and a review of recently published questionnaire research with institutional hospital physicians identified that response rates of between 50% and 60% were common for such a recipient cohort⁴³³⁻⁴³⁹. It is encouraging that a response was received from at least one staff member in 34 specialities, because response was obtained from most of the specialities within the hospital.

However, a response was not received from two-fifths of potential respondents. Use of the institutional antibiotic prescribing guidelines may have been over-estimated because recipients may erroneously have not responded because they have no need to prescribe antibiotics and refer to the antibiotic prescribing guidelines. It would have been especially interesting to have received responses from the 3 medical staff working in the Medical Assessment Unit, since they are likely to frequently encounter patients with infections. Junior doctors tend to prescribe most antibiotics and it would also have been interesting to have received more responses from PRHOs.

11.2.2 Use of the Institutional Antibiotic Prescribing Guidelines

One of the objectives was to identify how many clinicians routinely use the institutional antibiotic prescribing guidelines. The antibiotic prescribing guidelines were reportedly used by approximately one-half of staff, and appeared to be widely employed throughout the hospital, in 34 specialities. Staff in the Dermatology Department were less likely to use the guidelines and this Department has its own guidelines which respondents considered different to the “institutional antibiotic prescribing guidelines”. In many specialities only some members reportedly used the guidelines, possibly because not all staff prescribe antibiotics or other factors impacted upon their use of guidelines, e.g. age and personal characteristics and Hofstede identified five barriers to the implementation of guidelines; power, individuality, uncertainty avoidance, masculinity and long-term orientation (van der Meer, ESCMID conference 2004). Although the grade of a clinician was not associated with overall use of prescribing guidelines, it is possible that a staff’s grade within a certain speciality affected whether they use this document.

It was hypothesised that staff who had been employed for a shorter time would be more likely to use the institutional antibiotic guidelines, as they familiarised themselves with the prescribing guidance of their new hospital. It is therefore surprising that staff who had been employed for longer than 3 years were more likely to use the guidelines, and it is possible that staff who had been employed for a shorter time did not use the guidelines because they were unaware of them. Poor awareness can be a problem in the use of guidelines, and a survey of clinicians in a Scottish hospital identified that 24% (n=10) were unaware of the existence of the institutional antibiotic prescribing guideline^{18, 142}.

Of the staff who purportedly did not use the antibiotic prescribing guidelines, almost half had no need to use them in their routine practice. However, over one-sixth of the total questionnaire respondents were not aware of the antibiotic prescribing guidelines, and lack of awareness has been identified as one of the major barriers to the implementation of guideline recommendations in a systematic review²⁴⁵. Staff who had been employed at the hospital for less than three years were less likely to have been aware of the existence of the institutional antibiotic prescribing guidelines. This emphasises that the hospital needs to take proactive action to ensure that all new staff are aware of the guidelines.

It is difficult to speculate whether poor compliance with the institutional empirical antibiotic prescribing guidelines identified in the retrospective audit of CAP therapy was related to poor awareness and/or access to the guidelines. This is because the respondents might have been different to those who had treated patients with CAP in the previous year. However, it suggests that there is a need for education about the existence and purpose of the document, and a review of dissemination techniques, which are a necessary precursor to their use⁴⁴⁰. There is also a need for improving access to the guidelines for some staff, e.g. providing training to use the electronic version and giving more staff a personal copy. The results of this survey can be used to optimise the use of the institutional antibiotic prescribing guidelines in this particular hospital.

No respondents perceived that the guidelines had been poorly developed, or did not agree with their recommendations, and this has positive implications for the incorporation of guideline recommendations into clinical practice. It is important

that the views and beliefs of potential guideline users are considered in the guideline development process, and this has been previously discussed (Chapter 9).

11.2.3 Access to the Institutional Antibiotic Prescribing Guidelines

One of the objectives was to identify how guidelines were made available to staff.

Access to guidelines via the intranet was the most commonly reported method of access, which suggests that electronic technology is well-established at this hospital, and the benefits of electronic documents have been previously discussed (page 88, Chapter 4). In a previous study, 48% (n=31) of physicians thought electronic access would be convenient and avoid misplacing a personal copy, but concerns about training and provision of resources were also expressed⁴⁴¹.

Only approximately two-fifths of staff referred to a personal copy of the antibiotic prescribing guidelines, although those with intranet access could presumably print a personal copy. It is interesting that staff who had worked at the hospital for longer than 3 years were more likely to refer to a personal copy of the guidelines than those employed for a shorter time. This again suggests that staff who had been employed for a shorter time did not use the documents due to poor awareness of their existence. However, possession of a personal copy of guidelines is not synonymous with use, and although 51 junior staff in a previous study had a personal copy of antibiotic guidelines, 24 left it at home because it was inconvenient to carry⁴⁴¹.

11.2.4 Frequency of Reference to the Institutional Antibiotic Prescribing Guidelines

One of the objectives was to identify how often respondents used the institutional guidelines. Just over one-third of respondents in the present study reportedly referred to the antibiotic prescribing guidelines daily or weekly, which was very similar to the finding that 38% (n=12) of respondents from a Scottish hospital had referred to the guidelines at least once a week¹⁸.

However, staff may refer to a guideline for a specific infection a number of times, after which they remember the recommendation and have no need to refer to the document again. This was apparent in a previous survey⁸, where only 9.1% of surveyed staff referred to the policy daily or weekly, although other questions indicated that the policy had made an impact and it was assumed that their contents had been memorised. This emphasises the importance of informing staff about any changes in the recommendations of antibiotic prescribing control documents.

Staff were likely to refer to the institutional antibiotic prescribing guidelines more frequently if they were SHOs and if they had been employed at the hospital for less than 3 years. Junior staff are more likely to make initial antibiotic prescribing decisions than senior staff, and 48% of respondents to a previous survey thought that the antibiotic policy was of most use to junior staff¹²⁶. It is also possible that staff who had worked at the hospital for less than 3 years were more likely to be junior and these may be confounding variables. Staff employed for a shorter time might be less familiar with the hospital's prescribing recommendations and likely to refer to the guidelines more often.

11.2.5 Perceived Usefulness of the Institutional Antibiotic Prescribing Guidelines

One of the objectives was to examine prescribers' attitudes towards the guidelines. A positive finding was that the guidelines were reportedly viewed favourably by almost three-quarters of respondents, with only a small minority expressing a negative view towards the document. Such positive opinion is encouraging and might suggest that the guideline recommendations would be incorporated into clinical practice. The authors of a study of the efficacy of an antibiotic prophylaxis policy in an Italian hospital believed that poor compliance was due to prescribers seeing the policy as a "bureaucratic apparatus rather than a supportive structure"⁴⁴².

However, a favourable opinion to a prescribing guideline is not always reflected in clinical practice, and although 89% of nephrologists thought national guidance was very useful/useful, only 39% felt that their practice had been consequently influenced⁴⁴³. In hindsight, this question may have been better-designed by using a traditional Likert scale, and the absence of a category, "not at all useful" may have slanted response to the positive end of the answer spectrum.

A study by Adu et al¹⁴² investigated the attitudes of hospital physicians in New South Wales hospitals to antibiotic policies, which was influenced by their speciality and age. It is interesting that in the present study, no association was identified between length of employment and grade and a positive attitude to the institutional guidelines.

11.2.6 Antibiotic(s) Recommended for CAP

One of the objectives was to identify which antibiotic regimen prescribers would recommend for a patient diagnosed with non-severe CAP.

Amoxicillin monotherapy was the regimen most frequently suggested (52%), compliant with both the “old” and “new” institutional guidelines recommendation. It is interesting that only 2 respondents (a Consultant medical microbiologist and Consultant pathologist) suggested the regimen exactly as denoted in the guidelines, “amoxicillin +/- clarithromycin”. It was of concern that both respiratory staff suggested the old regimen, “amoxicillin +/- erythromycin”, and a further 15 respondents recommended the use of these two antibiotics. This suggests a lack of reaction to change in guidance within the institution.

Compliance with institutional guidelines was similar in both groups of respondents; those that use the guidelines (60%) and those that don't. Although staff purportedly use the guidelines, it does not necessarily mean that they are aware of the recommendations for CAP treatment, because they may only refer to guidelines for guidance about the treatment of another infection or prophylactic regimen.

This question identified staff knowledge about the appropriate initial antibiotic treatment of an infection according to the recommendations of the institutional guidelines. Not all staff necessarily treat patients with CAP and it could be argued that it is irrelevant whether clinicians know the appropriate management unless they are likely to routinely encounter patients with the infection. However, staff in some disciplines may infrequently need to treat such patients and may not always

be able to obtain advice from colleagues. Presumably staff working within the Medical Assessment Unit and the General/Respiratory Medicine speciality would be more likely to encounter patients with CAP than staff in other areas. Unfortunately, a response was received for only 2 such staff, which is too small to enable statistical comparison.

It was an interesting time to perform such a study, because the recommendation for CAP treatment in the institutional guidelines had recently been changed. This allowed an estimation of whether such change had been recognised by staff. However, the guidelines can be criticised because although they recommend the regimen of amoxicillin +/- clarithromycin, no guidance is given about when the macrolide should be added. Such choice can be confusing for prescribers (Chapter 8), and guidance should be added about when clarithromycin should be used.

It is of concern that 5 staff had purportedly checked the institutional antibiotic prescribing guidelines before recommending a suitable regimen, but had then stipulated the “old regimen”. This suggests that they do not have access to the most up-to-date information, and there is a need for greater education of staff about change in guideline recommendations.

11.2.7 Electronic Mail for Questionnaire Distribution

Distribution of questionnaires by e-mail confers several methodological advantages compared to a traditional mail approach because it is less expensive and time-consuming. However, use of this communication method was associated with several limitations in the present study, due to the unavailability of a distribution

list and limited use of e-mail within the institution. This suggests that organisational barriers can prevent the efficient use of this research methodology and the low response rate of 12% by recipients who received an e-mail was also disappointing. In a Canadian study, anaesthesiologist respondents were half-as-likely to use electronic-mail as postal for completing a questionnaire⁴⁴⁴, and it would be interesting to investigate satisfaction of UK staff with this communication method.

The use of e-mail technology allows fast delivery of information and could be used to quickly notify staff of important clinical and associated matters. However, the use of this communication medium is dependant upon clinical staff having an e-mail account which they can manage effectively. Evaluation of the use of electronic mail in biomedical communication at a US hospital identified that two-thirds of staff used it at least weekly, and the majority found it useful⁴⁴⁵. There is a need for further research into the use and application of e-mail technology by staff across the NHS in the UK. E-mail can also provide a communication forum for health professionals to discuss antibiotic prescribing improvement issues²⁹⁹, and such discussion lists can act as “virtual colleagues”⁴⁴⁶.

11.3 Conclusion

This case-study examined the use of institutional antibiotic prescribing guidelines by staff employed in one UK NHS hospital, with the objectives of identifying methods of access, how often they are referred to and how useful they are. The present study also requested staff to recommend the appropriate empirical antibiotic regimen for a patient with CAP, which represents a novel methodology.

At least one member of 34 specialities used the institutional antibiotic prescribing guidelines, and most respondents who did not use the guidelines had no need for their guidance in routine practice. The guidelines were generally seen as useful.

This case-study was performed in order to examine physician attitudes towards the institutional guidelines in the same hospital where the audit of prescribing compliance had been performed (described in Chapter 10). Prescriber compliance with institutional recommendations for the empirical treatment of CAP was less than three-fifths. However, the results of the present study suggest that prescribers had an overall favourable attitude towards the antibiotic guidelines. Perhaps this does not translate into prescribing compliance for certain infections, and it would be interesting to investigate compliance with recommendations for other conditions, e.g. urinary tract infections etc.

About three-fifths of respondents suggested an empirical antibiotic regimen for CAP that complied with the recommendations of the institutional guidelines. However, suggestion of the “old regimen” by some respondents was a matter of concern and has implications for education of clinicians about the revision of guidelines.

The use of electronic mail as a medium for distributing questionnaires was disappointing, and suggests this communication method is poorly employed in the hospital.

The main findings of this study are;

- Institutional antibiotic prescribing guidelines were used widely throughout the hospital (in 32 specialities), within all responding specialities except breast surgery and neurology.
- 48% (n=101) of staff used the antibiotic guidelines. Approximately one-half 47% (n=52) of the 111 respondents who did not use the antibiotic prescribing guidelines had no need to use the document in their routine practice.
- Almost one-half of respondents (49%, n=48) accessed the antibiotic prescribing guidelines on the intranet and 38% (n=37) had a personal copy.
- 35% (n=32) of respondents referred to the institutional antibiotic prescribing guideline either daily or weekly, and these staff were more likely to be SHOs or to have been employed at the hospital for 3 years or less.
- Staff had a generally favourable attitude to the institutional guidelines, with 73% (n=69) finding them “very useful” or “useful”.
- Some key quality improvement issues were raised for the hospital; 34 (58%) respondents did not use the guidelines because they were unaware of their existence and 21 (36%) respondents had poor access to the guidelines.
- When recommending an appropriate regimen for a patient diagnosed with CAP, over 56% (n=88) of staff across all specialities suggested a regimen in accordance with the institutional guidelines. Recommendation of the “old regimen” by respondents, including some who had purportedly specifically referred to the guidelines for their answer, is more concerning and raises issues about the effective dissemination of updated guidance at the hospital.

- The use of e-mail for the distribution of questionnaires revealed several limitations; a mailing list of e-mail addresses was not available, mail was “undeliverable” to 55 recipients and the e-mail address was not recognised for 39 recipients. This suggests that more progress is required before such a research methodology could be applied on a widespread basis.

Chapter 12 Synopsis and General

Discussion

12.1.1 Documents

It has been over ten years since the last major study (performed by the BSAC)⁹¹ investigated national availability of antibiotic prescribing control documents (formularies, policies and guidelines). Increasing national and international concern about increasing antibiotic resistance and prudent prescribing meant it was particularly pertinent to perform such a study to update current information. It was disappointing that the availability of antibiotic formularies had not noticeably increased during this time-period, and that still some hospitals did not have any written documents for antibiotic prescribing control.

The electronic availability of antibiotic prescribing control documents has not been examined before, and this represented a novel area of study. A negative finding was that documents were only available electronically in less than one-half of hospitals, which suggests poor achievement of “Information for Health”²⁹⁸ targets for the accessibility of information. This was a disappointing result because information technology could offer many advantages for enhanced antibiotic prescribing control (such as electronic prescribing and computer systems). It is hoped that there will be greater application of IT in the NHS to facilitate these advantages, and this could be an important area for future study. The “Information for Health” strategy²⁹⁸ set a target of 35% of hospitals having electronic patient record level 3 in 1998, but only 3% of acute hospitals had actually installed this level in 2003⁴⁴⁷. A survey of

pharmacists and technical staff in one NHS Trust identified that staff were unaware of a specific policy for IT in the NHS, but they believed that future developments could offer benefits in practice, and that pharmacists had a key role in training prescribers to use electronic prescribing systems⁴⁴⁸.

It is important that the recommendations of antibiotic prescribing control documents are based on the most current evidence-based medicine. For this reason the proposed revision periods for documents were investigated, which represents a novel contribution to the knowledge base. In view of the fact that an NHS directive had been issued in 1999 encouraging annual revision of such documents, it was disappointing that less than one-half of surveyed hospitals proposed such a revision period. This suggests that many hospitals have poor systems for identifying and managing change and this is a key area for quality improvement by hospitals.

12.1.2 Antibiotic Prescribing Control

However accessible and appropriately revised, a document will not achieve its target of improved antibiotic prescribing unless its recommendations are actually implemented in clinical practice. Other healthcare professionals, especially pharmacists and medical microbiologists, can play a key role in monitoring and encouraging such prescribing compliance with the recommendations of documents. The BSAC's 1990 study briefly considered the roles of pharmacists and medical microbiologists in enforcing prescribing adherence with antibiotic prescribing control documents. However, the present study has greatly expanded on this area by examining the roles of staff in greater detail; the factors checked during the control process, frequency of control and communication of interventions with the

prescriber. This provides a baseline of information about the roles of pharmacists and medical microbiologists, and it is a novel contribution to the literature.

A positive finding was that pharmacists reported an increased level of antibiotic prescribing control activity compared to that identified by the BSAC's study performed more than ten years ago. This suggests that hospitals have placed more importance on the role of clinical pharmacy in the intervening decade. There are also new roles emerging for pharmacists in the management of infectious diseases, and the increasing employment of specialist "infectious diseases pharmacists" in UK NHS hospitals. The announcement of £12 million available to support infection control was particularly welcome³³⁵, and a recent survey of members of the Infection Management Group of the UKCPA indicated that such money is mostly being used to support staff time on projects, including implementing "automatic stop orders", compiling and revising antibiotic prescribing control documents, audit and education of staff. Such involvement of clinical pharmacists in antibiotic prescribing improvement has been recommended by national policy^{449, 450}, and their role could also be extended to include "supplementary prescribing"³³¹, a process whereby a non-medical health-professional can prescribe a medicine after diagnosis and development of a clinical management programme by the doctor⁴⁵¹. The challenge exists in recruitment and retention problems in the hospital pharmacy service, and an academy has been established at Manchester University to study and develop the pharmacy workforce⁴⁵². The possible future wide-scale use of automated dispensing systems should also afford pharmacists more time to devote to clinical work, including monitoring prescribers' adherence with antibiotic

prescribing control documents. This could allow expansion of this service to every ward daily.

12.1.3 Awareness of Colleagues' Roles in Antibiotic Prescribing Control

A primary focus of the study was to investigate the mutual awareness of two professional groups with a major interest in antibiotic prescribing control; pharmacists and medical microbiologists. Separate surveys were sent to pharmacists and medical microbiologists in UK NHS hospitals. A negative finding was that about two-fifths of pharmacist respondents did not know the role of medical microbiologists in antibiotic prescribing control, and one-fifth of medical microbiologist respondents did not know the role of pharmacists. Similarities between the results of the two different cohorts of respondents indicated that pharmacists mostly checked antibiotic prescribing against document recommendations on every ward, whilst medical microbiologists had a generally more limited role in selected units only.

Comparing the responses of pharmacist and medical microbiologist respondents to the same questionnaire about antibiotic prescribing control identified indications of apparent disagreement. These included the factors reviewed by medical microbiologists and whether they performed control daily. The main disagreement about the role of pharmacists was whether they communicated resultant interventions verbally with the prescriber.

To investigate mutual awareness more thoroughly, responses from pharmacists and medical microbiologists from the same hospital (n=83) were directly compared. In

a substantial number of hospitals one or both staff did not know about the existence of relevant documents and procedures; formulary availability (28%), performance of audits of antibiotic prescribing (27%) and the role of pharmacists (30%) and medical microbiologists (47%). This indicates that there is a need for education of staff about the existence of these control mechanisms in many hospitals.

Where both staff purportedly knew about antibiotic prescribing controls, disagreement was greatest about the role of pharmacists and medical microbiologists in antibiotic prescribing control. This poor awareness of professionals about the role of their colleague in antibiotic prescribing control is of concern because they both share a key role in improving antibiotic prescribing. The “Agenda for Change” initiative¹⁷⁵ emphasised the importance of a fluid healthcare system and multidisciplinary working. Areas of particular disagreement about the medical microbiologist’s role included what factors they included in their review process, whether they performed control daily and whether they communicated interventions verbally. In all cases pharmacists had apparently under-estimated the involvement of medical microbiologists based on the latter’s responses. Areas of disagreement about the pharmacist’s role included whether they communicated verbally with the prescribers. However, in general, medical microbiologists seemed to be more aware about the role of pharmacists in antibiotic prescribing control than pharmacists were aware about the role of medical microbiologists. It is suggested that pharmacists tend to operate in isolation, and hopefully the new breed of specialist “infectious diseases pharmacists” will encourage collaboration between the Pharmacy Department and the Medical Microbiology Department.

12.1.4 Agreement of Institutional Guidelines with National Guidance

The SMAC report, “The Path of Least Resistance”¹ emphasised the importance of institutional antibiotic prescribing guidelines being based upon national guidance, to ensure the use of evidence-based medicine and to avoid duplication of effort. For this reason the agreement of recommendations within institutional antibiotic guidelines with national guidance for the common infection of CAP was identified. This study updated previous work because it examined agreement with the 2001 BTS CAP guidance, an area which has not been studied previously. It was also possible to identify whether a second edition of 34 institutional guidelines had been appropriately updated following the publication of revised national guidance, also a novel aspect of study.

The recommendations of only about one-half of guidelines comparable with the 1993 BTS CAP guidance agreed with this national guidance, with disagreement being mostly due to the recommendation of amoxicillin and a macrolide. A definition of severe CAP was only provided by 39% of the institutional guidelines which provided guidance for its treatment.

Only 30% of institutional guideline recommendations for non severe CAP were in agreement with the 2001 BTS CAP guidance. This was mostly due to the recommendation of amoxicillin monotherapy, as per the outdated 1993 BTS CAP guidance. This indicates inadequate revision in the light of new national guidance. There was more wide-spread inclusion of severity definitions, but the addition of a new category of treatment in the 2001 CAP guidance was only incorporated into about one-tenth of institutional guidelines.

In cases where two editions of institutional CAP guidelines were received, less than one-fifth had been appropriately revised in-line with the publication of updated national guidance. This represents poor reaction to changing guidance and suggests that adequate systems are not in place in many hospitals for identifying and acting upon new guidance. This unacceptable result is similar to the finding that less than one half of documents would be revised annually.

12.1.5 Awareness of New National Guidance

Poor agreement of the recommendations of institutional guidelines with newly published updated national guidance (BTS 2001 CAP guidance) led to an examination of whether staff were aware of the latter's publication. A survey was sent to pharmacists to examine their awareness of the new national guidance, whether institutional guidelines had been subsequently revised, and which staff had initiated, and been involved in, this revision process. A negative finding was that 29% of pharmacist respondents were unaware of this important new national guidance. Furthermore, guidelines had only been revised in 45% of hospitals where pharmacists were purportedly aware of the new guidance. It is suggested that the responsibility of identifying new guidance could be the job of the new specialist "infectious diseases pharmacists" in the future. More positively, pharmacists and medical microbiologists were identified as having an important role in both initiating, and being involved in, revision of institutional antibiotic prescribing guidelines.

12.1.6 Prescriber Compliance with Guideline Recommendations

The previous studies in this thesis have considered the national situation in UK NHS hospitals; the existence of antibiotic prescribing control documents, enforcement of their recommendations by pharmacists and medical microbiologists, and whether the recommendations of institutional guidelines agree with national guidance.

However acceptable an antibiotic prescribing control document, it will not achieve its aim of improving antibiotic prescribing in clinical practice unless its recommendations are followed. A case-study was performed to identify whether prescribers had followed the recommendations of institutional antibiotic prescribing guidelines for the empirical antibiotic treatment of CAP. This is a novel study because such a case-study has not been published since the publication of the 2001 BTS CAP guidance. Although not generalisable on a national scale, a case-study allows the researcher to probe the dynamics of the prescribing process in one institution. In addition to identifying poor documentation of diagnostic criteria, the study identified that in over two-fifths of cases the initial antibiotic regimen was later modified, most often by the Consultant at the post-take ward round. This emphasises that junior prescribers are inexperienced and require guidance for appropriate antibiotic prescribing. Prescribing was non-compliant with the institutional recommendations in 57% of episodes of non severe CAP, 33% of episodes of severe CAP and for 49% of episodes which could be treated as either non severe or severe CAP at the discretion of the physician. Increasing emphasis on the evaluation of patient-based outcomes from quality-of-life surveys has led to the use of psychometrics in assessing whether a CAP episode has been effectively

treated⁴²³. A patient-based questionnaire of symptoms in CAP has been developed, CAP-Sym⁴⁵³. This is an outcome measure that could also be employed in future prospective studies in assessing the efficacy of CAP guidelines.

The present study's retrospective audit was greatly hindered by the difficulty in obtaining patients' medical records. Electronic records have been available in US hospitals for many years^{454, 455}, and this has aided data analysis for audits. By Summer 2005, UK healthcare professionals should be able to view basic patient data electronically, whilst initiatives for 2006-2008 include electronic prescribing³⁰². Hopefully the provision of electronic records would greatly facilitate access to patients' medical data for such studies. However, the House of Lord's Select Committee expressed doubt whether these targets are realistic¹³⁰, and there have been recent concerns that greater financial resources are required for the ten-year "National Programme for IT"⁴⁵⁶.

12.1.7 Attitudes of Prescribers to Institutional Antibiotic Prescribing Guidelines

It is possible that prescribers do not comply with the recommendations of institutional antibiotic prescribing guidelines because they do not have access to these documents, or because they have a negative attitude towards them. Therefore a further case study was performed at the same institution as the CAP audit to identify the general use of guidelines by the clinicians, and the attitudes of those staff towards these documents. Requesting clinicians to state what antibiotic regimen they would prescribe for CAP, and comparing this to institutional guidelines, is apparently a novel methodology.

Approximately one-half of surveyed clinicians used the institutional antibiotic prescribing guidelines, of whom almost three-quarters found the document to be “useful” or “very useful”. Another positive finding was that no respondents didn’t use the guidelines because they considered that the document had been poorly developed or because they disagreed with their recommendations. However, a more disturbing finding was that of the respondents who did not use the guidelines, about three-fifths were unaware of their existence, whilst two-fifths had poor access to this document. These findings might have impacted upon the poor compliance with guideline recommendations identified in the audit of antibiotic prescribing for CAP. Another negative finding was that some clinicians recommended the “old” institutional guideline recommendation for the empirical antibiotic treatment of CAP, even after purportedly checking the guidelines. Improved publicity about the existence of the antibiotic prescribing guidelines and easier access to them are areas of quality improvement for the hospital.

Almost one-half of respondents who used the institutional antibiotic prescribing guidelines accessed them via the intranet, which was the most common method of access. This is encouraging because the use of such electronic innovation is ultimately dependent upon physicians’ acceptance and use of this technology⁴⁵⁷.

12.2 Limitations of the Research

Although every attempt was made to conduct the research according to high standards, some limitations were identified;

- The response rate for the questionnaires sent to pharmacists and medical microbiologists achieved response rates of 54% and 48% respectively.

Although a response rate of approximately 50% suggests a successful survey due to the impersonal nature of this research method, it is possible that the results are biased because about one-half of recipients failed to respond (page 49, Chapter 3).

- The response rate for paired-respondents of pharmacists and medical microbiologists from the same hospital was 30% (page 161, Chapter 7). However, this low response rate was inherent in the methodological design of two independent surveys.
- As with all questionnaire research, the accuracy of these research results depends upon the knowledge and conscientiousness of the person completing the questionnaire. Due to the large number of respondents it was not possible to validate the accuracy of these results (page 49, Chapter 3).
- A lack of standardisation of the term “policy” meant that it was difficult to compare the results of the present study about the prevalence of antibiotic policies with the results of previous studies, including the BSAC study⁹¹ (page 84, Chapter 4).
- The option of “annotation in the patient’s medical record” was not provided to respondents in the question about how pharmacists and medical microbiologists communicated the results of their interventions following antibiotic prescribing review to prescribers. However, this answer was subsequently cited by respondents in the “other” free-text option. These results have been included, but must be interpreted with caution (page 113, Chapter 5).
- The medical records for only two-fifths of patients were available for analysis in the case-study audit of the empirical antibiotic treatment of

patients with community acquired pneumonia. Approximately one-fifth of the records could not be obtained because the patient had died, and the records were irretrievable from storage in an off-site location. Unfortunately this biases the results because it was not possible to assess whether patients died due to patient factors (e.g. advanced age), infection factors (e.g. severe infection) and/or therapy factors (e.g. inappropriate antibiotic treatment) (page 259, Chapter 10).

12.2 Recommendations for Policy

This research programme has identified important aspects for policy in UK NHS hospitals;

- Eighteen of the hospitals surveyed in 2001 did not have an antibiotic formulary, an antibiotic policy or antibiotic guidelines. The importance of having such documents must be emphasised to all hospitals (including psychiatric and other specialist units), so that any patient presenting with an infection can be treated appropriately as quickly as possible.
- The hospitals were surveyed about the availability of antibiotic prescribing control documents in 2001, before the medicines management agenda was published. However, only 60% of these hospitals had both an antibiotic formulary and antibiotic guidelines at that time. The remaining hospitals should have an evidence-based antibiotic formulary and antibiotic guidelines, preferably contained within the same document.
- Less than one-half of antibiotic prescribing control documents were available electronically in 2001. All professional staff should have access to electronic versions of antibiotic prescribing control documents and resources should be made available for the implementation of other

information technology systems that would facilitate improved antibiotic prescribing, including electronic records and e-mail facilities.

- A Health Service Circular issued in 1999³¹⁷ encouraged all UK NHS hospitals to revise their antibiotic prescribing control documents on at least an annual basis. However, only about one-half of hospitals surveyed in 2001 planned such a revision period. The importance of the use of current evidence-based medicine and regular revision should be emphasised again to all hospitals.
- Pharmacists mostly visited every ward in those hospitals where they performed antibiotic prescribing control. However, they did not perform antibiotic prescribing control on every ward in all hospitals, the ideal situation. It is hoped that some of the new financial resources available for the role of pharmacists in antibiotic prescribing improvement could be devoted to this activity.
- Variation in methods used by pharmacists and medical microbiologists to communicate resultant interventions from antibiotic prescribing control was common. These communication methods should be standardised and should include the provision of both verbal and written documentation to prescribers.
- Pharmacists did not know the role of medical microbiologists in antibiotic prescribing control in two-fifths of hospitals, and medical microbiologists did not know the role of pharmacists in one-fifth of hospitals. There was also disagreement between paired-respondents from the same hospital about the nature of control processes performed by these staff. This lack of mutual awareness of the involvement of colleagues in performing antibiotic

prescribing control highlights a need for closer collaboration and awareness of roles between pharmacists and medical microbiologists. There is necessity for proactive engagement between these professionals, which should be encouraged by specialist “infectious diseases pharmacists”, and multidisciplinary specialist ward rounds.

- One of the recommendations of the SMAC report¹ was that institutional antibiotic prescribing guidelines should be based upon national guidance. However, analysis of recommendations of institutional antibiotic prescribing guidelines identified poor agreement with national guidance (although reasons for this could not be fully identified). The importance of using evidence-based medicine from specialist societies should be advocated.
- A specific pharmacist (ideally a specialist “infectious diseases pharmacist”) should be designated as having responsibility for identifying, and responding to, the publication of new national antibiotic prescribing guidance.
- The case-study identified that there was a need to raise the profile of the institutional antibiotic prescribing guidelines within that hospital. Empirical antibiotic prescribing was compliant with the institutional CAP guidelines in less than one-half of CAP episodes. There is also a need to clarify these institutional guideline recommendations in-line with national guidance.
- A further case-study in the same hospital investigated whether any aspects of the institutional guidelines might have impacted upon the poor level of prescribing compliance identified in the CAP audit. There is an urgent need to publicise the institutional antibiotic prescribing guidelines because some

clinicians were unaware of their existence. It is recommended that several publicity campaigns be hosted throughout the year to maintain awareness of the importance of the guidelines. Attention should also be given to the ease of access of these documents, because some respondents cited that they did not use them due to poor access. It was concerning that some respondents suggested an empirical regimen for CAP based upon an outdated edition of institutional guidance. Availability of documents should be reviewed, to ensure that all clinicians can access the most current guidance.

12.3 Ideas for future research

Several ideas for future research have arisen from the current research programme;

- Research to standardise the definition of an “antibiotic policy” would be very helpful in ensuring that the results of future prevalence studies could be compared. It would be interesting to investigate further what policies operate in UK NHS hospitals (e.g. “automatic stop orders”).
- It is important that the roles of specialist “infectious diseases pharmacists” are validated to ensure their efficacy and cost-effectiveness. Such a nationwide investigation could identify the areas where these pharmacists can make the most contribution. That study could include an evaluation of those professionals’ multidisciplinary collaboration with medical microbiologists in approving antibiotic prescribing control documents, and in joint ward rounds.
- Detailed analysis of recommendations for CAP identified poor agreement of institutional guidelines with national guidance. It would be interesting to investigate further reasons for non-compliance with national guidance, and

to assess whether non-compliance was dependent on local bacterial resistance and cost-effectiveness issues. It would also be interesting to perform an analysis of recommendations for the empirical antibiotic treatment of nosocomial pneumonia, an area where there is a paucity of national guidance.

- Methicillin-resistant *Staphylococcus aureus* (MRSA) is an increasing problem that is attracting political and media attention¹. It would be interesting to review individual hospitals' MRSA policies.
- It would be interesting to repeat the investigation of the availability of antibiotic prescribing control documents in 5-10 years time. It would be interesting to identify whether the emergence of new infectious diseases such as SARS has increased the emphasis on the importance of appropriate antibiotic therapy.
- Another important area for research is to identify whether improvements have been made in encouraging communication between pharmacists and medical microbiologists involved in antibiotic prescribing improvement measures, and between hospitals about prescribing policies.

Publications

Woodford EM, Marriott JF, Wilson KA, Langley CA. **Antibiotic prescribing for lower respiratory tract infections within secondary care.** International Journal of Pharmacy Practice 2001; 9 (supp): R39 (Appendix F).

Woodford EM, Wilson KA, Marriott JF. **Documentation of antibiotic prescribing controls in UK NHS hospitals.** Journal of Antimicrobial Chemotherapy 2004; 53 (4): 650-652 (Appendix F). Referred to by E.Brown, "Resistance is useless" SACAR conference, London 7th July 2004. Referred to by G.Jones, "Antimicrobial drug resistance is an increasing, inevitable global problem", The Pharmaceutical Journal, 2004; 273: 124.

Woodford EM, Wilson KA, Marriott JF. **Antibiotic prescribing control by pharmacists within UK NHS hospitals.** International Journal of Pharmacy Practice 2004; 12 (2): 101-106 (Appendix F).

Woodford EM, Wilson KA, Marriott JF. **Professionals' awareness of operational antibiotic prescribing controls in UK NHS hospitals.** Journal of Hospital Infection 2004; 58: 193-199. Available online⁴⁵⁸ (Appendix F).

Woodford EM, Wilson KA, Marriott JF. **Hospital Pharmacists' Awareness of a New Antibiotic Guideline in the UK: Implications for Practice.** Pharmacy World and Science – In Press.

Poster Presentations

Woodford EM, Marriott JF, Wilson KA, Langley CA. **Antibiotic prescribing for lower respiratory tract infections within secondary care.** The British Pharmaceutical Conference, 2001, Glasgow (Appendix F).

Woodford EM, Marriott JF, Wilson KA, Langley CA. **Revision of Community-Acquired Pneumonia Guidelines Within UK Hospitals.** Third Forum on Respiratory Tract Infections, 2004, Monte-Carlo (Appendix F).

Sponsored Meetings

Provided with an ESCMID sponsorship grant to attend the meeting, "Measuring, Auditing, and Improving Antimicrobial Prescribing", 2004, Czech Republic (Appendix F).

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**CONTROL OF ANTIBIOTIC
PRESCRIBING IN UK NHS HOSPITALS**

VOL 2

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Doctor of Philosophy

ASTON UNIVERSITY

May 2005

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COPIES OF PUBLICATIONS AND CONFERENCE
DOCUMENTATION

Antibiotic prescribing for lower respiratory tract infections within secondary care. International Journal of Pharmacy Practice 2001; 9 (supp): R39.

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Copy of Certificate of Attendance at the 27th ESCMID Post-Graduate Education Course: Measuring, Auditing and Improving Antimicrobial Prescribing, 29th April-1st May 2004, Czech Republic.

Appendix A

“ANTIBIOTIC PRESCRIBING DOCUMENTS, SURVEY 2001”



**Antibiotic Prescribing
Documents
Survey 2001**

Please Return By:

Please read the following notes before answering the enclosed questionnaire.

a. Aim of the Questionnaire

To identify general antibiotic prescribing document issues in relation to the control of antibiotic prescribing.

b. Confidentiality

The results of this questionnaire will be kept completely confidential and data providers and individual hospitals will not be identified.

However, it is necessary to include a coding number on the sheets to calculate response rates, and to avoid unnecessary follow-ups.

c. The Questionnaire

The questionnaire contains two sections.

- Section A requests information regarding your hospital.
- Section B requests information regarding your hospital's antibiotic prescribing documents.

Most of the questions require you to simply tick the appropriate box(es) for ease of completion.

It should not take you longer than 15 minutes to complete.

Please complete as many questions as possible.

However, feel free to leave blank any questions which you don't wish to answer. Please return your questionnaire, even if not completely answered, because any of your completed answers are very valuable for the research.

d. Following completion of the questionnaire

When the questionnaire has been completed please post it back in the pre-paid envelope provided, with a copy of your hospital's antibiotic formulary/policy and/or guidelines attached.

Please return your completed questionnaire and a copy of your hospital's antibiotic documents by:

DATE

Thank-you for your assistance in this research.

I hope that you will be able to spare a short time to complete the enclosed confidential questionnaire.

However, if you are unable to complete the questionnaire, it is very important to know the reason(s) for this to allow validation of the research. To ensure the validity of the research methods and data, it is necessary to account for all the questionnaires sent. Therefore I would be very grateful if you would complete the form below by indicating the reason for your non-completion of the questionnaire.

Reason(s) for non-completion Please tick the appropriate box(es) below.

Not enough time	No interest in research topic	Do not complete questionnaires	Other

If other, please specify below.

.....

If your hospital's antibiotic prescribing document has also not been sent back with this completed sheet, please tick the reason below.

Please tick the appropriate box(es) below.

Document	None Exists	Unavailability	Currently being reviewed	Other
Formulary				
Policy				
Guidelines				

If other, please specify below.

.....

Thank you for your time.

Please return this completed sheet with the questionnaire in the pre-paid envelope provided.

A. Your Hospital

Q A1. How would you classify your hospital?

Please tick the box which corresponds to the classification of your hospital.

Type of Hospital	
District General	
Teaching	
Specialist	
Other (please specify)	

Q A2. Does your hospital contain any regional speciality units?

Please tick **all** the boxes that apply.

	Yes	No	Don't Know
Infectious Disease			
Transplant			
Oncology			
None			
Other Speciality Unit			

If other, please specify the regional speciality unit contained within your hospital in the space below.

.....

.....

Q A3. How many beds does your hospital contain?
Please tick the appropriate box below.

No. of beds	No. of beds in your hospital
<100	
100-250	
251-500	
501-750	
751-1 000	
1 001 +	
Don't know	

Q A4. How many of the following staff work in your hospital?
Please write the numbers in the boxes, or tick the "Don't know" box if you do not know.

Staff	Number in your Hospital	Don't Know
Medical Practitioners - UK registered with full prescribing rights, whole time equivalent		
Pharmacists- Ward and dispensary pharmacists, whole time equivalent		
Medical Microbiologists- With clinical input into prescribing, whole time equivalent		

Q A5. Which Trust is your hospital in?
Please specify the Trust name in the space below.

.....

B. Your Hospital's Antibiotic Prescribing Documents

Q B1. Does your hospital have an antibiotic formulary, policy, and/or guidelines?
Please Note: Combinations of these may be contained within the same document.

Please tick **all** the boxes that apply.

Document	Definition of Document	Yes	No	Don't Know	Other Similar
Formulary	A limited list of drugs available for prescription. It does not include guidance for use.				
Policy	A general statement of hospital strategy.				
Guidelines	A document offering guidance regarding what drug should be prescribed for a specified clinical condition.				

If none of the above ➡➡➡➡ Please go to Q B16.

If other similar, please specify the classification of the antibiotic document(s) in the space below.

.....
.....

Q B2. Are the antibiotic document(s) used within your hospital contained within a general hospital policy document, a general Trust policy document, within a separate document and/or accessible by computer?

Please tick **all** the boxes that apply.

	General Hospital Policy Document	General Trust Policy Document	Separate Document	Accessible on Computer	Don't Know	Not Applicable N/A
Formulary						
Policy						
Guidelines						
Other(as per Q B1)						

Q B3. When were the antibiotic document(s) used within your hospital approved?
*Please enter the dates in the spaces provided,
 or tick the "Don't Know" box if you do not know,
 or tick the Not Applicable "(N/A)" box if your hospital does not have this document type.*

Document	Date	Don't Know	N/A
Formulary	--/--/---		
Policy	--/--/---		
Guideline	--/--/---		
Other (as per Q B1)	--/--/---		

Q B4. Who approved the antibiotic document(s) used within your hospital?
*Please tick **all** the boxes that apply.*

Document	Drug and Therapeutics Committee (or similar)	Pharmacy Department Representation	Microbiology Department Representation	Other	Don't Know	N/A
Formulary						
Policy						
Guidelines						
Other (as per Q B1)						

If other, please specify who approved the antibiotic document in the space below.

Formulary:.....

Policy:.....

Guidelines:.....

Other (as per Q B1).....

Q B5. Is there a planned revision of the antibiotic document(s) used within your hospital?

Please tick **all** the boxes that apply.

Document Type	Yes	No	Don't Know	N/A
Formula				
Policy				
Guidelines				
Other Similar (as per Q B1)				

If No / Don't Know for **all** document types ➡➡➡➡ Please go to Q B7.

Q B6. If there is a planned revision of the antibiotic document(s), when will it be?

Please enter the dates in the spaces provided,

or tick the "Don't Know" box if you do not know,

or tick the Not Applicable "N/A" box if your hospital does not have this document type.

Document Type	Date	Don't Know	N/A
Formulary	--/--/---		
Policy	--/--/---		
Guidelines	--/--/---		
Other Similar (as per QB1)	--/--/---		

Q B7. Is the antibiotic document(s) disseminated to staff within your hospital?

Please tick the appropriate box.

Yes

No

➡➡ Please go to Q B9.

Don't Know

➡➡ Please go to Q B9.

Q B8. How widely is the antibiotic prescribing document(s) disseminated to staff within your hospital?

Please tick **all** the boxes that apply.

a). **Doctors with full prescribing rights**

Document Type	All have a personal copy	Copies available at the nurse's station	Accessible on computer	Other	Don't Know	N/A
Formulary						
Policy						
Guidelines						
Other Similar (as per QB1)						

If other, please specify the dissemination method in the space below.

.....

b). **Pharmacists**

Document Type	All have a personal copy	Only Ward Pharmacists have a personal copy	Copies available in Pharmacy Department	Accessible on computer	Other	Don't Know	N/A
Formulary							
Policy							
Guidelines							
Other Similar (As per QB1)							

If other, please specify the dissemination method in the space below.

.....

Q B9. Do pharmacists and medical microbiologists check empirical antibiotic prescribing against hospital antibiotic prescribing documents (clinical review) as part of their routine job within your hospital?

Please tick the appropriate boxes.

Staff Type	Yes-on every ward	Yes-in restricted Units (please specify)	No	Don't Know
Pharmacist				
Medical Microbiologists				

If No/Don't know for both staff types ➡➡➡➡ Please go to Q B13.

Q B10. What is reviewed for the prescribed empirical antibiotic regime?

Please tick all the boxes that apply.

Review of Prescribed Empirical Antibiotic Regime	Pharmacists	Medical Microbiologists
Drug/s in accordance with prescribing document recommendations		
Drug/s Dosage in accordance with prescribing document recommendations		
Drug Regime Lengths in accordance with prescribing document recommendations		
Drug/Drug Interactions exist between empirical regime and other therapy which justify deviation from recommendation		
Patient Factors exist which justify deviation from empirical regime recommended (e.g. penicillin allergy/poor renal function)		
Other		
Don't Know		

If other, please specify what is reviewed in the space below.

.....

Q B11. How often is this clinical review of antibiotic prescribing undertaken?

Please tick **all** the boxes that apply.

Frequency of clinical review	Pharmacists	Medical Microbiologists
Daily as part of a routine clinical ward service		
Weekly as part of a routine clinical ward service		
During participation in a routine Consultant ward round		
When requested by the prescriber		
Other		
Don't Know		
Never		

If other, please specify the frequency of clinical review of antibiotic prescribing in the space below.

.....

Q B12. If the prescriber is informed following clinical review, how is this achieved?

Please tick **all** the boxes that apply.

Staff Type	Annotation on Prescription	Verbally	During participation in routine Consultant ward-round	Other	Not Informed	Don't Know
Pharmacist						
Medical Microbiologist						

If other, please specify how the prescriber is alerted in the space below.

.....

Q B13. Does your hospital undertake audits of antibiotic prescribing?
For the purposes of this questionnaire, an audit is defined as a systematic examination of compliance with prescribing guidance.
Please tick the appropriate box.

- Yes
- Never been audited ➡➡➡➡ Please go to Q B16.
- Don't know ➡➡➡➡ Please go to Q B16.

Q B14. If an audit has been undertaken, when was the last occasion?
Please tick the appropriate box.

Time Period for Audit	
During the last year	
1-2 years ago	
2-3 years ago	
Other (please specify)	
Don't Know	

Q B15. If an audit has been undertaken, who has carried it out?
Please tick all the boxes that apply.

Staff Involved	Yes	No	Don't Know
Doctors with full prescribing rights			
Pharmacists			
Medical Microbiologists			
Auditing Department			
Other			

If other, please specify which staff have carried out the audit in the space below.

.....

Q B16. Has a copy of each of the antibiotic documents used within your hospital been returned with this completed questionnaire?

(Data providers will not be identified.)

Please tick **all** the appropriate boxes.

Document	Yes	No	N/A
Formulary			
Policy			
Guidelines			
Other (as per Q B1)			

If Yes, ➡➡➡➡ Please go to Q B18

Q B17. If the antibiotic prescribing document used within your hospital has not been sent back with this completed questionnaire, please tick the reason(s) below.

Please tick **all** the boxes that apply.

Document Type	None Exists	Confidentiality Issues	Unavailability	Currently being reviewed	It is too large for the envelope	Other	N/A
Formulary							
Policy							
Guidelines							
Other (as Q B1)							

If other, please specify why you antibiotic document(s) has not been sent in the space below.

.....

P.T.O

Q B18. At a later stage of this study I would like to follow-up some hospitals in greater detail. Would you be prepared to participate in this research at a later date? If so, please specify your details below.

Name:

Position:

Telephone Number:.....

E-mail Address:.....

Q B19. Would you like to receive a report of the results (anonymous data) of the completed research?

Yes

No

END

Thank you for your assistance in this research.



Pharmacy Practice Group,
School of Pharmacy
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woodfoem@aston.ac.uk

Name
Title
Hospital
City
Postcode

7th November 2001.

Dear Name,

Re: Antibiotic Prescribing Documents, Survey 2001

I am a pharmacist undertaking PhD research within the Aston Pharmacy Practice Group, School of Pharmacy, Aston University, Birmingham.

My current research involves a review of antibiotic prescribing document recommendations (formularies, policies, guidelines) for the treatment of pneumonia, and antibiotic control practices within secondary care.

A questionnaire has been designed to identify antibiotic prescribing practice and has been sent to the chief pharmacist within every NHS hospital in the United Kingdom. It is intended to identify current practice within the United Kingdom.

This project has the support of the West Midlands Antibiotic Prescribing Group, the PHLS Disease Surveillance Centre and the British Society for Antimicrobial Chemotherapy. Any information provided will be treated confidentially, and data will not be used in a manner that will allow identification of individuals or particular NHS hospitals.

Your assistance is vital for this research, and I will be pleased to send you a report of the results (with anonymous data) when the research has been completed in thanks for your support.

I would be very grateful if you would assist in this research by completing the enclosed questionnaire and returning it to me by **28th November 2001**, with copies of any antibiotic prescribing documents (e.g. antibiotic formularies/policies/prescribing guidelines) operative within your hospital.

A FREEPOST envelope has been provided. However, if your document(s) is too large for the envelope, please indicate this on the questionnaire and I will make alternative arrangements.

Thank you in anticipation,
Yours sincerely,

Eleanor Woodford MRPharmS

Appendix B

“ANTIBIOTIC PRESCRIBING DOCUMENTS, SURVEY 2002”



Antibiotic Prescribing Documents

Survey 2002

Please Return By:
Date

Please read the following notes before answering the enclosed questionnaire.

a. The Questionnaire

Aims to evaluate antibiotic prescribing documents in relation to the control of antibiotic prescribing.

The questionnaire contains two sections:

- Section A is about your hospital.
- Section B is about your hospital's antibiotic prescribing documents.

It should not take you longer than 15 minutes to complete.

Most of the questions require you to simply tick the appropriate box(es) for ease of completion.

Please complete as many questions as possible.

However, feel free to leave blank any questions that you don't wish to answer.

Please return your questionnaire, even if not completely answered, because any of your completed answers are very valuable for the research.

b. Confidentiality

The results of this questionnaire will be kept completely confidential and data providers and individual hospitals will not be identified.

A coding number has been included on the sheets in order to calculate response rates, and to avoid unnecessary follow-ups.

c. Return of the questionnaire

When the questionnaire has been completed please return it in the pre-paid envelope provided, with a copy of your hospital's antibiotic formulary/policy and/or guidelines attached.

I am especially interested in prescribing documents pertaining to pneumonia.

Please return your completed questionnaire and a copy of your hospital's antibiotic documents by: **Date**

If your hospital's antibiotic prescribing document(s) has not been sent back with the completed questionnaire, please indicate the reason below.

Please tick all the box(es) that apply.

Document	None Exists	Unavailability	Currently being reviewed	Other
Formulary				
Policy				
Guidelines				

If other, please specify below.

.....

If you are unable to complete the questionnaire

I hope that you will be able to spare a short time to complete the enclosed confidential questionnaire.

However, if you are unable to complete the questionnaire, it is very important that I know the reason(s). To ensure the validity of the research methods and data, it is necessary to account for all the questionnaires sent.

Therefore I would be very grateful if you would complete the form below by indicating the reason for your non-completion of the questionnaire.

Reason(s) for non-completion

Please tick the appropriate box(es) below.

Not enough time	No interest in research topic	Do not complete questionnaires	Other

If other, please specify below.

.....

Thank you for your time.

Please return this completed sheet with the questionnaire in the pre-paid envelope provided

A. Your Hospital

Q A1. How would you classify your hospital?

Please tick the box which corresponds to the classification of your hospital.

Type of Hospital	
District General	
Teaching	
Specialist (please specify)	
Other (please specify)	

Q A2. Does your hospital contain any regional speciality units?

*Please tick **all** the boxes that apply.*

	Yes	No	Don't Know
Infectious Disease			
Transplant			
Oncology			
None			
Other Speciality Unit			

If other, please specify the regional speciality unit contained within your hospital in the space below.

.....

B. Your Hospital's Antibiotic Prescribing Documents

Q B1. Does your hospital have an antibiotic formulary, policy, and/or guidelines?
Please Note: Combinations of these may be contained within the same document.

Please tick **all** the boxes that apply.

Document	Definition of Document	Yes	No	Don't Know	Other Similar
Formulary	A limited list of drugs available for prescription. It does not include guidance for use.				
Policy	A general statement of hospital strategy.				
Guideline	A document offering guidance regarding what drug should be prescribed for a specified clinical condition.				

If none of the above ➡➡➡➡ Please go to Q B17.

If other similar, please specify the classification of the antibiotic document(s) in the space below.

.....

.....

Q B2. This question is about access to prescribing documents.

Please indicate whether the antibiotic prescribing document(s) used within your hospital are contained within a general hospital/Trust policy document, are available as a separate document and are accessible by computer.

Please tick **all** the boxes that apply.

	General Document	Separate Document	Accessible on Computer	Don't Know	Not Applicable N/A
Formulary					
Policy					
Guidelines					
Other(as per Q B1)					

Q B3. When were the antibiotic prescribing document(s) used within your hospital approved?

Please enter the dates in the spaces provided, or tick the "Don't Know" box if you do not know, or tick the Not Applicable "(N/A)" box if your hospital does not have this document type.

Document	Date	Don't Know	N/A
Formulary	--/--/---		
Policy	--/--/---		
Guidelines	--/--/---		
Other (as per Q B1)	--/--/---		

Q B4. Who approved the antibiotic prescribing document(s) used within your hospital?

Please tick all the boxes that apply.

Document	Drug and Therapeutics Committee (or similar)	Pharmacy Department	Microbiology Department	Other	Don't Know	N/A
Formulary						
Policy						
Guidelines						
Other (as per Q B1)						

If other, please specify who approved the antibiotic document in the space below.

Formulary:.....

Policy:.....

Guidelines:.....

Other (as per Q B1)

Q B5. Is there a planned future revision of any of the antibiotic prescribing document(s) used within your hospital?

Please tick **all** the boxes that apply.

Document Type	Yes	No	Don't Know	N/A
Formulary				
Policy				
Guidelines				
Other Similar (as per Q B1)				

If No / Don't Know for **all** document types ➡➡➡➡ Please go to Q B8.

QB6. What is the planned period between reviews for the antibiotic prescribing document(s) used within your hospital?

Please tick **all** the box(es) that apply.

Time Period for Review Process	<6 months	6-11 months	1-2 years	2 years 1 month-3 years	Other (please specify)	Don't Know
Formulary						
Policy						
Guidelines						
Other Similar (as per QB1)						

Q B7. If there is a planned revision of the antibiotic document(s), when will it be?

Please enter the dates in the spaces provided,

or tick the "Don't Know" box if you do not know, or tick the Not Applicable "N/A" box if your hospital does not have this document type.

Document Type	Date	Don't Know	N/A
Formulary	--/--/---		
Policy	--/--/---		
Guidelines	--/--/---		
Other Similar (as per QB1)	--/--/---		

Q B8. Is the antibiotic document(s) disseminated to staff within your hospital?

Please tick the appropriate box.

Yes

No ⇒⇒ Please go to Q B10.

Don't Know ⇒⇒ Please go to Q B10.

Q B9. How widely is the antibiotic prescribing document(s) disseminated to the two staff groups below?

*Please tick **all** the boxes that apply.*

a). Doctors with full prescribing rights

Document Type	Personal copy	Copies available on ward	Accessible on computer	Other	Don't Know	N/A
Formulary						
Policy						
Guidelines						
Other Similar (as per QB1)						

If other, please specify the dissemination method in the space below.

.....

b). Medical Microbiologists

Document Type	Personal copy	Copies available on ward	Copies available in Microbiology Department	Accessible on computer	Other	Don't Know	N/A
Formulary							
Policy							
Guidelines							
Other Similar (As per QB1)							

If other, please specify the dissemination method in the space below.

.....

Q B10. Do medical microbiologists and pharmacists check empirical antibiotic prescribing against hospital antibiotic prescribing documents (clinical review) on the ward, as part of their routine job within your hospital?

Please tick all the boxes that apply.

Staff Type	Yes-on every ward	Yes-in restricted Units (please specify)	No	Don't Know
Medical Microbiologists				
Pharmacists				

If No/Don't know for both staff types ➡➡➡➡ Please go to Q B14.

Q B11. What is reviewed for the prescribed empirical antibiotic regime?

Please tick all the boxes that apply.

Review of Prescribed Empirical Antibiotic Regime	Medical Microbiologists	Pharmacists
Drug/s in accordance with prescribing document recommendations		
Drug/s Dosage in accordance with prescribing document recommendations		
Drug Regime Lengths in accordance with prescribing document recommendations		
Drug/Drug Interactions exist between empirical regime and other therapy which justify deviation from recommendation		
Patient Factors exist which justify deviation from empirical regime recommended (e.g. penicillin allergy/poor renal function)		
Other		
Don't Know		

If other, please specify what is reviewed in the space below.

.....

Q B12. How often is this clinical review of antibiotic prescribing undertaken?

Please tick **all** the boxes that apply.

Frequency of clinical review	Medical Microbiologists	Pharmacists
Daily as part of a routine clinical ward service		
Weekly as part of a routine clinical ward service		
During participation in a routine Consultant ward round		
When requested by the prescriber		
Other		
Don't Know		
Never		

If other, please specify the frequency of clinical review of antibiotic prescribing in the space below.

.....

Q B13. If the prescriber is informed following clinical review, how is this achieved?

Please tick **all** the boxes that apply.

Staff Type	Annotation on Prescription	Annotation in Medical Notes	Verbally	During Participation in routine Consultant ward-round	Other	Not Informed	Don't Know
Medical Microbiologists							
Pharmacists							

If other, please specify how the prescriber is alerted in the space below.

.....

Q B14. Does your hospital undertake audits of antibiotic prescribing?
For the purposes of this questionnaire, an audit is defined as a systematic examination of compliance with prescribing guidance.
Please tick the appropriate box.

Yes

Never been audited **➡➡➡➡ Please go to Q B17.**

Don't know **Please go to Q B17.**

Q B15. If an audit has been undertaken, when was the last occasion?
Please tick the appropriate box.

Time Period for Audit	
During the last year	
1-2 years ago	
2 years 1 month - 3 years ago	
Other (please specify)	
Don't Know	

Q B16. If an audit has been undertaken, who has carried it out?
Please tick all the boxes that apply.

Staff Involved	Yes	No	Don't Know
Doctors with full prescribing rights			
Medical Microbiologists			
Pharmacists			
Nurses			
Auditing Department			
Other			

If other, please specify which staff have carried out the audit in the space below.

.....

Q B17. Has a copy of each of the antibiotic documents used within your hospital been returned with this completed questionnaire?
 (Data providers will not be identified.)
 Please tick **all** the appropriate boxes.

Document	Yes	No	N/A
Formulary			
Policy			
Guidelines			
Other (as per Q B1)			

If Yes, ➡➡➡➡ Please go to Q B19

Q B18. If the antibiotic prescribing document used within your hospital has not been sent back with this completed questionnaire, please tick the reason(s) below.
 Please tick **all** the boxes that apply.

Document Type	None Exists	Confidentiality Issues	Unavailability	Currently being reviewed	It is too large for the envelope	Other	N/A
Formulary							
Policy							
Guidelines							
Other (as Q B1)							

If other, please specify why your antibiotic document(s) has not been sent in the space below.

.....

P.T.O

Q B19. At a later stage of this study I would like to follow-up some hospitals in greater detail. Would you be prepared to participate in this research at a later date? If so, please specify your details below.

Name:

Position:

**Telephone
Number**.....

E-mail Address:

Q B20. Would you like to receive a report of the results (anonymous data) of the completed research?

Yes

No

END

Thank you for your assistance in this research.



Pharmacy Practice Group
School of Pharmacy
Aston University
Birmingham
B4 7ET
07866414452
woodfoem@aston.ac.uk

«Name»
«Title»
«Hospital»
«Town»
«Postcode»

25th October 2002.

Dear «Name»,

Re: Antibiotic Prescribing Documents, Survey 2002

I am a pharmacist undertaking PhD research within the Aston Pharmacy Practice Group, School of Pharmacy, Aston University, Birmingham. My current research involves a review of antibiotic prescribing document recommendations (formularies, policies, guidelines) for the treatment of pneumonia, and antibiotic control practices within secondary care.

A questionnaire has been designed to identify antibiotic prescribing practice and has been sent to the "chief medical microbiologist" within every NHS hospital in the United Kingdom. It is intended to identify current practice within the United Kingdom. This project has the support of the European Study Group on Antibiotic Policies (ESGAP), a study group of the European Society for Clinical Microbiology and Infectious Diseases (ESCMID).

A copy of this questionnaire was previously sent to the chief pharmacist within every hospital in the UK. An excellent response was received, and I am in the process of analysing these results. It will be very interesting to compare the perceptions of pharmacists and medical microbiologists regarding antibiotic prescribing documents. Any information provided will be treated confidentially, and data will not be used in a manner that will allow identification of individuals or particular NHS hospitals.

Your assistance is vital for this research, and I will be very pleased to send you a report of the results (with anonymous data) when the research has been completed in thanks for your support. I would be very grateful if you would assist in this research by completing the enclosed questionnaire and returning it to me by **15th November 2002**, with copies of any antibiotic prescribing documents (e.g. antibiotic formularies/policies/prescribing guidelines) operative within your hospital. I am especially interested in guidelines pertaining to the treatment of pneumonia. A FREEPOST envelope has been provided. However, if your document(s) is too large for the envelope, please indicate this on the questionnaire and I will make alternative arrangements.

Thank you in anticipation,
Yours sincerely,

Appendix C

“ANTIBIOTIC GUIDELINE MODIFICATIONS, SURVEY 2002”



Antibiotic Guideline Modifications, Survey 2002

Please Return By:
Date

Please read the following notes before answering the questionnaire.

Aim of the Questionnaire

- The new BTS guidelines for community-acquired pneumonia were issued in December 2001.
- We are interested in the subsequent response in hospitals throughout the UK.

Confidentiality

- The results will be kept completely confidential and data providers and individual hospitals will not be identified.
- It is necessary to include a coding number on the sheets to calculate response rates, and to avoid unnecessary follow-ups.

The Questionnaire

- All the questions require you to simply tick the appropriate box(es) for ease of completion.
- It should not take you longer than 2 minutes to complete.

Antibiotic Guideline Modifications, Survey 2002

Q1. Are you aware of the publication of the 2001“British Thoracic Society Guidelines for the Management of Community Acquired Pneumonia in Adults”?

(Thorax; December 2001;Volume 56:Supplement IV.)

Please tick the appropriate box.

Yes No

Q2. Has there been a subsequent revision of the antibiotic guidelines for community-acquired pneumonia operative within your hospital following this publication (ie. since December 2001)?

Please tick the appropriate box.

Yes No **⇒ Back Page** Don't Know **⇒ Back Page**

Q3. Had this revision been planned prior to the publication of the new British Thoracic Society Guidelines?

Yes No Don't Know

Q4. Was this revision especially implemented in response to the publication of the British Thoracic Society guidelines?

Please tick the appropriate box.

Yes No Don't Know

Q5. Who has initiated the revision of the antibiotic guidelines?

Please tick all the boxes that apply.

- Respiratory Physicians
- General Physicians
- Infectious Disease Specialists
- Medical Microbiologists
- Pharmacists
- Don't Know
- Other (please specify below)

.....

Q6. Who has been involved in the revision of the antibiotic guidelines?

Please tick all the boxes that apply.

- Respiratory Physicians
- General Physicians
- Infectious Disease Specialists
- Medical Microbiologists
- Pharmacists
- GPs
- Don't Know
- Other (please specify below)

.....

P.T.O.

Q7. When did the revised guidelines become effective?
Please specify the date in the space below.

--/--/--

Documentation

Please enclose a copy of antibiotic guidelines operative within your hospital.

If you have already sent me a copy of your guidelines and they have not been updated since, please indicate this in the boxes below.

Please note: antibiotic guidelines may be a separate document, or contained within a general hospital formulary or policy.

Please tick the appropriate box

Antibiotic guidelines sent last time. Guidelines have been subsequently updated and a new copy enclosed	Antibiotic guidelines not sent last time. Current guidelines enclosed.	Antibiotic guidelines sent last time and not subsequently updated.

Please return your completed questionnaire and a copy of your hospital's antibiotic documents, if applicable, in the FREEPOST envelope provided by:

Date

Would you like to receive a report of the results (anonymous data) of the completed research?

Please tick the appropriate box.

Yes

No

END

Thank you for your participation in this research.



Pharmacy Practice Group
School of Pharmacy
Aston University
Birmingham
B4 7ET
07866414452
woodfoem@aston.ac.uk
7th November 2002.

Name
Title
Hospital
City
Postcode

Dear Name,

Re: Antibiotic Guideline Modifications, Survey 2002

On 15th October 2002 I sent you a copy of the questionnaire "Antibiotic Guideline Modifications, Survey 2002" with an accompanying letter explaining the purpose of this research.

I received an excellent response to this first mailing and the results look very interesting. However to increase the validity of the research, it is important to receive as many responses as possible. Your response is extremely important to me.

I do appreciate the many demands that you have on your time. However, I wonder if you are now in a position to spare the 2 minutes required to complete this questionnaire. Most of the questions require you simply to tick the appropriate box(es) for ease of completion. Your contribution is extremely important. If you consider that it is more appropriate for another member of your staff to complete the questionnaire, please could you pass it onto that person.

In the hope that you are willing to help with this research, I have enclosed a further copy of the questionnaire and the FREEPOST envelope in case it did not reach you, or was mislaid. I have also enclosed a copy of the original cover-letter which explains in greater detail the aims, sponsorship and confidentiality of the research.

I shall be extremely grateful if you will

- Complete and return the enclosed questionnaire
- Send me a copy of antibiotic guidelines (especially pertaining to pneumonia) if these have subsequently been updated

PTO

As before, any data provided will be treated with the strictest confidence and neither individual hospitals nor data providers will be identified. However, it is necessary to include a coding number to calculate response rates, and to avoid unnecessary follow-ups.

Thank you in anticipation.
Yours sincerely

Eleanor Woodford MRPharmS

Appendix D

“ANTIBIOTIC GUIDELINES, SURVEY 2003”



*In Collaboration with the Pharmacy Department,
Hospital X*

Antibiotic Guidelines

Survey 2003

<p>Please Return By: Date</p>

Q1. When did you join Hospital X?

Please write the date in the space provided below.

-- -- / -- -- / -- --

Q2. What is your grade?

Please tick the appropriate box.

PRHO SHO Registrar Consultant

Q3. Do you use Hospital X's antibiotic guidelines in your routine practice?

Please tick the appropriate box.

Yes No ⇒ Q8

Q4. Do you have a personal copy of Hospital X's antibiotic guidelines?

Please tick the appropriate box.

Yes No Don't Know

Q5. How do you access Hospital X's antibiotic guidelines?

Please tick all the boxes that apply.

Personal copy

Ward copy

On Hospital Intranet

Don't Know

Other (please specify)

.....

Q6. How often do you refer to Hospital X's antibiotic guidelines in your routine practice?

Please tick the appropriate box.

- Daily
 - Weekly
 - Rarely
 - Never
 - Don't Know
 - Other (please specify)
-

Q7. How useful do you find Hospital X's antibiotic guidelines in your routine practice?

Please tick the appropriate box.

- Very useful Q9 ⇨
 - Useful Q9 ⇨
 - Ambivalent Q9 ⇨
 - Not Useful
 - Don't Know
 - Other (please specify)
-

Q8. If you do not use Hospital X's antibiotic guidelines in your routine practice, or do not find them useful, please specify the reason(s) for this.

Please tick all the boxes that apply.

Unaware of these guidelines

Poor access to these guidelines

No need to refer to these guidelines in my routine practice

Think guidelines have been poorly developed

Do not agree with guideline recommendations

Don't Know

Other (please specify)

.....

Q9. What antibiotic(s) would you prescribe for a patient you had diagnosed with (non-severe) community-acquired pneumonia?

Please specify what you would prescribe in the space below.

.....

.....

Q10. Have you specifically looked in Hospital X's antibiotic guidelines for this answer?

Please tick the appropriate box.

Yes

No

END

Thank you for your participation in this research.

In Collaboration with the Pharmacy Department, Hospital X

Name	Pharmacy Practice Research Group
Position	School of Pharmacy
Dpartment	Aston University
Hospital X	Birmingham
City	B4 7ET
Postcode	07866414452
	elliew@fish.co.uk
	6 th November 2003.

Dear Name,

Re: Antibiotic Guidelines, Survey 2003

The Pharmacy Department, Hospital X is undertaking a programme of research into antibiotic prescribing in collaboration with the Pharmacy Practice Research Group, Aston University. We are especially interested in the use of antibiotic guidelines by prescribers within this hospital.

The enclosed questionnaire has been sent to all prescribers within City Hospital and it is intended to identify prescribers' views of the hospital's antibiotic guidelines. It contains questions regarding your ease of access to, and your opinions regarding, the guidelines. City Hospital's local research ethics committee has endorsed this study (LREC 03/10/704).

We do appreciate the many demands on your time. However, we would be extremely grateful if you could spare the 2 minutes required to complete the enclosed questionnaire. It has been designed with ease of completion in mind and only requires you to tick a couple of boxes.

We can assure you that all results will be kept completely confidential and no data providers will be identified. However, it is necessary to include an identification number to facilitate following-up non-responders.

We would be very grateful if you would assist in this research by completing the questionnaire and returning it by **26th November 2003** in the FREEPOST envelope provided.

Thank you in anticipation,
Yours sincerely,

Eleanor Woodford (Lead researcher, Aston University)

LOCAL RESEARCH ETHICS COMMITTEE - APPLICATION FORM

1. **Title of Project**

Prescribers' use and opinions of Hospital X's antibiotic prescribing guidelines.

2. **Investigators**

Principal Investigator. Signature:
13/10/2003.

Date:

Print Name: Eleanor Woodford

Other Investigators:

Hospital X

Dr B Hebron	Chief Pharmacist
Dr C Jamieson	Antibiotic Pharmacist
Dr T Weller	Consultant Microbiologist

Aston University

Prof K Wilson	Head of Pharmacy
Dr J Marriott	Senior Lecturer, Pharmacy Practice Group

Contact name, address, telephone & fax number:

Miss Eleanor Woodford, The Pharmacy Practice Research Group, School of Pharmacy, Aston University, Birmingham, B4 7EJ.

Tel: 07866414452
Fax: 01213590733
e-mail: elliew@fish.co.uk

Head of Department/SupervisorSignature:
13/10/2003

Date:

If the study is funded principally by commercial sponsors, will the confidentiality agreements allow limited information to be supplied to the NHS Executive to support the NHS National Research Register, held on the Internet?

Not Applicable-not funded by commercial sponsors.

a) **Study Descriptors**

Delete all that **DO NOT** apply to this study:

Single Centre Questionnaire Grant funding

a) **Study Design**

a) Scientific background to the Study.

- Antibiotic prescribing guidelines have a vital role in rationalising antibiotic prescribing to ensure cost-containment, conformity, quality and efficiency. In 1998, the Standing Medical Advisory Committee published a report examining antimicrobial resistance in relation to clinical practice ("The Path of Least Resistance", DOH). This report highlighted the importance of local hospitals possessing antibiotic guidelines based upon national recommendations and considered that antibiotic prescribing is likely to be inappropriate where guidelines do not exist. Prescribing guidelines also have an important educational role for inexperienced prescribers.
- We have previously identified that 87% of UK NHS hospitals surveyed (n=253) in 2001 had antibiotic guidelines (EW, KW, JM). Questionnaire respondents also indicated that these guidelines were available both in paper and electronic formats in approximately one-third of these hospitals (35%, n=207). Hospital X has medical antibiotic guidelines, which are available in a paper format and on the hospital's intranet.
- However, the potential benefits of antibiotic prescribing guidelines can only be realised if prescribers comply with their recommendations. Poor availability of, and prescribers' disagreement with recommendations, could lead to prescriber non-compliance with a hospital's antibiotic prescribing guidelines (Mansfield, Quality in Health Care 1995;4:250-255).
- The researchers are in the process of performing a study examining prescribers' compliance with hospital and national guidelines in the

antibiotic treatment of community-acquired pneumonia at City Hospital. It is perceived that this study would complement that research on guidelines utilisation.

b) Hypothesis or questions to be answered.

The study will be a questionnaire survey of **prescribers** based in Hospital X to ascertain their views regarding City Hospital's antibiotic prescribing guidelines.

Study Questions:

- Do prescribers have personal access to the hospital's antibiotic prescribing guidelines?
- What are the most common methods utilised by prescribers to access the antibiotic prescribing guidelines?
- How often do prescribers access the antibiotic prescribing guidelines in their routine practice?
- How useful do they find the antibiotic prescribing guidelines?
- If they do not find the antibiotic prescribing guidelines useful, why not?
- What antibiotic regime would they prescribe for a patient they had diagnosed with community-acquired pneumonia? (To link into the study of prescribing patterns for community-acquired pneumonia).

Please see the enclosed questionnaire and covering letter.

c) Plan of investigation

The study will be a questionnaire survey of **prescribers** based in Hospital X including PRHOs, SHOs, Regs, Senior Regs and Consultants.

The enclosed questionnaire and covering letter will be posted to the prescribers detailed above, with a return date of 3 weeks. As stated in the covering letter, the questionnaire has been designed to be quick and simple to complete. It is estimated that it should only take an individual 2 mins to complete.

Four weeks after the questionnaire has been sent to prescribers, the lead investigator (EW) will telephone non-responders. A suitable time for her to perform a telephone questionnaire with them will then be arranged.

d) Invasive investigators & procedures
(What, when, how often & risks)

Not Applicable. The study involves a questionnaire survey.

e) Duration of study & duration of an individual volunteer's

contribution

The duration of the study will be ~2 months following approval. A self-completion postal questionnaire will be distributed followed by follow-up telephone interviews with non-responders.

A volunteer's contribution will be ~2 mins – the time it will take them to complete the questionnaire.

- f) Statistical approach to be used, including advice during the design of the study
(Give details also of the source of the advice)

Not Applicable – The questionnaire will be distributed to all prescribers at Hospital X.

- g) Location of the study
(Name of Trust, Hospital, Health Centre etc)

Hospital X.

5. Recruitment of Subjects

IMPORTANT - Please see Guidelines - No. 5

Details of sources & numbers of volunteers with brief inclusion & exclusion criteria

The questionnaire will be sent to all prescribers employed by Hospital X- PRHOs, SHOs, Regs, Senior Regs and Consultants.

6. Drugs or Medical Devices

Are Drugs or Medical Devices to be used

NO

No-The study will be a questionnaire distributed to medical prescribers.

If **YES** complete 6a to 6g

- a) Details of the Drugs or Devices

(including name, strength, dosage, route of administration)

- or
Study -
- b) Details of Clinical Trial Certificate, Exemption Certificate
Product Licence
(The Product Licence **must** cover the proposed use in the
see Guidelines No. 10)
 - c) Details of any Risks
(Both to volunteers & staff; indicate current experience
with the drug or device)
 - d) Precautions to minimise any risks
 - e) Name & contact address of Company supplying the drug or
device
 - f) Dispensing arrangements
(Drugs should be dispensed through Pharmacy)
 - g) Guidelines to be used
(ABPI, ECGCP, Declaration of Helsinki etc)

7. Radiation

Are radioisotopes, x-rays or any other form of radiation being used in the study that would not be used in the normal clinical management of the volunteer?

NO

No-The study will be a questionnaire distributed to prescribers.

If **YES**, complete 7a and 7b

- a) **Why is this necessary?**
- b) **Radiation exposure**
(Describe dose & risks in terms that can be readily understood)

8. Indemnity

IMPORTANT - See Guidelines No. 8

Is written confirmation enclosed with this application? **YES**

Indemnity Insurance is provided by Aston University, where the principal investigator is undertaking research towards a PhD.

If **NO**, give details of Indemnity arrangements

9. Financial Arrangements

- a) Source of funding for the study

This study will be funded by a University's research training award (PhD) awarded to the lead investigator (EW) and **no** funding would be required from the NHS Trust.

There will be **no** funding from the Pharmaceutical Industry.

- b) Estimated cost of the study
- c) Details of use of the Funds
(Pay staff, running costs, supplement research funds etc)
- d) Details of payments to volunteers including travel or 'inconvenience'
- e) Details of any resource implications for the clinical service

10. Commercial Support

- a) Is the study sponsored or initiated by an Industrial Company:

NO

If **YES**, it is important to provide the contact name & address for invoicing purposes.

- b) Are there any publication agreements or constraints? **NO**

11. Collaboration

Please confirm that the application has been discussed in detail with all staff involved and with any groups that might be affected by the project.

Medical staff	To be discussed before commencing the study	by Dr B Hebron.
Nursing staff	Not Applicable	
Paramedical staff	Not Applicable	
Pharmacy staff	Yes - Dr B Hebron, Dr C Jamieson	
Imaging services	Not Applicable	
Laboratory services	Not Applicable	
Others (specify)	Not Applicable	

12. Information Documents

IMPORTANT - See Guidelines

Volunteer information leaflets enclosed	Not Applicable
Parent/carer information leaflets enclosed	Not Applicable
Informed consent forms enclosed	Not Applicable
Questionnaires enclosed	Yes
Sample letters enclosed	Yes

Research & Development Project Approval Form**A. PROJECT DETAILS**

1. Research Project Title LREC 03/10/704 - Prescribers' use and opinions of Hospital X's antibiotic prescribing guidelines

2. Lead Local Investigator

Surname	Hebron	Forename	Brian	Title	Dr	Department	Pharmacy
---------	--------	----------	-------	-------	----	------------	----------

3. Sponsor (Name, Address and Contact Details)

--

4. If there is no sponsor, will you require the Trust to act as "Sponsor" for this project?
YES NO

November 2003 5.

Planned start date:
Planned end date:

December 2003

B. RESEARCH INVESTIGATORS

6. Details of other Local Investigators

	Surname	Forename	Title	Department	Role in Project
Investigator 2	Jamieson	Conor	Dr	Pharmacy	Antibiotic Pharmacist-advice
Investigator 3	Weller	Tim	Dr	Microbiology	Microbiologist-advice
Investigator 4					
Investigator 5					

7. Details of Principal Investigator and contact information

Miss E Woodford, Pharmacy Practice Research Group, Aston University, Birmingham, B4 7ET,
Tel: 07866414452, e-mail: elliew@fish.co.uk

8. Details of other External Investigators

	Surname	Forename	Title	Institution	Role in project
Investigator 1	Wilson	Keith	Prof	Aston University	PhD supervisor
Investigator 2	Marriott	John	Dr	Aston University	PhD supervisor

C. SCIENTIFIC DETAILS

9. Is a written protocol or ethics submission attached with Registration Form?
YES NO

10. Brief statement of Research Hypothesis

The study will be a questionnaire survey of prescribers based in Hospital X to ascertain their views regarding Hospital X's antibiotic prescribing guidelines.

Study Questions:

- Do prescribers have personal access to the hospital's antibiotic prescribing guidelines?
- What are the most common methods utilised by prescribers to access the antibiotic prescribing guidelines?
- How often do prescribers access the antibiotic prescribing guidelines in their routine practice?
- How useful do they find the antibiotic prescribing guidelines?
- If they do not find the antibiotic prescribing guidelines useful, why not?
- What antibiotic regime would they prescribe for a patient they had diagnosed with community-acquired pneumonia? (To link into the study of prescribing patterns for community-acquired pneumonia).

11. Brief outline of Methods

The study will be a questionnaire survey of prescribers based in Hospital X including PRHOs, SHOs, Regs, Senior Regs and Consultants.
 The attached questionnaire and covering letter will be posted to the prescribers detailed above, with a return date of 3 weeks. As stated in the covering letter, the questionnaire has been designed to be quick and simple to complete. It is estimated that it should only take an individual 2 mins to complete. Four weeks after the questionnaire has been sent to prescribers a follow-up e-mail questionnaire version will be sent to non-responders.

12. Have you taken statistical advice?

YES NO

If so, from whom?

D. RESEARCH OUTCOMES and RELEVANCE to NHS PRIORITIES

13. Please describe the outcomes that you expect to derive from your work

Publication in peer-reviewed journal?

YES NO

Effect on clinical practice?

YES NO

Presentation at scientific meetings

YES NO

Other? Please specify

14. Do you expect a patent or other Intellectual Property from the research?

YES NO

E. ETHICS

15. Does the work involve human subjects?

YES NO

16. Does the work involve samples of tissue, blood or other human products?

YES NO

17. Does the work require access to records of data from individuals?

YES NO

18. Does the work involve animals?
 YES NO
19. Does the work have any other ethical dimension?
 YES NO

If the answer is 'YES' to any of these questions, then you must seek ethics committee approval for this work.

20. Ethics approval sought?
 YES NO
21. Ethics approval granted?
 YES NO
22. Please supply the project LREC/MREC numbers

LREC 03/10/704

23. If the work involves animal studies, do you hold an Animal Licence?
 YES NO

F. FINANCE

24. Was the project initiated by employees of the trust?
 YES NO

If NO, please supply details of the organisation instigating this research

Part of PhD research by E Woodford in the Pharmacy Practice Research Group, Aston University

25. Has the Finance Department reviewed this proposal?
 YES NO
26. Will the project receive external funding from any source
 YES NO

27. Type of Research

Non-commercial	<input type="checkbox"/>	Commercial	<input type="checkbox"/>	Educational	<input checked="" type="checkbox"/>	Not sure	<input type="checkbox"/>
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28. Please give the name(s) of the funding organisation(s) or if funded internally indicate funding source

Name of funder	Contact person
This study will be funded by a University's research training award (PhD) awarded to the lead investigator (EW) and no funding will be required from the NHS Trust. There will be no funding from the Pharmaceutical Industry.	Miss E Woodford, PhD Research Student, Pharmacy Practice Research Group, Aston University, Birmingham B4 7ET.

29. Please summarise all funding details, e.g. total funding for study, additional treatment costs, drugs, imaging, samples, equipment, other Trust resources, overheads

Funding	£
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G. GOVERNANCE

30. Will the proposed project involve patients?
YES NO

If so, how many patients will be involved?

31. Please give details of the location(s) & department(s) in the NHS and elsewhere where the research will take place.

The study is a questionnaire which will be distributed to prescribers within Hospital X.

32. Have Monitoring and Audit arrangements been arranged with the study's Sponsor? YES NO

33. Is the lead local investigator responsible for the clinical care of all local participants? YES NO

If NO, give the names and the contact details of all persons who will be responsible for the care of local participants

34. If samples are to be taken from these subjects, please describe the type and number of samples per subject

Blood samples		Urine samples		Tissue (specify)	
Other (specify)					

35. What arrangements have you made for the disposal of these samples?

36. Who will be responsible for ensuring that these samples are disposed of in the correct manner?

37. Does the project involve any experiments with genetically modified organisms
YES NO

38. Does it involve the use of genetic manipulation techniques?
YES NO

39. Will any ionising or radioactive X-rays be administered?
YES NO

(If radioactive substances are to be administered a Certificate will be required from ARSAC)

**PLEASE ENSURE THAT YOU SIGN THE DECLARATIONS ON THE
NEXT PAGE**

R&D Office use only

Ethics approval required: YES NO
 Ethics approval obtained: YES NO Date: _____
 Governance arrangements complete: YES NO
 Formal risk assessment? YES NO
 Level of risk? Low—1—2—3—4—5—6—7—8—9—10—high
 Finance department approved: YES NO Date: _____
 Entered on database: YES NO Date: _____
 Approval letter sent: YES NO Date: _____
 Other remarks:

If non-commercial, from which NHS R&D funding scheme should it be supported?

Support for Science <input type="checkbox"/>	Priority and Needs <input type="checkbox"/>
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Which Programme is it part of?

RESEARCH GOVERNANCE DECLARATIONS

Please initial each of the declarations

	<i>Local investigator</i>	<i>Responsib. person</i>
I undertake to abide by the provisions of the Declaration of Helsinki	EW	
I understand the importance of good research governance, and I will be responsible for ensuring that this project is conducted to a high and ethical standard		
I undertake to adhere to the study protocol, and will inform the Research & Development Department of any changes to the protocol		
I understand the requirements of the Data Protection Act with regards to the storing, retrieval, and use of patient data and agree to comply with them		
I undertake to ensure that, where written informed consent is a condition stipulated in the ethics committee approval for a project, valid consent will be obtained by an appropriately trained person from all subjects before they enter the study		
I give my consent for information about this research to be extracted from this application for inclusion where appropriate in the National Research Register		
I understand my responsibility to conform to Health and Safety Regulations whilst operating within Trust premises		

Investigators' Signatures

Local Investigator
this Research

Trust Responsible Person for

Signed.....

Signed.....

Print Name
Date

Date

Print Name

Approval of Project by Director, Research & Development

Signed.....

R E Ferner

Dated

Appendix E

“AUDIT OF PRESCRIBING COMPLIANCE WITH INSTITUTIONAL
PRESCRIBING GUIDELINES FOR THE EMPIRICAL TREATMENT OF CAP”

LOCAL RESEARCH ETHICS COMMITTEE - APPLICATION FORM

1. Title of Project

A study of empirical antibiotic prescribing for community-acquired pneumonia, and its relationship to Trust and national guidelines.

2. Investigators

Principal Investigator. Signature:

Date:

07/05/03

Print Name: MISS ELEANOR WOODFORD BPharm MRPharmS
Research Pharmacist undertaking a PhD

Other Investigators:

Dr B Hebron	Chief Pharmacist	Hospital X
Dr C Jamieson	Antibiotic Pharmacist	Hospital X
Dr T Weller	Medical Microbiologist	Hospital X
Dr K Wilson	Head of Pharmacy Practice	Aston University
Dr J Marriott	Senior Lecturer, School of Pharmacy	Aston University

Contact name, address, telephone & fax number:

The Pharmacy Practice Research Group, School of Life & Health Sciences, Aston University, Birmingham, B4 7ET.

Head of Department/Supervisor Signature:

Date:

07/05/03

Print DR KEITH WILSON

If the study is funded principally by commercial sponsors, will the confidentiality agreements allow limited information to be supplied to the NHS Executive to support the NHS National Research Register, held on the Internet?

Not Applicable

3. Study Descriptors

Delete all that **DO NOT** apply to this study:

Single Centre Retrospective Grant funding Record based

4. Study Design

Scientific background to the Study.

- There is increasing recognition by international organisations both of the growing problems of the overuse and misuse of antibiotics, and of the resultant consequences of escalating health-care costs and antibiotic resistance. In 1998 a specialist Sub-Group on Antimicrobial Resistance of the Standing Medical Advisory Committee published the report “The Path of Least Resistance”. This highlighted the importance of continual surveillance and research regarding antibiotic prescribing and outlined recommendations pertaining to antibiotic prescribing documents. The NHS and the government have published other high-profile documents that aim to control antibiotic prescribing. These include Health Service Circular 1999/049 and the “UK Antimicrobial Resistance Strategy and Action Plan”(2000).
- In 1993 the British Thoracic Society published empirical antibiotic prescribing guidelines for the treatment of community-acquired (“Guidelines for the management of community-acquired pneumonia in adults admitted to hospital.” The British Thoracic Society, Br J Hosp Med. 1993 Mar 3-16;49(5):346-50.). These were updated in 2001 in a more detailed form. (“BTS Guidelines for the Management of Community Acquired Pneumonia in Adults” Thorax. December 2001, Volume 56, Supplement IV).
- Following these publications, most hospitals have recommended empirical antibiotic regimes for community-acquired pneumonia. A survey conducted in 1999 (prior to the publication of the updated BTS Guidelines in 2001) identified that 84% (n=213) of hospitals had written CAP guidelines (Woodhead and Macfarlane, 2000). Hospital X has recommended empirical antibiotic guidelines for the treatment of patients admitted with community-acquired pneumonia.
- However relatively few studies have been performed in the UK considering antibiotic prescribing for community-acquired pneumonia and the application of empirical guidelines. Three previous studies of relevance performed within the UK have been identified: “Impact of management guidelines on the outcome of severe community acquired pneumonia”(Thorax,1997, 32:17-21), “Rationalised Prescribing for Community Acquired Pneumonia: a closed loop audit”(Archiv Dis Child, 2000, 83: 320-324), “Use of Indicators to Evaluate the Quality of Community-Acquired Pneumonia Management”(Clinical Infectious Diseases, 2002(conducted 1999-2000), 34:318-23). No studies have been conducted since the publication of the BTS Guidelines in 2001.

b) Hypothesis or questions to be answered.

The study aims to evaluate antibiotic prescribing practices for community-acquired pneumonia.

Study questions:

“What antibiotic regimes have been prescribed for community-acquired pneumonia, and how do these correlate with hospital and national guidelines?”

“What are the reasons for prescribing outside the guidelines; and what are the consequent implications for guidelines applicability and improvement?”

Study outcomes:

- Review of empirical antibiotic regimes
- Adherence of prescribed regimes with empirical hospital guidelines
- Evaluation of the usefulness, relevance and applicability of guidelines for empirical community-acquired pneumonia
- Evaluation of whether compliance with guidelines is affected by diagnostic criteria and the time of patient admission.
- Evaluation of whether the guidelines could be improved

c) Plan of investigation

In this retrospective audit patients admitted last Winter (November 2002-March 2003) with a primary admission diagnosis of community-acquired pneumonia will be identified by Information Services from ICD-10-codes (which have been obtained from the Coding Unit). Due to the difficulty of differential diagnosis, patients who had primary admission diagnosis codes pertaining to COPD and bronchitis will also be identified and their notes reviewed to identify if their primary admission diagnosis should have been coded for pneumonia.

The names and hospital IDs of patients with these codes will be sourced from Information Services, and their medical notes and prescription charts obtained from the Medical Records Department. The following information will be collected from medical notes/prescription charts.

A future prospective audit will aim to inform the accuracy of diagnosis codes for patients with community-acquired pneumonia

Patient Data Required for demographic characteristics

- Name and hospital ID number (these are only required for the

retrieval of notes and prescription charts and will be anonymised as soon as possible).

- Age/D.O.B.
- Gender
- Location admitted from (e.g. own home/nursing home)
- Previous hospital admissions within the past month-especially within the past 10 days (suspect nosocomial pneumonia)
- If antibiotic therapy was initiated in primary care prior to admission, and regime details
- Penicillin allergy & degree -e.g. anaphylaxis
- Recent influenza infection
- Co-existing morbidity- respiratory (eg.asthma), liver, renal

Physical & laboratory data

Required for assessment of the severity of the pneumonia, derived from "BTS Guidelines for the Management of Community Acquired Pneumonia in Adults" Thorax. December 2001, Volume 56, Supplement IV

- Temperature
- Diastolic & Systolic B.P.
- Altered mental state (confusion)
- Respiratory rate
- Pulse
- Chest X-Ray
- Oxygen saturation
- Full blood count
- LFTs
- Serum albumin
- Urea
- W.C.C.
- C.R.P.

Antibiotic Therapy

Required for review of antibiotic regimes prescribed

- Antibiotic course- route, dose & regime length
- Grade of prescribing physician (e.g. Junior/registrar/Consultant)
- Time of admission (e.g. middle of the night/ 9am-5pm)
- Post-take ward round review
- Explanation why following the guidelines was not considered appropriate (if appropriate)
- Interventions by, and involvement of, other health professionals (e.g. medical microbiologists and pharmacists)
- Change in antibiotic regime following receipt of aetiology, culture and sensitivity reports
- Iv to oral switch

Clinical Outcome

- Transfer to ICU
- Mortality (at 30 days)
- Length of stay
- Discharge with antibiotics on prescription
- Readmission within 4 weeks

- d) Invasive investigations & procedures
(What, when, how often & risks)

THE STUDY IS A RETROSPECTIVE REVIEW OF MEDICAL NOTES AND NO PATIENT INTERVENTIONS WILL BE INVOLVED.

- e) Duration of study & duration of an individual volunteer's contribution

Volunteer contribution is not required.

The duration of the study will be the time required to review the patients' notes and prescription charts to obtain the above information.

An estimate is 2 months.

- f) Statistical approach to be used, including advice during the design of the study
(Give details also of the source of the advice)

The number of patient records required in the study is ~250.

This is based upon a detection rate for non-compliance with guidelines of 20%, a power level of 0.9 and statistical significance of 0.005.

This figure of 250 has been obtained using the above parameters from the appropriate table in "How many subjects?, statistical power analysis in research" (Kraemer and Theimann, Newbury Park London, 1987).

- g) Location of the study
(Name of Trust, Hospital, Health Centre etc)

Hospital X.

5. Recruitment of Subjects

IMPORTANT - Please see Guidelines - No. 5

Details of sources & numbers of volunteers with brief inclusion & exclusion criteria

THE STUDY IS A RETROSPECTIVE REVIEW OF MEDICAL NOTES AND **NO** VOLUNTEERS WILL BE INVOLVED.

Patient records will be identified from all appropriate ICD codes for primary admission diagnosis of community-acquired pneumonia, COPD and bronchitis.

The only retrospective data collected will be as detailed under the four headings above.

Inclusion Criteria:-

- Patients over 16 years of age
- Positive diagnosis of community-acquired pneumonia
- Community-acquired pneumonia is primary indication for hospital admission
- Community-acquired pneumonia distinguished from other respiratory conditions by chest radiograph.

Exclusion Criteria:-

- Pulmonary TB
- CF
- Primary immune deficiency
- Secondary immune deficiency related to HIV
- Drug/systemic disease-induced immunosuppression (not including corticosteroids)

6. Drugs or Medical Devices

Are Drugs or Medical Devices to be used

THE STUDY IS A RETROSPECTIVE REVIEW OF MEDICAL NOTES AND **NO** DRUGS OR MEDICAL DEVICES WILL BE INVOLVED.

If **YES** complete 6a to 6g

a) Details of the Drugs or Devices
(including name, strength, dosage, route of administration)

b) Details of Clinical Trial Certificate, Exemption Certificate
or Product Licence

- Study - (The Product Licence **must** cover the proposed use in the see Guidelines No. 10)
- c) Details of any Risks
(Both to volunteers & staff; indicate current experience with the drug or device)
 - d) Precautions to minimise any risks
 - e) Name & contact address of Company supplying the drug or device
 - f) Dispensing arrangements
(Drugs should be dispensed through Pharmacy)
 - g) Guidelines to be used
(ABPI, ECGCP, Declaration of Helsinki etc)

7. Radiation

Are radioisotopes, x-rays or any other form of radiation being used in the study that would not be used in the normal clinical management of the volunteer?

THE STUDY IS A RETROSPECTIVE REVIEW OF MEDICAL NOTES AND NO FORM OF RADIATION WILL BE INVOLVED.

If **YES**, complete 7a and 7b

a) **Why is this necessary?**

b) **Radiation exposure**

(Describe dose & risks in terms that can be readily understood)

8. Indemnity

IMPORTANT - See Guidelines No. 8

Is written confirmation enclosed with this application?

THE STUDY IS A RETROSPECTIVE REVIEW OF MEDICAL NOTES AND NO INDEMNITY WILL BE REQUIRED

If **NO**, give details of Indemnity arrangements

9. Financial Arrangements

a) Source of funding for the study

This study will be funded by a University's research training award (PhD) awarded to the lead investigator(EW) and **no** funding would be required from the NHS Trust.

There will be **no** funding from the Pharmaceutical Industry.

b) Estimated cost of the study

There will be small opportunity costs involving the Information Services in the sourcing of the medical notes.

However, the results of the study will be available to the Trust, and it is expected they will be beneficial in service quality-improvement. The costs will also be offset by the prospective gain to the Trust of the publication of research findings in a peer-reviewed journal.

c) Details of use of the Funds

(Pay staff, running costs, supplement research funds etc)

d) Details of payments to volunteers including travel or 'inconvenience'

THE STUDY IS A RETROSPECTIVE REVIEW OF MEDICAL NOTES AND NO VOLUNTEERS WILL BE REQUIRED

e) Details of any resource implications for the clinical service

10. Commercial Support

a) Is the study sponsored or initiated by an Industrial Company:

NO

If **YES**, it is important to provide the contact name & address for invoicing purposes.

b) Are there any publication agreements or constraints?

NO

If **YES**, give details

11. Collaboration

Please confirm that the application has been discussed in detail with all staff involved and with any groups that might be affected by the project.

Medical staff Yes-via Medical Microbiology liaison

Nursing staff Not Applicable

Paramedical staff Not Applicable

Pharmacy staff Yes

Imaging services Not Applicable

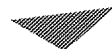
Laboratory services Not Applicable

Others (specify)

Clinical Improvement Unit Yes

Information Services Yes

Medical Records Yes



Aston University

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12. Information Documents

IMPORTANT - See Guidelines

Volunteer information leaflets enclosed Not Applicable

Parent/carer information leaflets enclosed	Not Applicable
Informed consent forms enclosed	Not Applicable
Questionnaires enclosed	Not Applicable
Sample letters enclosed (GP, recruitment etc)	Not Applicable

Hospital X

Research & Development Project Registration Form

Name	Eleanor Woodford	Directorate	Clinical Support	Date:	11/03/03
:		e:			

Lead/Administrative charge, responsible in CH:
(if different from above, must be consultant or senior manager grade)

Dr Brian Hebron,
Chief Pharmacist

Research Sponsor, (insert none, if none)

PhD grant from Aston University

Short/Working Title

A study of empirical antibiotic prescribing for community-acquired pneumonia, and its relationship to Trust and national guidelines.

Full Title

As above

Brief outline and relevance (eg Multicentre study, drug trial, survey of, investigation of, coursework for, etc)

Single centre retrospective study involving review of medical notes of patients admitted to Hospital X with a primary diagnosis of community-acquired pneumonia. Patients identified from ICD codes, and medical notes/prescription charts reviewed for details of antibiotic treatment. Prescribing analysis performed in the context of empirical hospital guidelines and national British Thoracic Society 2001 guidance ("BTS Guidelines for the Management of Community Acquired Pneumonia in Adults" Thorax. December 2001, Volume 56, Supplement IV)

CH Research Theme: Infection

Proposed Start Date (data collection/use of resources)	As soon as possible following ethical committee approval.	Proposed End Date (data collection/use of resources)	As long as required for retrieval and review of notes. An estimate is maximum of 2 months.
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Please indicate which CH Directorates, including Nursing Administration, will be involved?

Medicine	<input type="checkbox"/>	Surgery	<input type="checkbox"/>
Ophthalmology	<input type="checkbox"/>	Women & Child Health	<input type="checkbox"/>
Pathology	<input type="checkbox"/>	Accident & Emergency	<input type="checkbox"/>
Imaging	<input type="checkbox"/>	Dermatology	<input type="checkbox"/>
Clinical Support	<input checked="" type="checkbox"/>	Nursing	<input type="checkbox"/>
Clinical Improvement Unit	<input checked="" type="checkbox"/>	Medical Records	<input checked="" type="checkbox"/>

Other organisations involved in project, eg Trusts, Universities

Not Applicable

Which category of research do you consider this project. (please see notes below)

non-commercial <input checked="" type="checkbox"/>	commercial (generalisable) <input type="checkbox"/>	commercial <input type="checkbox"/>
--	---	-------------------------------------

	yes	no
Has this project been initiated by CH researchers?	<input type="checkbox"/>	<input checked="" type="checkbox"/>
What is the total funding for the whole research project over all the centres involved?	£	
Do you have commercial funding?	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Do you have non-commercial funding?	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Have you made provision for overheads in your funding arrangements?	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
If commercial, will all direct costs be covered by external income?	<input type="checkbox"/>	<input type="checkbox"/>
Is there an intention to publish the results in peer reviewed journal(s)?	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Does the project require Local Research Ethics Committee approval?	<input checked="" type="checkbox"/>	<input type="checkbox"/>

Authorised Dr R E Ferner

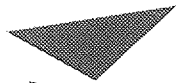
DIRECTOR R&D

Date

.....

Appendix F

COPIES OF PUBLICATIONS AND CONFERENCE DOCUMENTATION



Aston University

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