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Evaluation of Antibiotic Prescribing Practices in Infection Management: A Retrospective Observational Audit in a UK District General Hospital

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ABSTRACT

Antimicrobial resistance (AMR) is a significant global health threat driven largely by inappropriate antibiotic use. Optimising prescribing practices through antimicrobial stewardship is essential to reduce resistance and improve patient outcomes. To evaluate antibiotic prescribing practices in infection management within a UK district general hospital general internal medicine ward, focusing on compliance with guidelines, antibiotic consumption, microbiological investigation, and treatment outcomes. A retrospective observational audit was conducted between March and May 2025 on a general internal medicine ward at Eastbourne District General Hospital. Data from 65 antibiotic prescriptions were analysed and compared against NICE guideline NG15, the UKHSA "Start Smart - Then Focus" framework, and local antimicrobial guidelines. Co-amoxiclav accounted for 77% (50/65) of prescriptions, followed by levofloxacin (15%), meropenem (15%), and vancomycin (2%). Respiratory infections and sepsis were the most common indications. Repeat antibiotic courses were required in 68–70% of patients. Blood cultures were not performed in up to 18% of cases. The audit highlights several important challenges in antibiotic prescribing, including a high reliance on empirical therapy, frequent repeat prescribing, and inconsistent microbiological testing. Strengthening antimicrobial stewardship interventions, particularly 48–72-hour antibiotic review, improved biological investigation, and enhanced documentation, is necessary to improve prescribing practices and reduce AMR risk.

INTRODUCTION

In the 21st century, one of the most pressing public health challenges observed is antimicrobial resistance (AMR). The Global Research on Antimicrobial Resistance (GRAM) project reported there were 4.71 million deaths in 2021 associated with bacterial AMR, including over 1.14 million deaths directly attributable to resistance (Naghavi *et al.*, 2024). This death toll makes AMR surpass mortality rates of many other major infectious diseases, highlighting the need for urgent interventions. The World Health Organization (WHO) has ranked AMR among the top ten global health threats. Recent studies forecast that AMR will directly cause 39 million deaths worldwide by 2050 (Naghavi *et al.*, 2024) and its economic impact will be far more daunting, with an estimated cumulative cost of $100 trillion to the global economy (Woh & Zhang, 2025).

The United Kingdom is not immune to this crisis. The strain exhibited by AMR on the National Health Service (NHS) is already acknowledged in the UK Government's 20-year vision for antimicrobial resistance (2019-2049) policy document, given the constantly increasing incidence of multi-drug-resistant organisms (e.g., MRSA, ESBL-producing Enterobacteriaceae, carbapenemase-producing organisms) (Kingdom, 2019). The annual English Surveillance Program for Antimicrobial Utilization and Resistance (ESPAUR) report published by the UK Health Security Agency (UKHSA) confirmed the reduced antimicrobial consumption between 2017 and 2021. However, reports also pointed toward persisting and increasing resistance trends, particularly in Gram-negative bacteria (UKHSA, 2025).

Inappropriate antibiotic use is widely recognized as the primary modifiable driver of AMR. This encompasses multiple prescribing behaviours. For example, inappropriate antimicrobial prescription without proper indication causes unnecessary initiation (Kasse *et al.*, 2024). Incorrect dosing is due to incomplete treatment adherence, premature discontinuation, or use of previous prescriptions (Basir *et al.*, 2025; Ndaki *et al.*, 2025). Failure to review and de-escalate therapy, including self-medication or lack of monitoring (Ndaki *et al.*, 2025; Rajendran *et al.*, 2025).

In hospital settings, a substantial proportion of antibiotic use is considered inappropriate. Prescription inappropriateness (unnecessary or suboptimal) was the major issue identified within European countries in various point prevalence surveys across Dutch (16%) (Willemsen *et al.*, 2010), Italian (20% Northern Italy; 35-40% Southern Italy) (Garlasco *et al.*, 2024), Spanish (49%) (Núñez-Núñez *et al.*, 2022) and Portuguese hospitals (42%) (Palos *et al.*, 2025). Similarly, in the context of UK, audit data shows failure in meeting stewardship standards with studies reporting 24% unnecessary antibiotic days (Owens *et al.*, 2024), 19% lack of documented review of prescriptions (Roy-Bentley *et al.*, 2022), suboptimal document compliance for 14-16% of key metrics (Boreland, 2013) and low adherence to broad-

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spectrum prescribing guidelines (Razaq *et al.*, 2024). The consequences of inappropriate prescribing extend beyond AMR. Additional or unnecessarily prolonged exposure to antibiotics leads to adverse events such as superinfections (e.g., Clostridioides difficile infection) and disruption of the gut microbiome exacerbating resistance and infection risks (Curran *et al.*, 2022). Moreover, longer durations of antibiotic use exert a severe expenditure burden on healthcare systems; studies report that optimizing the unnecessary use of antibiotics may reduce up to 50% of the associated costs (Aiesh *et al.*, 2023), saving up to USD 150,000 (Tafish *et al.*, 2025).

Microbiological investigations, particularly blood culture, are fundamental to optimizing antibiotic therapy. The key to microbiological diagnosis and subsequent opportunities for antimicrobial stewardship is to obtain cultures before antibiotics are administered, enabling improved pathogen detection and targeted therapy (Tafish *et al.*, 2025). Similarly, timing of the culture is also crucial. Rand *et al.* (2019) reported that the rate of positive blood culture is reduced by more than 50% as early as the second hour of intravenous antibiotic treatment, aligning with the guidelines of the Surviving Sepsis Campaign Hour-1 bundle, which stresses obtaining blood cultures before starting antibiotics (Rand *et al.*, 2019). Despite this evidence, culture rates remain suboptimal across the UK, with only 31.5% of hospitals showing culture guideline compliance above 80% in a set of 146 NHS hospitals (Noone, 2025). This inadequate microbiological confirmation practice may lead to challenges like inability to provide patient-specific therapy, de-escalating treatments, or avoiding prolonged empirical prescribing.

General internal medicine wards are ideal settings for antimicrobial stewardship interventions, while patients are often presented with varying clinical presentations, increasing the diagnostic uncertainty, and adding to the challenge are comorbidities, collectively inclining towards a higher likelihood of antimicrobial therapy. Much of the published literature on antimicrobial stewardship originates from large teaching hospitals or specialized centers. There is a relative paucity of data from district general hospitals, which constitute a substantial proportion of UK hospital care and face unique challenges. Understanding antibiotic prescribing practices in these settings is essential for developing targeted stewardship interventions applicable across the NHS. The need for baseline data to inform stewardship interventions in resource-constrained district general hospital settings is of critical importance.

This retrospective observational audit was conducted to evaluate antibiotic prescribing practices in infection management within a general internal medicine ward of a UK district general hospital.

Specifically, the audit aimed to:

1. Characterize antibiotic prescribing patterns, including antibiotic selection, indications, and the proportion of empirical versus targeted therapy.
2. Assess compliance with national and local antimicrobial stewardship standards, including documentation of indication, 48–72-hour review, and stop/review dates.
3. Evaluate microbiological investigation practices, particularly blood culture utilization.
4. Identify opportunities for stewardship improvement to support safer and more effective antibiotic use.

MATERIALS AND METHODS

Study Design

This study was conducted as a retrospective observational audit evaluating antibiotic prescribing practices in infection management within a general internal medicine ward at a UK district general hospital. The retrospective design was selected to facilitate assessment of real-world prescribing behaviour without influencing clinician decision-making, thereby providing an authentic representation of routine clinical practice. Observational audits are widely employed in antimicrobial stewardship research to identify variations in practice, evaluate adherence to established guidelines and generate actionable quality improvement data (Barlam *et al.*, 2016; Charani *et al.*, 2011).

Settings and Study Duration

The audit was conducted in the general internal medicine ward providing acute medical care for adult patients for various medical conditions, including infectious diseases, at Eastbourne District General Hospital, part of East Sussex Healthcare NHS Trust. The hospital serves a mixed urban and rural population in East Sussex, United Kingdom. The audit spanned over three months from March to May 2025.

Participants

The audit reviewed consecutive adult inpatients who received antibiotic therapy during the study period (March to May 2025).

Inclusion criteria were defined as:

- Patients aged ≥18 years.
- Prescribed one or more of the following selected antibiotics: co-amoxiclav, levofloxacin, meropenem, or vancomycin.
- Treatment was for the management of suspected or confirmed infection.

These antibiotics were selected as they represent commonly used agents in both empirical and escalation therapy within acute medical settings, encompassing broad-spectrum penicillins, fluoroquinolones, carbapenems, and glycopeptides.

Exclusion criteria were applied to ensure data integrity:

- Antibiotic prescriptions with incomplete documentation.
- Treatment regimens initiated outside the study ward (for the maintenance of consistency in prescribing practices).
- Cases where documentation was insufficient to determine clinical indication or treatment outcomes.

Each prescription episode was treated as an independent case for analysis, even when multiple courses were prescribed to the same patient during the study period. This ensured that all prescribing decisions were captured while allowing the evaluation of each clinical episode separately.

Data Collection

Data were collected retrospectively from the hospital's clinical information systems, which included:

• Electronic prescribing and medicines administration system (ePMA), which provides comprehensive records of all medication orders, including antibiotic prescriptions, dosing information, and administration history.

• Electronic patient records, which contained clinical documentation including admission notes, progress records, investigation results, and discharge summaries.

Table 1 outlines the variables that were systematically extracted using a standardized data collection Performa.

Table 1: Extracted Variables

Variable Category	Specific Variables Recorded
Demographics	Age, gender
Clinical indication	Documented reason for antibiotic use
Antibiotic details	Drug name, dose, route of administration, and duration
Timing	Initiation date/time and documented review (if recorded)
Microbiology	Blood culture request status and culture results
Outcomes	Need for repeat antibiotic prescription.
Documentation	Presence of documented indication and stop/review date

Data were anonymised before analysis to maintain patient confidentiality. All of the identifying information (e.g., name, hospital number, date of birth, or NHS number) from patients was excluded from the audit dataset, ensuring data cannot be traced back to the patient. All of the data was securely stored on the hospital's password-protected servers with access only during the research time.

Data Analysis

Descriptive statistical analysis was employed to evaluate prescribing patterns and assess compliance with antimicrobial stewardship standards.

Descriptive Statistics

• Categorical variables (including antibiotic choice, clinical indication, and blood culture status) were summarised using frequencies and percentages, with numerators and denominators clearly reported for all proportional data.

• Continuous variables (such as patient age) were summarised using means or medians with measures of dispersion (standard deviation or interquartile range) where data were available.

Prescribing Pattern Analysis

Antibiotic utilisation was comprehensively analysed by examining:

• Proportion of each antibiotic prescribed (co-amoxiclav, levofloxacin, meropenem, and vancomycin) relative to total prescriptions.

• Distribution of clinical indications for antibiotic therapy

• Frequency of empirical versus targeted therapy where such distinction could be reliably identified from clinical documentation.

Guideline Compliance Assessment

Each prescription was assessed against antimicrobial stewardship standards based on:

• Appropriateness of antibiotic choice relative to the documented clinical indication.

• Documentation of clinical indication for antibiotic use.

• Documentation of stop date or review date.

• Performance of microbiological investigations, specifically blood cultures.

Compliance with each standard was expressed as percentages, enabling identification of specific areas of adherence and deviation from established guidance.

Outcome Analysis

Clinical outcomes were evaluated using available data through:

• Repeat antibiotic prescribing rates were calculated and used as a surrogate marker for treatment adequacy.

• An exploratory observation was made regarding the association between lack of microbiological investigation and repeat prescribing rates.

Temporal Trends

Data were analysed across the three months to identify:

• Monthly variation in prescribing patterns.

• Changes in antibiotic utilization or prescribing behaviour over time or practice.

Interpretation Framework

All findings were interpreted within the established context of antimicrobial stewardship principles, specifically:

• Empirical versus targeted therapy

• Early review at 48–72 hours

• De-escalation and duration optimisation

This framework allowed identification of system-level gaps, behavioural prescribing patterns, and opportunities for quality improvement.

Audit Standards

The audit standards were derived from:

1. National Institute for Health and Care Excellence (NICE) antimicrobial stewardship guidance (NG15), which provides comprehensive recommendations for systems and processes to support effective antimicrobial medicine use (NICE, 2015).
2. UK Health Security Agency "Start Smart - Then Focus" framework, which outlines a practical five-step approach to antimicrobial stewardship in hospital settings (Agency, 2023).
3. Local Trust antimicrobial prescribing guidelines, which provide institution-specific recommendations based on local antimicrobial resistance patterns and formulary availability.
4. British National Formulary (BNF), which provides nationally recognized prescribing information including drug dosage, contraindications, and interactions (Committee, 2012).

These standards collectively emphasise appropriate antibiotic selection, clear documentation of clinical indication, routine microbiological investigation before treatment initiation, and mandatory clinical review at 48–72 hours.

Ethical Considerations

Given the retrospective service evaluation nature of the study, formal patient consent was waived as the data were extracted from the hospital's records and anonymised, adhering to the Health Research Authority's guidance on service evaluation and audit (Authority, 2017). Handling of the data was carried out in accordance with the General Data Protection Regulation (GDPR) 2018 and the Data Protection Act 2018.

RESULTS AND DISCUSSION

Patient Cohort and Prescription Episodes

During the three-month study period (March and May 2025), a total of 65 antibiotic prescriptions were reviewed, which were prescribed to adult inpatients of the general internal medicine ward.

Each prescription episode was treated as an independent case analysis irrespective of multiple courses prescribed to the same patients. However, the exact number of patients represented by these prescriptions and demographic data (including age and gender) could not be systematically determined from the available audit data and therefore are not reported.

Antibiotic Prescribing Patterns

The most commonly prescribed antibiotic was co-amoxiclav, accounting for 77% of prescriptions (50/65). It was followed by levofloxacin and meropenem, each representing 15% of the total prescriptions. The least prescribed antibiotic was vancomycin at 2%. Percentages sum to >100% because some patients received multiple antibiotics concurrently (combination therapy). Figure 1 illustrates the distribution of antibiotic prescriptions.

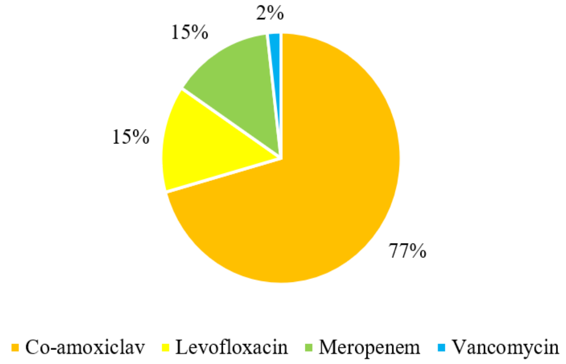

Figure 1: Distribution of Antibiotic Prescriptions (N=65)

Clinical Indications

Respiratory infections and sepsis emerged as the most common clinical indications for which antibiotics were prescribed. However, the exact distribution could not be determined due to missing information in available documents; this highlights limitations in record-keeping, calling for improved documentation processes.

Microbiological Investigations

Blood cultures were ordered for the majority of the cases, with 82% (53/56) being tested. In 18% (12/65) of the cases, no blood culture was conducted. The lack of ordering blood culture underscores deviation from recommended practice, especially in cases of suspected sepsis. Figure 2 presents blood culture utilization.

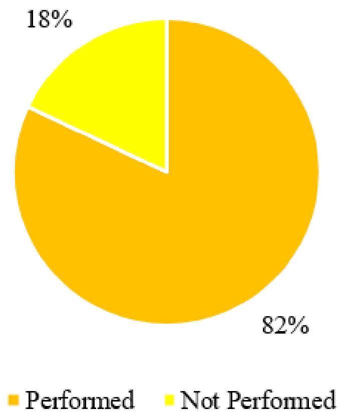

Figure 2: Blood Culture Utilization (N=65)

Treatment Outcomes

For a substantial portion of the cohort, repeat antibiotic courses were required in 68-70% (44-46/65) of patients. This trend points toward inadequate initial antibiotic selection, delayed clinical reassessment, or limited microbiological guidance to support targeted therapy. Figure 3 illustrates repeat prescribing rates.

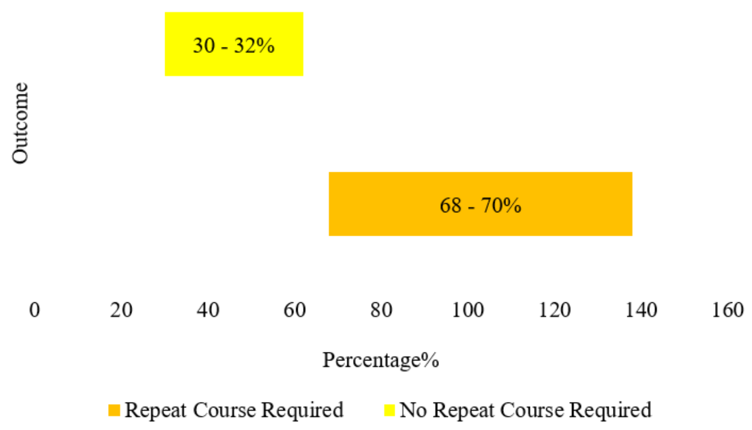

Figure 3: Repeat Antibiotic Prescribing Rates (N=65)

Documentation Compliance

Documentation compliance represented challenges across the board. In terms of clinical indication and stop/review dates were reported to be inconsistent across the reviewed prescriptions. It was noted that clear documentation of these entities was not accurately present, highlighting a deviation from antimicrobial stewardship standards, which require clear documentation to ensure clinical review and support consistent care. Due to lack of documentation, exact compliance rates were not calculated.

Discussion

This audit has identified several important antimicrobial stewardship challenges. The high reliance on empirical therapy, frequent repeat prescribing in 68–70% of patients, and inconsistent microbiological testing with blood cultures omitted in up to 18% of cases collectively suggest that opportunities for prescribing optimization are being missed. Respiratory infections and sepsis were the most common indications, and co-amoxiclav was the predominant antibiotic prescribed (77%), reflecting both the diagnostic challenges inherent in acute medical care and areas where stewardship interventions could be strengthened.

The predominance of co-amoxiclav (77%) reflects its established role as a broad-spectrum empirical antibiotic for respiratory infections and sepsis. However, the literature consistently demonstrates that excessive reliance on empirical therapy without subsequent optimization contributes to inappropriate antibiotic use and antimicrobial resistance (Damessa *et al.*, 2026). Studies report that 10% of targeted therapy and 20-30% of antibiotic prescriptions are suboptimal, lacking review dates, with empirical therapy continuation without review being a primary driver (Gobezie *et al.*, 2024). While empirical prescribing is essential in acute care, failure to de-escalate therapy based on microbiological results or clinical response may lead to unnecessary broad-spectrum exposure. The 68–70% repeat prescribing rate suggests that initial therapy may have been inadequate or that clinical reassessment was delayed, which is consistent with the research by Rhys Owens *et al.* (2024), who found that nearly half (45.7%) of unnecessary antibiotic days occurred at the pre-72-hour review point (Owens *et al.*, 2024).

Up to 18% of patients did not undergo blood culture testing, representing a significant deviation from recommended practice. Obtaining cultures before antibiotics is critical, as antibiotic administration significantly reduces culture positivity rates (Itaeli *et al.*, 2025). Furthermore, prior antibiotic exposure is associated with a reduced likelihood of identifying causative organisms (Hirosawa *et al.*, 2023). The failure to obtain microbiological confirmation limits the ability to tailor therapy, de-escalate treatment, and avoid prolonged empirical prescribing, which may partially explain the high repeat antibiotic use observed. UK audits report that blood culture omission is a significant problem in hospital settings, with studies reporting only 2.7% (n = 04) of hospital achieving full compliance with guidelines out of 146 NHS hospitals (Noone, 2025).

Although carbapenem use (meropenem 15%) and glycopeptide use (vancomycin 2%) were relatively limited, broad-spectrum agent use remains concerning. The WHO AWaRe classification identifies fluoroquinolones (levofloxacin 15%) and carbapenems as "Watch" group antibiotics requiring heightened stewardship (Organization, 2019). The proportion of levofloxacin (15%) and meropenem (15%) use raises questions about whether narrower-spectrum alternatives could have been considered, particularly given that respiratory infections and sepsis were the most common indications.

The findings reinforce the importance of structured antibiotic review at 48–72 hours, a cornerstone of antimicrobial stewardship frameworks including NICE guideline NG15 and the UKHSA "Start Smart - Then Focus" approach (Agency, 2023; NICE, 2015). Interventions such as antibiotic "time-outs" and pharmacist-led reviews improve prescribing appropriateness and reduce antibiotic use (Jawhar *et al.*, 2025; Jawhar *et al.*, 2026). The high repeat prescribing rate (68–70%) suggests structured reviews were not consistently performed, and strengthening adherence could reduce inappropriate use.

The observed patterns likely reflect diagnostic uncertainty, high workload, and inconsistent stewardship adherence, challenges common in district general hospitals with limited specialist resources. Respiratory infections remain a major driver of antibiotic prescribing despite diagnostic uncertainty (Gulliford *et al.*, 2016), highlighting the need for targeted interventions including improved diagnostics and system-level supports such as electronic prompts, checklists, and pharmacist involvement.

It is important to note the limitations of this audit, including the single-centre, single-ward design with a modest sample of 65 prescriptions, limiting generalizability. The retrospective design relies on record accuracy, and patient demographics, infection types, and culture results were not captured. The repeat prescribing rate is a surrogate marker rather than a direct outcome measure. Despite limitations, this audit provides valuable insight into prescribing challenges in district general hospitals, an under-represented context in the literature.

Based on the findings of this audit, several targeted interventions are recommended to improve antibiotic prescribing practices and strengthen antimicrobial stewardship. These system-level interventions can support clinicians in making evidence-based prescribing decisions.

- A structured antibiotic review ("antibiotic time-out") should be consistently implemented within 48–72 hours of initiation. This should include reassessment of diagnosis, review of microbiology results, and consideration of de-escalation or discontinuation of therapy.
- Blood cultures and other relevant microbiological investigations should be performed before antibiotic initiation, particularly in suspected sepsis. Improving compliance with this practice would enhance diagnostic accuracy and support targeted therapy.
- While empirical antibiotic therapy is often necessary, adherence to local and national guidelines should be reinforced. Prescribers should be encouraged to use narrow-spectrum antibiotics where appropriate and to avoid unnecessary escalation to broad-spectrum agents unless clinically indicated.
- It is important to enhance documentation practices, including clear documentation of the indication for antibiotic use, planned duration, and review or stop date. Improved documentation facilitates clinical review, supports continuity of care, and aligns with antimicrobial stewardship standards. Proper documentation should be mandatory.
- Regular teaching sessions, particularly for junior doctors, should be implemented to improve awareness of antimicrobial stewardship principles.
- Ongoing audit cycles with feedback to prescribers should be maintained. Audit and feedback mechanisms are effective tools in improving antimicrobial prescribing practices and promoting sustained behavioural change.
- Developing local stewardship interventions might prove beneficial, such as introducing antibiotic prescribing checklists, embedding electronic prompts within prescribing systems and strengthening pharmacist involvement in antimicrobial review.

CONCLUSION

This audit identified several important challenges in antibiotic prescribing within a general internal medicine ward, including a high reliance on empirical therapy (predominantly on amoxiclav at 77%), frequent repeat prescribing in 68-70% of patients, and inconsistent microbiological testing with blood cultures omitted in up to 18% of cases. These findings align with existing literature demonstrating variability in prescribing practices and suboptimal adherence to antimicrobial stewardship principles. The high repeat antibiotic rate suggests potential gaps in early clinical reassessment, while incomplete microbiological investigation limits opportunities for targeted therapies. Addressing these issues requires a multifaceted approach: strengthening the 48–72-hour antibiotic review process, improving microbiological investigation practices, enhancing documentation, and reinforcing antimicrobial stewardship education for junior doctors. Implementation of structured interventions, including antibiotic "time-outs" and regular audit cycles, is essential to support safe and effective prescribing. Strengthening antimicrobial stewardship practices will improve patient outcomes and contribute to the global effort to combat antimicrobial resistance.

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