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Assessment of antibiotic prescribing patterns in practising doctors: Clinical study

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Abstract:
Inappropriate and empirical antibiotic prescription by practising physicians remains a major contributor to the growing global burden of antimicrobial resistance (AMR). Therefore, it is of interest to assess the antibiotic prescribing patterns among practising doctors and identify common trends in drug selection, indications and adherence to prescribing guidelines. A cross-sectional clinical evaluation of prescriptions issued by practising physicians was conducted and analysed using descriptive statistical methods. The results showed that broad-spectrum antibiotics and empirical therapy were frequently prescribed, often for conditions where antibiotics were not clinically indicated. Thus, data shows the need for stronger antimicrobial stewardship strategies and continuing medical education to optimize rational antibiotic prescription practices.

Keywords: Antibiotic prescribing; antimicrobial resistance (AMR); prescribing pattern; antimicrobial stewardship; rational drug use

Background:
Designed for patients with medical histories, antibiotics specialized treatment of infectious diseases which are still one of the most important discoveries in modern medical therapy through the preventive use of food. Nevertheless, overuse and misuse of antibiotics have resulted in rapid emergence of antimicrobial resistance (AMR), which is now recognized as one of the major threats to global public health. Antimicrobial resistance is recognized as one of the greatest global challenges that compromise the ability to prevent and treat infections caused by bacteria, viruses, fungi and parasites **[1]**. The irrational use of antibiotics is one of the key contributors to this problem. Research has shown that a high percentage of antibiotic prescriptions are either unnecessary or inappropriate in the dose, duration, or indication. Global studies, for instance, have shown that inappropriate antibiotic prescribing can be as high as 38–62% particularly in outpatient and primary care settings **[2, 3]**. These expose resistant microorganisms to the selective pressure of antibiotics, increasing the rate at which resistance develops and diminishing the effectiveness of currently available agents. In clinical situations however, many antibiotics are started empirically before any microbiological confirmation. Although empirical therapy is crucial in some acute clinical settings, an overemphasis on empirical prescribing leads to unwarranted exposure to antibiotics and antimicrobial resistance. Data have indicated that three of the most common indications for antibiotic prescribing include respiratory tract infections (RTIs), urinary tract infections (UTIs) and gastrointestinal infections, with many of these diseases having a viral etiology and not requiring antibiotic therapy **[4]**. Recent research has also documented that broad-spectrum antibiotics such as cephalosporins, fluoroquinolones and macrolides are frequently administered by the physicians. This is particularly worrying, as wide-spectrum agents disturb the normal microbiota and facilitate the isolation of multidrug-resistant organisms **[5]**. In addition, these prescribing patterns can be shaped by a multitude of factors: the experience of the physician, expectations from the patient, availability of diagnostic facilities and promotion by pharmaceutical companies. These approaches faced challenges and global AMRs have led to the adaptation of antimicrobial stewardship programs. The focus is on promoting the rational use of antibiotics using guideline-based antimicrobial prescribing, prescription auditing and clinician education. Stewardship interventions have been shown to effectively reduce inappropriate antibiotic use and clinically relevant outcomes **[6–10]**. Therefore, it is of interest to determine whether antibiotics were being prescribed appropriately by doctors in their routine clinical practice.

Materials and Methods:
A clinical study was performed to examine the prescriptions of antibiotic drugs by practising physicians. The research methodology was cross-sectional observational and they performed the study in outpatient and inpatient clinical settings

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over a period of six months. The study included practicing physicians from various specialties, including general medicine, surgery and primary care. During the study period, a convenience sample of 120 prescriptions was included. Comprehensive data on antibiotics prescribed by involved doctors were obtained to determine the type of antibiotic(s) prescribed, indications for use, number of antibiotics per prescription and compliance with recommended prescribing guidelines. The analysis included prescriptions with at least one type of antibiotic and excluded incomplete or illegible prescriptions. Data were collected using a standardised data collection form developed for the study. The following patient demographics, clinical diagnosis, antibiotic used, dosage form, route of administration and duration of therapy was recorded in the form. Antibiotics were classified by pharmacological class as penicillin, cephalosporins, macrolides, fluoroquinolones and others. The tendency and fact to prescribe antibiotics inappropriately were measured with respect of antibiotic prescriptions rationality that is clinician used evidence based guidelines or guidelines of antimicrobial stewardship principles. Indication, dosing and duration of therapy for prescriptions were assessed. Examples of inappropriate use, such as prescribing antibiotics for viral infections, were reported. The collected data were analyzed statistically using SPSS software. Data were summarized using descriptive statistics (frequencies, percentages and mean values when appropriate). Categorical variables were reported as proportions and continuous variables are given as mean ± standard deviation. Data collection was done after approval of the study by the institutional ethics committee. The confidentiality of all patient and physician information was maintained during all stages of the study.

Results:

This study involved analysis of 120 antibiotic containing prescriptions issued by practising doctors. Results showed that there was a significant variation in antibiotic prescription patterns, with respect to the class of antibiotics, indications for therapy and number of antibiotics per prescription. The demographic profile of patients whose prescriptions were eligible for inclusion in the study is shown in **Table 1**. Most of the patients belong to age group 21–40 years, which is well known group coming for medical care. This study population was predominantly male, accounting for slightly more than half of the patients. Study results indicate that bacterial infections treated with antibiotics are similarly prevalent among younger and middle-aged adults as would be expected by outpatient clinical practice. The distribution of antibiotics prescribed according to pharmacological class is shown in **Table 2.** The most commonly prescribed antibiotics were cephalosporins, followed by penicillin and fluoroquinolones. Fewer prescriptions of macrolides and other classes of antibiotics over time. Much higher proportions of cephalosporins used show a general tendency to prefer using big guns when prescribing by active practitioners. This class of prescribing patterns can lead to the emergence of antimicrobial resistance when these drugs are used outside their clinical indications. Clinical indications for which antibiotics were prescribed are outlined in **Table 3.** The most frequent indication was for respiratory tract infections, followed by urinary and gastrointestinal infections. Of a less proportion, also antibiotics were listed for skin and soft tissue infections. The prevalence of respiratory infections reflects the typical outpatient presentations, but certainly many respiratory illnesses are viral in nature and may lend themselves to more opportunities for unnecessary antibiotic over-prescription. This is shown in **Table 4** where the number of antibiotics per prescription being prescribed. Most prescriptions had a single antibiotic, suggesting relatively rational use in many cases. However, some of our prescriptions had combination antibiotic therapy where two or more antibiotics were prescribed at the same time. When combination therapy is not clinically justified, such practices may increase treatment costs and cause antimicrobial resistance.

Table 1: Demographic distribution of patients (n = 120)

Variable	Frequency	Percentage (%)
Age Group		
<20 years	18	15.0
21–40 years	52	43.3
41–60 years	34	28.3
>60 years	16	13.4
Gender		
Male	66	55.0
Female	54	45.0

Table 2: Distribution of antibiotics by drug class

Antibiotic Class	Frequency	Percentage (%)
Penicillin	32	26.7
Cephalosporins	46	38.3
Fluoroquinolones	20	16.7
Macrolides	14	11.7
Others	8	6.6

Table 3: Indications for antibiotic prescription

Indication	Frequency	Percentage (%)
Respiratory tract infections	44	36.7
Urinary tract infections	28	23.3
Gastrointestinal infections	22	18.3
Skin infections	16	13.3
Others	10	8.4

Table 4: Number of antibiotics per prescription

Number of Antibiotics	Frequency	Percentage (%)
One antibiotic	74	61.7
Two antibiotics	34	28.3
Three or more	12	10.0

Discussion:

This study evaluated prescription patterns of antibiotics among serving physician and privileged the key trends of antibiotic usage. Results revealed that broad-spectrum antibiotics were often prescribed, respiratory tract infections represented the most common indication for antibiotic treatment and empirical prescribing was still prevalent in clinical practice. These findings are aligned with global concerns over indiscriminate usage of antibiotics and their potential contribution to antimicrobial resistance (AMR) development. These findings are consistent with those reported by Trikha *et al.*, who observed that broad-spectrum antibiotics were frequently prescribed by physicians, with considerable variation in prescribing practices and gaps in antimicrobial stewardship. Their study also highlighted that improving physician education, adherence to evidence-based prescribing guidelines and strengthening antimicrobial stewardship programmes are essential to promote rational antibiotic use and mitigate the growing burden of antimicrobial resistance (AMR) **[8]**. Antimicrobial resistance (AMR) has been identified as one of the greatest public health threats of the 21st century, with inappropriate prescribing and over-use of antibiotics in healthcare settings being major drivers **[11]**. In this study, the most common class of prescribed antibiotics were cephalosporins. This finding has been noted in several studies examining prescribing patterns within outpatient care and hospital settings. Browne *et al.* of global antibiotic use trends revealing a significant increase in broad-spectrum antibiotics administration like cephalosporins and fluoroquinolones in many areas of the world **[12]**. The authors noted that increased broad-spectrum agents usage contributes substantially to the expansion of multidrug-resistant organisms (MDROs). This necessitates rational antibiotic selection in accordance with available microbiological data and clinical guidelines in order to limit resistance development. In the present study, there is another considerable observation that respiratory tract infections were the most frequent clinical indication for prescribing antibiotics. This pattern has been repeatedly documented in studies of antibiotics for outpatients. A study by King *et al.* estimates that respiratory infections accounted for the highest percentage of antibiotic prescriptions written during outpatient visits in the US, despite a high percentage of these being viral illnesses and not requiring antimicrobial therapy **[13]**. The use of antibiotics inappropriately for viral respiratory illnesses is one of the largest targets for antimicrobial stewardship interventions. In a clinical setting, empirical antibiotic therapy is performed more frequently than microbiological diagnostic facilities such as culture and sensitivity tests. But excessive reliance on empirical treatment may cause an incorrect choice of antibiotic. Mittal *et al.* stated that antimicrobial stewardship programs should support the use of culture-guided therapy as well as provide incentives to clinicians to review and adjust empirical antibiotic regimens after microbiological results are available **[14]**. Stewardship strategies, including prescription auditing, feedback and clinical guidelines implementation have positively impacted prescribing. Demographic results of the current investigation showed that most of antibiotic prescriptions were written for young and mid aged adults. This trend confirms that this generation tends to get infections more frequently and visits the health care system more times. Observational studies of antibiotic prescribing patterns in clinical practice have reported similar demographic trends **[15]**. Using demographic trends to target the right patient populations where stewardship interventions would work best is important. Physician behavior physician habits and clinical decision making are drivers of antibiotic prescribing. Some physicians will prescribe antibiotics even when there is not a strict indication for them due to diagnostic uncertainty, perceived patient expectations or time constraints. Sekandarzad *et al.* performed a systematic review noted that both behavioural and institutional determinants drive prescribing decisions for antibiotics and suggested performance-based interventions such as educational initiatives, adherence to guidelines plus decision support tools, *etc.* **[16]**. Recently, technological innovations have broken ground as valuable tools to enhance antibiotic prescribing and stewardship efforts. Clinical decision support systems embedded in electronic health records have been demonstrated to help physicians choose appropriate antibiotic regimens tailored to patient characteristics and local resistance patterns. Research assessing these digital stewardship strategies has shown changes in guideline adherence and decreased inappropriate antibiotic prescribing **[17]**. Antimicrobial stewardship programmes have been widely recognised as a key strategy to promote appropriate antibiotic use. Almeleebia *et al.* did the first of these systematic reviews and identified that stewardship interventions led to a significant reduction in inappropriate antibiotic prescribing with no effects on mortality and improvements in patient outcomes **[18]**. These findings highlight the need for implementing structured stewardship programs at healthcare organizations. In addition, worldwide studies evaluating trends in antimicrobial resistance provide strong evidence for the requirement of collaborative actions to decrease appropriate antibiotic use. Hadano *et al.* At a global scale, antimicrobial resistance reports show that it causes a significant burden of morbidity and mortality, with inappropriate antibiotic prescribing noted as one of the major contributing factors **[19]**. Alleviating this problem is a collective responsibility that demands the collaboration of healthcare providers, policymakers and public health authorities **[20]**. In conclusion, the study results are in agreement with the existing global evidence of antibiotic prescribing practices. These findings indicate excessive usage of broad-spectrum antibiotics and prescriptions based on empirical evidence, highlighting the need for improvement in strategies regarding antimicrobial stewardship. Improving antibiotics through better physician education, guideline-concordant prescribing and reliance on digital decision support tools may effectively reduce antibiotic use and combat the rising problem of antimicrobial resistance.

Conclusion:

We show that broad-spectrum antibiotics and empirical therapy are more frequent prescriptions given by practicing physicians. Respiratory tract infection was the most common reason for antibiotic use, likely an indication of overprescribing. Strengthening antimicrobial stewardship programs and promoting guideline-based prescribing practice are crucial to promote rational antibiotics use and control the burden of AMR.

Advancement to knowledge:

This study provides updated clinical insight into current prescribing behaviours among practising physicians and identifies key areas requiring intervention for improved antibiotic stewardship.

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