PRESCRIBING TRENDS OF AMOXICILLIN, CEFTRIAXONE, AND MOXIFLOXACIN ACROSS DIFFERENT DISTRICTS OF KARACHI, PAKISTAN

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ABSTRACT

Antibiotic resistance is a major public health concern worldwide due to misuse and overuse of antibiotics. This study aimed to evaluate the dispensing trends of three frequently prescribed antibiotics including Amoxicillin, Ceftriaxone, and Moxifloxacin in various districts of Karachi. A cross-sectional study was conducted using a questionnaire distributed in pharmacies across different districts of Karachi, Pakistan. Data was analyzed to determine the dispensing trend of these three antibiotics. The results indicated that Amoxicillin was the most commonly prescribed antibiotic, followed by Ceftriaxone and then Moxifloxacin. District-wise analysis showed that Amoxicillin was the most commonly prescribed antibiotic in the south district. The frequent prescribing of these antibiotics has contributed to the antibiotic resistance. This study highlights the need for interventions to ensure rational prescribing practices so that antibiotic resistance can be prevented.

INTRODUCTION

Dispensing drugs is a vital service provided by clinical pharmacists, which offers convenient access to prescription medications and over-the-counter drugs for a large number of patients (1). Dispensing medication involves evaluating prescriptions to ensure they are technically and legally sound, determining an individual's health needs, and providing pharmaceutical interventions such as counseling and documentation during the use of medicines (2). Pharmacies not only dispense drugs but also serve as information exchange centers where patients receive counseling and advice for their common health-related issues (3). In this process, pharmacists play a critical role in ensuring the safe and correct dispensing of drugs to patients (4).

Irrational drug use is one of the major causes of health-related problems (5). The World Health Organization (WHO) has reported that more than 50% of medicines are prescribed, dispensed, or sold incorrectly, and about half of the patients fail to use medicines appropriately, leading to overdose or underdose and serious health hazards (6). Among the many hazards associated with irrational drug use, antimicrobial resistance is the most significant threat to the general population (6). Antibiotics are a class of drugs used to treat bacterial infections, and their overuse has led to the development of antibiotic resistance, making it difficult to treat a large number of infections (7).

The misuse and overuse of antibiotics is a growing problem worldwide, leading to increased antibiotic resistance. Self-medication with antibiotics has become a common practice in both developed and developing countries (8, 9), highlighting the need for health care workers to promote safe and rational use of drugs, particularly antibiotics (10). Health care workers can play a crucial role in this effort by educating patients about the proper use of antibiotics, encouraging adherence to treatment regimens, and discouraging self-medication with antibiotics. By promoting rational prescribing practices and responsible use of antibiotics, pharmacists can help combat antibiotic resistance and improve public health outcomes. It is essential for healthcare professionals to work together to promote effective antibiotic stewardship and prevent the emergence of antibiotic-resistant infections. Antibiotic resistance has been reported from all over the world. A report published in 2019 showed that 4.95 million people died due to antibacterial drug resistance. There is limited data available from Pakistan, thus this study was conducted to evaluate the dispensing trend of three antibiotics namely Amoxicillin, Ceftriaxone, and Moxifloxacin, at different pharmacies located in Karachi.

METHODS

This cross-sectional study was conducted over a period of six months, from January to June 2021, in various pharmacies located in Karachi, Pakistan.

Sampling and eligibility criteria:

Cluster sampling method was used where Karachi was selected as a cluster (representative of Pakistani population). Then Pharmacies were randomly selected, that met the eligibility criteria, including those located within hospital premises or in the community setting. Pharmacies from each district of Karachi (i.e. East, South, West, Malir, and Central) were included in the study. A minimum sample of 100 pharmacies was calculated using an online sample size calculator.

Research Instrument:

Ramay, Lambour (12) and Yu, Zhao (13) were referenced to develop the questionnaire for this study. The questionnaire was disseminated to various pharmacies in the area, where the pharmacy staff completed it and provided general information and data on the dispensing patterns of Amoxicillin, Ceftriaxone, and Moxifloxacin. An online version of the questionnaire was also prepared and sent via email to participating pharmacies, after informing the pharmacy administration of the study and receiving their consent. Participants were free to withdraw from the study at any point, and the confidentiality of their data and identity was ensured.

Statistical analysis

Data was analyzed using Statistical Package for Social Sciences (SPSS version 22.0). The responses were recorded and presented in the scores. Frequency distribution was presented in graphs.

RESULTS

A total of 108 pharmacies participated in the survey, distributed across different districts of Karachi. The majority of the pharmacies were located in the Central district (37.0%), while the smallest percentage of pharmacies (11.1%) were situated in the Malir district. The detailed distribution of pharmacies in each district is shown in Figure 1. The average number of prescriptions for Amoxicillin was the highest (n = 917), followed by Ceftriaxone (n = 712) and Moxifloxacin (n = 334). The mean duration of the establishment of the pharmacies was 7.7 years, ranging from 3 to 27 years. The pharmacies received an average of 2961 antibiotic prescriptions per month. Table 1 provides information about the average number of patients who visited the pharmacy each month and the patients with a prescription of three antibiotics, namely Amoxicillin, Ceftriaxone, and Moxifloxacin. To evaluate

the prescription patterns of the three antibiotics across different districts, a radar chart was constructed (Figure 2). It was observed that the mean prescriptions for Amoxicillin were the highest in every district, followed by Ceftriaxone and Moxifloxacin. Among the six districts, the mean prescriptions for Amoxicillin were highest for the South district (n = 1500), followed by East district (n = 1200) and Central district (n = 1000). The same trend was observed for Ceftriaxone and Moxifloxacin.

The trend of combined prescriptions of the three antibiotics in different districts of Karachi is presented in Figure 3. It was noted that the highest combined prescriptions were received in the Central district.
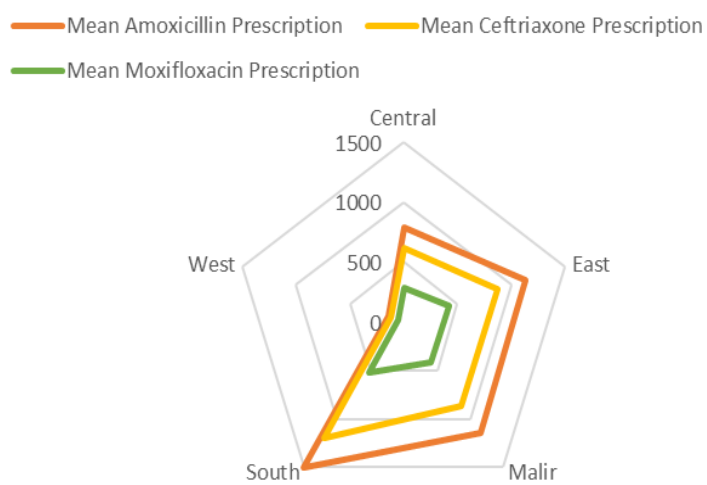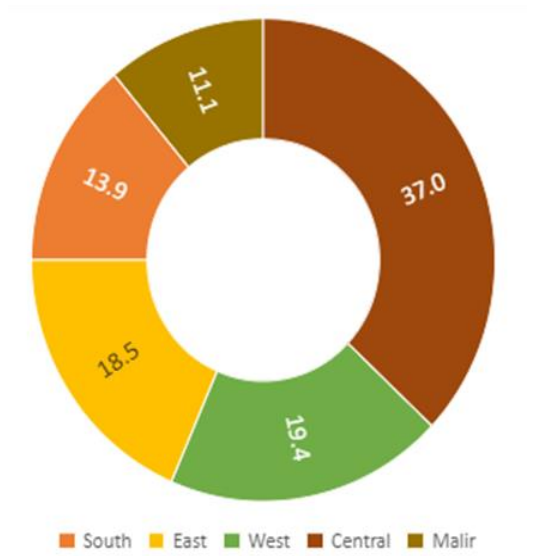

Figure 1: Allocation of pharmacies in districts

Figure 2: Prescriptions of Amoxicillin, Ceftriaxone, and Moxifloxacin according to districts

Table 1: Details of pharmacies

Question	Mean	Range
Duration of the establishment of the pharmacy (years)	7.7	3.0-7.0
Prescriptions of antibiotics each month	2961	300-10500
Patients with a prescription for Amoxicillin each month	917	90-3300
Patients with a prescription for Ceftriaxone each month	712	70-2500
Patients with a prescription for Moxifloxacin each month	334	25-1200

The sum of prescriptions of three antibiotics under study, i.e. Amoxicillin, Ceftriaxone and Moxifloxacin, is represented in Figure 4. The average number of prescriptions for Amoxicillin, Ceftriaxone and Moxifloxacin received per month in each district is indicated in Figure 5, Figure 6 and Figure 7 respectively. The highest average number of prescriptions received for Amoxicillin (1500 prescriptions per month), Ceftriaxone (1200 prescriptions per month) and Moxifloxacin (525 prescriptions per month) are in South District.
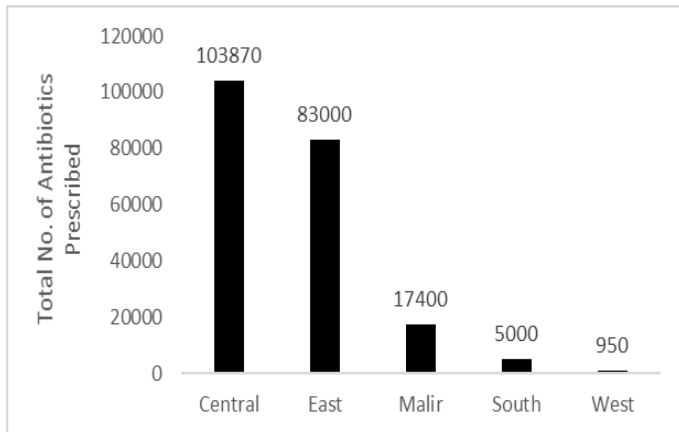
Figure 3: Trend of combined prescriptions of Amoxicillin, Ceftriaxone and Moxifloxacin in different districts of Karachi
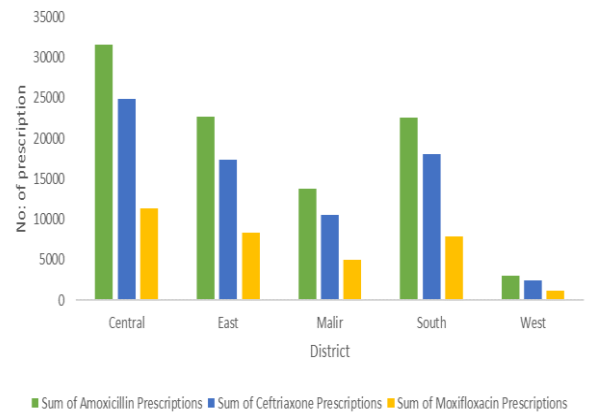

Figure 4: Trend of combined prescriptions of Amoxicillin, Ceftriaxone and Moxifloxacin
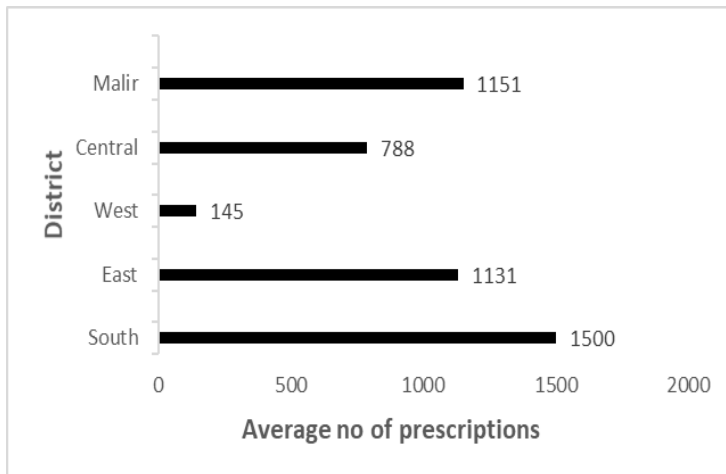

Figure 5: Average monthly prescriptions of amoxicillin in a single pharmacy of different districts of Karachi
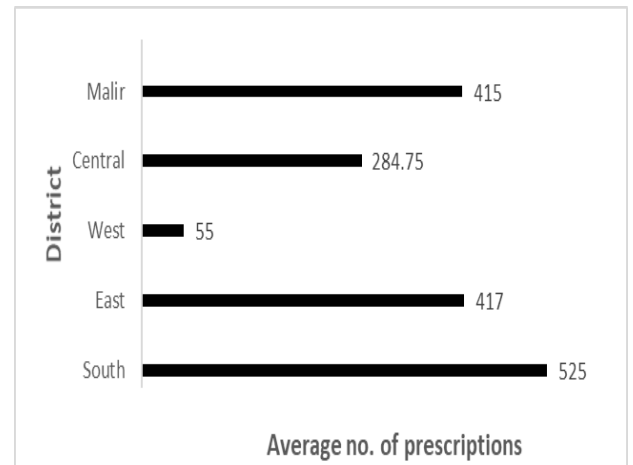

Figure 6: Average monthly prescriptions of Ceftriaxone in a single pharmacy of different districts of Karachi
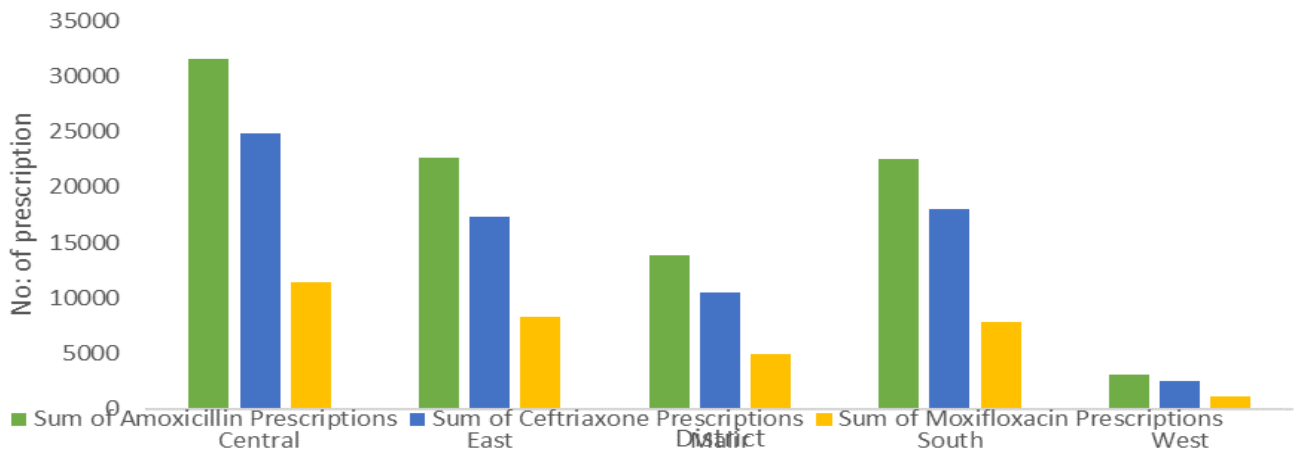

Figure 7: Average monthly prescriptions of Moxifloxacin in a single pharmacy of different districts of Karachi

DISCUSSION

Antibiotics are prescribed for infections, but their widespread use can promote the development of antibiotic resistance. Therefore, the rational use of antibiotics is crucial, which means prescribing the appropriate drug at the appropriate dose for the appropriate time period as and when needed (14). Literature from various research studies indicates that irrational and excessive use of antibiotics can result in several problems for the patient and society, including extra cost, frequent exposure to drug side effects, and the development of bacterial resistance against antibiotics (15). The rise in the population of resistant bacterial strains reduces the effectiveness of antibiotics, leading to increased morbidity and premature mortality (16). The current study focused on the consumption patterns of three commonly used antibiotics for respiratory tract infections, i.e., Amoxicillin, Ceftriaxone, and Moxifloxacin. The study was conducted in different community pharmacies located in all six districts of Karachi. The results of the study showed that the maximum number of prescriptions in all districts was for Amoxicillin, while the least number of prescriptions in all districts was for Moxifloxacin. Like other developing nations, Pakistan also has excessive and unnecessary use of antibiotics. One study conducted in Pakistan revealed that 13.45% of the total prescribed medicines consisted of antimicrobial drugs, while there were 45.19% of prescriptions that had at least one antibiotic prescribed to the patient (17). Results of different researchers suggest that antibiotics are the most widely used class of drugs to treat diseases, and their frequent use is responsible for the development of antibiotic resistance among the population (18, 19). The current study also showed large mean values for the prescriptions of antibiotics, particularly Amoxicillin, Ceftriaxone, and Moxifloxacin, in a month. These antibiotics belong to the class of Penicillin, Cephalosporins, and Fluoroquinolones, respectively. The study found that Penicillin was the highest-selling antibiotic followed by Cephalosporins and then Fluoroquinolones. This is contradictory to the results of the cross-sectional survey conducted in Bangalore, India which declared Cephalosporins as the highly prescribed antibiotic followed by Quinolones, anti-fungal, aminoglycosides, and then Penicillin (20). A similar style of ranking was observed in a study conducted in Bangladesh (21). This is probably the choice of the prescribing healthcare professionals. The study distributed questionnaires to pharmacies in different districts of Karachi, including South, East, West, Central, and Malir, to gather information on the number of prescriptions received for three antibiotics: Amoxicillin, Ceftriaxone, and Moxifloxacin. While, the Central district receives the most antibiotics prescriptions in general, the South district is leading in the sale of the three antibiotics under study. This might have influence of the catchment area and the choice of the doctor prescribing antibiotics. The effectiveness of antibiotics in curing infections can vary for various reasons. In a study, an equal percentage of people reported both success and failure in the use of antibiotics for treating their infections. Failure of the antibiotic treatment may occur due to several factors, including misdiagnosis or self-medication without proper diagnosis. If a patient has self-diagnosed their condition based on symptoms alone, without undergoing any confirmation test by a medical professional, then the prescribed antibiotic therapy may not be effective. It is important to consult with a healthcare provider and follow their advice regarding the use of antibiotics to ensure proper diagnosis and treatment (22).

It is essential to note that the use of antibiotics does not always produce a cure due to various reasons. For example, the disease may not disappear due to no infection, self-medication by the patient, or misdiagnosis by the doctor. Therefore, it is crucial to perform confirmation tests to diagnose the infection accurately and prescribe appropriate antibiotic therapy. In this regard culture sensitivity

is an essential test to be performed before prescribing any antibiotic. This test is also readily available in laboratories.

CONCLUSION

Antibiotic resistance has drastically increased due to the irrational use of antibiotics. The number of infections that were not considered critical and were easily treated with the use of antibiotics is becoming difficult to treat and ultimately resulting in increased cost of treatment. Strict actions needed to be taken by the health department to control the development of antibiotic resistance.

Conflict of interest:

Authors declare no conflict of interest

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Ethical Approval:

This study was approved by the Board of Advanced Studies and Research of the University of Karachi (ASRB/No. /02603/ Pharm.).

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