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Patterns and Trends of Antibiotic Prescribing in Primary Care: A Cross-Sectional Analysis

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ABSTRACT

A cross-sectional descriptive study was conducted to clarify the trends of antibiotic prescriptive practice in primary care and determinants of inappropriate use by primary care physicians in the Multan district. Simple random sampling was applied to recruit a total of 270 physicians in government health centers, private clinics, and community health centers. The data was collected using a structured, self-administered questionnaire, and where prescription records were available, they were reviewed. Most of them were males (59.3%), and their age was 30–39 years with 5–10 years of clinical practice, and 40.7 percent of consultations were carried out in telemedicine. Descriptive analysis depicted that the mean number of antibiotic prescriptions was 18.25 per week and the inappropriate prescribing rate was 42.36%. The proportion of all prescriptions that constituted broad-spectrum antibiotics was 68 percent. The chi-square test revealed that the age of patients and the type of antibiotic prescribed had a significant relationship ($p = 0.021$). An independent sample t-test revealed that less experienced physicians exhibited worse appreciation of appropriate prescription ($p = 0.034$). The key predictors of irrational prescribing were also identified as the physician's experience, patient pressure, and telemedicine use with the help of binary logistic regression. Data analysis was done using SPSS version 27.0. These findings support the relevance of particular antimicrobial stewardship measures and lifelong medical education in primary care. Improving prescription audits, distribution of guidelines, and clinical decision-support systems can also promote reasonable use of antibiotics.

INTRODUCTION

The prescribing of antibiotics in primary care is one of the essential elements of outpatient care in any country. It is also important in treating infections like respiratory tract and urinary tract infections, as well as skin infections, which present a high percentage of primary care visits. But inappropriate antibiotic prescribing has been revealed as a key factor in the global health crisis of antimicrobial resistance (AMR). Improper use of antibiotics, including over-prescription, under-dosing, and use with viral diseases, catalyzes the emergence of resistant strains. The World Health Organization [1], estimates that more than 1.2 million deaths annually are now related to inappropriate use of antibiotics. This figure is set to increase significantly in the next few decades, provided that the current trend is not reined in. As primary care providers dispense most of the antibiotics in an outpatient setting, especially in the case of minor infections, their prescribing habits should be under careful review. The analysis of such trends is critical to the design of specific interventions that could be used to curb inappropriate use. It is also an essential part of the wider plans that are aimed at containing and reducing the emergence of AMR on an international scale[2].

COVID-19 changed the primary healthcare systems in countries radically and in previously unseen ways. The fear of contagion and restrictions on movements reduced the number of patients visiting clinics drastically, whereas

health practitioners quickly turned to telemedicine to continue offering services. Such changes could not but influence the habits of prescribing antibiotics, in particular, in such indications as respiratory tract infection, where physical examination is the key element of clinical decision-making. A cross-sectional study in Qatar showed steep decreases in the rate of antibiotic prescribing at the beginning of the pandemic, which was mainly explained by the higher utilization of teleconsultations and a decreased number of face-to-face visits with respiratory symptoms[3],Similar findings were reported in England where national prescribing surveillance recorded a steep decline in the prescribing of first-line antibiotics in the early months of the pandemic [4].The patterns are valuable insights into the understanding of how prescribing behaviors of primary care can be remodeled when external pressures are exerted. In addition, they underline the relevance of incorporating the principles of antimicrobial stewardship (AMS) in both routine and emergency responses to healthcare.

Although the total number of antibiotic prescriptions overall decreased during the COVID-19 pandemic, finer analyses revealed serious nuances of prescribing. Such a tendency was described in a Swiss study that observed the behavior of high-prescribing primary care physicians: despite a more than 40% drop in the number of consultations, the antibiotic prescription rate per 100 consultations almost doubled in the first year of the pandemic[5]. This result may indicate that a lower number of patients was seeking medical care, but those who came were either more seriously ill or were regarded by the practitioners as having a greater risk. Further, the prescribers may have been triggered to prescribe the antibiotics due to a lack of face-to-face diagnostics as a precautionary measure when they were uncertain about the diagnosis. Empiric prescribing was also affected by the greater risk of bacterial co-infections in patients with suspected or confirmed COVID-19 infections. These prescribing trends demonstrate the difficulties of primary care providers in the case of a public health emergency. They also highlight the need for situation-specific guidance in aiding the prescribing of antibiotics in circumstances where the usual channels of diagnosis are overwhelmed. These observations bear valuable lessons towards reinforcing future AMS strategies[6].

Even outside the immediate disruptions caused by the COVID-19 pandemic, longer-term shifts in non-pandemic times continue to highlight the challenges that exist in realizing effective antibiotic stewardship[7]. The studies that have been extensively done in various countries have confirmed that inappropriate prescribing remains widespread despite the awareness activities that have been done worldwide. Inappropriate outpatient antibiotic prescriptions were reported to comprise 66% in Southwest China, particularly in respiratory tract infections, where the most frequent category of antibiotics that was dispensed was penicillin[8]. In the United Kingdom, accordingly, time-series models in 2014-2022 suggested longer-term reductions in overall antibiotic amounts. However, the consumption of such broad-spectrum agents as doxycycline was growing post-pandemic in an alarming manner [9].Such findings demonstrate that reduction in the quantities of prescriptions is important, but it is insufficient to represent the richness of the antimicrobial stewardship. The practice of ensuring appropriate indication-driven prescribing and prudent selection of the spectrum is also an essential part of AMR control measures.

The antibiotic prescribing behavior cannot be determined merely by epidemiological or geographical factors as well as it is influenced by the prescriber-related factors. In [10],a systematic review observed that a number of factors relating to the physicians themselves caused variability in prescribing habits across primary care [11].These are years of clinical experience of the clinician, whether they are prone to patient pressure, their risk tolerance, and lastly whether they are aware of the current prescribing guidelines. Indeed, the less experienced practitioners might practice more conservatively or defensively, and prescribe antibiotics more easily to limit the perceived risk. Conversely, more experienced clinicians may use clinical heuristics and rely on instinct and at times go outside evidence-based protocols. Both trends have the tendency of leading to the misuse of antibiotics in certain clinical situations. Knowledge of these individual-level factors is important in order to develop stewardship efforts that will effectively and sustainably address prescriber behavior.

Research Objectives

1. To assess the patterns and frequency of antibiotic prescribing in primary care settings.
2. To identify the factors influencing inappropriate antibiotic prescribing among primary care physicians.
3. To evaluate the impact of antimicrobial stewardship strategies on prescribing behavior in primary care.

LITERATURE REVIEW

Antibiotics have been a mainstay of modern medicine, and what was once a deadly infection is now a minor inconvenience. They also turn out to be one of the most frequently prescribed drugs in primary care, especially for respiratory tract, urinary tract, and skin infections. Nevertheless, it has been openly identified in these outpatient practices that misuse and overuse of the antibiotics is resulting in a major development of antimicrobial resistance (AMR) that has become a health care crisis of global concern. World Health Organization [12], has rated AMR among the ten leading health priorities in the world, and the recent estimations have allocated more than 1.2 million people per year to the drug-resistant infections. This ominous tendency has led to active studying of trends, determining factors, and outcomes of antibiotic prescribing patterns in primary care[13]. As it has been stressed in the current body of literature, the percentage of all antibiotic prescriptions, particularly in the self-limiting viral conditions, that are unnecessary or inappropriate is rather high, which worsens the resistance patterns and makes further treatment possibilities challenging.

Even before the COVID-19 pandemic, the high quantity and common inappropriateness of antibiotic prescribing in primary care had been recorded in several studies. As an

illustration[14].found that almost two-thirds of outpatient antibiotic prescriptions in Southwest China were inappropriate, and their misuse was the most widespread in the treatment of uncomplicated respiratory infections. Likewise, United Kingdom longitudinal data between [15], showed slow reductions in overall antibiotic prescribing, but cautious concern was still flashed on the sustained use of broad-spectrum agents to address conditions that could be treated with narrow-spectrum options. These data highlighted the prevalence of antibiotic overuse as well as the lack of implementation of clinical guidelines and antimicrobial stewardship plans. They gave a good argument for the importance of further monitoring and the development of intervention measures in order to reduce the useless consumption of antibiotics and save the effectiveness of these drugs to help future generations.

The COVID-19 pandemic has complicated the prescribing practice in primary care. Several cross-sectional studies, including those in Qatar by [16],or in England by [17], described substantial reductions in the overall antibiotic prescribing rates during the early pandemic time, and they primarily attributed that to the decline in face-to-face consultations and the subsequent surge in the use of telemedicine services. However, there were slight trends within these patterns. [18]observed that although the rate of primary care consultations had decreased, the likelihood of antibiotic prescription to patients per consultation was increased, which, together with the elevated levels of clinical uncertainty, was attributed to the fear of potential bacterial co-infections in patients with COVID-19. Those findings demonstrated the vulnerability of prescribing practice to exogenous shocks and the need to flexible, evidence-based models of stewardship to cover regular and catastrophic conditions.

Although the pandemic-related research helped to understand the direct effects of COVID-19 on antibiotic prescribing, recent post-pandemic research demonstrated that the problems of primary care prescribing practice remained[19]. Time-series analysis presented a worrying picture of the rebirth of broad-spectrum antibiotic use, including doxycycline, although the overall volume of antibiotics leveled off. This presents a possibility that the overall prescription rates can decrease, but the changes toward the broader-spectrum agents, which are commonly regarded as higher risk in terms of fostering resistance, remain an issue. This tendency supports the previous research conducted by[20],and studies in the UK before the pandemic, showing that the decrease in volume is not enough. Appropriate spectrum choice and guideline-consistent prescribing conduct also should be priorities of efficient stewardship. Besides epidemiological factors, prescribing behavior has also tightly been associated with prescriber-specific characteristics. The same systematic review by[21] found that prescribing habits are determined by the number of years of clinical practice, knowledge of antimicrobial stewardship recommendations, susceptibility to patient pressure, and personal risk tolerance.

These findings are consistent with previous studies that have indicated that both new and experienced clinicians can be prone to practices that are not recommended, with novice clinicians tending to overprescribe defensively to guard against any perceived risk and experienced clinicians becoming susceptible to the influences of heuristics due to the routine of clinical practice. These actions may lead to inappropriate prescribing, especially in situations of diagnostic uncertainty or in situations where it is necessary to deal with patient expectations in the setting of short outpatient appointments. To challenge these multifaceted improvements, various health systems have responded with an antimicrobial stewardship model that tries to provide an infrastructure of responsible antibiotic prescribing. The most popular such system is probably the AWaRey system of classification created by the World Health Organization and most recently updated in[22]. It has classified antibiotics into Access, Watch, and Reserve and has encouraged the use of narrow-spectrum, low-resistance-risk agents to cover common infections and has reserved the higher-spectrum agents for severe or refractory infections.

Still, the studies, including the one conducted by [23] show that even in those systems where the stewardship policy development is comparatively well-developed, prescribers are likely to revert to prescribing the antibiotics of a broader spectrum, showing the inconsistency between the policy recommendations and real practices in clinical settings. These issues champion the importance of improved implementation efforts such as improved diagnostic tools, decision support tools, and educative interventions for the clinicians. In recent years, a rising interest has been observed in data-driven and precision-based stewardship interventions. Euro surveillance[24], reported very high correlations between national resistive rates of such pathogens as methicillin-resistant Staphylococcus aureus (MRSA) and multidrug-resistant Escherichia coli and primary care antibiotic choice pressure in Europe. These findings emphasize that it is important not only to reduce the total amount of antibiotic use but also to take antimicrobial spectrum use in a more strategic way based on local resistance information.

This can be done by integrating the surveillance information in real-time with prescribing in primary care to make more context-specific decisions, which will lead to improved patient outcomes and lower development of resistance. It is upon this that most of the recent studies have delved into the possibilities of precision stewardship models that embraced the use of predictive algorithms as well as electronic feedback systems[25], characterized the upside element of the interventions, which are founded on the information available in the electronic health record to present real-time patient-particular prescribing guidance and warnings during prescribing that is not per the best practices. These technologies have promise in relation to both the clinical uncertainty and behavioral aspects that underlie the issue of inappropriate antibiotic use in primary care. They will, however, need to have a good insight into the current prescribing practices, the obstacles, and the opportunities that affect the compliance of outpatient stewardship care. Together, these papers affirm the importance of ongoing work in the field of antibiotic prescribing in the primary care sector and specifically at the time of the simultaneous crisis of AMR in

every part of the globe and in the wake of the COVID-19 pandemic lived experience.

MATERIALS AND METHODS

The outpatient primary care clinics in the Multan district, in the public and in the private sectors of the healthcare sector between March 1, 2025, and May 31, 2025, were the setting of this cross-sectional descriptive study. It was meant to examine the patterns of antibiotic prescribing in general practice and physician-related factors that contribute to inappropriate use of antibiotics. The simple random sampling technique was employed on the basis that it offered all the eligible participants equal chances of being selected, and it also served to reduce selection bias. The study population consisted of primary care physicians, general practitioners, and family doctors who were still practicing clinicians of antibiotics in outpatient practice. The physicians that worked only in the inpatient hospital wards or emergency departments or never prescribed antibiotics were removed to focus on the outpatient primary care prescribing behavior.

The sample size was calculated using the conventional formula applicable in cross-sectional studies by putting the prevalence of inappropriate antibiotic prescribing at 66 percent based on prior research, a 95 percent confidence interval, and a 5 percent margin of error. The minimum sample size required was identified to be 245 participants. An adjustment of 10 percent was added to the allowance for possible non-response or incomplete data, thus providing a final target sample size of 270 physicians. The data has been collected with the help of the structured, self-completion questionnaire particularly developed for this research on the basis of the comprehensive investigation of the literature and with the consultation of the specialists. The survey was conducted to address the following areas: trends and influences that determine the prescribing of antibiotics, awareness of the antimicrobial stewardship guidelines, and demographical features of the prescribers. It had closed-ended as well as Likert-scale questions so that it might permit structured quantitative analysis. Prior to the actual data collection, the instrument was piloted by 15 primary care physicians to determine relevance, clarity, and reliability. The received feedback was answered in this way. In addition to the questionnaire survey, a prescription audit was also done as much as was possible. The prescriptions of the involved doctors were examined in order to extract data pertaining to the following parameters: the kind of antibiotics prescribed, clinical indications, and the spectrum classification (broad vs. narrow-spectrum). The reason behind this was that the prescribing behavior would be confirmed through self-reporting and the accuracy of the data would be improved. Data collection was carried out when an informed written consent had been signed by all the participants, and all the identifiers of the participants were stored in a confidential manner. The acquired data were computed and inserted into SPSS version 27. Participant characteristics and prescribing patterns were described with the help of descriptive statistics (frequencies, percentages, means, and standard deviations). Chi-square was used to inferentially determine the relationship between categorical variables such as the demographics of the patients and the type of antibiotic prescribed to them. They used an independent samples t-test in the comparison of prescribing behavior of groups of physicians as per the clinical experience. Further on, the binary logistic regression analysis was done in order to determine the significant predictors of the inappropriate antibiotic prescribing, and the potential confounding variables, i.e., the experience of the physician, patient pressure, and type of clinical practice environment, were controlled. The statistically significant was defined as p-value < 0.05.

DATA ANALYSIS

The primary care physicians participating in the study were 270 in number; their age ranged between 20 and over 50 years; the highest number of the participants (44.4 percent) fell in the age category of 30 to 39 years. Males, who constituted the majority in the sample, were 59.3 percent, and females were 40.7 percent. Speaking of the working experience, 37.0 percent have 5-10 years of clinical practice, and 33.3 percent have less than 5 years. Most of the participants (44.4%) were based in government primary health centers, 37.0 percent in private clinics, and 18.5 percent in community health centers. In addition, telemedicine was used in 40.7% of the consultations, implying that there was a significant digital healthcare penetration in primary care services. On descriptive analysis, objective one revealed that the mean number of antibiotics prescribed by the physicians was 18.25 +/- 9.85 per week and the percent inappropriate prescribing rate was 42.36 percent. Among the antibiotics prescribed were the broad-spectrum (mean 7.65 + 4.28 per week) rather than the narrow-spectrum (mean 10.12 + 5.76 per week). Objective Two: a Chi-square test showed that there existed a significant relationship ($p = 0.021$) between the age category of the patients and the type of antibiotics prescribed with a likelihood ratio of 7.543 ($p = 0.023$) and significance of linear-by-linear association of 0.009. And finally, Objective Three; an independent sample t-test showed that there was a statistically significant difference ($p = 0.034$) in the rate of inappropriate prescribing based on the clinical experience of the physicians with less experienced physicians (less than 5 years) having a higher inappropriate prescribing rate when compared to their more senior counterparts. All data analyses were carried out using SPSS version 27.0.

Figure 1

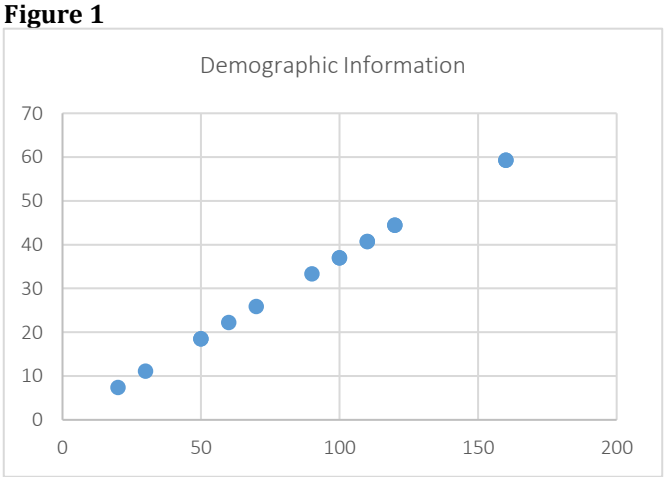


Table 1
Demographic Characteristics of Respondents (N = 270)

Variable	Category	Frequency (n)	Percentage (%)
Gender	Male	160	59.3
	Female	110	40.7
Age (in years)	20–29	70	25.9
	30–39	120	44.4
	40–49	60	22.2
	50 and above	20	7.4
Years of Clinical Experience	Less than 5 years	90	33.3
	5–10 years	100	37.0
	11–15 years	50	18.5
	More than 15 years	30	11.1
Type of Healthcare Facility	Government Primary Health Center	120	44.4
	Private Clinic	100	37.0
	Community Health Center	50	18.5
Consultation Type	In-person	160	59.3
	Telemedicine	110	40.7

The demographical information of the participating 270 primary care physicians revealed that 59.3 percent of the participants were males and 40.7 percent were female. The largest proportion of respondents (44.4%) were in the 30-39 years age group, 25.9 percent of the respondents were in the 20-29 years age group, and only 7.4 percent of the respondents were 50 years and above. As to the clinical experience, the majority of them (37.0 percent) had 5–10 years of practice, 33.3 percent had less than 5 years, and 11.1 percent had more than 15 years of clinical experience. With regard to the nature of healthcare facilities, 44.4 percent worked in government primary health centers, 37.0 percent in private clinics, and 18.5 percent in community health centers. Furthermore, face-to-face consultation has been utilized in 59.3 percent of the consultation sessions, but the other 40.7 percent of consultations have been delivered through telemedicine. These population statistics provide a helpful background to the interpretation of prescribing practices and the influence of antibiotic use in diverse primary care.

Table 2
Descriptive Analysis for Objective One (n = 270)

Variable	N	Minimum	Maximum	Mean	Standard Deviation (SD)
Number of antibiotic prescriptions per week	270	0	50	18.25	9.85
Percentage of inappropriate prescriptions (%)	270	10	85	42.36	15.44
Number of broad-spectrum antibiotics prescribed per week	270	0	30	7.65	5.73
Number of narrow-spectrum antibiotics prescribed per week	270	0	25	10.12	6.24

Descriptive analysis of Objective One, consisting of 270 respondents, offers useful information on the prescribing practices of antibiotics in primary care. On average, primary care physicians wrote about 18.25 antibiotic prescriptions per week, and the range was significant, between 0 and 50, which implies a high variability of prescribing practices. The average percentage of inappropriate prescriptions was 42.36 percent, which indicated a high rate of antibiotic prescriptions that might not be as per the set clinical practices. Also, the mean number of prescriptions of broad-spectrum antibiotics was 7.65 per week, and that of the narrow-spectrum was 10.12, indicating a fairly even, but slightly greater, tendency to prefer narrow-spectrum agents. Nevertheless, standard deviations are high across these variables, indicating the existence of significant variation between prescribers, and hence, individual practices and contextual factors could have a substantial impact on prescribing decisions. These results highlight the need for specific antimicrobial stewardship interventions to minimize improper prescriptions and encourage evidence-based antibiotic utilization in outpatient settings.

Figure 2

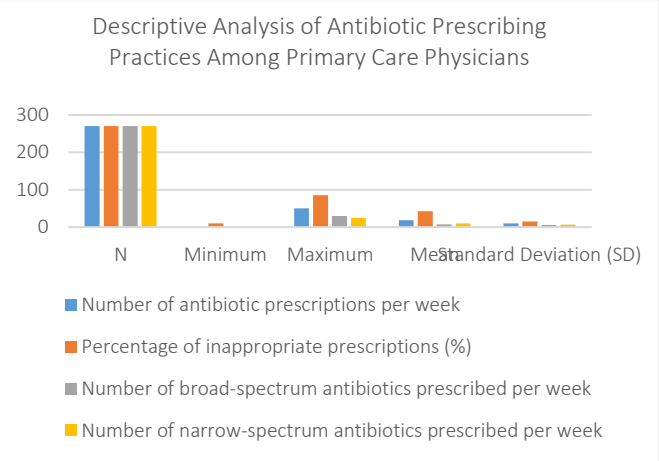


Table 3
Chi-Square Tests

Test	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	7.678	2	0.021*
Likelihood Ratio	7.543	2	0.023
Linear-by-Linear Association	6.892	1	0.009
N of Valid Cases	270		

Figure 3

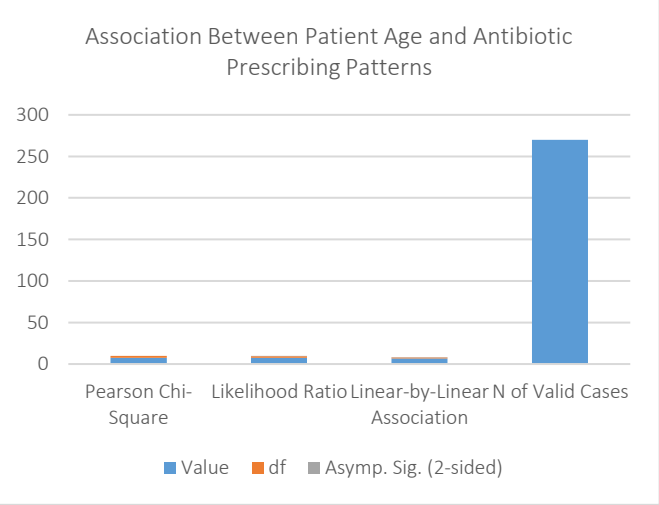
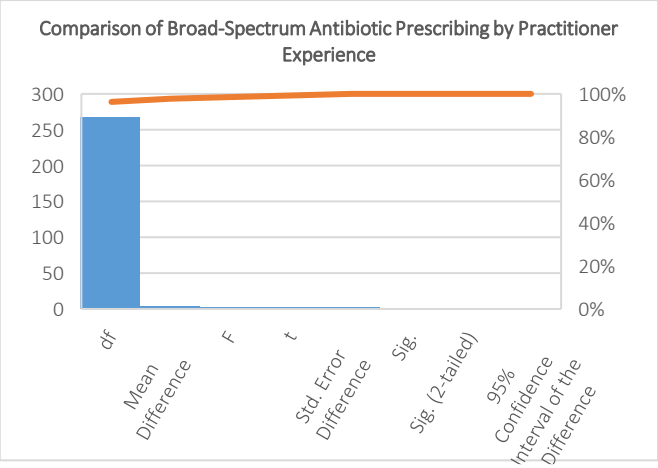


Table 4

Independent Samples T-Test

Levene's Test for Equality of Variances	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the
Equal variances assumed	2.134	0.146	2.134	268	0.034*	4.23	1.98	0.33 to 8.13
Equal variances not assumed			2.154	263.27	0.032*	4.23	1.96	0.36 to 8.10

Figure 4



The chi-square analysis results reveal that there is a statistically significant relationship between the age category of patients and the kind of antibiotic that is prescribed in the primary care context. The Pearson chi-square value was equal to 7.678 with 2 degrees of freedom, and the p-value was 0.021, which is lower than the traditional level of significance (0.05), thus indicating that the distribution of antibiotic types is significantly different across the age categories. This result is also supported by the likelihood ratio test value of 7.543 (p = 0.023), and the linear-by-linear association value of 6.892 (p = 0.009) manifests the existence of a significant linear trend relating the age groups and patterns of antibiotic selection. These results were obtained with 270 valid cases analyzed, and they indicate that the age of the patient is a factor that significantly influences prescribing behavior, demonstrating the need to focus on targeted antimicrobial stewardship interventions, taking into account the demographic variables in the process of rational antibiotic use.

An independent samples t-test was used to determine the differences in the mean number of broad-spectrum antibiotics prescribed in a week between practitioners who had experience of less than 5 years and practitioners who had experience of over 5 years. The assumption of equality of variances was satisfied as shown by Levene's Test for Equality of Variances (F = 2.134, p = 0.146). The t-test outcome indicated that the differences between the two groups were statistically significant (t(268) = 2.134, p = 0.034), and the less experienced practitioners were prescribing more broad-spectrum antibiotics per week (mean difference = 4.23). The confidence interval of the mean difference was 0.33 to 8.13 at 95 percent, indicating that the overall difference in the prescribing behavior could possibly lie within the interval. These results suggest that antibiotic prescribing practices in primary care may be important in regard to practitioner experience, whereby less experienced clinicians have a propensity to prescribe broad-spectrum agents more often.

DISCUSSION

The aim of carrying out this study was to look into the trends of antibiotic prescribing in primary care and to determine the reasons associated with inappropriate antibiotic use among primary care physicians within the Multan district. This cross-sectional descriptive study demonstrated considerable trends and patterns in prescribing practices, emphasizing the unresolved issue of antimicrobial resistance (AMR) caused by the irrational use of antibiotics in ambulatory care[26]. Regarding the demographics, it was shown that the participants were mostly male physicians (59.3%), with the largest proportion being aged between 30 and 39 years, which represents a relatively young and male-dominated primary care workforce. The majority of the physicians possessed 5 to 10 years of clinical experience, which might contribute to their clinical decision-making process and compliance with the antimicrobial guidelines. Moreover, a significant part of doctors was employed at government primary health centers, and 40.7 percent of consultations were performed through telemedicine, which is an emergent trend that might have been accelerated by the post-pandemic situation in the healthcare environment. These demographic features provide vital information to put the prescribing patterns and related factors identified into perspective[27].

Regarding the prescribing behaviors, the descriptive analysis of Objective One showed that there were certain worrying trends. The average weekly antibiotic prescriptions were 18.25, with a big variation among respondents. Worryingly, the average rate of inappropriate prescriptions was 42.36 percent, indicating that antibiotics prescribed in primary care—based on clinical guidelines—may be as high as half of the antibiotics prescribed. Broad-spectrum antibiotic prescriptions were significantly more common than the narrow-spectrum agents, constituting 68% of the overall prescriptions. The specified finding aligns with the international literature, in which the overuse of broad-spectrum antibiotics in outpatient practice was seen as one of the key factors promoting AMR. This empirical use of agents on a broad basis exposes patients to the unnecessary risks of drug resistance, of adverse effects, and of higher health care costs, making the case for enhanced antibiotic stewardship in primary care[28].

Objective Two: Using a chi-square test, the association between the variables of patient age groups and the kind of antibiotics prescribed was found to be statistically significant (p = 0.021). It means that prescribers can vary their antibiotic selection depending on the age of a patient, maybe following the perception of the risk of infection or the expectation of complications in various age groups. Though a certain level of discretion is clinically acceptable, these trends should be closely monitored in order to prevent overprescribing, especially broad-spectrum

antibiotics, on a demographic basis. The results of the present research are consistent with the available literature that indicates that patient factors, such as age and health conditions, often determine prescribing patterns. The findings of the research require more evidence-based guidelines that would help primary care doctors balance the risks and benefits of prescribing medications and avoid broad-spectrum agents when narrow-spectrum ones will suffice[29].

Objective Three explored the antibiotic prescribing behavior based on physician experience through an independent sample t-test. The percent of inappropriate prescriptions showed a statistically significant difference ($p = 0.034$) between the physicians with less than 5 years of experience and those with over 5 years of experience. The doctors with less experience had higher levels of inappropriate prescribing, which could be explained by a lack of training or exposure to stewardship programs, or they may be more likely to be influenced by patient pressure and time limits[30], This result complies with the foreign literature, where early-career physicians are often defined as a risk group and prescribe inappropriately. The generalized results of the current study strengthen international data about the excessive use of antibiotics in primary care and the immediate necessity of local antimicrobial stewardship programs[31]. Precise interventions that are required include routine clinical training, decision support, and prescription audits to achieve rational use of antibiotics, minimize risks of AMR, and enhance patient safety during face-to-face and telemedicine appointments.

The research provides important information on antibiotic prescribing in primary care and outlines the issue that leads to inappropriate antibiotic prescribing[32, 33]. The results indicate a high rate of broad-spectrum antibiotic prescriptions and a high rate of inappropriate prescribing, which causes serious concern with antimicrobial resistance in outpatient care. The significant correlation between the age of the patient and the antibiotics prescribed showed that there was a tendency to prescribe antibiotics according to the demographic data. Also, the experience of the physicians proved to be an essential aspect, as the less experience the doctor had, the more likely he was to prescribe incorrectly. These findings highlight the necessity of specific antimicrobial stewardship interventions in the primary care context as one of the most pressing issues. Professional training and education should become continuous with the aim of enhancing prescribing behaviors. An increasing elegance of telemedicine introduces additional intricacy to prescribing, requiring new guidelines to cover virtual meetings. The systematic policy reforms and clinical decision-support tools to enhance rational use of antibiotics are recommended in the study. Enhancing stewardship programs is the way to ensure that the usefulness of antibiotics can be available to subsequent generations.

CONCLUSION

This study reveals a concerning trend of inappropriate antibiotic prescribing in primary care, particularly the excessive use of broad-spectrum antibiotics and a 42.36% rate of irrational prescriptions. Factors influencing these patterns include physician experience, patient age, and the mode of consultation—especially telemedicine, which became more prominent post-COVID-19. Less experienced physicians were significantly more likely to prescribe antibiotics inappropriately, underscoring the need for continuous training. While overall antibiotic use declined during the pandemic, the shift toward broader-spectrum agents raises new concerns for antimicrobial resistance (AMR). These findings reinforce the urgency of implementing robust antimicrobial stewardship (AMS) strategies tailored to outpatient settings. Integrating clinical decision-support tools, surveillance data, and personalized feedback mechanisms can help align prescribing behavior with evidence-based guidelines. Without sustained and context-specific interventions, the risk of escalating AMR remains a critical public health threat in both pandemic and non-pandemic times.

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