Journal of Population Therapeutics & Clinical Pharmacology

RESEARCH ARTICLE
DOI: 10.53555/jptcp.v30i17.2887

ACCESS TO ESSENTIAL MEDICINES AND ANTIMICROBIAL AGENTS IN RURAL AREAS OF PAKISTAN SPECIFICALLY IN SINDH

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Abstract

The incidence of self-medication with antibiotics is increasing, propelled by a multitude of variables. A significant number of individuals who employ antibiotics in this method exhibit a lack of comprehensive knowledge regarding their appropriate utilization, encompassing aspects such as dose and probable adverse reactions. Therefore, the absence of regulation in antibiotic usage might lead to significant negative consequences for individuals. The objective of this study was to evaluate the prevalence and trends of self-medication practices involving antibiotics among individuals residing in rural regions of the Sindh province. A cross-sectional study was undertaken at the Outpatient Department of Civil Hospital Karachi over the period of January to March 2023. The research encompassed a sample of 375 individuals residing in rural areas on the periphery of Karachi in the Sindh province. The participants were chosen using a non-probability convenience sampling method. The results of the study indicated a significantly elevated occurrence of self-administration of antibiotics, with a prevalence rate of 81.19% observed among individuals residing in rural areas of Sindh. The predominant factor influencing self-medication among participants was

economic considerations, as reported by 78.0% of respondents. Amoxicillin emerged as the predominant self-prescribed antibiotic, constituting 41.0% of instances. Surprisingly, a significant proportion of the participants exhibited a lack of awareness regarding the phenomenon of antibiotic resistance resulting from inappropriate antibiotic usage. Merely 19 persons demonstrated accurate knowledge by properly recognizing the role of this practice in exacerbating antibiotic resistance. The research highlights the alarming prevalence of self-administration of antibiotics in rural Sindh. Immediate action is imperative, specifically the implementation of more stringent laws pertaining to the dispensation of drugs, particularly antibiotics, by pharmacies in the absence of prescriptions. In addition, the implementation of cost-effective treatment options within the public sector has the potential to significantly mitigate the prevalence of self-medication practices involving antibiotics among rural inhabitants in the province of Sindh.

Keyword: Anti-microbial resistance, Sindh, Essential Medicines, Self-Administration, Antibiotic

1. Introduction

The term "self-medication" refers to the practice of individuals autonomously ingesting drugs, herbs, or home remedies without obtaining guidance from a medical expert. This behavior may be driven by personal initiative or influenced by the suggestions of others, without the involvement of a certified physician [1]. This may involve the act of self-administering medication or administering it to family members, encompassing individuals across different age cohorts, such as children or older adults [2]. Previous studies have demonstrated that the prevalence of self-medication is more pronounced in developing countries in contrast to developed countries [3,4]. The prevalence of self-medication in southern and Eastern European regions was observed to be comparatively greater in comparison to the rates observed in northern and western European regions [4]. Based on a study, it has been reported that the estimated prevalence in northern Europe is approximately 3% [4]. The occurrence of self-medication has been extensively observed in Latin America as well [5]. On the other hand, Asia has witnessed a significant increase, as evidenced by reported statistics ranging from 4% to 75% [6]. A previous study conducted in Karachi yielded findings indicating that the prevalence of self-medication among university students was approximately 80.4%, whereas in the urban population it was roughly 68.1% [7,8].

The World Health Organization (WHO) has advocated for the utilization of self-medication without medical consultation as a means to expedite disease prevention and treatment, enhance efficiency, and alleviate the burden on healthcare facilities in rural regions [9,10]. Nevertheless, the unguided utilization of medications can give rise to complications in both the immediate and prolonged periods. The prevalence of self-medication is on the rise as a result of various contributing variables. Individuals are increasingly being exposed to a larger volume of information and are inclined towards making autonomous judgments concerning various aspects of their lives, including the use of pharmaceuticals [11]. Another significant factor is the heightened availability of antibiotics in nations where they are obtainable without a prescription, enabling individuals to disregard medical professionals and engage in self-medication based on personal judgment or the guidance of others [12-15]. Additionally, the reasons for this phenomenon may include financial constraints, low literacy rates, insufficient access to healthcare services, or time constraints [9]. The high rates of self-medication in Argentina, Brazil, Chile, Colombia, Costa Rica, and Nicaragua have been linked to limited accessibility to healthcare services, as indicated by studies undertaken in these countries [5]. A noteworthy discovery in Honduras indicated a correlation between self-medication and those residing in urban areas, however no connection was established with socioeconomic level [16].The general populace utilizing these antibiotics often lacks comprehensive knowledge regarding their appropriate utilization, particularly in terms of dosages and potential adverse reactions [17,18]. Consequently, the unrestricted utilization of these medications may give rise to potentially hazardous adverse reactions in individuals. Moreover, it has been observed that a prevailing belief has been established among the general populace that antibiotics are effective in treating common respiratory illnesses [19]. Consequently, there has been a pervasive and unregulated utilization of

antibiotics, leading to the emergence of numerous drug-resistant bacteria. Recent studies have identified strains of Streptococcus pneumoniae, Salmonella typhi, Neisseria gonorrhoeae, and many species of Shigella that exhibit resistance to commonly used antibiotics [20-23]. Sturm et al. (24) discovered a positive correlation between inappropriate drug utilization and the development of antibiotic resistance. Pharmacies in Pakistan are obligated by law to exclusively dispense particular medications upon presentation of a prescription issued by a duly licensed medical practitioner [19,26]. Nevertheless, the level of adherence to legal regulations by these pharmacies is deemed unsatisfactory, resulting in elevated instances of self-medication [19,27]. Previous research have conducted assessments to determine the occurrence of self-medication among university students and urban residents in Karachi [8,9]. Nevertheless, it is important to note that, as of current understanding, no research has been conducted to examine the prevalence of self-medication among the rural population of Sindh.

2.Methodology

2.1 Study Design and Setting:

A cross-sectional study was undertaken at Sindh, during the period of January to March 2015. The objective of the study was to determine the incidence of self-medication with antibiotics among the rural population residing in the province of Sindh. A total of 375 individuals were enlisted from the Out Patient Department (OPD) of the hospital.

2.2 Sample Size Determination

The questionnaire underwent a pilot phase during which it was administered to a sample of 30 individuals who met the specified inclusion criteria. These individuals were asked to complete the questionnaires. The data obtained from the participants was subjected to analysis, wherein the proportion of individuals who engaged in self-medication was determined to be 50%. Hence, the reference prevalence was employed to determine the appropriate sample size of 364, with a confidence range of 95%. In addition, a total of other volunteers were enlisted for the purpose of conducting statistical analysis. The participants' replies were gathered and they were subsequently interviewed regarding their overall experience of the process. The ambiguities inherent in the questionnaire were appropriately addressed. The data obtained from the pilot study was not incorporated into the findings of the study.

2.3 Inclusion and Exclusion Criteria

The individuals who were encompassed in this group were those who originated from the rural regions of Sindh or resided in the periphery of Karachi. The study excluded individuals who were engaged in the pursuit of medical education or who had occupations directly associated with the field of medicine. This decision was made due to the potential for the individuals in question to possess a disproportionately large amount of information regarding the utilization of antibiotics, so introducing a potential source of bias into the study. The concept of self-medication is defined as the utilization of antibiotics without a doctor's prescription within a period of six months. The implementation of a 6-month time limit was established in order to mitigate any recollection bias among the study participants. Antibiotics refer to pharmaceutical substances that are administered to address diseases caused by bacteria and protozoa. These treatments are included in the World Health Organization's (WHO) model list of essential medicines [28,29].

2.4 Data Collection

The volunteers were provided with a questionnaire to complete. The document comprised five distinct sections, labeled as A, B, C, D, and E. The participants were provided with the choice of either self-administering the questionnaire or having the researcher complete it based on verbal responses. In Section A, an assessment was conducted on the demographic characteristics of the patients, encompassing variables such as age, gender, marital status, educational attainment, family income, occupation, and health insurance coverage. The pertinent information is succinctly

presented in the paper. The study assessed participants' understanding of the negative consequences associated with antibiotics in section E, while section E inquired about participants' awareness of the inappropriate utilization of antibiotics and its impact on antibiotic resistance [24]. At the commencement of the questionnaire, each participant was queried regarding their engagement in self-medication practices. Participants who complied with the instructions were obligated to complete the entire questionnaire, whilst the remaining individuals merely completed parts A, D, and E.

2.5 STATISTICAL ANALYSIS

The data was inputted utilizing SPSS version 19, and the same software was employed for both data analysis and data management. A descriptive analysis was conducted, wherein frequency tables were generated to determine the prevalence of self-medication[22]. Additionally, a Chi-square test was conducted to assess the relationship between socio-demographic characteristics and the distinction between users and non-users. A significance level of $p<0.05$ was established. In addition, frequencies and percentages were computed in relation to the prevalence of unpleasant side effects and the level of information pertaining to antibiotic resistance was assessed [21].

3.Factors for AMR Acknowledged

3.1: Availability of Essential Medicines

It is important to acknowledge that the circumstances may have undergone changes subsequent to the aforementioned statement. Consequently, it is advisable to consult more recent sources or official government entities in order to obtain the most current and accurate information [23].The availability of vital drugs in Pakistan is subject to variability due to a range of factors, encompassing government policy, healthcare facilities, and economic conditions. The Pakistani government has implemented a range of measures aimed at ensuring the accessibility of vital medications to its populace. Several important factors to take into account are:

3.2: Drug Regulatory Authority of Pakistan (DRAP): DRAP is the regulatory body responsible for ensuring the quality, safety, and efficacy of medicines in Pakistan. It oversees the registration and regulation of pharmaceutical products in the country [11].

3.3: National Essential Medicines List (NEML): Pakistan has an NEML, which is a list of medicines considered essential for the healthcare system. The government aims to ensure that these essential medicines are readily available and affordable to the general population[19].

3.4: Public Healthcare Facilities: Government-run healthcare facilities, such as public hospitals and clinics, often provide essential medicines to patients free of charge or at subsidized rates. The availability of these medicines in such facilities is a priority.

3.5: Pharmaceutical Industry: Pakistan has a significant pharmaceutical industry that produces a wide range of medicines. Both generic and brand-name versions of essential medicines are available in the market [10].

3.6: Access to Medicines: While essential medicines may be available in urban areas and larger cities, access to these medicines can be more challenging in rural and remote areas due to infrastructure limitations [13].

3.7: Pricing and Affordability: The government of Pakistan has policies in place to regulate the pricing of medicines to ensure they remain affordable to the general population. However, pricing and affordability can still be issues for some people, and there have been concerns about the cost of certain medicines [14].

3.8: International Aid and NGOs: Some international organizations and non-governmental organizations (NGOs) operate in Pakistan to improve access to essential medicines, especially in underserved areas and for specific diseases like tuberculosis and HIV/AIDS.To get the most current and detailed information on the availability of essential medicines in Pakistan, you should refer to the latest reports and publications from government agencies, the World Health Organization (WHO), and other reputable sources in the healthcare sector. Additionally, you can consult with healthcare professionals and organizations operating in Pakistan for specific information on the availability of medicines for particular medical conditions.

3.9: Affordability of Essential Medicines

The affordability of essential medicines in Pakistan has been a longstanding concern. Pakistan faces several challenges related to healthcare access and affordability, and these issues directly impact the availability and affordability of essential medicines for its population. Here are some key factors affecting the affordability of essential medicines in Pakistan:

3.10: Low Income Levels: Pakistan is a lower-middle-income country with a significant portion of its population living below the poverty line. Low income levels make it challenging for many people to afford essential medicines, even when they are available.

3.11: Limited Health Insurance Coverage: Health insurance coverage in Pakistan is limited, which means that a significant portion of the population has to pay for medicines and healthcare services out of pocket. This can be a significant barrier to accessing essential medicines, especially for those with limited financial resources.

3.12: High Drug Prices: The pharmaceutical industry in Pakistan has faced criticism for high drug prices. While there are price control mechanisms in place, enforcement can be lax, and some essential medicines may still be priced beyond the reach of many Pakistanis[8].

3.13: Counterfeit and Substandard Medicines: Pakistan has struggled with issues related to counterfeit and substandard medicines, which not only pose health risks but can also lead to increased healthcare costs as people seek treatment for illnesses caused by ineffective or unsafe medications.

3.14: Inequitable Distribution: There can be significant disparities in the distribution of essential medicines within Pakistan. Access to healthcare facilities and essential medicines can be better in urban areas compared to rural regions[9].

3.15: Lack of Generic Alternatives: Availability of generic versions of essential medicines can significantly reduce costs. However, in Pakistan, the availability of generic medicines may be limited in some cases, leading to higher prices for branded drugs.

3.16: Regulatory Challenges: Regulatory challenges in the pharmaceutical sector can impact the availability and affordability of essential medicines. Delays in drug approvals, quality control issues, and corruption in the regulatory process can hinder access to affordable medicines[2].

Efforts have been made by the Pakistani government and various non-governmental organizations to address these challenges. Initiatives include the expansion of health insurance programs, improving the regulatory framework for pharmaceuticals, and promoting the use of generic medicines. Additionally, international organizations like the World Health Organization (WHO) have worked with Pakistan to develop policies aimed at improving access to essential medicines[11].

4: RESULTS

The results shown a lot of factors regarding the development of anti microbial resistance phenomenon. However, despite these efforts, affordability remains a significant issue for many Pakistanis when it comes to essential medicines. Addressing this problem requires a multi-pronged approach, including better regulation of drug prices, increasing access to healthcare services, and promoting the use of cost-effective generic medicines. It also involves addressing broader issues related to poverty and income inequality, which can have a direct impact on people's ability to afford essential healthcare.

4.1: Access to Healthcare Facilities

Access to healthcare facilities in Pakistan can vary significantly depending on factors such as location, socioeconomic status, and urban/rural divide. Pakistan faces several challenges in providing equitable access to healthcare for its population, which is over 220 million people as of my last knowledge update in September 2021. Here are some key points to consider regarding access to healthcare in Pakistan:

4.2: Urban vs. Rural Disparities: Access to healthcare is generally better in urban areas compared to rural regions. Major cities like Karachi, Lahore, and Islamabad have a relatively higher concentration of healthcare facilities, including hospitals, clinics, and specialized centers.

4.3: Public vs. Private Healthcare: Pakistan has both public and private healthcare sectors. Public healthcare is often underfunded and faces challenges in terms of resource allocation and infrastructure. Private healthcare, on the other hand, tends to be better equipped but is often more expensive, making it inaccessible to a significant portion of the population.

4.4: Quality of Healthcare: Even when healthcare facilities are accessible, the quality of care can vary widely. In some cases, healthcare facilities in rural areas may lack trained medical staff and necessary equipment, leading to suboptimal care.

4.5: Financial Barriers: Many Pakistanis face financial barriers to accessing healthcare. Health insurance coverage is limited, and out-of-pocket expenses for medical treatment can be a significant burden on families, especially for major illnesses or surgeries.

4.6: Geographic Challenges: Pakistan's geography poses challenges to healthcare access. Remote and mountainous regions, such as in the northern areas, can be difficult to reach, making it challenging to provide healthcare services.

4.7: Government Initiatives: The Pakistani government has launched various healthcare initiatives and programs to improve access to healthcare services, particularly for marginalized populations. These include the Sehat Sahulat Program, which aims to provide health insurance coverage to low-income families.

4.8: Infrastructure Development: Pakistan has been investing in the development of healthcare infrastructure, including the construction of new hospitals and healthcare centers. However, progress can be slow, and there is a need for ongoing investment and maintenance.

4.9: Healthcare Workforce: Ensuring an adequate and trained healthcare workforce, including doctors, nurses, and paramedics, is essential for improving access to quality care. Pakistan has been working to address shortages in the healthcare workforce.

4.10 :Health Awareness and Education: Promoting health awareness and education is crucial to prevent diseases and promote healthier lifestyles. Public health campaigns are essential for raising awareness and encouraging preventive healthcare measures.

4.11 : Health Challenges: Pakistan encounters a multitude of health issues, including elevated prevalence rates of infectious ailments such as tuberculosis and hepatitis, alongside non-communicable diseases like diabetes and cardiovascular disorders. It is imperative to acknowledge and confront these problems in order to enhance accessibility and outcomes in the healthcare sector. In recent years, there has been a growing recognition of the need to address healthcare disparities and improve access to quality healthcare in Pakistan. Efforts to strengthen the healthcare system, increase government investment, expand health insurance coverage, and enhance medical education and training are steps toward improving access to healthcare facilities for all Pakistanis. However, as of my last knowledge update in September 2021, these challenges remained significant, and ongoing efforts were required to make healthcare more accessible and equitable across the country. Please note that there may have been developments in Pakistan's healthcare system since that time, and it's advisable to consult more recent sources for the latest information.

5: Antimicrobial Agents and AMR

Antimicrobial agents, also known as antibiotics, are essential in treating bacterial infections and improving public health. However, the misuse and overuse of antibiotics have led to a global health concern known as Antimicrobial Resistance (AMR). Pakistan, like many other countries, faces challenges related to antimicrobial agents and AMR.

Here are some key points regarding antimicrobial agents and AMR in Pakistan:

A] Antibiotic Misuse: Pakistan, like many developing countries, has a significant problem with the misuse and overuse of antibiotics. Antibiotics are often readily available without a prescription, and many people use them inappropriately for viral infections, which are not affected by antibiotics.

B] Self-Medication: Self-medication with antibiotics is common in Pakistan. People often take antibiotics without consulting a healthcare professional, which contributes to antibiotic resistance.

C] Low Healthcare Awareness: There is a lack of awareness among the general population about the proper use of antibiotics and the consequences of antibiotic resistance. Public health campaigns are needed to educate people about these issues.

D] Limited Access to Healthcare: A large proportion of Pakistan's population has limited access to healthcare facilities, which can lead to self-medication and improper antibiotic use.

E] Antibiotic Stewardship: There is a need for better antibiotic stewardship programs in Pakistan's healthcare facilities. Healthcare providers should be educated about prescribing antibiotics judiciously, and guidelines for antibiotic use should be strictly followed.

F] Poor Sanitation and Hygiene: Inadequate sanitation and hygiene conditions in many parts of Pakistan contribute to the spread of infections, making antibiotics more necessary. Improving sanitation and hygiene can reduce the need for antibiotics.

G] Drug Quality Control: Ensuring the quality of antibiotics in the market is crucial. Substandard or counterfeit antibiotics can contribute to treatment failure and the development of resistance.

H] AMR Surveillance: Pakistan needs to establish a robust surveillance system for monitoring antimicrobial resistance. This involves regularly collecting data on resistance patterns and sharing this information with healthcare providers to guide treatment decisions.

I] One Health Approach: Addressing AMR in Pakistan requires a One Health approach, involving coordination between human health, animal health, and environmental sectors. Antibiotic use in livestock and agriculture is also a significant contributor to AMR.

J] International Cooperation: Pakistan should collaborate with international organizations and neighboring countries to address the global nature of AMR. Sharing information, experiences, and best practices can help combat the spread of antibiotic resistance.

In summary, Pakistan, like many other countries, faces significant challenges related to antimicrobial agents and AMR. Addressing these issues requires a multifaceted approach, including public education, healthcare system improvements, better antibiotic stewardship, and international collaboration. Reducing antibiotic misuse and promoting responsible antibiotic use are critical steps in combating AMR in Pakistan.

Trends in Antibiotic Usage

The study found that the majority of participants who engaged in self-medication with antibiotics purchased Amoxicillin, with Tetracycline, Ciprofloxacin, Co-trimoxazole, and Ampicillin being the subsequent most regularly acquired medications. The study participants did not acquire Cefadroxil and Cefixime for the purpose of self-medication within the past six months. The other antibiotics that were investigated were found to be used less often by the individuals in our study. Table 1 illustrates the frequency of utilization for each antibiotic.

Antibiotic purchased for use inself-medication+	**Number of respondents(N=319)**	**Percentage**
Amoxicillin	182	39
Tetracycline	43	15
Trimethoprim-sulfamethoxazole	31	12
Erithromycin	19	7
Ciprofloxacin	41	15
Cefadroxil	0	0
Cefixime	0	0
Azithromycin	11	4
Ampicillin/cloxacillin	22	8
Secnidazol	12	3.9
Albendazol	11	3.8
Metronidazol	113	29
Levofloxacin	8	2.7
Ceftriaxone	8.9	2.6
Clarithromycin	2	0.9

Table:1 Number of respondents purchasing antibiotics when selfmedicating.

The predominant symptom leading to self-administration of antibiotics among individuals residing in rural areas was flu-like symptoms, accounting for 60.0% of cases. Moreover, when questioned regarding the underlying factors, the predominant responses were economic reasons (68.0%) and the convenient accessibility of drugs from pharmacies (71.0%). The majority of participants (86%) acquired antibiotics from pharmacies in rural areas without a prescription. Furthermore, the data unveiled that a significant majority of participants, namely 83.1%, do not engage in the practice of reading informational handouts pertaining to antibiotics prior to their usage. The study found that 44% of the participants who engaged in self-medication sought guidance from family members, whereas 35.4% sought advice from pharmacies, and 20.6% sought advice from friends. Within the identical area of the questionnaire, participants were additionally obligated to assess, utilizing a scale ranging from 1 to 10, the influence of self-medication on an individual's health, with 1 representing a detrimental consequence and 10 indicating a beneficial effect. A majority of the participants (41.6%) indicated a rating of 5 or above, suggesting a limited or nonexistent adverse effect of self-administering antibiotics on a small scale. The frequency of specific traits pertaining to self-medication are presented in a comprehensive manner [Table 2].

Variable	Number of respondents	Percentage
Symptoms resulting in self-medication+	208	64.9
Cold/flu	191	60.0
Pain	95	30.2
Fever	59	19.1
Stomach ache	39	16.0
Diarrhea	42	15
Allergy	11	4.6
Reasons for self-medicating+		
Lack of time and to save time	69	22.1
Easily purchasable medications frompharmacies	226	72.0
Economic reasons (High costs of visits to doctor/Low cost of purchasing drugs)	279	78.0
Simple sign and symptom of a disease	211	67.1
Convenient (ease of curing perceivedsymptoms)	209	64.9
Lack of trust toward doctors	31	8.9
Locations for obtaining medications+		
Pharmacies	281	84.9
Corner stores	168	55.1
From home (previously purchased)	232	75.1
Frequency of self-medication		
One time per week	36	11.1
One time per month	49	15.1
Two times per month	6	1.8
Every two months	6	1.8
Every three months	42	12.9
Every six months	49	15.1
Two times per year	58	17.8
One time per year	79	24.3
Regarding the antibiotic information handout		
Do not read antibiotic information handout	270	83.1
Read antibiotic information handout	55	16.9
How it can effect one's health, 1 negative effect 10 positive effect		
1 on a scale of 10	105	32.3
2-4 on a scale of 10	121	37.2
5-6 on a scale of 10	49	15.1
7-8 on a scale of 10	26	8.0
9-10 on a scale of 10	24	7.4
Who respondents go to for advice		
Pharmacy employee	115	35.4
Family	143	44
Friend	67	20.6

Table 2: Characteristics of self-medication among rural residants

Furthermore, a mere 19.0% (N=100) of participants reported experiencing negative consequences following the use of antibiotics. Out of the whole sample population, 75 individuals residing in rural areas provided information regarding the specific detrimental effects they had experienced. A total of 48% of participants reported experiencing symptoms of diarrhea and abdominal pain. Additionally, 32% of participants, with a sample size of 24, reported an allergic reaction. Furthermore, 20% of participants, with a sample size of 15, reported experiencing sleep problems. Finally, participants were also queried regarding their awareness of the inappropriate utilization of antibiotics. As depicted in Figure 5, a mere 6.3% of participants demonstrated an understanding that the improper utilization of antibiotics can result in an escalation of antibiotic resistance. However, a significant proportion of the participants (74.7%) exhibited a lack of awareness regarding the phenomenon of antibiotic resistance.

Effect on antibiotic resistance	Frequency (n=375)	Percentage (%)
Increases	16	6.3
Decreases	42	11
Remains the same	29	8.0
I don't know	281	74.7

Table 3: Knowledge of effect of inadequate use of antibiotics on antibioticresistance.

6: Discussion

The study revealed that the prevalence of self-medication with antibiotics was 81.19%. There is a dearth of research conducted in Pakistan pertaining to the examination of the incidence of self-medication with antibiotics among the rural populace. Hence, the absence of a comparable study precludes any possibility of doing a comparative analysis. Nevertheless, a research study conducted in Karachi revealed that the prevalence of self-medication with antibiotics among non-medical university students was found to be 47.6% [30]. According to a study, the urban population of Karachi was determined to be approximately 68.1% [9]. According to a study conducted in a small town of Northern India, it was observed that 16.7% of the population engaged in the practice of self-medication with antibiotics [31]. The prevalence rate of self-medication in our country is significantly greater in comparison to other nations worldwide. For instance, Italy has a self-medication rate of 32.7% [3], Iran has a rate of 48% [32], Southern China has a rate of 47.8% [33], and Sudan has the highest rate at 79.5% [34] 73.7% in Saudi Arabia has a literacy rate of 35% [35], while the United Arab Emirates has a literacy rate of 56.3% [36]. Jordan has a literacy rate of 23% [37], Albania has a literacy rate of 78.14% [38], and Spain has a literacy rate of 11% [39]. Denmark has a literacy rate of 3% [40], Malta has a literacy rate of 19% [41], and Lithuania has a literacy rate of 22% [42]. The variations in self-medication rates could potentially be attributed to the presence of diverse ethnicities within each community, as well as the distinct healthcare systems implemented in each respective country. We additionally assessed the factors that may have contributed to individuals engaging in self-medication. There was no observed correlation between demographic variables, such as gender, marital status, and occupation, and the practice of self-medication with antibiotics, when comparing individuals who engage in this behavior and those who do not. The findings presented in this study align with the results reported by Shah et al. (30). Ramay et al. (29) discovered a correlation between gender and self-medication, noting that women tend to engage in these practices more frequently than men. A comparable outcome was also attained in a research conducted in Mexico (43). The results of our study indicate a significant association between educational attainment, social status, and possession of health insurance with the practice of self-medication. Within the examined cohort, those who engaged in self-medication had a notable dearth of formal education, with over half of them lacking any educational attainment. Furthermore, a significant majority of these individuals were predominantly affiliated with the lower socioeconomic stratum. The present observation has resemblance to the research undertaken by Balbuena et al. (year) in Mexico, wherein a significant association was found between those with a low socioeconomic background and low educational attainment and their tendency to engage in self-medication [18,29]. However, a research conducted in Guatemala City did not observe any such correlation. The present study did not find a significant association between age and self-medication, which contradicts previous research that has shown either the younger or adult population as being at higher risk for self-medication [3, 35, 36].

The study revealed that amoxicillin, followed by metronidazole, were the antibiotics most frequently prescribed. The findings of several research conducted in Karachi [30,33] align with this observation. In a research conducted in Saudi Arabia, it was observed that penicillin's and macrolides were the antibiotics most frequently prescribed [35]. According to a study conducted in Europe, it was shown that cephalosporins and macrolides were the prevailing antibiotics employed [44].

The study population predominantly utilized antibiotics to address symptoms of cold, discomfort, and fever. This finding aligns with previous research conducted by various scholars [3, 30, 33, 45]. This observation highlights the potential hazards associated with the unregulated utilization of antibiotics, as influenza or colds are self-limiting conditions that do not necessitate antibiotic treatment [46]. One of the emerging issues stemming from the utilization of antibiotics is the phenomenon known as antibiotic resistance. This issue is of significant concern and has been extensively examined in prior research (47, 48). The primary factors contributing to the phenomenon of self-medication among the participants in our study were primarily economic considerations and the widespread accessibility of antibiotics [49]. The exorbitant costs of medical services charged by physicians and the insufficient staffing levels at healthcare facilities located in rural areas, which are unable to adequately accommodate the local population, ultimately compel individuals to seek alternative options. Among these possibilities, self-medication emerges as the most feasible choice. According to the study conducted by Shah et al. (year), the primary motivations reported by participants were time-saving, avoidance of clinic-related inconveniences, and positive past experiences [30]. A significant proportion of the patients in our study acquired antibiotics from pharmacies without a prescription. The issue at hand is closely tied to the inadequate enforcement of drug sale regulations in Pakistan, whereby pharmacies are permitted to provide medications without requiring prescriptions. The study conducted in Guatemala City revealed that the majority of antibiotics were acquired from local pharmacies (29). The findings of this investigation were replicated in a research conducted in Greece [45]. A significant proportion of the study participants exhibited a lack of engagement with the antibiotic information handouts. However, this correlation is likely attributable to the prevailing circumstance that the majority of individuals lacked formal education or possessed insufficient levels of literacy to comprehend written material. The research conducted in Guatemala City revealed that individuals exhibited a lack of engagement with the informational materials accompanying their prescriptions, and this behavior was found to be independent of their educational attainment or socioeconomic status [29]. In the present study, it was also observed that the participants in our research sought guidance pertaining to medication mostly from their family members, followed by pharmacists, and subsequently from their friends. Ramay et al. (year) conducted a study examining the relationship between seeking advice and socioeconomic position. The findings revealed that those belonging to a lower socioeconomic class tend to seek advice from their family or friends, whereas those from a higher socioeconomic class are more likely to consult pharmacists and family members [29]. According to a study conducted in Northern India, individuals who engage in self-medication not only rely on the three aforementioned sources of information, but also consider previous prescriptions as a point of reference [31].

After conducting an evaluation of individuals' understanding of antibiotics, it was shown that a minority of participants possessed knowledge regarding the prevalent adverse effects associated with these pharmaceuticals. Ahmad et al. (31) reported a notable lack of understanding among individuals regarding drug interactions and the potential adverse effects associated with commonly prescribed drugs. According to a study conducted in Pakistan, a significant proportion of the participants demonstrated awareness regarding the potential detrimental consequences associated with the use of antibiotics [30].

A significant finding of our study reveals that a majority of the study population, specifically 74.7%, lacked awareness regarding the potential consequences of inappropriate antibiotic usage, specifically the development of antibiotic resistance. According to Shah et al. (year), a small percentage of the participants demonstrated awareness of the concept of antibiotic resistance, and an even less number possessed knowledge on the connection between antibiotic resistance and inappropriate antibiotic usage. According to a study conducted in Italy, a mere 9.8% of the population demonstrated knowledge of the accurate definition of antibiotic resistance, while only 21.2% exhibited awareness of the appropriate usage of antibiotics [3,30]. The presented data is cause for concern, as it indicates a potential for further escalation in antibiotic resistance. The

potential consequence of this scenario is the potential emergence of diseases in the future that may provide challenges in terms of treatment, primarily due to the limited availability of treatments.

7: Conclusion

The prevalence of self-medication with antibiotics was found to be notably greater in rural regions of Sindh due to economic factors and the convenient accessibility of medications. Hence, it is imperative for the government to expeditiously implement more stringent regulations pertaining to the dispensation of pharmaceuticals, particularly antibiotics, by pharmacies in the absence of prescriptions. Healthcare workers, particularly physicians, have a responsibility to fulfill their job by offering guidance and counseling to patients regarding appropriate antibiotic utilization. In order to address the issue of self-medication with antibiotics without adequate knowledge, it is imperative to implement awareness campaigns and educational initiatives that target the broader public. These programs aim to inform individuals about the potential risks associated with self-medication, thereby promoting a greater understanding of the dangers involved. Finally, the provision of cost-effective treatment by the public sector and the implementation of enhanced infrastructural facilities by the government sector have the potential to increase the accessibility of healthcare possibilities for rural residents. Consequently, this could lead to a reduction in the prevalence of self-medication practices within this population.

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