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Research Paper

Prevalence and misuse of antibiotics during omicron (covid-19) pandemic in pakistan

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ABSTRACT

Introduction: The prevalence of self -medication with antibiotics is quite high in Pakistan as compared to developed countries. Antibiotics are often taken erroneously for certain ailments, without having the appropriate and sufficient knowledge of their use. As a result, this carries potential risks for the individual as well as the community, in form of several side effects such as antibiotic resistance. Therefore, the prevalence of self-medicated antibiotics in COVID-19 Omicron Pakistan needs to be studied and evaluated. Methods: An online based cross-sectional survey was conducted using a self-administered, self-made and validated questionnaire to address this key issue in Pakistan. This questionnaire was delivered country wide and making it sure that it would reach all the provinces including the capital of Pakistan. The questionnaire included general as well as specific questions in such a way that it targeted almost every single person having at least certain knowledge about medicines especially antibiotics. Data was collected using self-administered questionnaires and analyzed using SPSS version 21. Results: A total of 390 respondents were included in the final analysis. In this study men made up the majority of respondents, 240 (61.5%), and females made up about 150 (38.5%). Self-medication was quite prevalent in our study population with 125 (32.1%) out of 390 (100%) individuals were using any of the drugs since the start of pandemic. The most commonly utilized medications were cephalosporin, ceftriaxone (32.1%). Followed by macrolides, azithromycin, clarithromycin which was used by 119 (30.5%) participants. And penicillin, amoxicillin with clavulanic acid (17.4%) and fluoroquinolones, ciprofloxacin (7.2%) while the percentage of use of other antibiotics is 12.8%. The most common reasons reported for the usage of these medications included fatigue, cough, sore throat and runny nose which was about (48.7%). Conclusion: Our study revealed common self-medication practices among General population. It is a significant health issue especially during the pandemic times, with high consumption reported as a prevention or treating symptoms of Omicron.

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1. INTRODUCTION

1.1. Coronavirus Disease

Coronavirus disease 2019 (COVID-19), the highly contagious viral illness caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), has had a catastrophic effect on the world's demographics. Resulting in more than 6 million deaths worldwide as of March 2022, emerging as the most consequential global health crisis since the era of the influenza pandemic. After the first cases of this predominantly respiratory viral illness were first reported in Wuhan, Hubei Province, China, in late December 2019, SARS-CoV-2 rapidly disseminated across the world in a short span of time, compelling the World Health Organization (WHO) to declare it as a global pandemic on March 11, 2020. Since being declared a global pandemic, COVID-19 has ravaged many countries worldwide and has overwhelmed many healthcare systems. The pandemic has also resulted in the loss of livelihoods due to prolonged shutdowns, which have had a rippling effect on the global economy. Even though substantial progress in clinical research has led to a better understanding of SARS-CoV-2 and the management of COVID-19, limiting the continuing spread of this virus and its variants has become an issue of increasing concern, as SARS-CoV-2 continues to wreak havoc across the world, with many countries enduring a second or third wave of outbreaks of this viral illness attributed mainly due to the emergence of mutant variants of the virus. Like other RNA viruses, SARS-CoV-2, while adapting to their new human hosts, is prone to genetic evolution with the development of mutations over time, resulting in mutant variants that may have different characteristics than its ancestral strains [1], [2], [3]. Several variants of SARS-CoV-2 have been described during the course of this pandemic, among which only a few are considered variants of concern (VOCs) by the WHO, given their impact on global public health. Based on the recent epidemiological update by the WHO, as of December 11, 2021, five SARS-CoV-2 VOCs have been identified since the beginning of the pandemic:

- **Alpha (B.1.1.7):** which was first variant of concern described in the United Kingdom (UK) in late December 2020.
- **Beta (B.1.351):** which was first reported in South Africa in December 2020.
- **Gamma (P.1):** which was first reported in Brazil in early January 2021.
- **Delta (B.1.617.2):** which was first reported in India in December 2020.
- **Omicron (B.1.1.529):** which was first reported in South Africa in November 2021.

Despite the unprecedented speed of vaccine development against the prevention of COVID-19 and robust global mass vaccination efforts including vaccine boosters, the emergence of these new SARS-CoV-2 variants threatens to overturn the significant progress made so far in limiting the spread of this viral illness [4].

Omicron Variant

Different variants of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) have been identified since the first coronavirus disease 2019 (COVID-19) infection appeared in December 2019. Until November 2021, the Delta variant was designated as variant of concern (VOC) because of different characteristics [5]. According to the Centers for Disease Control and Prevention (CDC), the variant responsible for increased transmissibility, severe disease course, reduced effectiveness of treatments, and

many other alarming factors is designated as the VOC. Omicron variant is a new heavily mutated SARS-CoV-2 variant known as B.1.1.529, and it is now designated as a VOC by the World Health Organization on November 26, 2021 [6], [1]. Many cases have already been identified after the first confirmed Omicron variant infection from a sample collected on November 9, 2021, in South Africa and reported to WHO on November 24, 2021. However, later it was found out that the Netherlands had the first Omicron variant positive patient diagnosed with the variant a week before the announcement from Africa, and surprisingly, the first Omicron variant positive patients of Africa were international travelers. The Omicron variant is the most heavily mutated variant among all the VOC so far, which paves the way for enhanced transmissibility and partial resistance to immunity induced by COVID-19 vaccines [5], [6], [1]. Following the D614G, Beta/Gamma, and Delta VOCs, the SARS-CoV-2 Omicron variant could be the catalyst for the fourth wave of the COVID-19 outbreak to sweep the globe. Unfortunately, this variant has already been spotted in 80 countries worldwide until December 15, 2021. The death of one confirmed patient infected with the Omicron variant of SARS-CoV-2 in the UK was reported on December 13, 2021 [4].

Prevalence and Misuse of Antibiotics during COVID-19

There may be several factors leading to the misuse or overuse of antibiotics. These factors which lead to misuse of antibiotics may be at the patient level or at the level of doctors. Behind misuse of antibiotics several factors are laying that resist patient to use antibiotics appropriately. These factors can be named as cultural factors, behavioral factors, socio-economic status of patients and level of education both at the level of health care professionals and patients especially in our community Karachi [7]. It may be concluded that in developing countries the antibiotics that are at the level of bacterial resistance are generally inexpensive and broad spectrum. It is not wrong to say that the misuse of antibiotics is more at clinical practices rather than at public health personnel, because it is more common at the level of private practitioners that they charge higher fees and here the demands for antibiotics is higher and hence because of this reason more drugs are available in private clinics as compared to public hospitals [8]. A trending worldwide practice of self-medication does not have enough literature on an ongoing pandemic. However, no study reports the prevalence of self-medication in the highly affected medical student population in Pakistan (the future of the healthcare system). It is important to assess self-medication practices among medical students, because they have relevant knowledge, and are more likely to access to prescription as well as OTC drugs [9]. Low tendency to consult health professionals, reliance on the internet for information on background medical knowledge, and treating self-diagnosed illnesses could be factors that promotes self-medication practice among medical students [10]. Anti-microbial resistance (AMR) is a global health issue that plays a significant role in morbidity and mortality, especially in immunocompromised patients. It also becomes a serious threat to the successful treatment of many bacterial infections. The widespread and irrelevant use of antibiotics in hospitals and local clinics is the leading cause of AMR. Well one thing we know for sure about SARS-CoV-2, the virus that causes COVID-19, is that it is changing constantly [10], [11]. Since the beginning of the pandemic, we've seen a number of prominent variants, including Alpha, Beta, Delta, and Omicron [12]. As virus replicates quite rapidly, hence new variants are an expected part of the evolution of viruses and monitoring each one that surfaces are very important in ensuring that all of us are well prepared for any new form of threat. And it's totally true that a new variant is more aggressive, highly transmissible, vaccine-resistant, able to cause more severe diseases or all of the above, compared with the original strain of the virus [1], [10].

Self-Medication

Self-medication is a common practice in healthcare system. People want to self-care using medicines following self-diagnosis. Management of minor ailments can be achieved using medicinal and non-medicinal agents. It also relates to the use of first-aid in everyday life. Socioeconomic culture, personal traits, and healthcare system play an important role in self-medication prevalence and practice. Self-medication has some pros and cons [13]. It rivets some risks to human: consumers may incur significant financial costs; excessive antimicrobial use can lead to pathogen-resistance; many adverse drug events and drug-drug interactions can occur; and life expectancy can shorten. However; appropriate

self-medication can save time and money, empower public to cure minor ailments themselves, and increase public confidence for making decisions to improve their own health [13]. Self-medication is global practice regardless of prescription cost and outline of health care system. Self-medication is general practice in developed nations such as Australia, Italy and Spain.

Antibiotics Resistance Due to Self-Medication

Antibiotic-resistance is the ability of bacteria to be not cured or prevented by the antibiotics used against them. Ever since, when antibiotics were developed, there was a continuous worry about the resistance of bacteria to antibiotics. It is one of the significant hazards developed by bacteria because it not only causes deadly infections but also responsible for causing increased mortality and morbidity. The poor management, unhygienic environment, untrained professionals, overuse, and misuse of antibiotics are the factors that lead to the development of these panic situations in the form of adopting or acquiring resistant genes by bacteria against these antibiotics [14].

Aim of the Study

Aim: The basic study aim is to evaluate Pakistan's public regarding self-medication and misuse of antibiotics especially during Omicron (Covid-19) pandemic.

2. METHODOLOGY

Settings

Study Design and Population

A cross-sectional survey was conducted online using a self-administered, self-made and validated questionnaire to address this key issue in Pakistan. This questionnaire was delivered country wide and making it sure that it would reach all the provinces including the capital of Pakistan. The questionnaire included general as well as specific questions in such a way that it targeted almost every single person having at least certain knowledge about medicines. Hence the questionnaire was presented to mostly Pharmacy technicians, Pharmacy helpers and anyone who can understand this questionnaire plus those who are working in pharmacies [15].

Sample Size Calculation

The sample size of the survey was obtained using Rao soft calculator. The minimum sample size was 385, with a confidence interval of 95%. We hypothesized that at least 50% of the participants would practice self-medication, with a 5% margin of error. The formula for sample size estimation was:

$$n = N \times / (N1)\ E2 + x)$$

Where N=is the population size and n= sample size estimation. A non-probability sampling technique was used to recruit participants from social media including face to face interactions. Overall 400 responses were collected out of which 10 responses were drop down due to margin error platforms.

Inclusion and Exclusion Criteria

Inclusion criteria includes; Pharmacy technicians, Pharmacy helpers and anyone who can understand this questionnaire plus those who are working in pharmacies. While the exclusion criteria include Physicians and Pharmacists.

Data Collection Procedure

A convenience sampling method was used to complete the required sample size. Official and more efficient way of data collection was done through online system using the Google forms. And for consecutive 4 months the online questionnaire was available to be filled by the individuals [15].

Data Collection Tool

An online based questionnaire was used and developed for data collection. The questionnaire consisted of a total of 17 questions that needed to be answered according to the given or mentioned

options. Details of this questionnaire are as follows: assessed subject demographics, including age, sex, marital status, occupation, qualification, ethnicity, residential area, usage of antibiotics during Omicron (covid-19), use of prescribed or non-prescribed medication i.e. self-prescribed medication, reason and significance for self-medication, assessment of sign and symptoms that leads to the use of antibiotics, level of effectiveness of antibiotics, duration and reason for antibiotics usage and route of administration. Hence, data collected was analyzed and feedback was taken from the subjects about possible difficulties faced while filling the online questionnaire. No difficulties were faced, however those subjects who had less knowledge about medications or those who illiterate, their responses were excluded from the results [16], [15], [17].

Data Sources

Questionnaires was used as the major and prominent source of data collection this questionnaire was delivered country wide and making it sure that it would reach all the provinces including the capital of Pakistan. The questionnaire included general as well as specific questions in such a way that it targeted almost every single person having at least certain knowledge about medicines. Hence the questionnaire was presented to mostly Pharmacy technicians, Pharmacy helpers and anyone who can understand this questionnaire plus those who are working in pharmacies; all these are referred to as the inclusion criteria while the exclusion criteria includes the Physicians and Pharmacists.

Data Entry and Analysis

Microsoft Excel was used for data entry. Data analysis was performed using SPSS version 21. The software was used to run a descriptive analysis and the frequency tables generated were used to calculate the prevalence of self-medication. Frequency of use of different classes of antibiotics and frequency of the reasons which led to use of self-medicated antibiotics was also calculated using descriptive analysis.

3. RESULTS AND DISCUSSION

Study Population

Table 1 provides a descriptive analysis of Three hundred and ninety (390) responses were received on Google forms. And these responses were almost from all over Pakistan i.e. covering all the provinces (Punjab, KPK, Baluchistan, Sindh, AJK and Gilgit etc.). A total of 390 questionnaires were completed. Table 1 Shows that men made up the majority of respondents, 240 (61.5%), and females made up about 150 (38.5%). Age of respondents were 18-24 years old (40.5%), age group 25-34 (40%) and above 35 years (19.4%). About, 34.1% of respondents were married and 65.9% were single respondents, while in terms of occupation, unemployed were (28.7%), employed (19.2%), self-employed (51.5%) and other business (0.5%).

Table 1. Demographic and Information of Study Participants

Genders	Frequency	Percentage
Male	240	61.5
Female	150	38.5
Age		
18-24	158	40.5
25-34	156	40
35-44	35	9
45-54	30	7.7
>55	11	2.8
Marital status		
Single	257	65.9
Married	133	34.1
Occupation		

Business	2	0.5
Employed	75	19.2
Self-employed	201	51.5
Unemployed	112	28.7
Residential Area		
Rural	127	32.6
Urban	263	67.4
Qualification		
No Qualification	3	0.7
Primary school	11	2.8
High school	72	18.5
Graduate	304	77.9
Total	390	100

Mostly Used drugs (Antibiotics) During Omicron

As shown in Table 2, (n = 390) of participants in consumed at least one antibiotic in the last one months. The prevalence of total consumption of antibiotics per self-medication were cephalosporin, ceftriaxone which was used by 125 (32.1%) study participants. Macrolides/ Azithromycin, clarithromycin which were used by 119 (30.5%) study participants. Followed by penicillin, amoxicillin with clavulanic acid (17.4%) and fluoroquinolones, ciprofloxacin (7.2%) while the other antibiotics included 12.8% of the study population.

Table 2. Mostly Used Drugs during Omicron

Drugs	Frequency (%)
Cephalosporin/ Ceftriaxone	125 (32.1)
Macrolides/Azithromycin, Clarithromycin	119 (30.5)
Penicillin/Amoxicillin Clavulanic acid	68 (17.4)
Fluoroquinolone/ Ciprofloxacin	28 (7.2)
Any Other antibiotics	50 (12.8)
Total	390 (100)

Order of Taking Antibiotics

As shown in Table 3 149 out of 390 study participants took antibiotics by prescription order of physician and 35 of the study participants took antibiotics by prescription order of paramedics (quack) while 81 of the study participants took by prescription order of pharmacists and self-prescription was done by 125 of the study participants.

Table 3. Order of Taking Antibiotics

Order of Taking Antibiotics	Frequency (%)
Prescription Order of Physician	149 (38.2)
Prescription Order of Paramedics (Quack)	35 (9)
Prescription by Pharmacist	81 (20.8)
Self-Prescription	125 (32.1)
Total	390 (100)

Reasons for Self-Medication

As shown in Table 4, the main reported reason for SMA is (45.1%) due to economical and easily accessible. The second most reported reason for SMA is (28.5%) due to lack of physican's trust. Moreover, the other reasons included knowledge related medication and advised by family and friends showing percentage of (18.5%) and (7.9%) respectively.

Table 4. Reasons for Self-Medication

Reason of Self-Medication	Frequency (%)
Economical and easily accessible	176 (45.1)
Knowledge related medication	72 (18.5)
Lack of physician's trust	111 (28.5)
Advised by family and friends	31 (7.9)
Total	390 (100)

Significance of Self-Medication

As shown in Table 5, most of the respondents (25.6%) didn't have any idea regarding significance of self-medication, while (23.3%) and (13.6%) of the respondents consider it as a bad practice and good practice respectively. Whereas, (23.1%) thinks that use of self-medication is acceptable.

Table 5. Significance of Self-Medication

Significance of Self-Medication	Frequency (%)
Good practice	53 (13.6)
Bad practice	91 (23.3)
Do not know	100 (25.6)
Acceptable	90 (23.1)
Non-acceptable	56 (14.4)
Total	390 (100)

Signs and Symptoms that Lead to the use of Antibiotics

According to the Table 6 fatigue, cough, sore throat and runny nose were among the most common signs and symptoms that lead to the use of antibiotics which was about (48.7%).

Table 6. Signs and Symptoms that Lead to the Antibiotic Usage

Signs and Symptoms that Lead to Antibiotics Usage	Frequency (%)
Fever and headache	73(18.7)
Cough and sore throat	80(20.5)
loss of sense of smell or taste	53(13.6)
Shortness of Breath	48(12.3)
fatigue and runny nose	110(28.2)
nasal congestion	26(6.7)
Total	390(100)

Discussion

This study was to determine the prevalence and to assess the knowledge, practice of self-medication across Pakistan. The present study is the from Pakistan to assess or analyze the prevalence and misuse of antibiotics i.e. self-medication during Omicron variant. Access to medicines without prescription sanctions self-medication practice that is a global challenge [16]. The prevalence and use of self-medication with antibiotics, is much higher in developing countries as compared to developed ones. In this study the prevalence of self-medication 32%, the study result was lower than the other studies conducted in various countries have shown prevalence of self-medication with antibiotics to be 47.8% in Southern China, 79.5% in Sudan and 48% in Iran [15], [18]. Similar to our study trend for prevalence of self-medication was found in study conducted for general community in Middle Eastern countries [15]. As far as no any particular study was available for comparison in Pakistan which had studied the prevalence of self-medication with antibiotics during Omicron. Previously study found 83% of use of any drug since the start COVID 19 [19]. Therefore, this study has very significant in this present condition of pandemic. This study also assessed different and various factors that could be associated with the use of self-prescribed antibiotics amongst the study population. Amongst the list of antibiotics given to the

participants the most commonly used antibiotics were cephalosporin/ceftriaxone (32.1%) followed by macrolides/azithromycin, clarithromycin (30.5%) and penicillin, amoxicillin with clavulanic acid (17.4%) respectively. This study reflects similar results to one another study done in Pakistan where the most common antibiotic used for self-medication was cephalosporin, followed by co-amoxiclav and amoxicillin respectively [12]. In this study, fatigue, cough, sore throat and runny nose were among the most common signs and symptoms that lead to the use of antibiotics which was about (48.7%). This finding matches the common reasons highlighted for self-medication with antibiotics in previous studies [20], [21]. In our study; 149 out of 390 study participants took antibiotics by prescription order of physician (38.2%) and 35 of the study participants took antibiotics by prescription order of paramedics (quack) (9%) while 81 of the study participants took by prescription order of pharmacists (28.8%) and self-prescription was done by 125 (32.1%) of the study participants. This shows a larger proportion (32.1%) of subjects admitted of taking the antibiotics by themselves. This high percentage might be due to our study subjects being educated university students who had access to online learning resources and may think of themselves as well equipped with knowledge of antibiotics. This study matches the results of a previous findings for taking antibiotics without prescription order that is among 85% of the participants who had used antibiotics were almost (42.2%) reported un-prescribed use [22], [23]. Furthermore, the main reported reason for SMA is (45.1%) due to economical and easily accessible. The second most reported reason for SMA is (28.5%) due to lack of physican's trust. Moreover, the other reasons included knowledge related medication and advised by family and friends showing percentage of (18.5%) and (7.9%) respectively [24]. Whereas other study showed the reasons for self-medication as ease of access to medicines, lack of healthcare knowledge, excessive marketing, inadequate enforcement of regulatory policies, poor accessibility to healthcare providers, and lack of public healthcare facilities [16] and most importantly the significance of self-medication among the study participants is illustrated in Table 4 showing that most of the respondents (25.6%) didn't have any idea regarding significance of self-medication, while (23.3%) and (13.6%) of the respondents consider it as a bad practice and good practice respectively. Whereas, (23.1%) thinks that use of self-medication is acceptable. While other studies showed that self-medication was a good practice only if one's has sufficient knowledge regarding the antibiotics [19]. The community pharmacies are ideally placed to educate the public about the careful use of medicines. Community pharmacists in Pakistan must play an effective role in combating excessive self-medication to improve health outcomes and reduce harm.

Further, authorities should implement and closely monitor National Drug Policy (NDP) of Pakistan regarding the sale of OTC and POM from distribution points [16]. Also, the use of antibiotics shouldn't highly be without physician's advice/ prescription order unless one has a complete or sufficient knowledge about the use of antibiotics. Ideally, it is the government's responsibility to establish that any population uses self-medication responsibly such as drugs like antibiotics should only be given on prescription order or by assessing the individual's knowledge responsibly and which can only be done by pharmacist. Therefore, must ensure the availability of at least a single pharmacist in the pharmacies to avoid this illiterate, ignorant and nescient use of antibiotics. Drugs that are available without the need for prescription by physician or trained medical personnel should only be the ones which are safe to use. The government should also ensure that users are educated properly about not only the use of the drug but also the correct dosages, duration of use and potential side effects associated with them as antibiotics are tailored not only according to the disease but also according to the individual patient profile [25], [26].

4. CONCLUSION

The study revealed common self-medication practices among General population. It is a significant health issue especially during the pandemic times, with high consumption reported as a prevention or treating symptoms of Omicron. The current study points to a significant prevalence of antibiotics usage in Omicron patients. Future studies should also assess medical practitioners and pharmacist's attitude toward self-medication, their knowledge regarding drug dosage and potential side effects to better ascertain their approach toward self-medication. The study also showed that there is a

need for strict law enforcement to limit the purchase of antibiotics without a prescription which can only be done if this issue is taken seriously and not ignored by the law makers.

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Author Contributions Statement

Name of Author	C	M	So	Va	Fo	I	R	D	O	E	Vi	Su	P	Fu
Afaq Wazir (RPH)	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	

C: **C**onceptualization
M: **M**ethodology
So: **So**ftware
Va: **Va**lidation
Fo: **Fo**rmal analysis
I: **I**nvestigation
R: Resources
D: Data Curation
O: Writing- **O**riginal Draft
E: Writing- Review& **E**diting
Vi: **Vi**sualization
Su: **Su**pervision
P: **P**roject administration
Fu: Funding acquisition

Conflict of Interest Statement

The authors declare that there are no conflicts of interest regarding the publication of this paper.

Informed Consent

All participants were informed about the purpose of the study, and their voluntary consent was obtained prior to data collection.

Ethical Approval

The studies involving human participants were reviewed and approved by the ethics and research committee at the Department of Pharmacy, Abasyn University Islamabad Campus.

Data Availability

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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