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Knowledge, attitude, and perception regarding antibiotic use and its associated resistance among the general public in Lahore, Pakistan

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ABSTRACT

BACKGROUND & OBJECTIVE: Increasing misuse and irrational prescribing of antibiotics by physicians has led to antimicrobial resistance (AMR) posing a major global threat. Furthermore, only a few studies have been conducted to evaluate this domain in Pakistan. The objective of this study is to assess the general public's knowledge, attitude, and perception towards antibiotic use and its resistance, and to determine positive associations between the various socio-demographic variables.

METHODOLOGY: A descriptive cross-sectional study was conducted from October 2022 to March 2023. A convenient sampling technique was employed, selecting participants ≥ 18 years of age (n= 339). Structured questionnaires were distributed on different study sites and random participants were asked to respond immediately.

RESULTS: Results showed that assessing antibiotics use among these 342 participants in the last year, it was determined that the majority of them had only used antibiotics once 108(31.6%). A closer number of individuals had used antibiotics more than thrice 101(29.5%) shows no significant association between rural and urban with a p-value=0.941>0.05. The majority were also aware of fatal allergic reactions produced by some antibiotics and agreed to stop antibiotic use if any adverse reaction were to occur 277(81.0%)p-value=0.674>0.05. No significance was observed, although some near-significant values of importance were noted and discussed.

CONCLUSION: Antibiotic usage is commonly observed among all individuals; however, views contain many deviations. Constraints, including sample bias, Lahore's urban dominance, and the omission of doctor-prescribing evaluations, highlight the study's limitations and have further skewed our results.

KEYWORDS: Antibiotic Use, Antibiotic Resistance, Cross-Sectional Studies, Breast Feeding.

INTRODUCTION

Even though bacteria are prone to rapid growth, antibiotics have the potential to save lives and protect against infectious diseases. Despite being a naturally occurring process, antimicrobial misuse and overuse have accelerated antimicrobial resistance (AMR), which frequently results in therapy failure [1]. In the context of antibiotic use, adherence refers to the patient following the antibiotic course as prescribed and not self-medicating without a doctor's prescription as described by Lee SY, Shanshan Y, and Lwin MO in 2016 [2]. A primary driver of AMR is restraint and non-adherence to anti-infection agents. According to population characteristics, the prevalence of nonprescription antibiotic use ranged from 1% to 66%, the prevalence of antibiotic storage for future use ranged from 14% to 48%, and the prevalence of intention to use antibiotics without a prescription was 25% [3]. The spread of antibiotic resistance poses a significant and growing threat to public health. Antibiotic resistance presents enormous challenges, such as prolonged hospital stays, increased mortality, a significant financial burden, and intangible costs. The inappropriate use of antibiotics has been identified as a major contributor to antibiotic resistance, even though several factors play a role [4]. In 2017, the Ministry of Health and Sports of Myanmar approved the Myanmar National Action Plan for Reducing

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Antimicrobial Resistance (AMR) (2017–2022). A part of it was to make people more aware of AMR. Antibiotics were familiar to 89.5% of participants overall; Only 0.9% of respondents provided correct responses to all five questions regarding antibiotics, while 9.7% provided incorrect responses to all questions. More than half of the participants (58.5%), mostly in medical supply stores or pharmacies (87.9%), purchased antibiotics without a doctor's prescription. (p = 0.004 and p 0.001), this was more prevalent in rural areas and among people aged 18 to 29. Only 46.3 percent of respondents were aware of antibiotic resistance and learned about it from doctors, family, or friends (38.9 percent), or the media (26.1%) [5]. Several nations have developed public health campaigns that emphasize avoiding the use of antibiotics to treat cold symptoms, particularly in children, to help halt the spread of antibiotic resistance. Due to this increased global threat antimicrobial resistance is posing, the World Health Organization (WHO) recently announced the 2015 World Antibiotic Awareness Week [6]. A UK report on antimicrobial resistance estimates that if resistance continues at current levels, by 2050, deaths from AMR will reach 10 million per year [7]. This problem is caused by many factors, such as low-quality antibiotics and incorrect (insufficient or excessive) use of antibiotics (including self-medication) [8].

Antimicrobial resistance is a major public health problem worldwide. The development of antimicrobial-resistant organisms (AR) is primarily aggravated by the irrational use of antibiotics [9]. AR affects both patients and healthcare professionals (HCPs); The development of antiretrovirals (ARVs) is directly linked to the use of antibiotics in excess. Countries with the highest antibiotic consumption per capita have the highest prevalence of resistant organisms. On the other hand, other studies in the UK have shown that one in four prescriptions for antibiotics are unnecessary, which amounts to a total of ten million unnecessary prescriptions each year [10]. However, since the beginning of the COVID-19 pandemic, there has been growing concern about the possibility of an increase in AMR because of the increased prescription of antibiotics for COVID-19 patients. A study that was carried out in January 2020 in an adult infectious disease unit in China found that 71% of the patients hospitalized for COVID-19 had received antibiotics despite having a confirmed bacterial co-infection rate of only 1% [11].

Our study is a cross-sectional study conducted in Lahore, recruiting random participants at different study sites (e.g. supermarkets, shopping malls, CMH OPD, CMH cafeteria). Information on demographic variables including age, marital status, educational level, income per month, occupation, and residence was obtained by each participant to ascertain any association that may be present.

The objective of our study is specifically to determine the presence of any positive association between these major socio-demographic variables and the general population's knowledge, attitude, and perception towards antibiotic use and its associated resistance among individuals residing in Lahore, Pakistan.

METHODOLOGY

A descriptive cross-sectional study design was used to assess knowledge, attitude, and perception of antibiotic use and resistance among the general public of Lahore, Pakistan. A non-probability convenient sampling technique was employed to assess members of the general population from 18 years of age to 50 and above. Ethical approval was taken from the ethical review committee of CMH Lahore Medical College (#623/ERC/CMH/LMC).

The sample size was calculated using Cochran's formula where a confidence interval of 95%, an error margin of 5% (0.05), and a prevalence of 67.1% (0.671) was used to give a sample size of 339. The prevalence was obtained from the parent article where 67.1% of the participants believed in antibiotics treating the common cold[12]. Despite the sample size being 339, a total number of 342 responses were received. As it is feasible to study further participants, all meeting inclusion criteria were included.

This survey was conducted from October 2022 to March 2023. A structured close-ended questionnaire was developed by the students of CMH Lahore Medical College for the purpose of data collection from the 339 respondents recruited at different settings. The inclusion criteria for form submission were all and any members of the general population consenting to fill the form and of ≥ 18 years of age. The exclusion criteria were participants not consenting, < 18 years of age, or unaware of the term 'antibiotics. Questionnaires were distributed on site and participants were asked to respond immediately. They were well informed about the purpose of the study and consent was taken. The confidentiality of their personal information was reassured. Information on demographic variables including age, marital status, educational level, income per month, occupation, and residence was obtained by each participant. All the participants were presented with a series of statements, on a Likert scale, to evaluate their attitude and perception towards antibiotic use and resistance.

All responses were reviewed, coded, and analyzed by entering them in the IBM Statistical Package for Social Sciences (SPSS) version 26. Variables were presented in the form of percentages and frequencies, displayed in tables, bar charts, and pie charts. The chi-square test was applied to determine any significant association between the various socio-demographic variables and the general population's knowledge, attitude, and perception of antibiotic use and resistance. A p-value of <0.05 was deemed significant.

RESULTS

A total of 342 participants were included in this study, the age range being 18 years of age to 50 and above. Participants aged 18-30, 295(86.3%) were more in number than participants aged 31-50 and >50 (8.5% and 5.3% respectively). The majority of these individuals were single 276(80.7%), with a small proportion of them being married 62(18.1%). A large population of the participants

were residing in urban areas 296(86.5%) compared to 46(13.5%) of the 342 participants residing in rural areas.

Table-I:Socio-demographic characteristics of the participants (n= 342).

Variables	Categories	n (%)
Age (Years)	18-30	295(86.3)
	31- 50	29(8.5)
	>50	18(5.3)
Marital Status	Single	276(80.7)
	Married	62(18.1)
	Divorcees/ Separated	3(0.9)
	Residence	1(0.3)
Residence	Urban	296(86.5)
	Rural	46(13.5)
Educational level	Primary	10(2.9)
	Middle	10(2.9)
	Secondary	121(35.5)
	Graduate	169(49.4)
	Masters	32(9.4)
Occupation	Housewife	26(7.6)
	Unemployed	241(70.5)
	Employed	75(21.9)
Income per month	Not earning	214(62.6)
	Low	102(29.8)
	High	26(7.6)

Education level varied considerably among the participants, with 32(9.4%) respondents having acquired a master's degree, 169(49.4%) respondents being university graduates, and 121(35.5%) respondents with secondary level education figure-I. Over half of the correspondents were unemployed 241(70.5%), with only a few being employed 75(21.9%). A higher proportion of them had a low income per month 102(29.8%). The socio-demographic characteristics of the participants are stated in Table -I.

The level of knowledge about antibiotic use, its resistance, and safety were evaluated by statements shown in tables along with their association with demographic variables.

Out of the 342 participants, 318 (93.0%) had knowledge of antibiotics and 303 (88.6%) had heard about antibiotic resistance. A proportion of respondents are knowledgeable about the side effects of antibiotics use in pregnancy (55.8%) and during breastfeeding (57.0%).

Upon assessing antibiotic use among these 342 participants in the last year, it was determined that the majority of them had only used antibiotics once 108(31.6%). A closer number of individuals had used antibiotics more than thrice 101(29.5%).

The majority were also aware of fatal allergic reactions produced by some antibiotics and agreed to stop antibiotic use if any adverse reaction were to occur 277(81.0%). (Table –II)

All the participants were presented with a series of statements to evaluate their attitude and perception toward antibiotic use and resistance on a Likert scale. Participants were well aware of the effectiveness of antibiotics against cough and cold 208(66.7%), though some respondents wrongly believed in antibiotics use in stopping fever 207(60.5%). Upon evaluation of participants' behaviour towards antibiotic use, 137(40.1%) participants strongly disagreed with not completing the antibiotic course once they felt better. Furthermore, around 96(28%) of participants strongly disagreed with consulting family and friends instead of a doctor.

Over one-third of the respondents had admitted to keeping antibiotics at home to be used in time of need 118(34.5%). Contrary to popular belief, 94(27.5%) and 101(29.5%) participants strongly disagreed and disagreed with buying antibiotics from the pharmacy without a doctor's prescription respectively.

Table-II:Association of residents with general population's knowledge of antibiotic use and resistance (n=342).

Statements evaluating participants' knowledge of antibiotic resistance	Response	Urban	Rural	Total	p-value
Antibiotics can be taken in pregnancy?	Yes	134(89.0%)	17(11.0%)	151	0.291
	No	162(85.0%)	29(15.0%)	191	
How frequently did you use antibiotics in the previous year?	Once	94(87.0%)	14(13.0%)	108	0.941
	Twice	74(88.1%)	10(11.9%)	84	
	Thrice	42(85.7%)	7(14.3%)	49	
	More than thrice	86(85.1%)	15(14.9%)	101	
Antibiotics can be taken during breastfeeding.	Yes	127(86.4%)	20(13.6%)	147	0.942
	No	169(86.7%)	26(13.3%)	195	
If you get adverse effects during a course of antibiotics, will you stop taking it as soon as possible?	Yes	239(86.3%)	38(13.7%)	277	0.764
	No	57(87.7%)	8(12.3%)	65	
Using antibiotics without a physician's prescription.	Yes	189(87.5%)	27(12.5%)	216	0.500
	No	107(84.9%)	19(15.1%)	126	

Regarding meal and drink preferences, the majority agreed and strongly agreed with the preference for taking antibiotics after meals. 134(39.2%) and 83(24.3%) respectively, while around three-fourths of the individuals agreed and strongly agreed with taking antibiotics with water. (Table- III)

Table-III:Attitude and perception of participants towards antibiotic use and resistance on a Likert scale. (n= 342).

Statements evaluating participants' behaviour toward antibiotic use	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
You do not complete the antibiotic course once you feel better.	27(7.90%)	64(18.7%)	54(15.8%)	60(17.5%)	137(40.1%)
You prefer to consult friends and family first instead of a doctor.	28(8.19%)	47(13.7%)	82(24.0%)	89(26.0%)	96(28.1%)
You prefer to keep antibiotics at home to be used in times of need.	61(17.8%)	118(34.5%)	77(22.5%)	51(14.9%)	35(10.2%)
You prefer buying antibiotics from a pharmacy without a doctor's prescription.	17(4.97%)	63(18.4%)	67(19.6%)	101(29.5%)	94(27.5%)
You would take antibiotics after meals.	83(24.3%)	134(39.2%)	80(23.4%)	26(7.60%)	19(5.56%)
You would take antibiotics with water.	107(31.3%)	145(42.4%)	42(12.3%)	26(7.60%)	22(6.43%)

Data on respondent's beliefs of factors causing AMR revealed that 216(63.2%) of them believed that using antibiotics without a physician's prescription was one the causes of AMR. Two-thirds of participants agreed that not completing a full course of antibiotics was one of the aggravating factors toward AMR 226(66.1%). Almost half 172(50.3%) agreed that taking antibiotics with other drugs is a factor contributing towards AMR too. (Table- IV)

Table-IV:Knowledge of participants regarding the cause of antibiotic resistance. (n= 342).

Statements evaluating participant's beliefs towards the cause of antibiotic resistance.	Yes	No
Using antibiotics without a physician's prescription.	216 (63.2%)	126 (36.8%)
Not completing a full course of antibiotics	226 (66.1%)	116 (33.9%)
Taking antibiotics with another drug.	172 (50.3%)	170 (49.7%)
Using antibiotics when they are not necessary.	205 (59.9%)	137 (40.1%)

The belief regarding using the same antibiotics with different brands leading to antibiotic resistance with occupation level of the respondents was higher among unemployed individuals (44.2%) compared to 13.7% in employed individuals and 4.7% in housewives. Furthermore, 205(60.0%) individuals believed unnecessary use of antibiotics to be contributing towards AMR, and 61.1% in carelessly using antibiotics during fever as one of the causes too (Table-V).

Table-V:Association of occupation with the general population's knowledge of antibiotic use and resistance (n=342).

Statements evaluating participants' knowledge of antibiotic resistance	Response	Housewife	Unemployed	Employed	Total	p-value
Antibiotics are used to stop fever?	Yes	15(7.3%)	145(70.0%)	47(22.7%)	207	0.885
	No	11(8.1%)	96(71.1%)	28(20.7%)	135	
Using the same antibiotic with a different brand.	Yes	16(7.5%)	151(70.6%)	47(22.0%)	214	0.994
	No	10(7.8%)	90(70.3%)	28(21.9%)	128	
Taking antibiotics with another drug.	Yes	15(8.7%)	119(69.2%)	38(22.1%)	172	0.721
	No	11(6.5%)	122(71.8%)	37(21.8%)	170	
Not completing the full course of antibiotics.	Yes	15(6.6%)	160(70.8%)	51(22.6%)	226	0.622
	No	11(9.5%)	81(69.8%)	24(20.7%)	116	
Using antibiotics when they are not necessary.	Yes	15(7.3%)	145(70.7%)	45(22.0%)	205	0.970
	No	11(8.0%)	96(70.1%)	30(22.0%)	137	

DISCUSSION

Our research offers valuable insights into the understanding, beliefs, viewpoints, and behaviours of the general population in Lahore regarding antibiotic resistance and usage. These findings can be leveraged to design appropriate educational strategies aimed at enhancing the appropriate prescribing and utilization of antimicrobial medications in the future.

According to our findings, we noticed a trend in the public's opinion of antibiotic usage whilst breastfeeding and geographical location, with 57% public believing that taking antibiotics during this time is an unsafe practice, whilst 43% believed in the opposite. This was seen by observing a near-significant value (p= 0.941) between breastfeeding and the residence of participants. Further broken down, 57% of the urban population believes it is unsafe, and 56.5% of the rural population also believes in the same.

This finding can be explained both in the perspective of education and in the view of social/cultural practices. From an educational standpoint, this finding correlates the awareness of the public to the dangers of antibiotic misuse during the nursing of a child and shows that adequate public knowledge may be present. However, this finding can also be explained by the overwhelming presence of misinformation and misguidance within the cultural values present in both the rural and urban populations of Pakistan, with both sides having fears of general medical practices based on social, cultural, and possibly religious values [13]. In 2019, A Swedish study was conducted on this very topic, which obtained a very similar pattern of data, showing that a predominant proportion of the female population in Southeast Sweden also holds homogenous opinions about the safety of using such medication during breastfeeding [14].

A study was also conducted about the safety of antibiotics within breastfeeding, with the results concluding that it is unclear if antibiotics in breast milk carry the same risks for infants [15]. Juxtaposed with this, a previous study conducted in Nigeria, concluded that the reality is that the prevalence of lack of education and information on such topics is the reason for the misuse of antibiotics among breastfeeding mothers in a low economically developed country similar to Pakistan [16]. With the analysis of these studies along with our findings, it can be seen that the general population within our study does not have a strong understanding of antibiotics and their sensible uses, however, do hold a similar trend in opinions as various other places in the rest of the world, regardless of geographic location.

When asked about the relation between antibiotic resistance and the usage of the same antibiotics with different brands, we found another near significant value (p= 0.994) between the occupation of the participants, and their viewpoint. Analyzing the data, one can extract that 61.5% of housewives, 62.7% of unemployed, and 62.7% of employed participants all agree that using the same antibiotics but under different brand names, can lead to increased antibiotic resistance. However, there has not been much research on whether antibiotic resistance is brand-dependent, and its relation to occupation, other than very few similar research based on substandard antibiotics and their relation to antibiotic resistance [17,18]. With the validation received from similar studies conducted in other developing countries, it can be justified that the correlation achieved by this study is one of importance, and can highlight the reasons for discrepancies in public knowledge towards antibiotics and the consequences of their improper usage.

There has been a multitude of variables that have been analyzed to be near-significant according to their p-value from chi-square testing, one such point being the relation between the age of the participant, and whether they would cease their prescribed antibiotic course prematurely. The p-value of 0.720 shows near-significance, and shows a degree of correlation between the variables, however a conclusive 'significant' pattern cannot be agreed upon. We can directly compare this result with a previous study conducted within Pakistan, which yielded a similar result, where they obtained a significant correlation between people prematurely stopping antibiotic courses based on their fears rather than knowledge of these medications thus providing validation for our near-significant result having a solid basis. We can also compare this result to a previous research paper conducted in the UK, which strongly argues that prematurely terminating an antibiotic course may be more beneficial than it is detrimental, on the basis that less exposure to an antibiotic to bacteria leads to a decreased likelihood of developing resistance [19].

Another similar paper was published arguing for the same basis, that premature cessation of an antibiotic course does not necessarily increase the likelihood of resistance [20]. The link between age and stoppage of antibiotic courses has been studied before and highlighted a link between the inappropriate stoppage/usage of antibiotics and an older population, concluding that it is mainly due to the lack of education/information available [21]. Therefore, it can be inferred that our near-significant result follows the pattern of other similar studies which found significant correlations between the variables of age and the likelihood of prematurely ceasing an antibiotic course, thus solidifying the possibility of these variables having significance, however, we cannot make this claim within the context of our study solely [22].

The data that we collected showed numerous areas where a "near-significant" p-value was achieved, categorized as a p-value between >0.05 and <1, which could have been further clarified if our study involved a larger sample size, thus providing a broader data set which would represent the population's beliefs more accurately, whilst simultaneously highlight outliers as well [23].

Our study had several constraints. Since the measurements were conducted cross-sectionally, the relationships identified do not give concrete reasons as to the discrepancies in public knowledge towards antibiotics and their usage, but only highlight that there is a correlation in patterns towards certain viewpoints amongst the public. The survey relied on self-administered questionnaires, leading to self-reported data

on antibiotic usage. Due to the possibility of recall bias, the frequency of antibiotic use may have been either exaggerated or underestimated. Another constraint within our study was the fact that the data we received was predominantly from urban residents compared to rural residents. This can be explained due to Lahore having a heavier urban development than that of the remaining rural areas [24,25].

These studies can be leveraged to highlight the possibility of awareness to the public of the dangers of suboptimal quality of medication and the development of microbial resistance, regardless of employment status, as both studies claim that improper production of such antibiotics has a link to increased likelihood of development of antibiotic-resistant bacteria. Another study conducted in Vietnam, also classed as a developing country, has highlighted the same correlation and concluded that there is an apparent association between employment status, educational level, and use of antibiotics, with the study displaying their findings supporting that the more educated population proceeded more cautiously with their antibiotics usage, and also had more knowledge about antibiotics [26]. The overuse and misuse of antibiotics not only contribute to the rising emergence of resistant bacterial strains but also lead to adverse reactions and impose a significant economic burden on national health systems (Albrich et al., 2004; Alsayed et al., 2019; Alsayed et al., 2020) [26-28].This pervasive issue constitutes a major public health concern on a global scale.

The issue that may arise from this is a skew in the representation of realistic public knowledge about antibiotics due to easy access to information within urban areas rather than rural areas in Lahore. Lastly, it is important to note that the findings are solely applicable to the region of Lahore (Pakistan), and do not represent the global population of the groups that participated in this study [29-30].

CONCLUSION

Antimicrobial resistance (AMR) transcends national boundaries, evolving into a global threat. Diverse disparities exist within the general population regarding their knowledge, attitudes, and behaviours regarding antibiotics and antibiotic resistance. Antibiotic usage is commonly observed among all individuals; however, views contain many deviations. Educating the public and implementing strict antibiotic surveillance are integral components of the strategy to collectively and effectively combat the increasing public health challenge posed by antibiotic-resistant bacteria. These findings underscore the need to further strengthen public education initiatives, focusing on raising more awareness about antibiotics and their associated resistance and promoting responsible antibiotic use.

In order to address this issue, we need a dual-pronged approach: educating the public and implementing strict antibiotic surveillance. Ensuring rational antibiotic prescriptions by physicians and restricting over-the-counter antibiotic distribution are integral components of this strategy.

Our research focused on the antibiotic landscape in Lahore, Pakistan. The public demonstrated sufficient awareness about antibiotic use, associated side effects, and resistance development through misuse. Despite this awareness, a paradox emerged – easy antibiotic accessibility contradicted the opinion against non-prescription usage. Constraints, including sample bias and the omission of doctor-prescribing evaluations, highlight the study's limitations. Lahore's urban dominance skewed results due to higher literacy rates and antibiotic availability. The absence of data on prescribing patterns hindered the correlation between physician practices and AMR. Finally, strict measures, such as regulating prescribing patterns and incorporating antibiotic stewardship programs, infection prevention protocols, and robust AMR surveillance on a national scale, are crucial in order to collectively and effectively combat the increasing public health challenge posed by antibiotic-resistant bacteria.

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Iqra Mushtaq : Reviewing it critically for important intellectual content.
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