

Parental Awareness and Practices of Self-medication with Antibiotics among Hospitalised Children in Pakistan: Findings and Implications from a Cross-sectional Study

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Abstract

Introduction: Antimicrobial resistance (AMR) is a global threat appreciably impacting on morbidity, mortality and costs, especially in low- and middle-income countries. The excessive use of antibiotics, especially in ambulatory care, is a primary factor increasing AMR. This includes inappropriate dispensing of antibiotics without a prescription for essentially viral infections, which is prevalent in Pakistan. This needs addressing to reduce AMR. **Materials and Methods:** A cross-sectional study was conducted among three district hospitals to extract data from parents of children up to 12 years concerning their awareness, practices and rationale of self-medication with antibiotics for their children. **Results:** Four hundred and thirty-eight parents participated in the study, with the majority between 30 and 39 years (65.5%) and possessing secondary school education (28.5%). 27.6% of parents stated that they knew the name of at least one antibiotic, with the majority knowing the name of amoxicillin (33%) and co-amoxiclav (19%). The prevalence of self-medication for their children was high at 63%, principally for self-limiting conditions including sore throats (27.1%), high fever (22.4%), nasal discharges (20.9%) and coughs (17.7%). The most commonly consumed antibiotics among their children were amoxicillin (33.6%), co-amoxiclav (18.1%) and azithromycin (15.2%), with the common reasons for self-medication including similar signs and symptoms to before (42.6%) and financial constraints (39%). Increasing education levels and familiarity with antibiotic names were associated with higher antibiotic usage ($P < 0.001$). **Conclusions:** Self-medication with antibiotics among their children for essentially self-limiting conditions was common. Appropriate corrective measures, including targeted educational initiatives, are urgently need to address ongoing concerns and associated rising AMR.

Keywords: Antibiotics, antimicrobial resistance, children, knowledge, Pakistan, practice, self-medication

INTRODUCTION

Antibiotics are among the most commonly purchased medicines globally, often without a prescription, especially in low- and middle-income countries (LMICs), and typically for self-limiting conditions including acute respiratory infections.^[1-4] In some LMICs, 100% of community pharmacies or drug stores will dispense antibiotics without a prescription.^[3,5]

Self-medication is broader than this and typically defined as the consumption of medicinal products, including over-the-counter or non-prescription medicines, as well as prescription only medicines, including antibiotics, to treat self-diagnosed

illnesses without consultation with a physician, pharmacist or other healthcare professionals (HCPs).^[6,7] Self-medication also includes the continuous or intermittent use of a medication

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previously prescribed by a physician or other prescribers working in primary healthcare clinics for chronic or recurring symptoms or diseases and subsequently purchased from a pharmacy or drug store without any medical supervision.^[8,9] However, no formal definition for self-medication currently exists.^[10]

Prevalence rates for self-medication vary considerably across countries, ranging from 10.32% to 97.2% of medicines dispensed depending on the population and the country.^[11-25] Various factors contribute to self-medication in LMICs. These include a lack of financial resources for medical consultations, especially where there are high co-payment levels, long distances to healthcare facilities requiring travel expenses and possibly loss of income, desire for self-care, especially for conditions considered not serious enough to warrant a physician visit, information received from family, friends and neighbours, advertisements in print and electronic media, previous prescriptions for the same disease, previous successes with antibiotics, limited knowledge among pharmacists and patients regarding antibiotics and antimicrobial resistance (AMR) and the ready availability of antibiotics from drug sale outlets without valid prescriptions.^[3,4,9,26-29] However, the inappropriate purchasing of antibiotics without a prescription may lead to undesirable outcomes. These include unnecessary consumption of antibiotics increasing AMR, adverse drug reactions related to antibiotic use, drug–drug and drug–food interactions, delays in attaining professional services and potentially abuse of their use.^[3,10,29-31]

AMR is not only a leading threat to global public health but also compromises development and growth within a country due to considerable morbidity, mortality and economic costs.^[32-36] More than 1.27 million deaths globally have been reported due to AMR, with the highest burden seen in African and South Asian countries.^[35] Annual mortality rates attributable to AMR are envisaged to rise to an estimated 1.91 million deaths globally, alongside an estimated 8.22 million deaths associated with AMR, by 2050 unless concerns with current practices are addressed.^[37] The economic burden of AMR is also expected to be > US\$ 1 trillion by 2030 unless addressed.^[38]

There are currently considerable concerns with rising rates of AMR as well as multidrug resistance (MDR) and extensively drug-resistance pathogens in Pakistan, which requires urgent attention.^[39-44] Excessive and inappropriate use of antibiotics, including those from the World Health Organization's (WHO) Watch and Reserve lists, is regarded as the key driver of AMR in humans.^[45-47] The WHO has divided antibiotics into three categories, namely, 'Access', 'Watch' and 'Reserve' as part of the AWaRe system based on their potential for resistance.^[45,46,48] Under this system, antibiotics in the Watch group have a higher resistance, with those in the Reserve group only used to treat MDR infections.^[45,46,48]

High rates of antibiotic utilisation in Pakistan are exacerbated by excessive dispensing of antibiotics without a prescription in

the country, with their ready availability in drug stores, which includes those from the Watch and Reserve groups.^[49-56] Such malpractices are not helped by the current drug laws in Pakistan which include a lack of appropriate legislation to reduce the extent of inappropriate dispensing of antibiotics without a valid prescription.^[57]

Alongside this, the list of antibiotics currently contained in the drug laws does not principally concentrate on antibiotics from the Access group.^[57] As a result, self-medication, including the use of antibiotics, is common in Pakistan, exacerbated in children by requests from parents with often limited knowledge of antibiotics and AMR.^[56,58-60]

However, there are currently limited data reporting awareness and practices of self-medication among parents of children in Pakistan to guide future initiatives to address rising AMR rates in this vulnerable population. This is important given current high inappropriate use of antibiotics among neonates and children across all sectors in Pakistan.^[61-66] Consequently, we sought to address this information gap through a multicentre study. This was the objective of this study.

MATERIALS AND METHODS

Study design, population and location

A cross-sectional, questionnaire-based study was conducted among the parents of children below the age of 12 years admitted to the children's wards of three public sector district hospitals in Punjab Province, Pakistan. We chose this group as a starting point for this research to address this information gap since if there were concerns with issues and practices among this population, these are likely to be exacerbated among a wider group of parents and children in Pakistan. This is because physicians treating children are in a key position to influence parent's views regarding the appropriate management of infectious diseases in their children. This includes addressing misinformation and lack of knowledge, especially regarding the effectiveness, or lack of it, of antibiotics in treating viral infections in children.

Punjab Province was chosen for this initial study as it is the most populous province in Pakistan containing more than half of the country's population as well as an appreciable proportion of hospitals treating sick children.^[61,65-67] All the participants were recruited using a convenient sampling technique between September and November 2023.

Data collection form

We used a previously validated data collection tool in this survey taken from previous studies including a recent study from Pakistan conducted by the co-authors.^[8,68,69] The internal consistency or reliability of the study tool was assessed using Cronbach's alpha. The value of Cronbach's alpha was more than 0.7, which indicated an acceptable range of all the scales included in the survey.

A pilot study was subsequently conducted among 20 potential participants prior to the main study to add further robustness

to the scale being used. None of these participating parents subsequently participated in the main study. The pilot study's participants were asked about the clarity and the understanding of the content of the study tool. All of the pilot study participating parents stated that they understood the meaning of the study questions. Three out of the 20 participants also suggested minor corrections about the demographic variables' section, which were subsequently included in the final questionnaire.

The final version of the study tool [Supplementary Table 1] contained the following three sections:

- Section I contained questions about the demographic variables of the study participants, including their age, the number and age category of their children, their level of education, their residence and their average monthly household income. Graduation included those parents with a diploma
- Section II assessed the awareness of antibiotics among the parents of hospitalised children. Each question had multiple possible answers and participants were requested to select one of these according to their level of awareness about the antibiotics
- Section III evaluated the self-medication practices with antibiotics for their children among the study participants. This included the possible reasons and symptoms for self-medication among the children of participating parents, the actual antibiotics administered as well as the sources of antibiotics used for self-medication.

Sample size determination

Assuming the total population of 20,000, a sample size was computed through Raosoft (<http://www.raosoft.com/samplesize.html>) online sample size calculator by estimating response rate of 50%, a confidence interval of 95% and a margin of error of 5%, the minimum sample required for current study was 377. However, additional study participants were recruited to increase the robustness of our findings.

Inclusion and exclusion criteria

All parents whose children were admitted to the children's wards of the surveyed hospitals, and who were willing to participate in the survey, were included in the study to help limit any bias in the study. However, those parents who were unwilling to participate in the survey were subsequently excluded from the study.

Data collection process

The team of investigators including medical doctors, pharmacists, pharmacy and laboratory personnel visited the children wards of the participating hospitals after getting ethical approval for the study. Potential study parents were approached by the investigators and administered the study tool after a briefing concerning the design and objectives of the study. Potential parents were targeted at public places, including waiting areas of childrens' wards in hospitals, to enhance participation and were requested to provide their responses.

The primary mode of data collection was through interviews. However, if requested by the participants, the data collection form was handed out to them and collected once completed.

After 10–15 min, the study questionnaires were collected and the investigators subsequently ensured that all questions were answered by the participants to enhance the robustness of the analysis.

Statistical analysis

Data were entered and analysed using SPSS v20 for Microsoft Windows (SPSS v20 for Microsoft Windows, 64 bit By IBM, Chicago, Ill., USA). Categorical variables were expressed using numbers and percentage, whereas continuous data were presented as means and standard deviations. Any association between demographic variables and outcomes was assessed using bivariate analysis (Chi-square test). In addition, a binary logistic regression analysis was performed to confirm the most significant predictors of parental practices of antibiotic use among their children without medical advice. $P < 0.05$ was considered statistically significant.

Ethical approval

Ethical approval for this study was obtained from the Office of Research, Innovation and Commercialization, Lahore College for Women University, Lahore, Pakistan (Ref. No. ORIC/LCWU/464). Moreover, ethical approval of this study was also obtained from the ethics committees/office of the administrators of the participating hospitals prior to study initiation. Written informed consent was also obtained from all the parents prior to their enrolment in the study. Furthermore, no personal data was recorded, and all the collected data were subsequently coded and entered into a password-protected Microsoft Excel® sheet (Microsoft Corporation' Redmond, Washington, USA) accessible only to the researchers to ensure participants' confidentiality.

RESULTS

Data from 438 parents were included in the analysis (275 mothers and 163 fathers). Characteristics of the study sample are shown in Table 1. The majority of participating parents were between the ages of 30 and 39 years (65.5%) and had 2–3 children (64%).

Regarding parents' educational status, the majority of participating parents had secondary school education (28.5%), followed by primary school (23.3%) and higher secondary school education (14.8%). 72.1% of the study samples were from rural areas and the majority had a monthly income between 31,000 and 60,000 Pakistani Rupees (1 US Dollar = 282.34 PKR).

As show in Table 2, 27.6% of participating parents stated that they knew the name of at least one antibiotic, with the majority knowing the names of amoxicillin (33%) and co-amoxiclav (19%). 44.3% of parents reported that antibiotics are used to kill germs, whereas 31.3% and 6.4% of parents,

Table 1: Sample characteristics (n=438 parents)

Variable	n (%)
Respondent	
Mother	275 (62.8)
Father	163 (37.2)
Parent's age (years)	
<30	132 (30.1)
30–39	287 (65.5)
40–49	19 (4.3)
Number of children	
One	86 (19.6)
Two	140 (32.0)
Three	140 (32.0)
Four or more	72 (16.4)
Education	
No formal education	37 (8.4)
Religious education only	53 (12.1)
Primary	102 (23.3)
Secondary	125 (28.5)
Higher secondary	65 (14.8)
Graduation including a diploma	56 (12.8)
Residence	
Rural	316 (72.1)
Urban	122 (27.9)
Monthly income (PKR)	
≤30,000	170 (38.8)
31,000–60,000	227 (51.8)
>60,000	41 (9.4)

respectively, believed that antibiotics can reduce fever and pain. Only 31.7% of participating parents provided a correct response to the questions enquiring about the purpose of antibiotic treatment in patients [Table 2] and only 5.5% of parents knew that antibiotics can cause adverse effects.

However, 55% of parents knew that it was quite risky to use antibiotics among children without medical consultation, with 32.4% providing the answer as 'don't know'. Regarding antibiotic resistance, 41.1% of parents were aware that the improper use of antibiotics contributes to antibiotic resistance; however, the majority of participating parents were unaware of this.

Table 3 details parents' self-medication practices regarding the use of antibiotics for their children without seeking medical advice. 63.2% of parents reported using antibiotics for their children without seeking any medical advice, with the majority of participating parents performing such practices two to three times during the last 6 months. The top three most commonly used antibiotics by parents for their children included amoxicillin (33.6%), co-amoxiclav (18.1%) and azithromycin (15.2%).

The most common infection for which an antibiotic was used without medical advice was a sore throat (27.1%), followed by a high fever (22.4%) and nasal discharge (20.9%). The predominant reason for using antibiotics without a physician's advice was that parents already had a prescription for

Table 2: Knowledge of antibiotics, their use and antibiotics resistance

Items	n (%)
Do you know the name of an antibiotic?	
Yes	121 (27.6)
No	317 (72.4)
Antibiotics and their percentages known among study participants (n=121)	
Ceftriaxone	9 (7.4)
Cefixime	18 (14.9)
Cefotaxime	6 (5.0)
Meropenem	4 (3.3)
Amoxicillin	40 (33.0)
Co-amoxiclav	23 (19.0)
Co-trimoxazole	6 (5.0)
Clarithromycin	5 (4.1)
Ciprofloxacin	2 (1.7)
Doxycycline	1 (0.8)
Ampicillin	3 (2.5)
Amikacin	3 (2.5)
Gentamycin	1 (0.8)
Signs and symptoms warranting antibiotics use	
Fever	121 (27.6)
Cough	73 (16.7)
Ear pain	56 (12.8)
Runny nose	29 (6.6)
Sore throat	23 (5.3)
Pus discharge (suppuration)	18 (4.1)
Don't know	118 (26.9)
Perceived role of antibiotics	
Reduce fever	137 (31.3)
Reduce pain	28 (6.4)
Kill germs	194 (44.3)
Don't know	79 (18.0)
Purpose of antibiotic treatment	
Viral infections	132 (30.1)
Bacterial infections	139 (31.7)
All infections	68 (15.5)
Don't know	99 (22.6)
How long do you think an antibiotic stays active and present in the body?	
A few hours	133 (30.4)
A few days	89 (20.3)
A few weeks	38 (8.7)
Don't know	178 (40.6)
Do antibiotics have adverse effects?	
Yes	24 (5.5)
No	132 (30.1)
Don't know	282 (64.4)
Self-reported side effects (n=24)	
Breathing issues	1
Abdominal pain	5
Diarrhoea	4
Fever	2
Joint pain	4
Low immunity	1
Skin rash	3

Contd...

Table 2: Contd...

Items	<i>n</i> (%)
Face redness	1
Headache	1
Legs pain	2
Do you think it is risky to use antibiotics without medical advice?	
Yes	241 (55.0)
No	55 (12.6)
Don't know	142 (32.4)
Do you know that the improper use of antibiotics can negatively affect body's natural defences?	
Yes	150 (34.2)
No	138 (31.5)
Don't know	150 (34.2)
Do you know that the improper use of antibiotics can cause antibiotics resistance?	
Yes	180 (41.1)
No	149 (34.0)
Don't know	109 (24.9)

similar signs and symptoms (42.6%), followed by financial constraints (39%). Only 37.5% of parents reported reading the medicine's leaflet before administering antibiotics to their children.

The majority of parents who practiced self-medication cited improvement in their children health status after antibiotic usage. Of the parents who denied using antibiotics in their children without medical advice ($n = 161$), the majority did this as they believed that they did not have sufficient knowledge of such medicines to undertake this (66.5%). 18.6% of parents stated that they were afraid of their child's health, so they always consult a physician before giving any medicine. 14.9% of parents reported of being afraid of any negative effects of antibiotics as the main reason of not self-medicating their children with antibiotics.

The factors associated with parental practices of antibiotic use without medical consultations are shown in Table 4. An increasing level of education was associated with higher antibiotic usage without medical advice ($P < 0.001$). Almost all parents who were familiar with the names of antibiotics more readily administered antibiotics without a medical consultation to their children ($P < 0.001$). This primarily included self-limiting viral infections. Other factors associated with self-medication with antibiotics among the study participants included the 'perceived benefits of antibiotics' and 'knowing the purpose of antibacterial treatment' ($P < 0.001$), with approximately half of surveyed parents believing that antibiotics were effective against viral infections.

In the multivariate binary logistic regression analysis, the only significant predictor of antibiotic usage among children without medical advice was parents' familiarity with an antibiotic ($P < 0.001$; odds ratio = 96.02) as 120 out of 121 parents who reported knowing at least one antibiotic name

Table 3: Self-reported antibiotics use among children without seeking medical advice

Items	<i>n</i> (%)
Antibiotics use in children without medical advice	
Yes	277 (63.2)
No	161 (36.8)
Details of antibiotics used without medical advice ($n=277$)	
Amoxicillin	93 (33.6)
Co-amoxiclav	50 (18.1)
Azithromycin	42 (15.2)
Cefixime	32 (11.6)
Metronidazole	15 (5.4)
Ciprofloxacin	10 (3.6)
Co-trimoxazole	16 (5.8)
Clarithromycin	10 (3.6)
Cefaclor	4 (1.4)
Cephalexin	3 (1.1)
Doxycycline	2 (0.7)
Antibiotics self-medication among children in the last 6 months ($n=277$)	
Once	66 (23.8)
Twice	102 (36.8)
Thrice	86 (31.0)
Four or more	23 (8.4)
Indications for using antibiotics without medical advice ($n=277$)	
Flu	23 (8.3)
Cough	49 (17.7)
Nasal discharge	58 (20.9)
Sore throat	75 (27.1)
High fever	62 (22.4)
Dental problem	10 (3.6)
Reason for not consulting a physician ($n=277$)	
Don't have time	33 (11.9)
Troubleshooting solution while waiting to go to doctor	18 (6.5)
Earlier prescription for the same signs and symptoms	118 (42.6)
Financial constraints	108 (39.0)
Where did the antibiotics used come from? ($n=277$)	
Leftover antibiotics from an old prescription of the same child	32 (11.6)
Leftover antibiotics from an old prescription of the other child	51 (18.4)
Pharmacy/medical stores	159 (57.4)
Available at home for adults	35 (12.6)
Reading leaflet before administering antibiotics ($n=277$)	
Yes	104 (37.5)
No	173 (62.5)
When you reused antibiotics without medical advice, was it for a similar indication as before (signs and symptoms)? ($n=277$)	
Yes	105 (37.9)
No	95 (34.3)
Do not know	77 (27.8)
Self-medication treatment response ($n=277$)	
Improvement	190 (68.6)
No improvement	87 (31.4)

Contd...

Table 3: Contd...

Items	n (%)
Reasons for not self-medicating children (n=161)	
Afraid of negative effects	24 (14.9)
Don't have good knowledge of antibiotics usage	107 (66.5)
I am afraid of my child's health so I always consult a doctor before giving any medicine	30 (18.6)

were practicing self-medication with antibiotics among their children.

DISCUSSION

We believe that this is one of the first surveys regarding the awareness and practices of self-medication with antibiotics among parents of children treated in hospitals in Pakistan. Of concern is that our findings revealed that only one-third of parents knew the name of any antibiotic and the purpose of antibiotics. Moreover, less than half of the surveyed parents stated that antibiotics were used to kill germs and were aware that improper use of antibiotic can cause AMR. These findings are similar though to patients visiting community pharmacies in Pakistan where 83.7% of them didn't know the term AMR and 71.4% were hearing it for the first time. The majority of patients visiting these pharmacies believed that antibiotics can treat viral infections and that all types of infection can be cured with the help of antibiotics.^[59] In addition, among parents of children in Pakistan being treated for upper respiratory tract infections (URTIs) including coughs and colds, a high proportion would choose antibiotics to preferentially treat URTIs in their children similar to other countries.^[4,70,71]

Our findings are also similar to a study conducted in Oman, where 45.1% of parents visiting ambulatory care centres believed that antibiotics were the optimal treatment for their children with URTIs.^[72] Another study from Bangladesh also revealed that only one-third of parents had moderate knowledge about antibiotic use in their children,^[73] with a further study from Bangladesh suggesting that 63% of parents believed that antibiotics could effectively treat colds.^[74] However, the findings of our study are an improvement from a study conducted in Peru, where an appreciable number of parents (79%) were unaware about the actual uses of antibiotics.^[75]

Our findings also showed that nearly two-thirds of participating parents were practicing self-medication of their children with antibiotics in recent times. These findings are similar to those from Saudi Arabia, where 68.6% of parents were involved in self-medication of their children with antibiotics.^[76] However, there are studies among other LMICs that reported lower percentages of parental self-medication of their children with antibiotics. These include 20.6% in Tunisia,^[28] 23.3% in China^[77] and 39.2% in Jordan.^[69] As a result, providing some guidance to Pakistan and other LMICs on possible quality targets, building on current initiatives.^[78]

Common antibiotics used under self-medication in our study were amoxicillin, co-amoxiclav and azithromycin, and the common symptoms for which these antibiotics were used included sore throats, fever and a nasal discharge. This is similar to other studies in LMICs involving children, emphasising again concerns with parents' knowledge regarding antibiotics in LMICs and their beliefs regarding the effectiveness of antibiotics in treating self-limiting viral infections.^[28,77,79-81]

Our study also revealed that the most common factors associated with self-medication practices with antibiotics were an increasing level of education and parents' familiarity with the names of antibiotics. Familiarity with the names of certain antibiotics may give parents more confidence when requesting antibiotics to treat infections in their children however inappropriate. This though needs further investigation before we can say anything with certainty, especially as our findings are direct in contrast with those from Tanzania. In their study, Simon and Kazaura (2020) ascertained that the key factors associated with parental self-medication with antibiotics included household incomes, distance to the nearest health facilities and awareness of parents/caregivers about antibiotics.^[81] Our findings are also partly in contrast to those of Waseem *et al.* in Pakistan, Yusef *et al.* in Jordan and Zahreddine *et al.* in Lebanon, who found that age and education levels did affect knowledge scores about self-medication.^[82-84] One possible reason that higher education levels may correlate with increased practices regarding self-medication with antibiotics could be parents' confidence coupled with their perceived ability to make informed judgements regarding the treatment of their child's infectious disease. This is despite often poor knowledge regarding antibiotics and viral infections. We will also be exploring this further in future studies to help guide appropriate initiatives in Pakistan and beyond to reduce inappropriate use of antibiotics.

Suggested next steps to address concerns with parents' knowledge regarding antibiotics and AMR, and the subsequent implications, can be divided into three principal activities. First, there is an urgent need to improve the knowledge of antibiotics and their uses among physicians treating neonates and children in Pakistan given current appreciable overuse of antibiotics in this patient group, including those from the WHO Watch group.^[61-63,65,66,85,86]

This should enable physicians to more appropriately discuss the optimal use of antibiotics in children, including where these should not be prescribed or dispensed, when meeting with parents in hospital either in outpatients or on the wards. As a result, reduce the urge of parents to put pressure on prescribers in the community to prescribe antibiotics for essentially self-limiting conditions. Alongside this, parents resisting the urge to put pressure on community pharmacies to dispense antibiotics without a prescription for self-limiting viral infections.

Table 4: Factors associated with practices of antibiotics use without medical consultation

Variables	Antibiotics use without medical advice		P
	Yes	No	
Respondent			
Mother	180 (65.5)	95 (34.5)	0.220
Father	97 (59.5)	66 (40.5)	
Parent's age (years)			
<30	81 (61.4)	51 (38.6)	0.734
30–39	185 (64.5)	102 (35.5)	
40–49	11 (57.9)	8 (42.1)	
Number of children			
One	55 (64.0)	31 (36.0)	0.972
Two	88 (62.9)	52 (37.1)	
Three	90 (64.3)	50 (35.7)	
Four or more	44 (61.1)	28 (38.9)	
Education			
Illiterate	17 (45.9)	20 (54.1)	<0.001
Religious education only	21 (39.6)	32 (60.4)	
Primary	54 (52.9)	48 (47.1)	
Secondary	82 (65.6)	43 (34.4)	
Higher secondary	50 (76.9)	15 (23.1)	
Diploma/graduation	53 (94.6)	3 (5.4)	
Residence			
Rural	196 (62.0)	120 (38.0)	0.440*
Urban	81 (66.4)	41 (33.6)	
Monthly income (PKR)			
≤30,000	106 (62.4)	64 (37.6)	0.514
31,000–60,000	148 (65.2)	79 (34.8)	
>60,000	23 (56.1)	18 (43.9)	
Know the name of an antibiotic			
Yes	120 (99.2)	1 (0.8)	<0.001*
No	157 (49.5)	160 (50.5)	
Perceived benefit of antibiotics			
Reduce fever	71 (51.8)	66 (48.2)	<0.001
Reduce pain	11 (39.3)	17 (60.7)	
Kill germs	150 (77.3)	44 (22.7)	
Don't exactly know	45 (57.0)	34 (43.0)	
Know the purpose of antibiotic treatment			
Viral infections	65 (49.2)	67 (50.8)	<0.001
Bacterial infections	118 (84.9)	21 (15.1)	
All infections	45 (66.2)	23 (33.8)	
Don't know	49 (49.5)	50 (50.5)	
Being aware that the use of antibiotics without medical consultation is risky			
Yes	152 (63.1)	89 (39.6)	0.996
No	35 (63.6)	20 (36.4)	
Don't know	90 (63.4)	52 (36.6)	
Being aware of negative effects of improper antibiotics use on the immune system			
Yes	97 (64.7)	53 (35.3)	0.039
No	76 (55.1)	62 (44.9)	
Don't know	104 (69.3)	46 (30.7)	
Being aware of antibiotics resistance			
Yes	115 (63.9)	65 (36.1)	0.631
No	90 (60.4)	59 (39.6)	
Don't know	72 (66.1)	37 (33.9)	

*Fisher's exact test. Data are presented as n (%). Bold represents statistical significance

The recent publication of the WHO AWaRe book giving suggestions for the management of multiple infections, including alternatives to antibiotics, should help physicians, community pharmacists and parents to improve future antibiotic use.^[87,88] Key ways to improve the prescribing of antibiotics among physicians treating children with infectious diseases in hospitals, which should help in their future discussions with parents, includes the instigation of antimicrobial stewardship programs (ASPs) incorporating adherence to current guidelines in both in- and outpatients.^[89-93] However, there are concerns currently with the limited extent of ASPs actually being undertaken among hospitals in Pakistan, although this is not always the case.^[94-98] There have also been issues regarding available personnel and finances to undertake ASPs in LMICs;^[99] however, again, this is no longer the case providing future direction and guidance to physicians treating children in hospitals in Pakistan.^[100-103]

Concomitant with activities with physicians starting in hospitals, educational and other activities are needed among dispensers to enhance their management of infectious diseases when faced with parents and their children, especially for self-limiting viral infections, and away from recommending or dispensing antibiotics, especially those from the Watch list.^[52,64,104] Coupled with this, subsequent monitoring of dispensing practices against accepted guidance based on the WHO AWaRe book once the list of available antibiotics in the community has been updated.^[57,78,87,88,105,106] Increased education of dispensers has helped improve appropriate management of patients across LMICs, which helps provide guidance to key stakeholder groups in Pakistan.^[3,106-108]

Alongside this, the authorities in Pakistan should also assess the potential for educational campaigns among parents given their success in a number of LMICs.^[109-111] However, we are cognizant that language is very important when HCPs are discussing antibiotics and AMR with parents and patients and that targeted educational campaigns can be challenging.^[112-118]

Having said this, such initiatives are urgently needed in Pakistan to help improve future antibiotic usage and reduce AMR in this vulnerable population. These are also considerations for the future in this and other similar countries. We will be exploring these suggestions further in future studies in Pakistan, given current concerns with high levels of AMR in the country, alongside excessive use of Watch antibiotics across all sectors, as well as existing challenges with implementing the National Action Plan to reduce AMR in the country.^[52,60,61,63,119]

We are aware of a number of limitations with our study. First, this cross-sectional survey was conducted through convenient sampling. As a result, there may be some degree of sampling bias in our study. Second, we conducted our study only in Punjab Province for the reasons discussed. Finally, we conducted this initial study in only three hospitals. However, we believe that our findings are robust, providing direction for future research and health authority activities in Pakistan

to improve antibiotic utilisation in this vulnerable population and reduce AMR.

CONCLUSIONS

It is of great concern that the majority of surveyed parents practiced self-medication with antibiotics among their children to treat principally self-limiting conditions, which included sore throats, fever and a nasal discharge. Common antibiotics used for self-medication included amoxicillin, co-amoxiclav and azithromycin. This needs to be addressed going forward among all key stakeholder groups in Pakistan to reduce AMR in this vulnerable population.

Potential activities include targeted educational campaigns among parents. We will be monitoring this in the future.

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Conflicts of interest

There are no conflicts of interest.

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SUPPLEMENTARY TABLE 1: PARENT QUESTIONNAIRE

Section 1: Demographic details of parents and children

Please select one option

- Q1 Do you have any children?
1. Yes
 2. No
- Q2 How many children do you have?
1. 1
 2. 2
 3. 3
 4. 4 or more
- Q3 Age category of your children
1. Neonates (0–28 days)
 2. Infants (29 days–1 year)
 3. Young child (>1–5 years)
 4. Child (>5–12 years)
- Q4 Age of the parents
1. 18–29
 2. 30–39
 3. 40–49
 4. 50–59
 5. 60 or more
- Q5 Gender of parent?
1. Female
 2. Male
- Q6 Education level of the participant?
1. Illiterate
 2. Religious education
 3. Primary school
 4. High school
 5. Higher secondary education
 6. Graduation
- Q7 Household average monthly income?
1. Less than 30,000 PKR
 2. 31,000–60,000 PKR
 3. More than 60,000 PKR
- Q8 Residence
1. Rural
 2. Urban
- Q9 Any of your child have comorbidity or long-standing illness?
1. Yes
 2. No
- If yes, then please mention.....

Section 2: Awareness of antibiotics

Please select option

- Q1 Can you give the name of an antibiotic?
1. Yes
 2. No
- If yes, then please name it.....
- Q2 Which of the following signs or illnesses do you think warrants the prescription of an antibiotic?
1. Fever for more than 3 days
 2. Cough
 3. Ear pain
 4. Runny nose

5. Suppuration
6. Sore throat
7. Don't know
8. Other:.....

Q3 For you, what is their role?

1. Fight against fatigue
2. Reduce fever
3. Calm pain
4. Kill germs
5. Don't know
6. Other:.....

Q4 Antibiotics can treat:

1. All types of infections
2. Only viral infections
3. Only bacterial infections
4. None Don't know

Q5 How long do you think an antibiotic stays active and present in the body?

1. A few hours
2. A few days
3. A few weeks
4. Do not know

Q6 Do antibiotics have side effects?

1. Yes
2. No
3. Do not know

If yes, then please mention these side effects.....

Section 3: Self-medication practices

Q1 Do you ever give your child antibiotics without medical advice?

1. Yes
2. No

If yes, which antibiotic?.....

How many times (in last six months)

- I. 1
- II. 2
- III. 3
- IV. 4
- V. 5
- VI. 6
- VII. 7 or more

If not why (select one of the commonest options from below)

- I. I am afraid of side effects of Antibiotics
- II. I don't know their uses
- III. I am afraid of health of my children therefore I consult doctors before given any medicines
- IV. I couldn't get antibiotics from medical store/pharmacies without having prescription
- V.

Q2 Why didn't you take the doctor's advice?

1. No time to consult
2. Troubleshooting solution while waiting for the appointment with the doctor
3. The treatment had already been prescribed for the same signs
4. For financial reasons
5. Other:.....

Q3 In general, where did the antibiotic used come from?

1. Leftover antibiotic from an old prescription from the same child
2. Leftover antibiotic from an old prescription from another child
3. Pharmacy/medical store

4. Available at home for adult person
 5. Do not know
- Q4 Before taking the antibiotic again, did you reread the leaflet?
1. Yes
 2. No
- Q5 Why did you use the antibiotic without medical advice?
1. Flu-like syndrome
 2. Cough that drags purulent sputum
 3. Thick or coloured nasal discharge
 4. Sore throat
 5. Severe fever
 5. Dental problem
 6. Urinary signs
 7. Other:.....
- Q6 When you reuse antibiotics without medical advice, is it for the same initial indication?
1. Yes
 2. No
 3. Don't know
- Q7 When you used the treatment without medical advice, what was the result?
1. Improvement
 2. No improvement
- Q8 In your opinion, is the use of antibiotics without medical advice risky?
1. Yes
 2. No
 3. No opinion
- Q9 Did you know that if antibiotics are used improperly, they can inhibit natural defences?
1. Yes
 2. No
 3. Don't Know
- Q10 Did you know that if antibiotics are used improperly, they can become ineffective on the bacteria they are meant to fight?
1. Yes
 2. No
 3. Don't Know