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Parents' behaviour toward antibiotic self-medication in children and incidence of resistance: a cross-sectional study from Punjab, Pakistan

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A – Study Design, **B** – Data Collection, **C** – Statistical Analysis, **D** – Data Interpretation, **E** – Manuscript Preparation, **F** – Literature Search, **G** – Funds Collection

Summary **Background.** Antibiotic resistance is mostly brought about through antibiotic self-medication, which is a common issue in impoverished countries. The most at-risk group is children, while there is no protection evidence released for them. Due to a lack of proper knowledge, parents often inappropriately administer antibiotics to their children.

Objectives. The current study aims to evaluate the parents' knowledge of antibiotic use and their knowledge of the medical conditions for which self-medication is used.

Material and methods. A cross-sectional descriptive study was carried out in parents. Parents' direct interviews and self-administered questionnaires were used to gather the data. Descriptive analysis and chi-square tests were performed to determine the significance of these findings using IBM SPSS Statistics version 22.

Results. There were 1,034 individuals who self-medicated their children in total. Male participants outnumbered female participants by a small margin. In the past 12 months, 88.6% of parents gave antibiotics to their children. Pharmacy advice and past prescriptions were the main causes of this behaviour, whilst cough, fever and tooth discomfort were the conditions for which antibiotics were prescribed. Throughout the course, 45.5% of patients changed antibiotics on their own.

Conclusions. The findings of this study underscore the urgent need to address the issue of self-medication of antibiotics in children, emphasising the potential harm it can cause. Parents often resort to self-medication without a proper understanding of the underlying causes of their children's illnesses, relying on antibiotics as a panacea. To mitigate this practice and protect the well-being of children, it is imperative to implement a multifaceted approach involving regulatory measures and educational initiatives beyond the scope of pharmacist interventions.

Key words: child, anti-bacterial agents, self medication, parents, behavior.

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Background

Self-medication, according to the World Health Organization, is the decision to use medications without a prescription to cure ailments or symptoms that the user has identified [1]. Children are thought to be the most vulnerable group when it comes to self-medication [2] as there has not been much research on how safe medications are for children [3]. Children's products can be purchaced over the counter, and when used properly, the majority of over-the-counter (OTC) medications for children are regarded as safe. However, improper usage of these can have detrimental, potentially fatal consequences [4]. Antibiotic usage, especially in children, without sufficient doctor or pharmacist input is a significant international issue [5, 6]. Self-medication is an idea that persists and is widely accepted everywhere [7]. Numerous research projects are underway throughout the world to examine the patterns of self-medication in children by their parents, showing that the prevalence

of self-medication in children is high, and these patterns are inappropriate due to parents' insufficient understanding of the medication used for children [8].

In certain nations, such as Italy, 69.2% of parents utilized self-medication, as did Mongolia, 71%, France, 96%, Brazil, 51%, Jordan, 42.5%, Mumbai (India), 85%, Nepal, 85%, Germany, 25.2%, Bangladesh, 26.69%, Yemen, 26%, China, 62%, and Pakistan, 51.3% [9, 10]. This data is comparable to certain industrialised countries, such those in Europe, and other emerging ones [11]. In Pakistan, many people prefer self-medication, as they perceive themselves as highly intellectual [9]. In Pakistan, antibiotics can be purchased over the counter (OTC) without the need for a prescription. Antibiotic misuse is rising quickly as a result of a lack of financial resources, deteriorating socioeconomic situations, subpar healthcare standards and rising poverty. Many elements, including education and place of residency, are connected to the inappropriate and illogical use of antibiotics [9, 12]. The other reasons of self-medication in children include the parents' wages [5], laziness to go to the doctor, the online world, already available medicines [11], and hefty consultation charge. Families, friends, neighbours, the Internet and commercials round up the rest of the list [13]. Children's immunity is deteriorating quickly as a result of the inappropriate abuse of antibiotics, which can cause a number of other problems down the road. Parents do not monitor the dosage and course of antibiotics when their children self-medicate, and as a result, factors like short treatment durations, insufficient dosages, treatment discontinuation after symptom reduction and the prescription of drugs to others based on personal experience also contribute to irrational drug use behaviours [14].

Antimicrobial resistance (AMR), a widespread issue, is the main problem with non-prescription antibiotic usage [15], especially in developing (low- and middle-income) countries [15, 16]. In addition to AMR, overusing antibiotics and failing to effectively treat patients can result in serious side effects, such as enteropathy, hypersensitivity, prolonged hospital stays, exposure of the general public to the risk of contracting a resistant bacterial strain and a high risk of death, particularly in children [17–19]. Although using antibiotics poses a number of hazards, it is nevertheless the drug that parents self-medicate with and then give to their children the most [20]. The WHO cautioned in its 2014 Geneva-released World Report on Global Resistance, which covered 114 nations, that the consequences of continued irrational antibiotic use and inaction to reduce the prevalence of infection would be disastrous [21].

For parents and patients in healthcare systems, medical shops or neighbourhood pharmacies serve as focus points. As a result, community pharmacists may be quite helpful in educating parents on how to properly use antibiotics when their children self-medicate [22]. It has also been noted that the habit of self-medication is spreading globally and is unlikely to stop until the government adopts stringent regulations. There is no publicly available data that refute the Pakistani community's practice of giving children antibiotics for self-medication [23]. Consequently, the purpose of this survey was to identify the contributing factors to parental self-medication with antibiotics for their offspring. The current study aims to evaluate parents' knowledge of antibiotic use and their knowledge of the medical conditions for which self-medication is used.

Research methodology

Study design

The general population (n = 1,034) from different urban and rural areas of Punjab, Pakistan, belonging to the age group 17 years and older, was recruited for a descriptive cross-sectional study. The study was carried out over a 7-month timeframe, spanning November 2020 until May 2021. The objectives and expected benefits of the particular research were adequately explained to every respondent.

Questionnaire development

The questionnaire was designed after a literature survey and improved upon after consultation with academic experts in the field. Their recommendations were added to the questionnaire to make it more subject-oriented. The questionnaire consisted of 46 questions and was divided into 5 sections.

Section 1: Demographic groups of the population (gender, age, area of residence, education, occupation, monthly income).

Section 2: Children's self-medication habits (pointed towards documenting the trends and reasons for self-medication through antibiotics in children).

Section 3: Understanding and considerations for using antibiotics for self-medication (involved assessment of knowledge of the participants regarding the use of medications).

Section 4: Understanding of the usage of antibiotics by parents and how they affect children whom they self-medicate (documentation of the overall convictions of individuals regarding antibiotic use in children without physician consultation).

Section 5: Experiences of parents, the relationship between parents and doctors and infection control (eliciting the importance of counselling on drugs to parents and the role of a pharmacist in drug therapy).

Study population

A total of 1,034 individuals from various cities in Punjab, Pakistan, participated in the data collection. Informed consent was obtained from the parents of the children to participate in the research.

Inclusion criteria:

- Parents with children under 10 years of age.
- Parents who engage in self-medication practices for their children, both those who use antibiotics and those who do not.
- Members of the general public, including both medical and non-medical individuals, who administer medicines to children under 10 years of age.

Exclusion criteria:

- Parents of children older than 10 years of age.
- Individuals who expressed unwillingness to participate in this study.

Data collection

The information was acquired by conducting an interview or collecting survey responses from individuals who use pharmaceutical drugs or medications on children without consulting a doctor or another licensed healthcare professional. The respondents came from a variety of hospitals, colleges and schools, as well as from the entire inclusive community.

Data analysis

The survey was checked, the data entered, and the analysis completed using IBM SPSS Statistics version 22. In frequency tables, descriptive analysis was used to summarise the data as tallies and rates. To determine the significance of these findings, we performed a chi-square test, which demonstrated a statistically significant association between self-medication and relevant variables.

Results

Demographic characteristics of participants

The 1,034 participants' demographics are shown in Table 1, where 519 (50.2%) men and 515 (49.8%) women are included.

Table 1. Demographic characteristics of participants			
Characteristics		**Frequency**	**Percentage**
Sex	male	519	50.2%
	female	515	49.8%
Age (in years)	below 18	17	1.6%
	18–26	448	43.3%
	27–35	319	30.9%
	36–55	223	21.6%
	above 55	27	2.6%
Area of residence	urban	946	91.5%
	rural	88	8.5%
Education	illiterate	26	2.5%
	matric	94	9.1%
	intermediate	131	12.7%
	undergraduate	413	39.9%
	graduation	275	26.6%
	master's or above	95	9.2%
Occupation	student	335	32.4%
	employee	313	30.3%
	housewife	199	19.2%
	retired	94	9.1%
	farmer	0	0.0%
	not working	34	3.3%
	business	40	3.9%
	other	19	1.8%
Monthly income	unemployed	309	29.9%
	20,000 – 50,000 PKR*	434	42.0%
	above 50,000 PKR	291	28.1%

*Pakistan Rupee.

Below the age of 18 (1.6%), 18 to 26 (43.3%), 27 to 35 (30.9%), 36 to 55 (21.6%) and 56 years of age and over (2.6%) were the different age groups that the participants were separated into. The majority came from Punjab, Pakistan's urban areas (91.5%). Most people were undergraduate students (39.9%), graduates (26.6%), intermediate students (12.7%), those with master's degrees or higher (9.2%) and matriculants (9.1%), and others (2.5%) had no formal education. The participants came from a variety of occupational groups, including students (32.4%), workers at various companies (30.3%), housewives (19.2%), retirees (9.1%), company owners (3.9%), those who were not in the labour force (3.3%) and others (1.8%). Most individuals (42.0%) earned between 20,000 and 50,000 PKR. Others earned more than 50,000 PKR (28.1%), and the remaining (29.9%) were jobless.

Self-medication practices in children

Table 2 lists the self-medication habits of youngsters. According to the table, when a child becomes ill at home, 7.9% of people constantly, 30.5% most of the time, 31.9% frequently, 21.8% occasionally, and 7.9% seldom supplied medications. Therefore, 6.5% of people always, 28.6% nearly usually, 31.7% frequently, 21.1% occasionally, and 12.1% rarely went to the pharmacy to buy drugs or used existing prescriptions to treat their child when they got sick. Self-medication choices are greatly influenced by peer, family and neighbour recommendations. As a result, 2.8% of people always, 10.5% most of the time, 27.6% frequently, 30.1% occasionally, and 29.0% seldom ask for guidance from friends, family or neighbours. Penicillin was the most commonly used antibiotic, with a usage rate of 27.2%, followed by cephalosporins (16.6%), macrolides (14.7%), fluoroquinolones (11.6%), tetracyclines (11.0%) and others (19%). In the last 12 months, 916 people (88.6%) used antibiotics in children, of whom 342 (33.1%) used them only once, 452 (43.7%) twice to five times, and 122 (11.8%) more than five times. Out of the alternatives on the questionnaire, the two main factors contributing to children using antibiotics for self-medication were pharmacist advice (16.1%) and past prescriptions (14%); the remaining factors are listed in Figure 1. Cough 196 (19.0%), fever 129 (12.5%), dental pain 125 (12.1%), headache 43 (4.2%), eye infection 42 (4.1%), running nose 81 (7.8%), ear pain 64 (6.2%), mouth ulcer 89 (8.6%) and genital infections 99 (9.6%) were some common illnesses in children for which antibiotics were used, while the frequency of other ailments is outlined in Figure 2. Our data indicates that 535 participants (51.7%) used antibiotics in children for a period of 1 to 3 days, 427 (41.3%) for a period of 4 to 7 days, and the remaining 72 (7.0%) for a period longer than 7 days. The course of medication is important, and when it comes to antibiotics, one needs to be extra careful.

Table 2. Self-medication practices in children			
Statements		**Frequency**	**Percentage**
When the child falls sick at home, do you give him/her medicine at home?	always	82	7.9%
	most of time	315	30.5%
	often	330	31.9%
	sometimes	225	21.8%
	rarely	82	7.9%
When the child falls sick, do you go to the drug store and buy drugs OR use previous prescriptions to treat him/her?	always	67	6.5%
	most of time	296	28.6%
	often	328	31.7%
	sometimes	218	21.1%
	rarely	125	12.1%
Do you buy medicine according to the advice of relatives, neighbours, friends or others?	always	30	2.9%
	most of time	109	10.5%
	often	285	27.6%
	sometimes	311	30.1%
	rarely	299	28.9%
Do you know the term antibiotic?	yes	934	90.3%
	no	100	9.7%
Name some of the antibiotics you know	Cephalosporins	224	16.6%
	Macrolides	198	14.7%
	Sulphonamides	100	7.4%

Table 2. Self-medication practices in children			
Statements		**Frequency**	**Percentage**
Name some of the antibiotics you know	Tetracycline	149	11.0%
	Penicillin	367	27.2%
	Aminoglycosides	86	6.4%
	Fluoroquinolones	156	11.6%
	Miscellaneous	70	5.2%
How many times have you given antibiotics in your child during the past 12 months?	never	118	11.4%
	once	342	33.1%
	2–5 times	452	43.7%
	more than 5 times	122	11.8%
What was your reason for giving antibiotics to your child?	doctor	125	12.1%
	saves time	65	6.3%
	high fees of doctor	71	6.9%
	I have an old prescription	145	14.0%
	no trust in the doctor	39	3.8%
	doctor is busy with many patients	77	7.4%
	I have medicines from family members	114	11.0%
	past experience	101	9.8%
	pharmacist advice	167	16.2%
	I know how to treat infections	71	6.9%
	other	59	5.7%
For which illness you have given antibiotics to your child in the last 3 months?	headache	43	4.2%
	eye infection	43	4.2%
	runny nose	81	7.8%
	ear pain	64	6.2%
	mouth ulcer	89	8.6%
	dental pain	125	12.1%
	cough	196	19.0%
	genital infection	99	9.6%
	vomiting	54	5.2%
	fever	129	12.5%
	skin disease	28	2.7%
	diarrhoea	62	6.0%
	other	21	2.0%
The duration of antibiotic intake was	1–3 days	535	51.7%
	4–7 days	427	41.3%
	> 7 days	72	7.0%

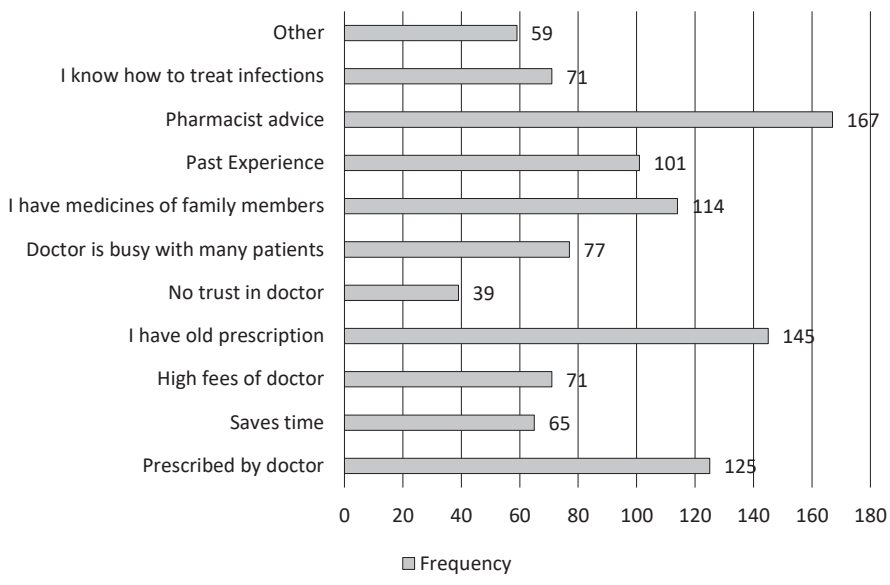

Figure 1. Reason of taking antibiotics

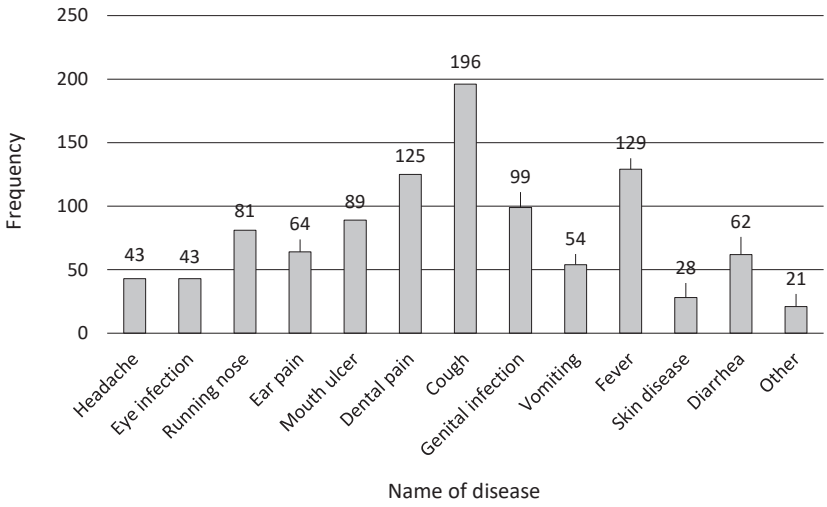

Figure 2. Disease for which antibiotics is administered to child in last 3 months

Knowledge about antibiotics

Table 3 explains how parent and other people's knowledge of antibiotics relates to using them in children. 3,781 individuals (75.5% of the population) agreed that it is crucial to read the label before administering medications, particularly antibiotics, without first consulting a doctor. Similarly, 68.6% of individuals (709) are aware that over-the-counter antibiotics may have negative effects. A total of 625 respondents (62.4%) agreed that prolonged use of antibiotics can lead to resistance; 139 individuals (13.4%) disagreed; and 250 individuals (24.5%) were unsure.

Table 3. Knowledge about antibiotics

Characteristics		Frequency	Percentage
Non-prescription antibiotic use requires the reading of leaflets in the drug pack and is important before taking drug	right	781	75.5%
	wrong	127	12.3%
	uncertain	126	12.2%
Non-prescription antibiotics can lead to some side effects	right	709	68.6%
	wrong	121	11.7%
	uncertain	204	19.7%
Continuous use of non-prescription antibiotics may cause resistance	right	645	62.4%
	wrong	139	13.4%
	uncertain	250	24.2%
Antibiotics, most of the time, end up complicating the sickness of the child	right	385	37.2%
	wrong	381	36.8%
	uncertain	268	25.9%
Antibiotics often cause side effects such as diarrhoea, stomach ache, etc.	yes	722	69.8%
	no	312	30.2%
Antibiotics decrease the child's own immunity	yes	566	54.7%
	no	468	45.3%
Antibiotics always work in children	yes	521	50.4%
	no	513	49.6%
Once your child's symptoms are relieved, antibiotic use should be stopped immediately	yes	406	39.3%
	no	628	60.7%
Antibiotics are effective for viral infections like sore throat, flu, etc.	yes	382	36.9%
	no	652	63.1%

When it came to the concept that antibiotics typically make the sickness worse, the results were similar: 385 (37.2%) thought it was true, 381 (36.8%) thought it was false, and 268 (25.9%) were not sure. 566 (54.7%) believed that antibiotics can lower a child's immunity, while 521 (50.4%) believed that antibiotics always work in children. 722 (69.8%) agreed that antibiotics can cause diarrhoea, stomach aches and other unpleasant symptoms. When a child's illness symptoms have subsided, 406 respondents (39.3%) agreed that antibiotic treatment should be immediately discontinued, whereas 382 respondents (39.6%) thought antibiotics could treat a variety of viral diseases, including the flu and sore throats.

General practices of parents about antibiotics

Common methods of the common parental attitudes against giving antibiotics to children are displayed in Table 4 below. Before giving their children medication, 623 (60.3%) of the population polled check, 111 (10.7%) do not check, and 300 (29.0%) occasionally do so. 365 individuals (35.3%) suffered negative effects from antibiotics, while 669 (64.7%) did not. When asked what they do if their children's antibiotics lead to any negative side effects, the participants indicated that they go to a private doctor – 429 (41.5%), a pharmacist – 119 (11.5%), a primary healthcare centre – 126 (12.2%), stop giving the medication – 187 (18.1%), change the medication – 147 (14.2%), or do something else – 26 (2.5%). The children's dosage and drug type are key considerations, and when antibiotics are administered without a doctor's advice, more caution must be taken. To determine the dosage for their antibiotics, people who used them consulted a doctor – 212 (20.5%), a pharmacist – 293 (28.3%), friends and family – 38 (3.7%), a primary healthcare centre – 26 (2.5%), checked the prescription information – 313 (30.3%), used the Internet – 79 (7.6%), followed advertisements – 2 (0.2%), relied on prior experience – 57 (5.5%), or made an educated guess at the dosage – 14 (1.4%). The study found that 52 individuals (5.0%) always altered the antibiotic dose, 391 (37.8%) rarely, and 494 (47.8%) had no idea if they changed their dose at all. 412 individuals (39.8%) altered their child's antibiotic dosage for health reasons, 261 (25.2%) to lessen side effects, 237 (22.9%) for worsening disease, 49 (4.7%) for insufficient medication, and 75 (7.3%) for other reasons. 44 individuals (4.3%) did not know or could not recall whether they changed the antibiotic or not, while 356 individuals (34.4%) changed it, and 634 (61.3%) did not change the antibiotic during the course of illness. 474 individuals (45.8%) stated the previous antibiotic did not work, the new one was cheaper – 53 (5.1%), the pharmacy ran out of the previous antibiotic – 93 (9.0%), the previous antibiotic had run its course – 66 (6.4%), there were fewer side effects – 74 (7.2%), and there were additional rea-

sons – 275 (26.5%). 415 people (40.1%) think that expensive antibiotics are more effective than cheap ones. A range of options was put forward to the those surveyed in the questionnaire to see when do they stop giving antibiotics to their children and results were like; stopping the treatment after a few days, regardless of the result 110 (10.6%), after symptoms lessened 344 (33.3%), after the antibiotics wear off 228 (22.1%), and after the course of treatment was finished 352 (34.0%). Individuals learned about the course of antibiotics from the following sources: 223 from prescription information (21.6%), 293 from pharmacies/medical stores (28.3%), 200 from primary healthcare centres (19.3%), 241 from doctors (23.3%), 41 from peers (4.0%), and 36 from others (3.5%). When choosing an antibiotic for their children, 187 individuals (18.1%) took into account the cost, the pharmaceutical firm – 337 (32.6%), and the type of drug – 510 (49.3%), when choosing an antibiotic for their children. 73 individuals (7.1%) stated the choice of a particular brand was influenced by advertisements, past prescriptions – 272 (26.3%), peer recommendations – 127 (12.3%), previous experience – 189 (18.3%), recommendations from pharmacists – 350 (33.8%), and other – 23 (2.2%).

Table 4. General practices of parents about antibiotics			
Statements		**Frequencies**	**Percentages**
Do you check the prescrition information before giving antibiotics to your child?	yes	623	60.3%
	no	111	10.7%
	sometimes	300	29.0%
Have you ever experienced side effects with antibiotics in your child?	no	669	64.7%
	yes	365	35.3%
What do you do for side effects?	go to private doctor	429	41.5%
	go to pharmacist	119	11.5%
	go to primary health centre	126	12.2%
	stop taking medicine	187	18.1%
	changed medicine	147	14.2%
	other	26	2.5%
How did you know the dosage of antibiotics to be given in your child without a prescription?	by checking the prescription information	313	30.3%
	Internet	78	7.5%
	consulting pharmacist	293	28.3%
	consulting doctor	212	20.5%
	consulting friends/family	38	3.7%
	previous experience	57	5.5%
	consulting primary health care centre	26	2.5%
	advertisements	2	0.2%
	guessing the dosage by myself	15	1.5%
Did you ever change the dosage of antibiotics during the course?	yes, always	52	5.0%
	yes, sometimes	391	37.8%
	no, never	494	47.8%
	do not know	97	9.4%
Why did you change the dosage of antibiotics during the course?	health improved	412	39.8%
	to reduce side effects	261	25.2%
	disease worsened	237	22.9%
	drug insufficient for self-medication	49	4.7%
	did not change	75	7.3%
The last time you used antibiotics for your child, did you change that antibiotic during the course of therapy?	yes, always	26	2.5%
	yes, sometimes	330	31.9%
	no, never	634	61.3%
	do not know	44	4.3%
Why did you change antibiotics?	the former antibiotic did not work	474	45.8%
	the latter one was cheaper	53	5.1%
	pharmacy ran out of the former antibiotic	93	9.0%
	the already available antibiotic finished	66	6.4%
	to reduce side effects	74	7.2%
	did not change	274	26.5%
Expensive antibiotics are more effective than cheap ones	yes	415	40.1%
	no	311	30.1%
	do not know	308	29.8%

Table 4. General practices of parents about antibiotics			
Statements		**Frequencies**	**Percentages**
When did you stop giving antibiotics to your child?	after a few days regardless of the outcome	110	10.6%
	after symptoms disappeared	344	33.3%
	after the pack of antibiotic finished	228	22.1%
	after complete course	352	34.0%
Where did you get the knowledge about the course of antibiotics?	prescribing information	223	21.6%
	pharmacy/medical store	293	28.3%
	primary health care centre	200	19.3%
	doctor	241	23.3%
	peers – family/friends	41	4.0%
	others	36	3.5%
What do you consider when selecting the antibiotic for your child?	price	187	18.1%
	pharmaceutical company	337	32.6%
	type of medicine	510	49.3%
Your selection of particular brand depends on which of the following choices?	recommended by pharmacist	350	33.8%
	old prescription of doctor	272	26.3%
	used by peers – friends/family	127	12.3%
	advertisement	73	7.1%
	my previous experience	189	18.3%
	other	23	2.2%

Table 5. Parents' understanding about antibiotics use			
Characteristics		**Frequency**	**Percentage**
I only use antibiotics on condition that I have a good ability to diagnose/treat symptoms	strongly agree	215	20.8%
	agree	427	41.3%
	neutral	300	29.0%
	disagree	68	6.6%
	strongly disagree	24	2.3%
When the condition is similar to a previous illness, then I can use non-prescription antibiotics	strongly agree	139	13.4%
	agree	419	40.5%
	neutral	340	32.9%
	disagree	103	10.0%
	strongly disagree	33	3.2%
Before I use a drug, I must be aware of its possible side effects	strongly agree	550	53.2%
	agree	315	30.5%
	neutral	153	14.8%
	disagree	11	1.1%
	strongly disagree	5	0.5%
The body can usually fight mild infections on its own without antibiotics	strongly agree	429	41.5%
	agree	411	39.7%
	neutral	147	14.2%
	disagree	35	3.4%
	strongly disagree	12	1.2%

Parent's understanding about antibiotic use

Table 5 evaluates parents' attitudes when they consider giving their children antibiotics without consulting a doctor. Questions revolved around basic knowledge of antibiotic use, including people's aptitude for symptom diagnosis and antibiotic selection, awareness of potential adverse drug effects and the body's immune system function in warding off minor infections. The following is a summary of their responses.

Parent-Doctor interaction

Table 6 lists parents' experiences, parent-consultant relationships and assessments of parents' opinions on infection control. In answer to a series of inquiries about their experiences working with consultants, participants indicated whether they strongly agreed, agreed, were neutral, disagreed or strongly disagreed.

Table 6. Parent–Doctor interaction			
Characteristics		**Frequency**	**Percentage**
Doctors always conduct a thorough examination regarding whether a patient is in need of antibiotics or not	strongly agree	199	19.2%
	agree	323	31.2%
	neutral	289	27.9%
	disagree	184	17.8%
	strongly disagree	39	3.8%
When antibiotics are prescribed, the doctor takes time to provide information on how they should be used, in an understandable manner	strongly agree	146	14.1%
	agree	332	32.1%
	neutral	316	30.6%
	disagree	187	18.1%
	strongly disagree	53	5.1%
The pharmacy staff take their time to inform parents on how antibiotics should be used	strongly agree	117	11.3%
	agree	350	33.8%
	neutral	327	31.6%
	disagree	192	18.6%
	strongly disagree	48	4.6%
If a child get an infection, parents often wait and see if the infection goes away on its own	strongly agree	104	10.1%
	agree	305	29.5%
	neutral	275	26.6%
	disagree	274	26.5%
	strongly disagree	76	7.4%
Hand hygiene reduces the risk of spreading common infections, such as influenza	strongly agree	413	39.9%
	agree	382	36.9%
	neutral	201	19.4%
	disagree	26	2.5%
	strongly disagree	12	1.2%
I am confident in the work that our healthcare system is carrying out to minimise the development of resistance	strongly agree	137	13.2%
	agree	332	32.1%
	neutral	283	27.4%
	disagree	242	23.4%
	strongly disagree	40	3.9%

Discussion

Pakistan, a developing nation, is currently experiencing difficulties in several areas, including the economy, education, jobs and health, among others. The prevalence of self-medication in children has always been on the rise and is currently at an all-time high due to other factors, such as a lack of adequate health infrastructure. Lack of time, poverty and education appear to be major contributors to children in Pakistan using self-medication. The study sought to create the position of a pharmacist in community pharmacies with an emphasis on drug counselling to document the population's knowledge, behaviour and practices regarding antibiotic usage in children through self-medication. Most participants were parents, older than 26 years of age, residing in urban regions of Punjab, Pakistan, and lacking any formal education up to and including a university degree.

Individuals either use an old prescription or confer with relatives, neighbours, friends, etc., when giving medicine to their children when they become ill [20]. The majority of people felt that it is important to be aware of medications and any potential adverse effects; however, only 7.3% to 85.59% of individuals (on average 42.64%) gave their children medicine at home [14]. This prevalence can be directly compared to Lahore's prevalence of 77.25% [24] and Karachi's prevalence of 51.3% [25] in their studies. Parents from different nations used antibiotics on their children for self-medication, with 10% of Greek parents [26], 60% of Mongolian parents [27] and 62% of Chinese parents doing so [28]. The disparities in data collection methods, the availability of pharmaceuticals without a current and valid prescription and the expense of medical care are regarded as the causes of this variation [24]. This study found that middle-class individuals (those making between 20,000 and 50,000 PKR) use self-medication in children more frequently than upper-class individuals. In contrast, a study done in Germany found that parents from higher classed used self-medication more frequently [29]. Table 7 provides a detailed socio-demographic comparison of parents' knowledge of antibiotic usage and reveals that only about 40% of individuals possess the fundamental knowledge needed to utilise antibiotics. Parents with advanced degrees were all familiar with the terms "self-medication" and "antibiotics", and they had all used them extensively. Contrarily, those with lower levels of education or literacy lacked awareness and did not appear to self-medicate. Our poll found that mothers self-medicate frequently with antibiotics because, unlike fathers, most mothers work as housewives and spend most of their time with their children. Prior research indicates that 70% [30–32] to 95.8% [33] of mothers gave their children antibiotics without a prescription. Similarly to this, in China, 35.12% of young children with diarrhoea were self-medicated with antibiotics [34]. Antibiotics are meant to "cure everything" in some underdeveloped societies, yet AMR is also frequently reported in these regions [35]. In a hospital setting, this is an extremely frightening circumstance [36]. In our study, 90% of the participants claimed to be familiar with the phrase "antibiotic", and we asked them to name a few. Many of the individuals who asserted to be knowledge-

Table 7. Comparison of knowledge among parents

Socio-demographic characteristics		Adequate knowledge (*n* = 442)	Inadequate knowledge (*n* = 592)	*p*
Gender	male	260	259	0.000
	female	182	333	
Age (in years)	below 18	4	13	0.000
	18–26	129	319	
	27–35	178	141	
	36–55	118	105	
	above 55	13	14	
Area of residence	urban	409	537	0.354
	rural	33	55	
Education	illiterate	14	12	0.025
	matric	46	48	
	intermediate	54	77	
	undergraduate	185	228	
	graduation	117	158	
	master's or above	26	69	
Occupation	student	85	250	0.000
	employee	175	138	
	housewife	98	101	
	retired	48	46	
	not working	13	21	
	business	18	22	
	other	5	14	
Monthly income (PKR)*	unemployed	107	202	0.000
	20 k–50 k	175	259	
	above 50 k	160	131	

*PKR – Pakistan Rupees.

able about antibiotics also included various over-the-counter medicines, including analgesics, antipyretics, cough suppressants, antihistamines, anti-emetics, anti-diarrheal medications and others. Thus, it may be inferred that education is needed, because a significant number of people (around 22%) did not recognise the distinction between over-the-counter medicines and antibiotics.

Penicillin was the most widely utilised antibiotics by parents for their children, particularly amoxicillin and amoxicillin/clavulanic acid. The same findings have been reported from various studies conducted in Greece, Saudi Arabia [37], Sudan [16], India [38], Jordan [39], Eretria [40] and other locations.

To save the time and money spent going to a doctor for minor ailments, most people used the pharmacist's guidance, their old prescriptions and their own prior experience [41] to acquire and use antibiotics for their children. This contrasts with a study conducted in Makkah city, where mothers gave antibiotics to their children by consulting with pharmacists (50.8%) followed by the advice of relatives or friends (33.7%), which was contrary to the study conducted in Jordan, where prior experience was number one and pharmacist's advice came in second in getting the medicines without a doctor's order [41, 42]. One of the participants in Mayo Hospital holding her infant told us, "It is better to self-medicate your children at home by using previous knowledge or using past prescriptions instead of the exhausting waiting times in these protracted lines, and if the child does not seem to get better, then we should go and see the doctor." This idea, in general, is the primary factor behind the rise in self-medication. Because of this, as opposed to their judgement or some prior knowledge, most individuals adhere to the most recent prescription they get from the doctor to self-medicate their children.

Cough, fever, tooth pain, mouth ulcers, runny nose and even headache were among the most frequent conditions for which antibiotics were prescribed. Fever (23.8%), sore throat (23%) and influenza (44.2%) were shown to be the most frequent causes of self-medication with antibiotics in the research is Makkah city. This result is consistent with the prevalent justifications mentioned for self-medicating with antibiotics in other investigations [43]. This behaviour can be linked to a perceived lack of information regarding antibiotics, their processes and indications [44]. Of course, societal trends occasionally have nothing to do with a lack of understanding.

Antibiotics are not necessary for self-limiting viral diseases including the common cold, cough, fever and upper respiratory tract infections, although it is customary in Pakistan to use and prescribe antibiotics in these situations. Even among those who recognised that antibiotics cannot be used to treat viral infections, many nevertheless inappropriately used them to treat cough, fever, rhinitis and other conditions [3, 22]. Generally, very little is known about using antibiotics to treat viral infections [45]. The result is greater than Portugal and Romania (14%), Lithuania (20%), Cyprus (21%) and Bulgaria (22%) but equivalent to public understanding of antibiotics in eastern and southern Europe (Great Britain: 50%, Netherlands: 52%, Sweden: 73%) (Eurobarometer & Social, 2010).

Antibiotic dosage and duration are essential for the complete eradication of the causing bacterium. A lot of people alter their antibiotic dosage after experiencing health improvements or a decrease in adverse effects, and some even alter the medication itself because they believe their children were not helped by the prior antibiotic. Since the discovery of antibiotics in the 1940s up to the present, many microorganisms have developed resistance to the available antibiotics. This reckless tendency is

a key contributor to antimicrobial resistance. Antimicrobial resistance is posing a danger to the health advantages of antibiotics [35]. Research organisations and the pharmaceutical sector are unable to resolve this global dilemma [46]. According to the WHO, many doctors occasionally prescribe many medications at once (polypharmacy) in an attempt to combat the problem of drug resistance [21]. Drug-drug interactions brought on by polypharmacy can be harmful to one's health [14]. This also makes it more expensive for individuals and states economically. It is important to not neglect the demand for and necessity of research into the creation of novel antibiotics and antimicrobials [47].

The general populace favours pricey pharmaceuticals as they typically associate high prices with superior products. As 95% of prescriptions in Pakistan are based on brand-name medications, parents are frequently ill-equipped to tell the difference between generic and brand-name medications [9]. As a result, pharmaceutical companies exert an influence over doctors' prescriptions, which, if left unchecked, can result in polypharmacy [39], drug resistance, health risks and economic costs to the patient and the family.

The fact that these antibiotics are purchased from a pharmacy or medical supply store after describing the symptoms of the disease [48] also suggests that there are no antibiotic stewardship programmes (ASP) or antibiotic policies in both the private and public sectors [49–51]. The government should prohibit and outlaw this behaviour as it contributes significantly to youngsters misusing antibiotics [52].

Doctors frequently have multiple patients to attend to; therefore, they are unable to provide advice to their patients on how to utilise drugs. Our research also reveals that this is one of the reasons people save time by not waiting at the doctor's office. To address the issue of resistance and to ensure the prudent use of medications, particularly antibiotics, it is necessary to define the role of clinical and community pharmacists in such a situation. To reduce hazards and ensure the wise use of antibiotics, programmes for education and communication between doctors and patients, patients and pharmacists and pharmacists and doctors are necessary [53]. To lessen the financial burden on patients and to advance the pharmacy profession and the legacy of a pharmacist in Pakistan, the government of Pakistan and DRAP should implement policies that ensure the sale of antibiotics only by generic-based prescription [54].

Limitations of the study

This study has a few limitations. Firstly, most participants were literate. As a result, not all socio-economic classes may be represented by the sample. Participants were either interviewed or asked to self-report through a questionnaire. Secondly, parents had trouble remembering when they had used antibiotics. Furthermore, because the participants were drawn from metropolitan regions of Punjab, it is impossible to extrapolate these findings to the entire population of Pakistan. Furthermore, because our study was cross-sectional, it is unable to establish a causal link between the variables. All these problems could influence our outcomes, yet these variations are inevitable in such studies.

Recommendations for future research

To build upon these findings and further address this critical issue, we offer several suggestions for future research. Future research could benefit from long-term, longitudinal studies that track the consequences of self-medication with antibiotics on children's health outcomes over time.

- Conducting controlled trials to assess the effectiveness of pharmacist-led interventions in reducing self-medication practices among parents and improving antibiotic stewardship.
- Investigating the impact of educational initiatives, both within schools and healthcare settings, to enhance antibiotic knowledge and promote responsible antibiotic use among parents.
- Exploring the underlying behavioural factors that contribute to self-medication practices, such as parental beliefs, attitudes and cultural influences.
- Assessing regional variations in self-medication patterns and their implications for healthcare policy and interventions.

By addressing these research avenues, future studies can contribute to a more comprehensive understanding of antibiotic self-medication in children and help with evidence-based strategies for its prevention and management.

Conclusions

The findings of this study underscore the urgent need to address the issue of self-medication of antibiotics in children, emphasising the potential harm it can cause, especially in developing nations. Although it is a necessary practice, enforcing rigorous standards will help to lower the general frequency of youngsters who self-medicate. A restriction on the sale of antibiotics without a prescription is also necessary, since the emergence of bacterial resistance could endanger the health of children. Parents often resort to self-medication without a proper understanding of the underlying causes of their children's illnesses, relying on antibiotics as a panacea. To reduce the usage of antibiotics in children, parents must be educated. The findings show that adequate recommendations and antibiotic stewardship programmes must be developed and put in place for doctors, pharmacists and parents to ensure the prudent use of antibiotics.

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