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ORIGINAL RESEARCH PERIOPERATIVE MEDICINE

Knowledge, attitude and practice of pharmacists regarding antibiotic usage and its possible trends

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ABSTRACT

Background & Objective: Antimicrobial resistance is a worldwide issue. According to United Kingdom Government Commissioned Review on Antimicrobial Resistance, antimicrobial resistance might cause mortality of 10 million people each year by 2050. Microbes developed resistance to antimicrobial agents, largely due to irrational antibiotic use. The presence of a certified pharmacist, as well as prescriber's level of education and experience, are all linked to proper medication use. We aimed to find the differentiation in knowledge, attitude and practices of the pharmacists regarding the differences in experience, education level, graduation institute and working sector. Another area of our study was to ascertain the commonly prescribed antibiotics.

Methodology: It was a quantitative, cross-sectional and multicenter study performed in Lahore, Pakistan. The sample size for prescriptions was 324, calculated by Daniel's equation and 230 for questionnaires by convenient sampling. Questionnaires were administered to clinical, community, industrial and academic pharmacists with consent. A data collection form was utilized for finding prescription patterns.

Results: According to 72% community, 71% clinical, 53% industrial, and 69% academic pharmacists, samples for culture and sensitivity must be taken before starting antibiotics. Contrarily, 28% community, 19 % clinical, 10% industrial and 23% academic pharmacists disagreed upon the useof broad-spectrum antibiotics, where narrow spectrum antibiotics were effective. The most commonly prescribed antibiotic was ceftriaxone (38.7%), followed by ciprofloxacin (6.8%) and meropenem (5.8%).

Conclusion: The study found good knowledge, attitude and practices among pharmacists regarding antibiotic use. Negligible significant differences were observed in scores among pharmacists working under various set-ups. Irrational prescribing can be avoided by introducing training for physicians and pharmacists.

Keywords: Antimicrobial Resistance, Pharmacist, Knowledge, Narrow Spectrum, Ceftriaxone, Irrational Prescribing

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1. INTRODUCTION

Antimicrobials are defined as substances produced by one living organism that kills or slows the growth of another organism.[1] Antibiotics are one of the most important medical breakthroughs inmodern years. They have rescued the human race from a great deal of misery caused by infectiousdiseases. Millions of people would have died if antimicrobial drugs had not been invented.[2] Antimicrobial agents are divided into different classes based on their mechanism of action. These primary classes include inhibitors of cell wall synthesis, membrane depolarizers, protein formation inhibition, inhibitors of nucleic acid synthesis, and inhibitors of metabolic pathways in bacteria.[3] The antibiotics managed to prevent and treat infections in patients exposed to chemotherapy, patients having diabetes, rheumatoid arthritis, or, and the ones who went through complicated procedures like organ transplants, joint replacements, or cardiac surgery.[4]

Despite the obvious advantages of antibiotics, their inappropriate use or overuse can increase antibiotic-resistant bacteria and infections caused by these organisms. Observations of organismsthat withstood the effects of antimicrobial drugs were made within a few years after discovering and using the first antibiotics. That was the start of the suspicion that many microbes were developing resistance to the antibiotics, which is now known as antimicrobial resistance (AMR). AMR in bacteria develops when the medications used to treat infections become less effective due to changes in the bacteria. It has become one of the potentially serious issues of the twenty- first century and a significant cause of morbidity and mortality around the world.[5] Gram-negative bacteria, for example, have an outer barrier that inhibits glycopeptide antibiotics, like vancomycin, from entering the cell wall, where the drug is active and thus rendering the bacteria intrinsically resistant to these medications. Antibiotics, particularly those potent against Gram-negative bacteria, are running scarce.[6] According to the UK Government-Commissioned Review on Antimicrobial Resistance, AMR might be the cause of mortality for 10 million people each year by 2050.[7]

The increased use of antibiotics is likely the underlying cause of antimicrobial resistance, inappropriate or irrational antibiotic use, which occurs frequently is also a cause for antimicrobial resistance.[8,9] Improper antibiotic use can manifest itself in a varietyof ways, including polypharmacy, irrational self- medication (most commonly occurring with prescription-only medications), infections not originating from bacteria, incorrect route of administration, insufficient dosage, or usage of injections where oral formulations would be better, [10, 11] All of these circumstances introduce bacteria to sub-optimal levels of antibiotics causing the bacteria to become resistant to the treatment and causing failure of treatment plan.[12, 13] In a survey conducted in Europe on the usage and awareness of antibiotics, it was revealed that despite knowing that antibiotics do not treat viral infections, many residents admitted to using antibiotics to treat symptoms indicating flu; 14% of the population stated that they had taken antibiotics as a treatment for the common cold.[14] Antibiotic misuse is also linked to other typical behaviors like not taking the medication for the prescribed duration of time or taking medication on their own. This pattern of self- medication invariably results in unwanted, insufficient, and erroneous doses, allowing bacteria to adapt rather than be destroyed.[15]

In terms of healthcare community, the pharmacists are frequently the first healthcare professionals' patients encounter when they have a problem, and thus has significantimportance in subsequent disease management or providing pharmaceutical care. Lack of enough information about antibiotics leads to irrational antimicrobial dispensing and use of antibiotics among Pakistani community pharmacists. Patients' behavior and the societal environment are the factors that can contribute to the irrational antibiotic use and thus a risk of developing AMR. Education about proper antibiotic usage and understanding of AMR can assist to slow down the emerging threat of AMR.[16]

In this cross-sectional study, we opted to assess the 'Knowledge, Attitudes, and Practices' (KAP) of working pharmacists irrespective of their working sector given the lack of such study in Lahore, Pakistan. We aimed to present relevant evidence of KAP of pharmacists working in different setups regarding antibiotic usage and different factors such as working experience, working sector, education level influencing KAP of pharmacists regarding antibiotic usage.

2. METHODOLOGY

Formal approval was granted by Ethical Committee of University of Central Punjab. The study was approved by Institutional Review Board (IRB) of hospitals involved in the study. The purpose of the study was explained to the pharmacists and a written informed consent was taken. They were free to refuse participation in the study. They were assured for confidentiality. Incentives were not offered for completion of the questionnaire.

2.1. Study design

This quantitative, cross-sectional study was conducted in Lahore, Pakistan, from February to May 2022.

2.2. Participants and study area

The study population consisted of community pharmacists, clinical pharmacists, industrial pharmacists and academic pharmacists. Exclusion criteria was any healthcare professional other than pharmacists and pharmacists with age < 21 y based on assumption that mostly pharmacy students graduated by the age of 21 y. The exclusion criteria for analyzing the prescribing trends were prescriptions without antibiotics.

The area where the study was conducted under the umbrella of hospitals included; Ghurki Hospital, Government Kot Khawaja Saeed Hospital, Sheikh Zaid Hospital, Mayo Hospital, Services Hospital, Faran Hospital, Raza Hospital, Jinnah Hospital, Ghulab Devi Hospital, Sir Ganga Ram Hospital, Hameed Latif Hospital, Indus Hospital, National Hospital, Evercare Hospital, Shaukat Khanum Hospital & Research Center, Doctors Hospital, Shareef Medical Hospital, Iqra medical complex, Naizi Hospital, Saadan Hospital, Latif Hospital, Horizon Hospital, City Clinic, Khair-un-Nissa Hospital, Jamila Fareedi Medical Center. Akhtar Saeed Medical College, Faran College of Pharmacy, University of Central Punjab, University of Lahore, Azra Naheed Medical College, Lahore College of Pharmaceutical Sciences, Punjab University, University of Veterinary and Animal Science. These institutions were visited to collect data for this purpose of study. Various community pharmacies including chain pharmacies and independent set-ups including Servaid pharmacy and its various branches in different localities of Lahore, Mahmood and Sons Pharmacy, Bashir Sons Pharmacy, various branches of Punjab Pharmacy, Hassan pharmacy, Boots Pharmacy, Apple Pharmacy, and Health Care Pharmacy.

2.3. Instrumentation for study

To select possible study method, a literature review of similar previous studies was carried out. On its basis, a validated questionnaire that was previously used in Iran was selected. The reliability and validity of this questionnaire were established using Cronbach alpha test. The finalized questionnaire consisted of 5 questions in each of the three portions; 'Knowledge', 'Attitude' and 'Practice'. Answers were scored using a Likert scale with symmetric range of 'strongly agree,' 'partly agree,' 'partly disagree,' and 'strongly disagree.' Answers to questions as 'partly agree' and 'completely agree' were considered as positive answer, and consequently, 'partly disagree' and 'completely disagree' were to be considered as a negative answer to the corresponding question. The participants' names, and initials were not required in the questionnaire, and their answers were kept confidential.

2.4. Data Collection Form

Standardized paper data collection forms were used to collect data about antibiotic prescription patterns at community and hospital pharmacies. The data form included the age, gender, illness of patient, antibiotic pharmacological classes, the prescribed antibiotics dosage regimen, the causative microorganisms and other prescribed medications. Hospital computerized record system and patient's files were evaluated for the purpose of data collection.

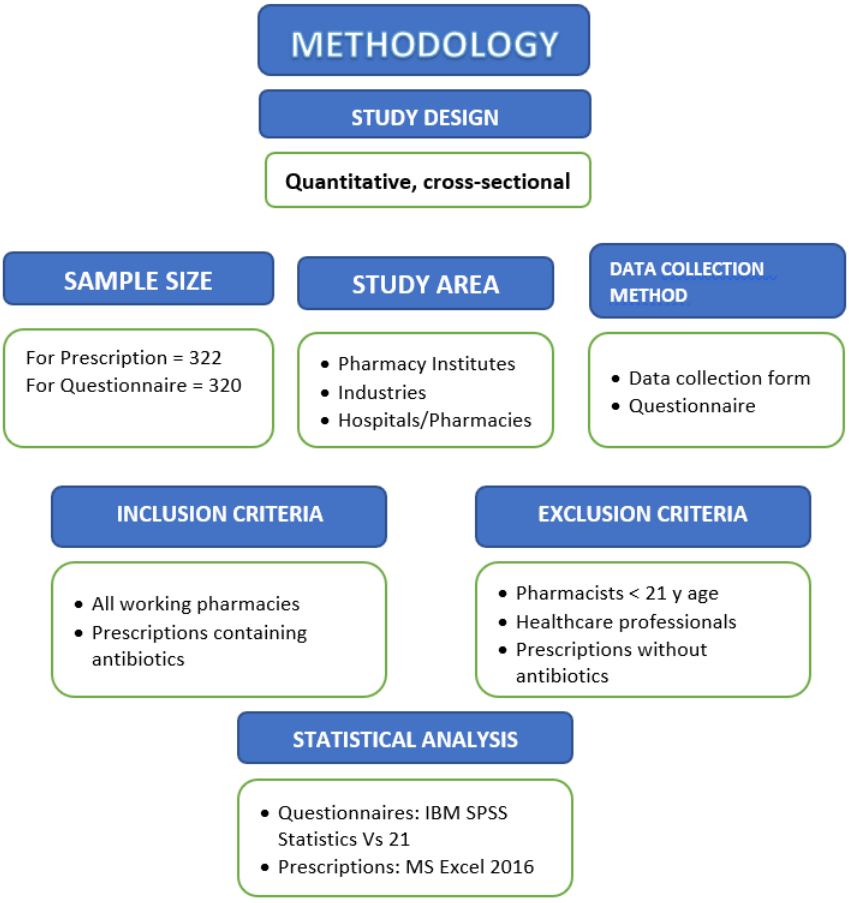

Figure 1: Flow chart of the study methodology

2.5. Statistical analysis

Descriptive statistics was applied to the collected data containing quantitative variables; age and experience. and qualitative variables such as gender, graduation universities, working in different set-ups. IBM SPSS Statistics 21 was used to carry out the statistical analysis of questionnaire data. Differences amongst education levels, experience levels, graduation college (public vs private), working set-ups of participants were tested using Pearson's chi-squared test. MS Excel 2016 was used for analyzing data of prescriptions. The final results were compared to the standard criteria, and the results were presented using tables, diagrams, and graphs.

The flowchart of the methodology is shown in Figure 1.

2.6. Sampling method and sample size

The minimum sample size estimated for the KAP study was 230 by convenient sampling method. Sample size for prescriptions was determined using the Daniel`s formula [$n= z^2 p (1-p)/d^2$)] where n = Sample size, z = z statistic for a level of confidence (if the confidence interval = 95%, then z = 1.96), p = Expected prevalence or proportion (if the expected prevalence is 20%, then P = 0.2) and d = margin of error (If the margin of error = 5%, then d = 0.05). The sample size for prescriptions was based on assumption that 70% of prescriptions will contain antibiotics. The maximum sample size estimated was 322 with a margin of error of 5%, a confidence interval of 95%, and an expectedprevalence of 70%.

Table 1: Detailed response of participants to questions regarding knowledge, attitude and practice

Questions		Completely Agree	Partly Agree	Partly Disagree	Completely Disagree
KNOWLEDGE	The efficacy of newer and more costly antibiotics is better	76 (33.0)	106 (46.1)	37 (16.1)	11 (4.8)
	Samples for culture and sensitivity must be taken before start of antibiotics	155 (67.4)	56 (24.3)	13 (5.7)	6 (2.6)
	Resistant antibiotics to microorganisms can become sensitive once more	74 (32.2)	83 (36.1)	49 (21.3)	24 (10.4)
	Combination of antibiotics can help prevent antimicrobial resistance	115 (50.0)	88 (38.3)	19 (8.3)	8 (3.5)
	OTC (over the counter) handing out of antibiotics by a pharmacist for minor infections is allowed	72 (31.3)	75 (32.6)	44 (19.1)	39 (17.0)
ATTITUDE	Cost of an antibiotic must be considered before prescription	151 (65.7)	55 (23.9)	15 (6.5)	9 (3.9)
	Poor hand hygiene can provoke antimicrobial resistance	86 (37.6)	76 (33.2)	39 (17.0)	28 (12.2)
	Development of new antibiotics can keep up with current resistance patterns	97 (42.2)	94 (40.9)	31 (13.5)	8 (3.5)
	Knowledge about the correct use of antibiotics can help reduce antimicrobial resistance	158 (69.3)	59 (25.9)	10 (4.4)	1 (0.4)
	Local guidelines for antibiotic use can be more helpful than global ones	100 (43.5)	75 (32.6)	35 (15.2)	20 (8.7)
PRACTICE	By limiting use of antibiotics, good patient care will be impaired	70 (30.4)	85 (37.0)	52 (22.6)	23 (10.0)
	Despite narrow spectrum antibiotics being effective, broad spectrum should be used	50 (21.8)	79 (34.5)	48 (21.0)	52 (22.7)
	I am always sure about my choice of antibiotic combination regimen	82 (35.7)	103 (44.8)	35 (15.2)	10 (4.3)
	Certain antibiotic approval programs restrict me in my choice of antibiotics and urges me to choose an alternative	61 (26.8)	123 (53.9)	34 (14.9)	10 (4.4)
	If medical conditions allow intravenous antibiotics will be changed to oral form after 3 days	93 (40.4)	80 (34.8)	39 (17.0)	18 (7.8)

Data presented as numbers (percentage)

3. RESULTS

A total of 230 participants filled out and returned the prepared questionnaire. Table 1 shows all questions and responses of all participants with respect to number and percentage.

3.1. Results for antibiotic prescription trends

The study population comprised of 324 patients. The majority of the prescriptions, were prescribed for males as shown in Table 2. Majority of the patients were between the ages of 25 and 35 years as shown in Table 3. Summary of the commonly prescribed antibiotics is graphically presented in Figure 2.

4. DISCUSSION

In our study, around half of the participants thought that newer antibiotics were more effective (as shown in Table 1), although this was not the case in the study by Chandan et al.[17] In the same study conducted by Chandan, nearly half of the participants felt that a culture was required before prescribing antibiotics; the 92% of our study participants completely or partially agreed that a culture was necessary before prescribing antibiotics. This shows that prior to antimicrobial selection and administration, there is a greater understanding of the prerequisitesamong majority pharmacists.

Majority of the participants in our study partly agree upon the fact that resistant antibiotics to microorganisms can become sensitive once more. In research by Garcia et al., the majority of the participants saw AMR as a danger in community medicine instead of in health facilities. Antibiotic demand among patients was identified as a big concern in the community. Patients' need for antibiotics was also recorded in the hospital setting, particularly among low socioeconomic patients, but to a limited degree than in the community setting.18 In our study, only 19.1% partly disagreed and 17.0% completely disagreed upon handing out of OTC antibiotics by pharmacists for minor infections. This shows poor knowledge of pharmacists regarding it (Table 1). The high demand for antibiotics in communities can be ascribed to the general public's lack of knowledge about AMR, emphasizing the importance of public education. Large majority of community (48%), hospital (38%), industry (45%), academic (51%) pharmacist s partly agreed that the cost of antibiotics

Table 2: Age distribution of sampled patients

Age Bins	N (%)
< 5	16 (5)
5-15	12 ((4)
15-25	44 (14)
25-35	60 (19)
35-45	52 (16)
45-55	50 (15)
55-65	44 (14)
65-75	32 (10)
75-85	11 (3)
85-95	3 (1)
Grand Total	324 (100)

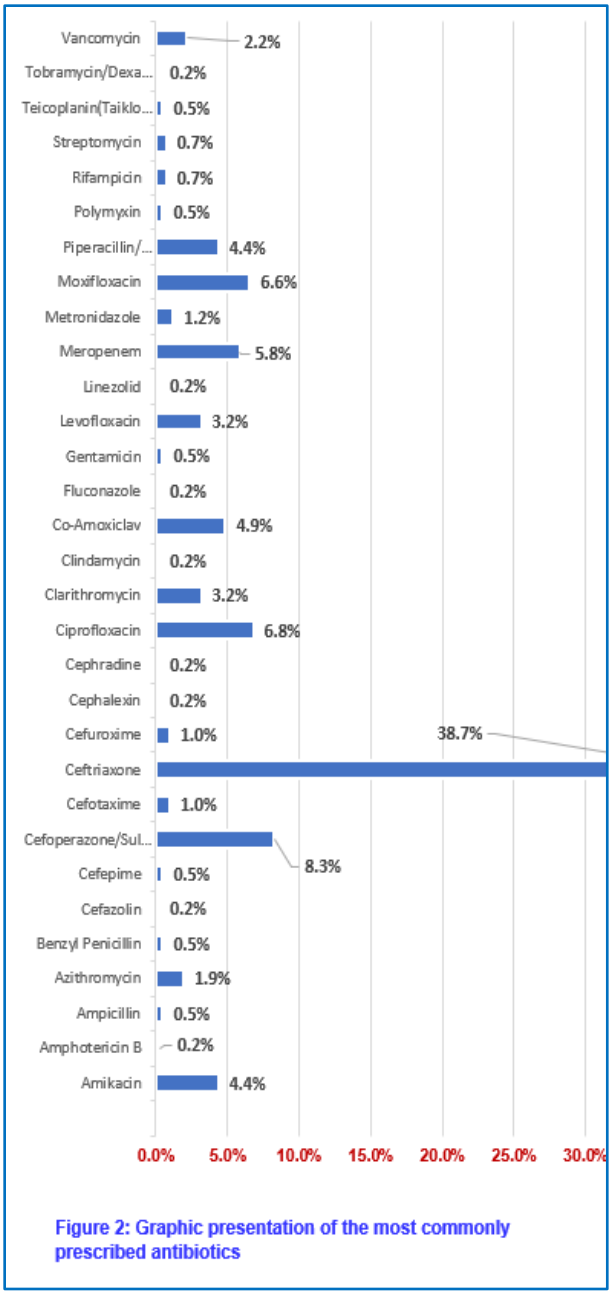

Figure 2: Graphic presentation of the most commonly prescribed antibiotics

must be considered before their prescription; however, in a study by Tegagn et al.19, only half agreed to this fact.

In our study, a great majority of participants felt that inadequate hand cleanliness may lead to AMR; yet, in a study conducted by Pulcini et al.[20] in France, fewer than half of the participants had the same belief and mostly regarded hand hygiene as an inconsequential role in generating resistance (Table 1).

In our survey, approximately half of the participants felt that newer antibiotic development can meet today's resistance pattern demands. This is close to the results published by Tegagn et al.[19] but greater than the relatively low count (11% and 12.5%, respectively) of positive responses of participants in two different surveys in India.[13, 21] AMR was deemed a big concern in our study, as it was in the study by Srinivasan et al., since the majority (69.3%) of the participants in our study had a favorable attitude toward the fact that greater understanding of antibiotic selection can assist reduce AMR (Table 1). A high number of the participants in the mentioned survey found AMR to be a key concern when choosing antibiotictherapy for patients, and 97% agreed that proper antibiotic selection can assist to reduce AMR (20). Local guidelines were thought to be more effective in controlling AMR in our study. This finding is consistent with other studies that found local antibiotic recommendations to be effective [22], however only 58% of participants in the Cotta et al. study complied.

Similar to a research in which more than half of the participants believed that limiting antibiotics would impede effective patient care, the majority of our study population (37.0%) agreed in part on this issue. They felt that limiting antibiotic use would have an impact on patientoutcomes (Table 1).

In this study, 35.7% pharmacists were completely sure and 44.8% were partly sure about their choice of antibiotic combination regime. This shows high confidence level in the participants which is similar to other studies. Previous research yielded conflicting findings when it comes to using antibiotic approval standards as a restricting factor for prescribing physicians. According to the Srinivasan et al., 38% of doctors view the need for permission to be a barrier to antibiotic usage. However, 53.9% of pharmacists in our survey acknowledged that they were limited in their usage of some antibiotics due to the necessity for approval.

4.1. Pharmacists education level vs. KAP of antibiotic use

This study concluded that when it comes to the level of education of different categories of pharmacists, there was no significant difference in KAP, with the exception of one question in the knowledge portion about the requirement of a culture and sensitivity test before prescribing antibiotics. In this regard, thefour groups of pharmacists exhibited a significant difference (0.00) in responses as shown in Table 2.

4.2. Pharmacists experience level vs. KAP of antibiotic use

According to the findings of this study, clinical pharmacists, community pharmacists, hospital pharmacists, and academic pharmacists have a substantial difference in response (P = 0.002) as shown in Table 3, about their choice of antibiotics being restricted owing to specific approved antibiotics programs. The four groups did not differ significantly in knowledge and attitude based on the amount of time they had served in respective fields.

4.3. KAP of pharmacy graduates of public vs private universities regarding antibiotic use

Both public and private pharmacy graduates were extremely competent, and there was no significant difference in response in the knowledge and attitude components. In the practice portion, four out of five questions have comparable responses, with just one question having a significant difference in opinion (P = 0.022) that the approved antibiotic programs limit their choice of antibiotics. Difference in knowledge, Attitude, and Practice of Pharmacists working in different Set-ups. The differences in the responses of the four categories of community, hospital, industry, and academics were evaluated in our study. Only when it came to the dispensing of non-prescription antibiotics by pharmacists for minor diseases, participants' answers differ significantly in the knowledge portion (P = 0.026). In the attitude section, there was a significant difference in responses when it came to assessing the cost of antibiotics before prescribing them (P = 0.032) and provoked resistance owing to inadequate hand cleanliness (P = 0.044). However, in the practice section, 5 out of 5 questions showed no significant difference among the four groups' responses, which was not unexpected.

4.4. Antibiotic prescribing trends

We also determined the antibiotic prescribing trends. The most commonly prescribed antibiotic was ceftriaxone (38.7%), followed by ciprofloxacin (6.8%) and meropenem (5.8%) (Table 8). This trend was determined because overuse or repetitive usage of the same antibiotic I one of the factors leading to AMR. In the study of Chinedum, the more often an antibiotic was

taken, the higher was the likelihood of microorganisms developing resistance to it. According to Chinedum et al., antibiotics are prescribed too frequently and needlessly by providers due to patient demand, a lack of proper understanding or information about the medications, and ambiguity about the treatment choice. [23] This is a nod to the necessity for continual education on how to use antibiotics correctly and avoid resistance. A research by Cotta et al. in Australia found that improving antibiotic prescriptions can help minimize resistance, and that half of the physicians who participated in thesurvey were eager to participate in Antibiotic Stewardship Programmes (ASPs).[22]

5. LIMITATIONS

There were certain limitations in this research. The possibility that participants would offer sociallydesired responses rather than their genuine beliefs is a shortcoming of KAP investigations. Studiesconducted at teaching hospitals are especially susceptible to this constraint, though our participants were promised that their responses would be kept private.

6. CONCLUSION

The study revealed that there are some aspects in which pharmacists from all backgrounds, with varying degrees of education and experience, are knowledgeable about antibiotics and antimicrobial resistance. For instance, a significant portion of the pharmacist community agreed that it is important to consider the cost of antibiotics before prescribing them and that poor hand hygiene contributes to the development of antimicrobial resistance. While there are considerable differences in some responses as only half of participants believe new antibiotics are more successful in some places, and culture and sensitivity tests must be undertaken prior to beginning antimicrobial therapy. Ceftriaxone was the antibiotic that was most frequently prescribed, followed by ciprofloxacin and meropenem.

Our findings show that pharmacists have a general understanding of antibiotic resistance; nonetheless, there is a lack of expertise in the handing out of OTC antibiotics by pharmacists for minor infections and the misuse of broad-spectrum antibiotics are all evidence of the need for stronger antimicrobial resistance teaching programs at health facilities. Antimicrobial Stewardship Programs must be implemented through the formation of local guidelines, continual instruction, and feedback to practitioners. Future research ideas include establishing a system for evaluating knowledge after training on a regular and long-term basis.

7. Data availability

The numerical data generated in this study is available with the authors and can be requested for academic use with appropriate acknowledgement.

8. Conflict of interest

The study utilized the hospital resources only, and no external or industry funding was involved.

9. Ethical considerations

The written consent was obtained from the parents of the patient to publish this case report as an academic service.

10. Authors' contribution

MM: Study Design, Literature Review, Data curation, Final compilation

TR: Study Design, Literature Review, Analysis of data, Final compilation

MAW: Article Review, Editing and Formatting, Correction & Finalizing of the article

MJ, ST: Literature Review, Correction, Analysis of data

SI, SS, SZA: Literature Review, Correction, Drafting the Article

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