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Original Research Article

Knowledge on antibiotic use and antibiotic dispensing practices in pharmacies in Bengaluru city

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ABSTRACT

Background: Community pharmacists are pivotal in healthcare by dispensing medications and providing health education. However, the misuse of antibiotics, contributing to antimicrobial resistance (AMR), is a major global health threat.

Aims and Objectives: This study aims to find the discrepancies in sale on antibiotics and asses the knowledge of the dispensers.

Materials and Methods: A cross-sectional observational study was conducted from June to December 2023. Data were collected from 50 people dispensing at community pharmacies in Bengaluru using a pre-validated questionnaire. The questionnaire included of 11 knowledge-based and 11 practice-based.

Results: The study included 50 pharmacists: 17 registered (58.8% B. Pharm, 41.2% D. Pharm) and 33 non-pharmacists (12-B.Sc, 5-12th Pass, 5-B.Com, 4-BA, 2-Diploma in Health education, 2-BAMS Graduate, 2-10th Pass, 1-MBBS). 64% unaware of multi-drug resistant bacteria.28% thought antibiotics could be used for diabetes or hypertension. Around 80% incorrectly identified the use of antibiotics for fever, body ache, cold, and cough.26%dispensed antibiotics without prescriptions, mainly non-pharmacists. Common antibiotics dispensed included Amoxicillin (44%).

Conclusion: The study revealed critical deficiencies in knowledge and practice among people dispensing at community pharmacies in Bengaluru. There is an urgent need for comprehensive educational initiatives and updated regulatory guidelines to improve antibiotic use and combat AMR.

1. Introduction

Community pharmacists play a crucial role in healthcare by providing numerous services, including the supply and sale of medicines both with and without prescription, where legally allowed, to improve public health.[1] They are involved in healthcare education programs, preventive measures for diseases, dental care and medication adherence, highlighting their importance in promoting the rational use of drugs.[2] Despite the critical role pharmacists play, the rapid emergence of antimicrobial resistance (AMR) poses a significant challenge to modern medicine. AMR occurs when bacteria, viruses, fungi and parasites evolve to resist medications, making infections harder to treat and increasing the risk of disease spread, severe illness and death.[3]

The high prevalence of irrational antibiotic usage, such as self-medication and over the counter (OTC) antibiotic sales contributes to the spread of AMR.[4] Community pharmacists, being the first point of contact for many patients are pivotal in combating the issue However, factors such as lack of knowledge, awareness about right antibiotic use, and the fear of losing customers to competing pharmacies often influence their practices.[5]

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In India, the situation is particularly challenging, with community pharmacists often dispensing antibiotics without prescription due to weak regulatory enforcement.[6] Despite the critical condition, many pharmacists in India lack adequate knowledge about antibiotics and their proper use, with studies showing considerable proportion of pharmacists not fully aware of the guidelines for dispensing these medications.

Efforts to educate Health workers must continue to ensure the best patient care practices. Future studies should focus on conducting educational programs targeting the specific cadre of professionals, as per their job description and area of lacking.[7] Community pharmacists must also engage in patient counselling to ensure that medications are used appropriately, thereby enhancing the therapeutic outcomes and reducing the misuse of antibiotics.[8]

Therefore, our aim is to assess the knowledge and practices of antibiotic dispensing among community pharmacists in Bengaluru, India, to find areas for improvement and implement targeted interventions.

2. Materials and Methods

2.1. Study design and site

A cross-sectional observational questionnaire-based study was conducted during June 2023 to December 2023, to assess people dispensing medicines in pharmacies about knowledge and dispensing practices of antibiotics and over the counter medications in Bengaluru North and Bengaluru South, India.

2.2. Sampling, data collection and technique

A total of 50 pharmacies were interviewed, 25 from Bengaluru North and 25 from Bengaluru South, India. They were chosen randomly. The interview was done face-to-face through a standard pre-validated questionnaire having 22 questions, 11 knowledge-based and 11 practice-based questions.

2.3. Inclusion criteria

Independent and Hospital attached pharmacy drug dispensers.

2.4. Sampling method

Simple random sampling.

Before beginning the interview, consent was taken on the condition that the anonymity would be kept. The purpose of the questionnaire and research was explained to the dispensers and their responses were obtained.

2.5. Preparation of questionnaire

A separate validated Questionnaire was developed to assess the knowledge and dispensing practices of antibiotics among dispensers. There were a total of 22 questions, eleven about Knowledge and eleven about Practice. The demographic data, knowledge, and prescribing practices was assessed with both open and close ended questions, Yes and No, True and False questions. Then the data was analyzed statistically. The average values thus obtained was used to compare the association between Knowledge among B. Pharm, D. Pharm, and Non-Pharmacists.

2.6. Statistical analysis

SPSS version 20.0 software was used to enter and analyze the data. Descriptive statistics, frequencies, crosstabs, and percentages was used to summarize the data.

3. Results

3.1. Demographic details

The study involved 50 community pharmacists in Bengaluru North and Bengaluru South, India, including 17 registered pharmacists and 33 non-pharmacists. Among the registered pharmacists, 58.8% held a Bachelor of Pharmacy (B. Pharm) degree, and 41.2% had a Diploma in Pharmacy (D. Pharm). Female representation in the sample was 14 (28%), with most of the participants having over 10 years of experience in the field. The age range of the participants spanned from 25 to 55 years, with the highest concentration (38%) in the 25-35 years category. Additionally, the study noted that 92% of the pharmacies were stand-alone establishments, while the rest were attached to hospitals (Table 1).

3.2. Knowledge on antibiotics assessment

Q1: The knowledge assessment revealed significant gaps, especially about awareness of multi- drug resistant (MDR) bacteria, with 64% of participants lacking knowledge in this area. Non- pharmacists accounted for most of this group (40%).

3.3. Misconceptions about antibiotics

Q2: A notable 84.8% of non-pharmacists and 76% of pharmacists incorrectly believed that antibiotics are effective against viral infections.

Q3: 28% mistakenly thought antibiotics could be used for diabetes or hypertension.

Q4 and Q5: Around 80% of participants incorrectly identified the use of antibiotics for fever, body ache, cold, and cough.

Q6: 56% incorrectly disapproved of the use of antibiotics in animal husbandry.

Q10: 98% correctly acknowledged that antibiotics destroy normal intestinal flora

Q11: 78% agreed that antibiotics cause side effects, yet we see 22% who believe antibiotics do not cause side effects. (Figure 1).

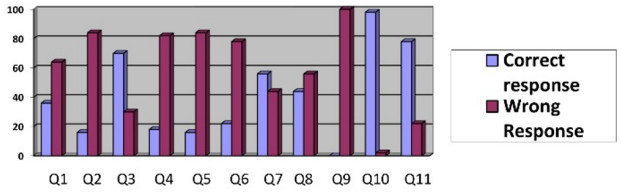

Figure 1: Question wise response (%) on knowledge related to antibiotics among the responders

3.4. Practice on antibiotic dispensing assessment

The practice-based assessment showed concerning trends in antibiotic dispensing and prescription practices. Notably, 13 (26%) of the participants reported selling antibiotics without a prescription, with 11 of these being non-pharmacists. The primary reason cited for this practice was the high demand for common antibiotics such as Amoxicillin (44%), Amoxicillin+ Clavulanic acid (28%), Cefixime (24%), and Azithromycin (4%).

Moreover, none of the personnel reported having attended any formal training on the dispensing and judicious use of antibiotics. This lack of updated knowledge was clear in several areas:

Q7: 68.5% of non-pharmacists admitted to prescribing drugs for common cold, diarrhea, or fever.

Q8: The most common antibiotic prescribed for upper respiratory tract infections was Cephalosporins (46%).

Q9: 48% of participants chose not to prescribe antibiotics for diarrhea.

Additionally, the study found that anti-tubercular drugs were sold by 22% of non-pharmacists and 14% of registered pharmacists.

Figure 1 shows around 80% of the questions were answered wrong. Figure 2 highlights among the three categories B. Pharm outperformed the rest and wrong responses from D. Pharm and Non-pharmacists were same. This deficiency in understanding underscores the urgent need for improved training and education among pharmacists to ensure the proper use of antibiotics, ultimately reducing the risk of antibiotic resistance and potential harm to patient health. The study's findings suggest that comprehensive educational initiatives and updated regulatory guidelines are imperative to address these gaps. Efforts should focus on providing continuous professional development opportunities and stringent monitoring of antibiotic dispensing practices to enhance pharmacists' knowledge and ensure safer healthcare outcomes.

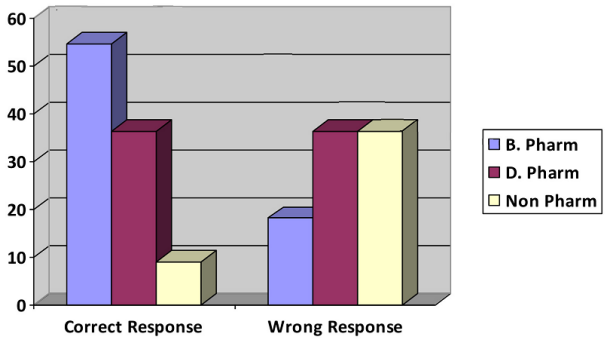

Figure 2: The average % response on knowledge related to antibiotics among the responders

Table 1: Demographic details of the responders

S. No.	Parameters	N=50 (%)
1.	**Do you agree to participate in the study?**	
	Yes	50 (100)
	No	0
2.	**Pharmacy is registered under the person with qualification of:**	
	Pharmacy Graduates	50 (100)
	Non-Pharmacy Graduates	0
3.	**Qualification of personnel dispensing medication**	
	B. Pharm	10 (20)
	D. Pharm	7 (14)
	Non-Pharmacy	33 (66)
4.	**Number of years of experience**	
	<1	4 (8)
	1-10	33 (66)
	11-20	8 (16)
	21-30	4 (8)
	31-40	1 (2)
5.	**Gender**	
	Male	36 (72)
	Female	14 (28)
6.	**Age**	
	<25	16 (32)
	25-35	19 (38)
	35-45	6 (12)
	45-55	9 (18)
7.	**Type of Pharmacy**	
	Attached to Hospital	4 (8)
	Stand Alone	46 (92)

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4. Discussion

Antimicrobial resistance (AMR), the ability of microorganisms to resist antimicrobial drugs, is a critical global health threat. Annually, antibiotic-resistant infections cause approximately 700,000 deaths worldwide; this

Table 2: Assessment of knowledge related to antibiotics among responders

S. No.	Category of Questionnaire on antibiotic	B. Pharm N = 10 (%)	D. Pharm N = 7 (%)	Non - Pharmacy N = 33 (%)
1.	**Have you heard about Antibiotic resistant bacteria?**			
	Yes	4 (40)	1 (14.3)	13 (39.4)
	No	6 (60)	6 (85.7)	20 (60.6)
2.	**Antibiotics are useful for viral infections**			
	True	7 (70)	6 (85.7)	28 (84.8)
	False	3 (30)	1 (14.3)	4 (12.1)
	NA	0 (0)	0 (0)	1 (3.1)
3.	**Antibiotics are useful for diabetes and hypertension**			
	True	1 (10)	1 (14.3)	12 (36.4)
	False	9 (90)	6 (85.7)	20 (60.6)
	NA	0 (0)	0 (0)	1 (3)
4.	**Antibiotics are useful for fever and body ache**			
	True	10 (100)	5 (71.4)	26 (78.8)
	False	0	2 (28.6)	7 (21.2)
	NA	0	0	0
5.	**Antibiotics are useful for cold and cough**			
	True	9 (90)	5 (71.4)	28 (84.8)
	False	1 (10)	2 (28.6)	5 (15.2)
	NA	0	0	0
6.	**Antibiotics are useful for loose stools**			
	True	7 (70)	7 (100)	25 (75.8)
	False	3 (30)	0 (0)	8 (24.2)
	NA	0	0	0
	Have you taken antibiotics for common cold or Acute gastroenteritis?			
7.	Yes	4 (40)	4 (57.1)	14 (42.4)
	No	6 (60)	3 (42.9)	19 (57.6)
	Is there use of antibiotics in animal husbandry?			
8.	Yes	4 (40)	3 (42.9)	15 (45.5)
	No	6 (60)	4 (57.1)	18 (54.5)
	Can you name any drug resistant pathogens?			
9.	Yes	0	0	0
	No	10 (100)	7 (100)	33 (100)
	Do antibiotics destroy normal intestinal flora?			
10.	Yes	10 (100)	7 (100)	32 (97)
	No	0	0	1 (3)

number could rise to 10 million by 2050 if unaddressed.[9] The World Health Organization warns that current AMR trends may lead to a disastrous "post- antibiotic era" characterized by untreatable infections and the loss of life-saving medications.[10]

AMR primarily stems from the overuse and misuse of antibacterial agents in both healthcare and agriculture.[11] Contributing factors include spontaneous bacterial evolution, mutation, and horizontal gene transfer of resistance genes.[12] The financial burden of AMR is significant, with increased healthcare costs due to higher hospital admissions and medication use.[13]

The current study conducted in Bengaluru assessed pharmacists' knowledge of antibiotic use and dispensing practices. This cross-sectional observational study covered 50 pharmacies and evaluated personnel with B. Pharm, D. Pharm, and non-pharmacy qualifications using a validated 22-question survey (11 knowledge-based and 11 practice-based questions).

The findings revealed that non-qualified personnel, who lack adequate knowledge about AMR, predominantly dispensed antibiotics. This finding is in line with a study conducted by Abdul Razzaque Nohri et al whose study had 90% non-pharmacist dispensers.[14]

About 80% of knowledge-based questions were answered incorrectly, particularly by D. Pharm and non-pharmacy personnel, highlighting their incompetence in antibiotic dispensing. Another study by Pelluri R et al showed less than 50% of their participants answering correctly regarding Knowledge, Attitude and Practice (KAP).[15]

Additionally, 26% admitted to selling antibiotics without prescriptions, and many had not attended formal training on the judicious use of antibiotics. A study by Neusa F Torres

Table 3: Assessment of practice related to antibiotic dispensing among the responders

S. No .	Category of questionnaire on antibiotics	B. Pharm N = 10 (%)	D. Pharm N = 7 (%)	Non- Pharmacy N = 33 (%)
1.	**Doyousell Antibiotics and Antimicrobials in your pharmacy?**			
	Yes	10 (100)	7 (100)	33 (100)
	No	0	0	0
2.	**Have you dispensed Antibiotics without doctor's prescription?**			
	Yes	1 (10)	1 (14.3)	11 (33.3)
	No	9 (90)	6 (85.7)	22 (66.7)
3.	**If Yes, Reason for dispensing**			
	General Antibiotics	2 (20)	0	9 (27.3)
	NA	8 (80)	7 (100)	24 (72.7)
4.	**At whose request was the antibiotic dispensed**			
	Patient's own	0	1 (14.3)	1 (3)
	Patient's Relative	1 (10)	0	8 (24.2)
	Pharmacist	0	0	1 (3)
	Others	9 (90)	6 (85.7)	23 (65.7)
5.	**Name thecommonest antibiotic prescribed in your pharmacy**			
	Amoxicillin	4 (40)	2 (28.6)	16 (48.5)
	Augmentin	5 (50)	2 (28.6)	7 (21.2)
	Cefixime	0	2 (28.6)	10 (30.3)
	Azithromycin	1 (10)	1 (14.3)	0
6.	**Have you attended any training on judicious use of antibiotics?**			
	Yes	0	0	0
	No	10 (100)	7 (100)	33 (100)
7.	**For which of the following conditions would you prescribe antibiotics?**			
	Common Cold	1 (10)	0	11 (33.3)
	Diarrhoea	1 (10)	1 (14.3)	2 (6.1)
	Fever	2 (20)	1 (14.3)	4 (12.1)
	More than one option	6 (60)	5 (71.4)	16 (68.5)
8.	**Commonest Antibiotic prescribed for Upper respiratory tract infection at your pharmacy**:			
	Cephalosporins	8 (80)	2 (28.6)	13 (39.4)
	Penicillin	1 (10)	1 (14.3)	6 (18.2)
	Macrolides	0	0	2 (6.1)
	None	1 (10)	4 (57.1)	12 (36.4)
9.	**Commonest Antibiotic prescribed for diarrhoea at your pharmacy**			
	Cephalosporins	2 (20)	1 (14.3)	4 (12.1)
	Quinolones	0	3 (42.9)	5(15.2)
	Aminoglycosides	3(30)	0	8 (24.2)
	None	5 (50)	3 (42.9)	16 (48.5)
10.	**Do you prescribe anti-tubercular drugs at your pharmacy?**			
	Yes	4 (40)	3 (42.9)	11 (33.3)
	No	6 (60)	4 (57.1)	22 (66.7)
11.	**If yes, Name them**			
	Rifampicin	3 (30)	1 (14.3)	4 (12.1)
	AKT4	1 (10)	2 (28.6)	2 (6.1)
	Others	6 (60)	3 (57.1)	27 (81.8)

showed 15 out 17 participants accepting for the sale of Non-prescription drugs.[16]

Our study shows that 68.5% sold antibiotics for common conditions such cold, cough, fever, etc which is in line with a study done by Dharanindra M et al who showed similar results.[17] This shows that antibiotics are often dispensed without proper laboratory confirmation or consideration of necessity.

Additionaly, our study found that anti-tubercular drugs were sold by 22% of non-pharmacists and 14% of registered pharmacists. The fight against tuberculosis is very much affected by drugs rather than drugs, drugs such as moxifloxacin, used to treat multi-drug-resistant tuberculosis, are in the program. If these drugs are sold over the counter as an over-the-counter medicine, bacterial resistance will increase. This leads to spiral cases of Drug-resistant tuberculosis.[18]

In response to the AMR crisis, the World Health Assembly, in collaboration with the World Health Organization, Food and Agricultural Organization, and World Organization for Animal Health, launched the Global Action Plan on AMR in 2015. India's Union Ministry of Health and Family Welfare published the National Action Plan (NAP) for AMR in April 2017. The NAP focuses on enhancing infection prevention and control, promoting investments, increasing awareness, improving surveillance, and supporting research and development.[19]

5. Conclusion

The study in Bengaluru underscores a pressing concern about the knowledge and practices of people dispensing medicines in pharmacies , which is intrinsically linked to the growing threat of antimicrobial resistance (AMR). AMR occurs when microorganisms evolve to resist the effects of medications, making standard treatments ineffective and leading to persistent infections.

The findings reveal that a massive portion of both pharmacists and non-pharmacists harbor serious misconceptions about antibiotics. A staggering 84.8% of non-pharmacists and 76% of pharmacists incorrectly believe that antibiotics are effective against viral infections. This misunderstanding leads to the inappropriate use of antibiotics, contributing to the development of resistant bacterial strains.

Furthermore, 26% of the study participants admitted to selling antibiotics without a prescription, driven by the high demand for common antibiotics like Amoxicillin and Amoxicillin+Clavulanic acid. Such practices bypass the critical step of professional medical assessment and contribute to the misuse and overuse of antibiotics.

The study also highlights a considerable knowledge gap about multi-drug resistant (MDR) bacteria, with 64% of participants, particularly non-pharmacists, lacking awareness in this area. This lack of understanding further worsens the inappropriate use of antibiotics, as pharmacists are ill-equipped to make informed decisions about dispensing these powerful drugs.

These findings emphasize the urgent need for comprehensive educational initiatives and stringent regulatory guidelines to address these deficiencies. Improved training and continuous professional development are crucial to equipping pharmacists with the necessary knowledge to use antibiotics judiciously. By fostering better education and enforcing stricter monitoring of antibiotic dispensing practices, we can mitigate the risk of AMR, ensuring that antibiotics stay effective for treating infections and safeguarding public health for future generations.

6. Ethical Approval

The study was approved by the Ethical and Scientific Committee of Sapthagiri Institute of Medical Sciences and Research Centre.

7. Source of Funding

Nil.

8. Conflict of Interest

Nil.

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