Original Article

Exploration of Knowledge, Attitude and Practice in Pharmacies on Antibiotic Use and Antimicrobial Resistance Through Survey in Chennai, India.

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Received: 10-10-2024; **Revised:** 30-12-2024; **Accepted:** 08-01-2025; **Published online:** 20-01-2025.

ABSTRACT

Background: The discovery of antibiotics marked a pivotal moment in medical history, but proper use is crucial to preserve their value. Misuse leads to antibiotic resistance. The research involved two methods: A descriptive cross-sectional survey, A simulated patient interview of community pharmacists, covering knowledge, attitude, and practice.

Aim and objectives: To evaluate the knowledge, attitude and practice of Community Pharmacists on over-the-counter antibiotic dispensing using a standard questionnaire as well as comparing it to their practices by simulating patients' visits at pharmacies.

Methods: A descriptive cross-sectional survey has been performed. During the survey, which lasted for six months, 173 responses were collected in our study. Using GraphPad Prism 10 software and Microsoft Excel, all responses were analysed and evaluated. Simulated patient interviews were conducted in 20 random pharmacies to observe their practice in dispensing over the counter antibiotics.

Results: Antimicrobial resistance is a growing threat. Our study found gaps in pharmacists' practices: 56.65% wrongly thought antibiotics were available over-the-counter, and 57.80% dispensed them contrary to prescriptions. Simulated interviews revealed poor patient history inquiry and prescription checks. Key factors affecting pharmacists' knowledge and practices include age and experience. Despite positive attitudes, gaps in antimicrobial resistance awareness and ethical practices remain.

Conclusion: Antimicrobial resistance is critical, underscoring the need to assess pharmacists' knowledge and practices. Our study reveals significant gaps in antibiotic dispensing and awareness of resistance. Combating this issue requires better regulation, enforcement, and public education. Key recommendations include monitoring dispensing, upholding ethical standards, and balancing technology with traditional values.

Keywords: Antibiotics, Antimicrobial Resistance, Community Pharmacists, Prescription, KAP, Stewardship.

INTRODUCTION

Antibiotic use dates back over 2000 years, with ancient remedies like mouldy bread used to treat infections. Modern chemotherapy started with Paul Ehrlich's salvarsan for syphilis and progressed with Gerhard Domagk's Prontosil, the first broad-spectrum antimicrobial. Alexander Fleming's discovery of penicillin in 1928 revolutionized bacterial infection treatment and led to widespread antibiotic use[1,2]. In 1945, Fleming warned that antibiotic overuse would lead to resistance, a concern that has proven true. Over prescription, especially in the U.S., has accelerated the emergence of resistant bacteria. This global threat undermines antibiotic effectiveness and is exacerbated by a lack of new drug development. The CDC has identified several urgent bacterial threats, calling for coordinated efforts to address this crisis[3,4]. Historically, people used dyes, molds, and heavy metals for infections before antibiotics specifically targeted bacteria to treat and prevent bacterial infections, as well as other microorganisms like viruses, fungi, and parasites[5].

However, their extensive use has led to problems such as overuse, misuse, and addiction, culminating in antibiotic resistance. This resistance arises when bacteria, fungi, or viruses become immune to drugs. Addressing antimicrobial resistance is crucial now to mitigate its future impact, even though it poses a complex challenge.

In India, it is predicted that infections resistant to first-line antibiotics will cause sepsis to claim the lives of over 50,000 babies[6]. It is believed that the elderly and newborns would be more severely impacted. By 2050, it is predicted that AMR-related deaths in India will surpass two million. In 2008, about 29% of S. aureus isolates were resistant to methicillin; by 2014, that number had risen to 47%[7]. Furthermore, reports of MDR yeast have been made in India since 2011. Tetracycline-resistant Vibrio cholerae have been reported to make up between 17% and 75% of the species. E. Coli samples from 2004 to 2007 had resistance rates to nalidixic acid, co-trimoxazole, and ampicillin of 73%, 59%, and 75%, respectively. Additionally, between 2008 and 2013, E. Coli resistance to third-generation cephalosporins went from 70% to 83%, while resistance to fluoroquinolones increased from 78% to 85% and resistance to carbapenems increased from 10% to 13%[6,8,9].

According to estimates, 1.27 million global deaths in 2019 were directly caused by bacterial AMR and accounted for 4.95 million[10]. To coordinate the One Health global response to AMR, WHO works closely with the Food and Agriculture Organization of the United Nations (FAO), the UN Environment Programme (UNEP) and the World Organisation for Animal Health (WOAH). The 4 organizations (FAO, UNEP, WHO and WOAH) are known as the Quadripartite [12]. The global health is seriously threatened by antimicrobial resistance (AMR). By 2050, drug-resistant diseases could be responsible for 10 million deaths every year. The National Centre for Disease Control (NCDC), in New Delhi, is in charge of coordinating the National Programme on AMR Containment, which was launched by the Indian government in response to the threat[11,13].

Since community pharmacists serve as a liaison between patients and other healthcare providers and the general public, it is incumbent upon them to uphold the highest standards of ethics, knowledge, and service delivery[14]. It is imperative that pharmacists take up and actively engage in steering society in the proper direction with unwavering medical health care services. They have to make sure patients are informed about the benefits and drawbacks of antibiotics, and they have to make sure society is aware of AMR[15].

Knowledge, Attitude, and Practice (KAP) Surveys are widely used in the field of health research because they facilitate the acquisition of correct knowledge and the mindset necessary to perceive ideas and put them into practice[16]. In any particular field of knowledge, particularly in health or medical science, KAP aids in comprehension and analysis. KAP facilitates the quantitative analysis of the results we obtain by examining how humans react to different situations[17].

By evaluating the judicious administration of antibiotics in pharmacies, we were able to identify AMR and the different contributing factors by using KAP as a method[18]. We think that KAP might serve as a standard curriculum for a survey. Based on the data gathered from the pharmacies, we constructed the elements contributing to AMR and probable antibiotic resistance by using a statistical analysis.

The primary aim of this study is to evaluate the rational use and practice of antibiotics in pharmacies by pharmacists, as well as to assess their knowledge, attitude, and practices concerning antibiotics. The aim is to solely focus on the relationship between pharmacy practice, antibiotics and antimicrobial resistance (AMR). A pre-validated semi-structured questionnaire was used to evaluate knowledge, attitude, and practice through a survey conducted in various regions of Chennai district, Tamil Nadu. Additionally, the practices of individuals working in pharmacies were observed in a real-world community setting using simulated patient interviews.

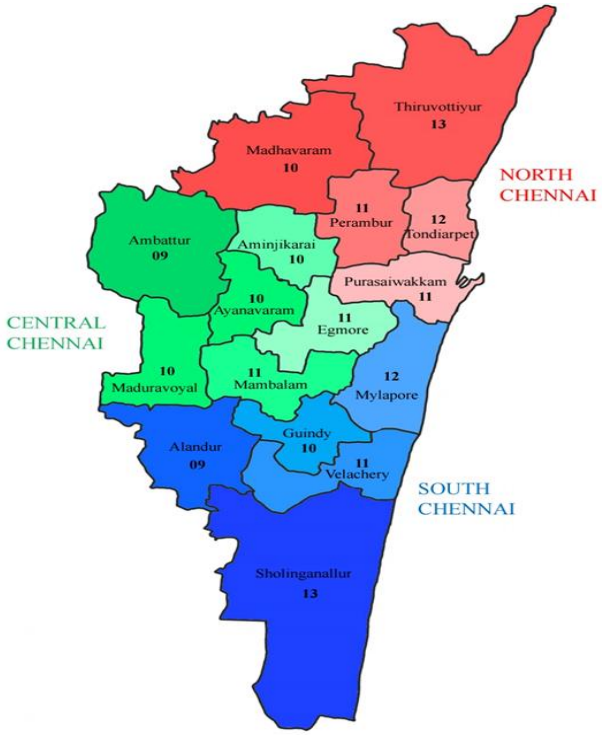

Figure 1: Data collection of different regions of Chennai district

MATERIALS AND METHODS

Study design:

A cross sectional study was conducted over a six months period from May 2024 to October 2024. A semi-structured questionnaire was circulated to the community pharmacists across the Chennai region, covering North, Central, and South Chennai, as detailed in Fig. 01. Additional simulated patient interviews were also conducted in 20 randomly selected pharmacies to observe antibiotic dispensing practices among community pharmacists.

The sample size of 173 was calculated with 95% confidence interval and a 7.5% margin of error. Convenience and snowball sampling methods were used to conduct the survey across the Chennai region. All pharmacists who are working in a community pharmacy and were willing to participate in the study were included. Pre structured questionnaire form and simulated patient interview model were used for data collection among study population.

Study procedure:

The pre-designed questionnaire used for data collection consists of 4 sections. 1) Socio-demographic section which contains questions to collect information on age, gender, educational qualification, location, and years of experience. 2) Section with Knowledge based questions. 3) Attitude-based question section, and 4) Section with Practice-based questions.

The participants' knowledge and attitude responses were evaluated using Bloom's taxonomy cut-off pattern as follows:

- Good Level (80-100%): Strong knowledge and a positive attitude toward the topic.
- Fair Level (60-79%): Moderate knowledge with a neutral attitude.
- Poor Level (<60%): Limited knowledge and a negative attitude.

For Practice, the score 50 % and above was considered as good practice.

This scoring system facilitated a clear interpretation of the participants' overall knowledge, attitudes, and practices, which were used to analyze their responses and draw meaningful conclusions.

Statistical Methods

Data were entered and analysed using GraphPad Prism 10 software. Descriptive statistics using frequency and proportion were used to summarize the data; t test and Pearson rank correlation were used to assess the association between demographic data and knowledge, attitude, and practice; and a p-value of less than 0.05 was considered statistically significant.

RESULTS

Socio-demographic response:

Among 173 study participant, majorities (140, 80.92%) of the pharmacists were male, and most of the pharmacists were found to be in the age group of 41 – 60 years (88, 50.87%). Regarding qualifications, the most common degrees held by pharmacy workers were BSc, BA, and BE, (75, 43.35%) and among pharmacy degree holders, 59 (34.10%) pharmacists were diploma graduates and 34 (19.65%) were found to be B. Pharmacy graduates. Unfortunately there were only 3 (2%) pharmacists with M. Pharmacy degree and 2 (1%) with Pharm. D degree. In terms of employment, 161 (93%) study participants were fulltime employees and at the same time majorities (90, 52.02%) were employed as managers. 90 (52.02%) participants were found to be the proprietors of their pharmacies. Refer (Table. 01)

Table 1: Socio-demographic Characteristic of the Participating Pharmacists

Variables	Category	Frequency (n=173)	Percentage (100%)
Age	Less than 25	28	16.18%
	26 – 40	48	27.75%
	41 – 60	88	50.87%
	Above 60	9	5.20%
Gender	Male	140	80.92%
	Female	33	19.08%
Years of Experience	<5-20	107	61.85%
	21 – 40	60	34.68%
	41 – 60	6	3.47%
Locality	North Chennai	57	32.94%
	Central Chennai	61	35.26%
	South Chennai	55	31.79%
Educational level	D pharm (Diploma in pharmacy)	59	34.10%
	B pharm (Bachelors in pharmacy)	34	19.65%
	M pharm (Masters in pharmacy)	3	1.73%
	Pharm D (Doctor of pharmacy)	2	1.16%
	Others	75	43.35%
Employment Type	Manager	90	52.02%
	Employee	70	40.46%
	Proprietor	13	7.51%
Employment Status	Full time	161	93%
	Part time	12	6.9%

Response to Knowledge, Attitude and Practice Related Questions:

The questionnaire aimed to assess the knowledge of pharmacists on antibiotics revealed several key insights. More than half of the pharmacists (98, 56.65%), stated that, antibiotics can be dispensed as over-the-counter (over the counter) medications. Though 148 pharmacists (85.55%) were knowledgeable about the antibiotics schedule, only 58 (33.53%) pharmacists were correctly identified the right teratogenic antibiotic from the option

given to them. Among the study participants, 63 (36.42%) of them knew that, India is the capital of antimicrobial resistance (AMR) but only 9.25% were aware of Antimicrobial Stewardship (AMS), which is a crucial responsibility for pharmacists. Only 22 (12.72%) pharmacists from our study were aware of Continuing Pharmacy Education (CPE), which is a crucial responsibility for pharmacists. More than half of the (101, 58.38%) pharmacists in our study knew that, antibiotic resistance can occur through the use of antibiotics in animals and the dumping of antibiotics in soil. All these responses from the participants indicated a lack of knowledge in several areas that could contribute to therapeutic inefficacy. In our study most of the pharmacist updated their knowledge on antibiotics and AMR from their colleagues and at the same time social media was also found to be the major source of knowledge to stay updated. Refer (Fig.02).

In terms of attitude towards antibiotics and its resistance, only 112 (64.74%) pharmacists considered themselves as direct access professionals to patients, emphasizing their responsibility in reducing antimicrobial resistance through proper practice and counseling. As a positive note, a total of 127 pharmacists (73.41%) agreed that, reducing the AMR rate is an important step and should be implemented across India, and 115 (66.47%) pharmacists agreed the importance of attending educational programs to enhance their understanding of antibiotics and resistance. Furthermore, 117 (67.63%) preferred dispensing antibiotics only with a prescription, viewing this as a better approach to avoid misuse without compromising patient health. An overwhelming majority, 148 pharmacists (85.55%), stressed the urgent implementation of regulations for the prevention of AMR in the future. Lastly, 118 (68.21%) pharmacists stated that, they would explain the patients about the reasons for not giving antibiotics without prescription.

This study on practice of pharmacists, revealed that, 122 (70.52%) pharmacists dispensed antibiotics without a prescription on request by the customers, in terms of patient counseling, 126 pharmacists (72.83%) reported that while dispensing, they educate patients on importance of adherence and completing the full course of antibiotics, out of 173 respondents, 92 (53.18%) of them would recommend home remedies for minor ailments and the remaining indicated a willingness to dispense antibiotics. Pharmacists were also questioned about dispensing more affordable classes of antibiotics upon patient request if the patient lacked financial resources, of the 173 responses, 100 (57.80%) respondents stated that they will dispense the requested antibiotics. Refer (Table. 02).

Among the 173 pharmacists surveyed, the most commonly dispensed antibiotic (76, 43.93%) by them was amoxicillin for cold (74, 42.77%) followed by fever (40, 23.12%) was the most common condition for which antibiotics were dispensed. Refer (Fig. 02).

Table 2: Community pharmacists' knowledge, Attitude and Practices on Antibiotics and Antibiotic Resistance

S.NO	Pre - Determined Questions	Response	Frequency (n=173)	Percentage (%)
	KNOWLEDGE RELATED QUESTIONS			
1)	Can antibiotics be dispensed as Over The Counter (OTC) drugs in India?	Correct	98	56.65
		Wrong	75	43.35
2)	Do you know the full form of CPE?	Correct	22	12.72
		Wrong	151	87.28
3)	What schedule do antibiotics come under?	Correct	148	85.55
		Wrong	25	14.45
4)	Which of the following is a teratogenic antibiotic?	Correct	58	33.53
		Wrong	115	66.47
5)	What is the full form of AMS?	Correct	16	9.25
		Wrong	157	90.75
6)	Which country is the "Antimicrobial resistance (AMR) capital of the world"?	Correct	63	36.42
		Wrong	110	63.58
7)	Do you think the use of the broad range of antibiotics for veterinary (calf, pig) and the bio-waste antibiotics damped in the soil will cause resistance in humans?	Correct	101	58.38
		Wrong	72	41.62
8)	Before the completion of the full course of antibiotic therapy, if symptoms improve then can you stop taking it?	Correct	97	56.07
		Wrong	76	43.93
	ATTITUDE RELATED QUESTIONS			
9)	Pharmacists have a responsibility to take a prominent role in antibiotic resistance and infection-control programs in the health system. What do you think?	Positive	112	64.74
		Negative	61	35.26
10)	The Kerala government decided to cancel the license of pharmacies selling	Positive	127	73.41

	antibiotics without a doctor's prescription to avoid misuse and overuse of antibacterial. What is your take on it?	Negative	46	26.59
11)	Relevant conferences, workshops, and other educational activities are required to be attended by retail pharmacists. What is your opinion? Will you attend?	Positive	115	66.47
		Negative	58	33.53
12)	Statement: Cancellation of dispensing antibiotics without prescription. What will be your preference?	Positive	117	67.63
		Negative	56	32.37
13)	AMR is a future problem and it need not be taken care of in present. What is your perspective on this statement?	Positive	148	85.55
		Negative	25	14.45
14)	If you refuse to give antibiotics to patients, as there is no need for antibiotics, they can easily get them from another pharmacy. What will be your action on it?	Positive	118	68.21
		Negative	55	31.79
PRACTICE RELATED QUESTIONS				
15)	What will you do if customers ask for antibiotics without a prescription?	Correct	51	29.48
		Wrong	122	70.52
16)	When dispensing antibiotics without a prescription, I educate patients about the importance of adherence and completing the full course of antibiotics	Correct	126	72.83
		Wrong	47	27.17
17)	Do you usually advise the Patients on taking home remedies (Gargle saltwater, Steam) for minor ailments (Common cold, Fever) or will you dispense antibiotics?	Correct	81	46.82
		Wrong	92	53.18
18)	If the patient does not have enough money, will you dispense another class of antibiotic that is affordable, at their request?	Correct	73	42.20
		Wrong	100	57.80
19)	What will you do if the patient asks for Tab. Chloramphenicol?	Correct	139	80.35
		Wrong	34	19.65
20)	If a patient complaint that a particular antibiotic is not working for their throat infection, what will you do?	Correct	80	46.24
		Wrong	93	53.76

Table 3: Multivariate logistic regression analysis on factors associated with KAP

Variables	Category	Knowledge (Model 1)			Attitude (Model 2)			Practice (Model 3)		
		Mean ± SEM	p Value	R^2 (95% CI)	Mean ± SEM	p Value	R^2 (95% CI)	Mean ± SEM	p Value	R^2 (95% CI)
Age	Less than 25	-38.17 ± 0.9792	<0.0001	0.8154	-37.40 ± 0.9786	<0.0001	0.8094	-38.48 ± 0.9770	<0.0001	0.8185
	26 – 40									
	41 – 60									
	Above 60									
Gender	Male	2.295 ± 0.1100	<0.0001	0.5586	3.069 ± 0.1047	<0.0001	0.7143	1.988 ± 0.08795	<0.0001	0.5978
	Female									
Years of Experience	<5-20	-10.75 ± 0.7492	<0.0001	0.3742	-9.971 ± 0.7485	<0.0001	0.3403	-11.05 ± 0.7463	<0.0001	0.3893
	21 – 40									
	41 – 60									
Locality	North Chennai	1.497 ± 0.1223	<0.0001	0.3034	2.272 ± 0.1176	<0.0001	0.5205	1.191 ± 0.1030	<0.0001	0.2800
	Central Chennai									
	South Chennai									
Educational level	D. Pharm	0.4855 ± 0.1744	0.0057	0.02203	1.260 ± 0.1711	<0.0001	0.1365	0.1792 ± 0.1614	0.2678	0.0035
	B. Pharm									
	M. Pharm									
	Pharm D									
	Others									
Employment Type	Manager	2.087 ± 0.1122	<0.0001	0.5013	2.861 ± 0.1070	<0.0001	0.6751	1.780 ± 0.09073	<0.0001	0.5282
	Employee									
	Proprietor									
Employment Status	Full time	2.416 ± 0.1076	<0.0001	0.5945	3.191 ± 0.1021	<0.0001	0.7394	2.110 ± 0.08493	<0.0001	0.6421
	Part time									

Analysis of significance and correlation. $p < 0.05$ considered significance.

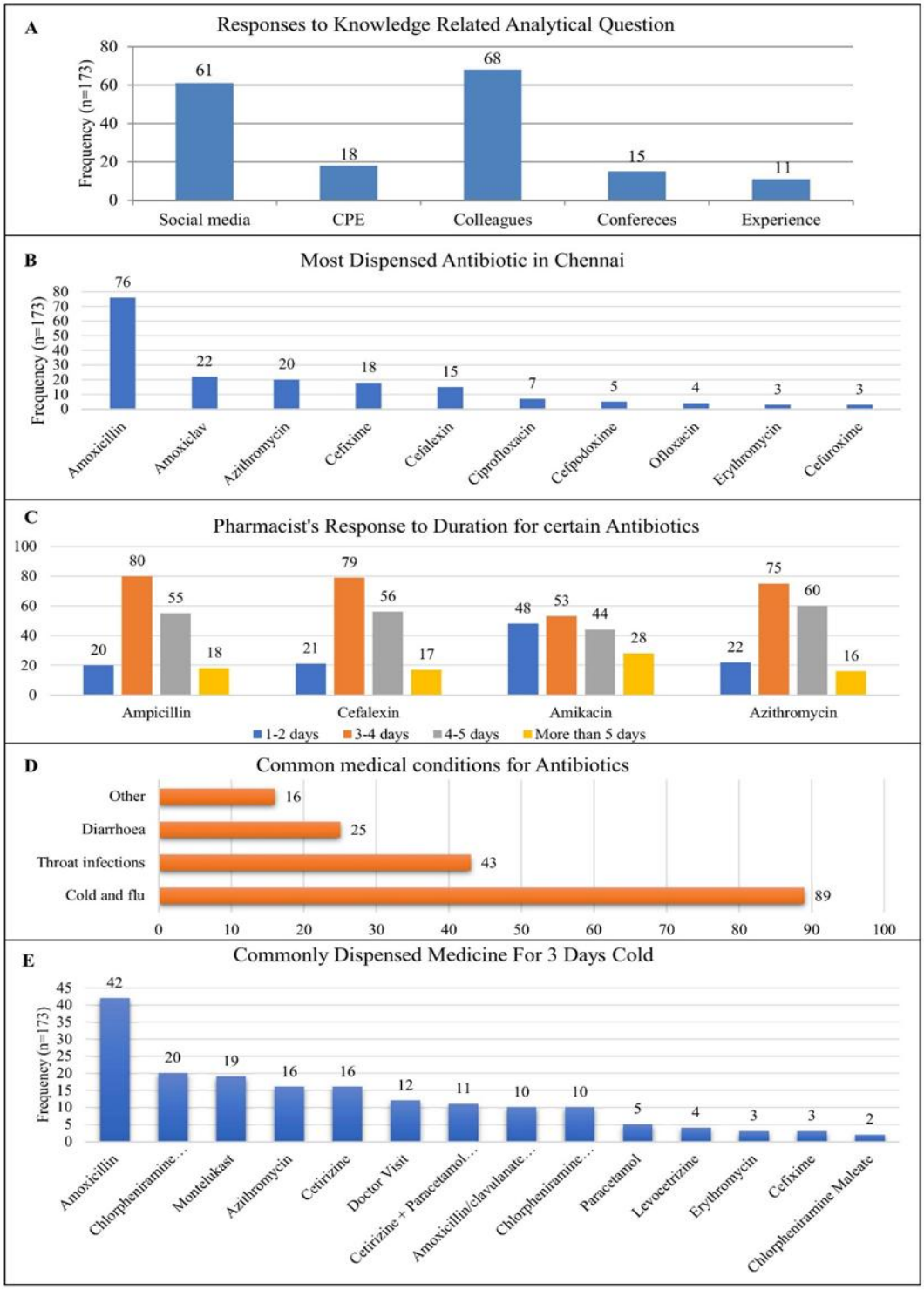

Figure 2: A - Graphical Analysis of Sources for Knowledge Updates in Antibiotics Dispensation; **B** - Dispensation Trends, Most Frequently Dispensed Antibiotics; **C** - Duration Patterns - Commonly Prescribed Antibiotic Courses; **D** - Analysis of Conditions Leading to Non-Prescription Antibiotic Use; **E** - Medication Dispensation Trends for 3-Day Cold Symptoms.

Table 4: Analysis of Attitude and Practice with respect to Knowledge levels

Variables (N-173)		Attitude		Practice	
		Average%	p-value	Average%	p-value
Knowledge	Good (n = 13)	80.77%	0.0012	66.67%	<0.0001
	Fair (n = 74)	61.54%	0.7054	56.41%	<0.0001
	Poor (n = 86)	67.95%	<0.0001	52.56%	<0.0001

Community pharmacists' knowledge, Attitude and Practices on Antibiotics

The knowledge levels and their corresponding attitudes and practices among the study participant were determined and the study data revealed that, among those with good knowledge (13 pharmacists), the average score for attitude was 80.77% and score 66.67% in practice, with p value < 0.05. For pharmacists with fair knowledge (74 pharmacists), the average scores were 61.54% in attitude and 56.41% in practice and Lastly, pharmacists with poor knowledge (86 pharmacists) scored an average of 67.95% in attitude and 52.56% in practice. The p-values indicated significant relationships between good knowledge levels and corresponding attitudes and practices (p< 0.05). Refer (Table. 3 & 4)

Simulated Patient Interview:

Simulated patient was carried out among visited 20 pharmacies in Chennai to analyse the response we have received.

We asked for a T. NORFLOX 400mg (prescription only medicine) for UTI without a prescription. The following reasons were fixed to tell the pharmacies that we visit:

- It is for our grandmother suffering from a long-term UTI.
- She needs a refill for her prescription.
- We could not find the prescription, as she started this medication 1 month back, and the prescription is missing.

Generic Name: NORFLOXACIN 400mg

Table 5: Simulated patient interview outcomes and analysis

Response	Frequency (n=20)
ENQUIRY ABOUT THE MEDICAL HISTORY	
a) Enquired	5
b) Did not enquire	15
ACCEPTANCE OF REASONS	
a) Agrees	20
b) Disagrees, but easily convinced	0
c) Strongly disagrees	0
PRESCRIPTION	
a) Ask for prescription	1
b) Did not ask for a prescription	19

DISCUSSION

Antimicrobial resistance (AMR) poses a serious and escalating threat to public health worldwide. Evaluating pharmacists' knowledge, attitudes, and practices (KAP) regarding antibiotics and AMR is crucial due to their essential role in patient care and medication dispensing.

The demographic trends among pharmacists showed that, the majority (50.87%) are aged 41 to 60, indicating a workforce with significant experience but nearing retirement. The gender distribution reveals a notable imbalance, with males making up 80.92% of the sample, highlighting the underrepresentation of women in the profession. These findings suggest the need for attention to workforce aging and gender diversity in pharmacy. This distribution aligns with similar studies conducted in India (1. Poyongo BP, et al, 2020)[19], where 140 (71.1%) were males and 57 (28.9%) were females. The majority of pharmacists (61.85%) in our study have 5 to 20 years of experiences, most are in the prime of their careers with substantial practical knowledge. The geometric mean for years of experience is 9.945, with a standard deviation of ±2.678. A significant concern is the educational background: 43.35% of pharmacists hold degrees classified as "other graduates," which may encompass a range of non-standard or less recognized qualifications. This large proportion highlights a major problem, as it suggests potential inconsistencies in educational standards and qualifications within the profession. Furthermore, the Pharm D degree is held by only 1.16% of participants, reflecting a low prevalence of this advanced qualification. In a study of 181 pharmacists, majority being male (n = 145, 80.1%), most participants held Doctor of Pharmacy (Pharm D) degrees (n = 132, 72.9%), though this contrasts with findings elsewhere in our study (Rehman IU et al., 2018)[20].

The study shows that 43.57% of pharmacists had accurate knowledge about antibiotics and AMR, this level of knowledge is promising but also highlights room for improvement and 71.00% had a positive attitude towards these issues, which is similar to the study conducted by Hadi MA, et al., 2016[21] where the majority of pharmacists (77.2%) recognized that DAwP contributes to the irrational use of antibiotics and development of resistance.

The questionnaire assessing pharmacists' knowledge about antibiotics revealed several critical gaps. A significant portion, 56.65%, incorrectly believed that antibiotics could be dispensed as over-the-counter medications, which underscores a concerning misunderstanding of regulations and the potential for misuse. This finding reflects the results of a similar study conducted by Porter, G et al, 2021[22], and in their study they found that a concerning issue highlighted in a study from India, which notes that despite being illegal, over-the-counter sales of antibiotics without a prescription are widespread.

73.41% of pharmacists from our study recognized the importance of reducing antimicrobial resistance (AMR) and ready to support the various measures to address this issue across India. This shows a strong awareness of the broader public health implications, even if specific knowledge areas need strengthening.

Regarding practice, our study revealed that, one third of the study participants (27.17) fail to do counselling on drug use while dispensing the antibiotics engage educational

practices, and half of the of pharmacists (57.80%) dispensed different classes of antibiotics than those prescribed by doctors, all these contributing to the ongoing issue of antimicrobial resistance (AMR). This discrepancy underscores the importance of enhancing education and enforcement of best practices in antibiotic stewardship among pharmacists and potentially due to a lack of diligence.

The survey also highlighted various practices adopted by community pharmacists in the Chennai region regarding antibiotic dispensing and counselling. The most frequently sold antibiotics were found to amoxicillin (44.06%), amoxiclav (12.14%), azithromycin (11.56%), cefixime (10.40%), and cefalexin (8.96%) and these antibiotics were dispensed for the minor ailments such as colds, fevers, and coughs, which could typically be managed with home remedies. This is reflecting a very low level of knowledge towards antibiotic resistance. Pharmacy associations should conduct short term, intensive training programmes to improve their knowledge on antibiotic resistance and to practice good antibiotic dispensing by the pharmacists. This can reduce overall consumption and combat resistance.

The study's analysis through three models provides valuable insights into the factors influencing pharmacy workers' knowledge, attitudes, and practices. Model 1 demonstrated that knowledge is significantly influenced by multiple factors, with age being the most dominant, explaining 81.54% of the variance. Gender, years of experience, locality, education level, employment type, and status also contributed, albeit to a lesser extent. Model 2 revealed similar associations with attitudes, where age (80.94%) and gender (71.43%) were the most influential factors, suggesting that demographic characteristics heavily shape attitudes toward pharmacy practice. Model 3 focused on practices, finding that age explained 81.85% of the variance, indicating that older pharmacists tend to have more established practice patterns. Interestingly, education level did not significantly impact practice, suggesting that practical experience may outweigh formal education in shaping behaviour. Overall, age and gender emerged as particularly impactful factors across all models, underscoring their critical role in pharmacy practice. Refer (Table 3).

The study revealed interesting correlations between pharmacists' knowledge levels and their attitudes and practices. Pharmacists with good knowledge scored higher on both attitude (80.77%) and practice (66.67%).

Our simulated patient interviews revealed a concerning trend in antibiotic dispensing practices. Only 5 out of 20 pharmacists inquired about the patient's medical history, indicating a lack of rationality in antibiotic use. Alarmingly, all pharmacists accepted unverified reasons for antibiotic requests, treating them as over-the-counter medications. Only one pharmacist asked for a prescription, while the other 19 did not. This practice is suggesting an urgent need for strict adherence to guidelines and better education towards antibiotic stewardship. Refer (Table 6)

Our observations during survey and simulated patient interviews revealed significant concerns in pharmacy practices. Many pharmacy staff has no pharmacy background leading to errors in dispensing, particularly with antibiotics. We observed that prescription drugs, including antibiotics, were often dispensed without proper inquiry or prescriptions. Some pharmacists felt it was the physician's responsibility to manage resistance.

CONCLUSION

Antimicrobial resistance (AMR) is a critical global health issue, making it essential to assess pharmacists' knowledge, attitudes, and practices (KAP) regarding antibiotics and AMR. Our study found that while most pharmacists were between the age group of 41-60 years, predominantly male, and moderately experienced. There is need for the community pharmacists to update their knowledge and improve their awareness on antibiotic resistance and its proper dispensing. Implementation of strict laws is needed to stop the pharmacy operation without qualified pharmacists. Simulated interviews revealed only 5 out of 20 pharmacists inquired about patients' medical histories or asked for prescriptions, indicating poor current practices. In summary, the study highlights considerable deficiencies in pharmacists' KAP related to AMR. Although many pharmacists have a positive attitude and moderate knowledge, a lack of awareness about AMR's seriousness and unethical dispensing practices persist. Urgent improvements are needed in regulation, enforcement, and public education. To combat AMR effectively, we recommend tracking antibiotic dispensing frequencies, adhering to ethical standards, and balancing technological advancements with traditional values in pharmacy practice.

ABBREVATIONS

OTC- Over The Counter; **KAP**- Knowledge Attitude Practice; **AMR**- Antimicrobial resistance; **MDR**- Multidrug resistance; **WHO**-World Health Organisation; **FAO**-Food and Agriculture Organization of the United Nations; **UNEP**-United Nations Environment Programme; **WOAH**-World Organisation for Animal Health; **NCDC**-National Centre for Disease Control; **ABR**- Antibiotic resistance; **ASP**-Antimicrobial stewardship programme; **ICMR**- Indian Council of Medical Research; **iAMRSS**- ICMR's Antimicrobial Resistance Surveillance system; **CPE**-Continuing Pharmacy Education; **AMS**- Antimicrobial Stewardship; **UTI**- Urinary tract infection; **PCI**- Pharmacy Council of India; **MRSA**-Methicillin Resistant Staphylococcus aureus; **MSSA**-Methicillin-Sensitive Staphylococcus aureus; **STP**-Sewage Treatment Plant; **ESBL**- Extended-Spectrum β-Lactamase.

ACKNOWLEDGEMENT

The authors would like to thank the Institution for its constant support.

Source of Support: The author(s) received no financial support for the research, authorship, and/or publication of this article

Conflict of Interest: The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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