Original Article

Community Pharmacists' Knowledge, Attitude, and Nonprescription Dispensing Practices of Antibiotics: An Explorative Study in a Selected City of South India

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Abstract

Objective: This study aimed to assess the community pharmacists' knowledge of antibiotics, their attitude toward antibiotic usage and antibiotic resistance, and their nonprescription dispensing practices of antibiotics. **Methods:** A cross sectional-questionnaire-based study was conducted among 75 community pharmacists practicing in a selected city of South India. Data on their age, years of experience, and educational qualifications were obtained. A modified, 33-items, prevalidated structured questionnaire was used to assess the community pharmacists knowledge, attitude, and nonprescription antibiotic dispensing practices knowledge, attitudes and practices (KAP). The responses obtained were expressed in descriptive statistics. The association between years of experience and their KAP was assessed using Pearson's correlation. **Findings:** Most pharmacists (60%) agreed that antibiotics are used for bacterial infections, and 35% believed that antibiotics could be given for pain and inflammation. Fourty-one percentage of pharmacists agreed that dispensing antibiotics without prescription increases the risk of antibiotic resistance. Seventy-two percentage agreed that they are responsible for taking a prominent role in antimicrobial resistance and infection-control programs in healthcare. Only 46% of pharmacists stated that they always dispensed antibiotics only with a prescription, and 56% dispensed antibiotics for longer than the doctor prescribed. Amoxicillin, metronidazole, and cephalexin were the most commonly dispensed antibiotics without a prescription. The most common reason for dispensing antibiotics without a prescription was the fear of losing customers. **Conclusion:** The study identified an average KAP interquartile range 1 among community pharmacists, indicating a lack of awareness of antibiotic resistance and dispensing antibiotics without a prescription.

Keywords: *Antibiotics, attitude, knowledge, nonprescription dispensing, resistance*

Received: 26-06-2021.
Accepted: 24-03-2022.
Published: 14-12-2022.

Introduction

Antibiotics have emerged as the most frequently used medicines and have become invaluable lifesavers, particularly in the developing world, where infectious diseases are the common cause of death.[1] Antibiotics are the antimicrobial agents used to treat bacterial infections by either killing or inhibiting the growth of bacteria. Antibiotics and other antimicrobials have mitigated the encumbrance of common infectious diseases. Nowadays, the misuse of antibiotics is a common issue in most world regions.[2] Major factors leading to misuse include frequent use of antibiotics, inappropriate prescribing, and self-medication.

Self-medication of antibiotics is a major issue. It may cause significant adverse effects such as treatment

Access this article online

Quick Response Code:

Website: www.jrpp.net

DOI: 10.4103/jrpp.jrpp_48_21

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How to cite this article: Kumar KS, Saranya S, Rani NV. Community pharmacists' knowledge, attitude, and nonprescription dispensing practices of antibiotics: An explorative study in a selected city of South India. J Res Pharm Pract 2022;11:51-8.

failure, drug toxicity, antibiotic resistance, and the emergence of multi-drug resistant bacteria, posing a major global concern. Multidrug resistance may risk increasingly frequent therapeutic deadlocks with a shortage of novel antibiotics.[3] Antimicrobial resistance is progressing as a major threat in both developed and developing countries, resulting in increased healthcare costs, length of hospital stay, morbidity, and mortality.[4] Recently, the World Health Organization addressed its concern about running out of antibiotic options to treat some resistant bacterial infections.[5,6]

Self-medication uses drugs to treat a self-diagnosed disorder or symptoms or the intermittent or continued use of prescribed medication for chronic or recurrent disease or symptoms. Self-medication is facilitated by procuring medicines without a prescription, refilling medicines with old prescriptions, sharing drugs with relatives or members of one's social circle, or using leftover medicines stored at home. Self-medication has always been favored by usually over-the-counter (OTC) drugs sold without a prescription in community pharmacies.[7] Studies have revealed that 3%–68% of antibiotics are sold without prescription in developed countries,[8,9] with the burden being higher (30%–85%) in developing countries.[10,11] In most countries, the supply of antibiotics without a prescription is illegal. However, it has been estimated that more than 50% of antibiotics are purchased without a prescription and used OTC in most parts of the world.[12] This practice is common in developing countries with no regulations regarding the sale and distribution of medicines or the enforcement of these regulations is weak.[13]

As per the report given by a recent systematic review and meta-analysis on global access to antibiotics without prescription in community pharmacies, the nonprescription supply of antibiotics is highest in South America.[14] There is an overall global increase in antibiotic consumption. However, notably, more than three-quarters of the general increase in antibiotic consumption occurred in Brazil, Russia, India, China, and South Africa.[15] While in recent times, several interventions have been designed to optimize the use of antibiotics in the antimicrobial stewardship programs, they are often targeted at hospitals, thereby missing the nonprescription source of antibiotics.[16,17] There is a need for evidence from well-designed studies on the use of antibiotics by the general public to help plan and implement specific strategies and interventions to prevent their irrational use of antibiotics resistance.[2]

Community pharmacy is one of the important parts of India's healthcare-related business. However, community practices are deprived of such efforts resulting in community pharmacists being primarily responsible for self-medication with antibiotics in low and middle-income countries. Community pharmacists can play a crucial role in developing and executing health-related educational programs in the community settings. Although knowledge and professional competency of community pharmacists in antibiotic dispensing are vital to ensure appropriate antibiotic supply to the community, limited studies have evaluated these characteristics in India, especially where antibiotic supply without a prescription is high. Important strategies for rational antibiotic usage in community settings must include raising awareness of regional antibiotic resistance patterns, improving knowledge of the community pharmacist on the latest treatment guidelines, and limiting and adjusting the inventory of antibiotics. In India, as antibiotics are accessed mostly through community pharmacies, intervening in the practice of these drugs in retail outlets can minimize inappropriate use of antibiotics, including self-medication and sales without a prescription.[18] This study hypothesized that community pharmacists' knowledge of rational antibiotic usage and antibiotic resistance would significantly affect their attitude and practice of antibiotic dispensing without a prescription. Assessing the knowledge, attitudes, and practices (KAP) of the community pharmacists on these issues would form a strong basis for implementing interventions in community pharmacy settings.

Methods

A cross-sectional survey was conducted among community pharmacists practicing in 15 zones of a selected metropolitan city of Tamil Nadu from September 2019 to April 2020. The study was conducted with the Approval of the Institutional Ethics Committee (IEC NO: CSP/19/SEP/80/344**)**. The selected five community pharmacists of each zone explained the study, and informed consent was obtained. Knowledge, attitude, and antibiotic dispensing practice of the pharmacists were assessed using a modified version of the prevalidated structured questionnaire developed by Sarwar *et al*., with the author's permission.[19] The questionnaire was administered to the pharmacists by an interviewer, and the responses obtained were documented in the response sheets.

The original questionnaire has 31 items divided into four sections. The first section comprises of four questions on the demographics of the participants. The second section has eight questions on the knowledge of participants about antibiotics. The third section has eight questions to give a clear assessment of the attitude of pharmacists towards antimicrobial stewardship and antimicrobial resistance. The fourth section has eleven questions to assess the knowledge of the pharmacists on

antimicrobial resistance, which are rated using a 5-point Likert scale.

The modified questionnaire has 33 items. In section A, Diploma in Pharmacy was added as an option to the 3rd question, and two more questions were added in this section. Question 5 was added to assess the antibiotics commonly dispensed without prescriptions, and question 6 was added to assess the reasons the patient's state when they ask for an antibiotic without a prescription. Section B was included as such. In Section C – questions 1, 2, and 5 were modified to assess the knowledge of antibiotic resistance as the questions in the original version focused on the assessment of antimicrobial stewardship. In Section D – all the questions were included as such.

The questions were scored similarly to that given in the original questionnaire. Scoring for Sections B and C was 1 for strongly disagree, 2 for disagree, 3 for neutral, 4 for agree, and 5 for strongly agree. For section D, scoring was 1 for never, 2 for rarely, 3 for occasionally, 4 for often, and 5 for always for questions 3–11. For questions 1 and 2 in this section, reverse coding was done as they were negatively worded statements. Overall scoring for knowledge, perception, and practice was done in such a way that a median score of 0.5–1 was assigned "very poor," 1.5–2 "poor," 2.5–3 "acceptable," 3.5–4 "good," and 4.5–5 "very good." Outcomes regarding practices were dichotomized as "good" versus "poor." For this, scores for practices (range 11 − 55) were summed, scores ≥ 28 were considered good, and scores < 28 were deemed poor.

The modified questionnaire was statistically validated for the total correlation and inter-rater and intra-rater reliability items using Cohen's Kappa. A Kappa = 0.82 was obtained, indicating almost perfect agreement (a Kappa = 1 is considered an ideal agreement for inter and intra rater reliability).

The needed sample size was estimated using n-Master software Version 2.0 (Department of Biostatistics, Christian Medical College, Vellore, Tamil Nadu, India). With an expected proportion of 0.78, a precision of 10%, and the desired confidence level (1-alpha) of 95%, the calculated sample size was 75.

The required sample was recruited by a cluster sampling method. The 15 zones of the selected metropolitan city were considered as 15 clusters. The representative sample for each cluster was 5, thus a total of 75 from 15 clusters. The first sample from each cluster was selected randomly, and the four consecutive pharmacies that consented to participate were included in each cluster.

The collected data were analyzed with IBM. SPSS statistics software 23.0 Version, International Business Machines Corporation, New York, USA. The categorical variables were expressed with descriptive statistics as frequency and percentage analysis, and the continuous variables were expressed as median and interquartile range (IQR). The relationship between the variables (KAP; years of experience) was assessed using Pearson's correlation. In all the above statistical tools, the probability value of < 0.05 was considered significant.

Results

The study was conducted on 75 community pharmacists sampled from 15 zones of a metropolitan city. All the participants were males and were working in independent community pharmacies. Table 1 explains the characteristics of the study population, including the mean age, gender, mean years of experience, the most commonly dispensed antibiotics, and the reason for dispensing antibiotics without a prescription. The pharmacists were 35–67 years old, with a mean age of 47 ± 7 years. The educational qualification of all the participants was a Diploma in Pharmacy. The mean years of experience of the participants were 10 ± 3 years. The most commonly dispensed antibiotics/ antimicrobials without the prescription were found to be

Table 1: Baseline characteristics of the participants n=75

Characteristics	Number of participants, *n* (%)
Age range (years)	
30–39	12 (16.4)
40–49	33 (45.2)
50–59	26 (35.6)
≥60	2 (2.70
Gender	
Males	75 (100)
Years of experience	
<5	5 (7)
5–9	28 (37)
≥10	42 (56)
Antibiotics dispensed without prescription	
Amoxicillin	14 (19)
Metronidazole	14 (19)
Cephalexin	11 (15)
Cefixime	9 (12)
Azithromycin	9 (12)
Ciprofloxacin	9 (12)
Erythromycin	8 (10)
Clindamycin	1 (1)
Reasons for dispensing without prescription	
For local persons	22 (29)
For trusted persons	17 (23)
For medical-related professionals	12 (16)
For regular customers	11 (15)
For unknown persons	13 (17)

amoxicillin and metronidazole by 14 (19%) pharmacists each, which was followed by cephalexin (15%) and cefixime (12%). The common reasons stated by the community pharmacists for dispensing antibiotics without prescriptions were "dispensed for local persons" by 22 (29%) pharmacists and "dispensed for trusted persons" by 17 (23%) pharmacists.

Table 2 explains the community pharmacists' knowledge of antibiotics and their indications. Sixty percent of the pharmacists agreed that antibiotics are used for bacterial infections; 65% stated that Antibiotics are useful for viral infections; only 9% disagreed with antibiotics being indicated to reduce any kind of pain inflammation; 31% agreed that antibiotics could kill normal gut bacterial flora; only 30% agreed that antibiotics could cause secondary infection after killing normal gut flora; 27% pharmacists agreed that antibiotics could cause an allergic reaction; 32% agreed that misuse of antibiotics can lead to a loss of sensitivity of an antibiotic to a specific pathogen; when asked whether antibiotic intake can be stopped before completion of a full course of treatment if symptoms improve, 58% pharmacists disagreed.

Table 3 explains the attitude of the pharmacists toward antibiotic resistance. When asked whether antibiotic resistance has become a major health issue and whether dispensing antibiotics without prescription increases its risk, 32 (41%) pharmacists agreed. The majority of the pharmacists gave a neutral response when asked whether any stringent steps are to be taken to limit or eliminate the practice of dispensing antibiotics without prescription. When questioned whether awareness of antibiotic resistance should be implemented at the community pharmacy level as they can reduce the problem of antibiotic resistance, 35% agreed. Thirty-three (44%) pharmacists agreed on the need for adequate training on antimicrobials for the community pharmacists. When asked whether individual efforts at rational usage of antibiotics have minimal impact on the antimicrobial-resistance problem, the responses were mixed. Only 26% of community pharmacists disagreed that prescribing physicians are the only professionals who need to understand antimicrobial resistance. Most pharmacists (72%) agreed to take a prominent role in antimicrobial resistance and infection-control programs if introduced by the Government of India and the statutory bodies.

Table 4 explains the responses given by the pharmacists to the questions to assess their dispensing practice of antibiotics. Only 35 (46%) pharmacists stated that they always dispensed antibiotics only with a prescription, and 56% said they always dispensed antibiotics for a duration longer than that prescribed by the doctor. Around 44% responded that they always check whether the antibiotics are prescribed appropriately for infections before dispensing. In contrast, only 20% admitted that they always ask for additional clinical information before deciding to dispense the antibiotic without a prescription.

Table 5 depicts the association between the variables knowledge, attitude, and dispensing practices of the community pharmacists. There was a significant negative correlation between knowledge and attitude and knowledge and practice, indicating that poor knowledge negatively impacted their attitude and practice ($P < 0.05$). Attitude had a significant positive correlation with the practices of the community pharmacists on antibiotic dispensing and antibiotic resistance ($P < 0.05$).

Table 6 explains the association between years of experience of the community pharmacists and their

Table 2: Knowledge of participants on the antibiotic usage

Questions K1 to K8	Strongly disagree, *n* (%)	Disagre, *n* (%)	Neutra, *n* (%)	Agree, *n* (%)	Strongly agree, *n* (%)	Median (IQR)
K1 - Antibiotics are useful for bacterial infections	0	0	30 (40)	45 (60)	0	3.5 (1)
K2 - Antibiotics are useful for viral infections	0	0	26 (35)	49 (65)	0	2 (1)
K3 - Antibiotics are indicated to reduce any kind of pain inflammation	0	7 (9)	42 (56)	26 (35)	0	3 (1)
K4 - Antibiotics can kill " normal flora" present in our body	0	16 (21)	36 (48)	23 (31)	0	3 (1)
K5 - Antibiotics can cause secondary infection after killing normal flora present in our body	0	25 (33)	28 (37)	22 (30)	0	3 (2)
K6 -Antibiotics can cause allergic reaction	0	31 (41)	24 (32)	20 (27)	0	3 (2)
K7 - Misuse of antibiotic can lead to a loss of sensitivity of an antibiotic to a specific pathogen	0	26 (35)	25 (33)	24 (32)	0	3 (2)
K8 - If symptoms improve before the full antibiotic course of is completed, you can stop taking it	0	44 (58)	14 (19)	0	17 (23)	2 (0)

IQR=Interquartile range

Table 3: Attitude of the participants toward antibiotic usage and resistance

Questions A1 to A8	Strongly disagree, *n* (%)	Disagree, *n* (%)	Neutral, *n* (%)	Agree, *n* (%)	Strongly agree, *n* (%)	Median (IQR)
A1 - Antibiotic resistance has become a major health issue	0	0	43 (59)	32 (41)	0	3 (1)
A2 - Dispensing antibiotics without a prescription can increase the risk of antibiotic resistance	0	0	43 (59)	32 (41)	0	3 (1)
A3 - If dispensing antibiotics without a prescription is a cause for antibiotic resistance, stringent steps are to be taken to limit or eliminate this practice	0	3 (4.1)	50 (68.5)	22 (27.4)	0	3 (1)
A4 - Awareness on antibiotic resistance should be implemented at community -pharmacy level as they can reduce the problem of antibiotic resistance	0	15 (20)	34 (45)	26 (35)	0	3 (1)
A5 - Adequate training on antimicrobial use should be provided to community pharmacist	0	20 (26)	22 (39)	33 (44)	0	3 (2)
A6 - Individual efforts at rational usage antimicrobial have minimal impact on the antimicrobial-resistance problem	0	32 (43)	18 (24)	25 (33)	0	3 (2)
A7 - I think that prescribing physicians are the only professionals who need to understand antimicrobial resistance	0	26 (35)	14 (19)	35 (46)	0	3 (2)
A8 - Pharmacist have a responsibility to take a prominent role in antimicrobial resistance and infection- control programs in the health	0	0	21 (28)	54 (72)	0	4 (1)

IQR=Interquartile range

Table 4: Antibiotics dispensing practices of the participants

Questions D1 to D11	Always, *n* (%)	Often, *n* (%)	Occasionally, *n* (%)	Rarely, *n* (%)	Never, *n* (%)	Median (IQR)
D1 - I dispense antibiotics without a prescription on the patient request As I know the patient I may lose my patients or they may try to get it from another pharmacy	38 (51)	37 (49)	0	0	0	2 (1)
D2 - I dispense antibiotics for duration longer than that prescribed by the doctor	42 (56.0)	31 (41.0)	0	2 (3.0)	0	1 (1)
D3 - I dispense antibiotics with a prescription	35 (46.0)	17 (23.0)	8 (11.0)	12 (16.0)	3 (4)	4 (2)
D4 - I check whether the antibiotics are prescribed appropriately for infections before dispensing	32 (43.0)	14 (19.0)	10 (13.0)	18 (24.0)	3 (4)	4 (3)
D5 - I ask for additional clinical information before deciding to dispense the antibiotic without prescription	15 (20.0)	11 (15.0)	10 (13.0)	24 (32.0)	15 (20.0)	2 (2)
D6 - I dispense antimicrobial for duration longer than prescribed by the physician on patient request	13 (17.0)	0	25 (33.0)	23 (31.0)	14 (19.0)	4 (1)
D7 - I take part in antimicrobial- awareness campaigns to promote the optimal use of antimicrobials	13 (17.0)	2 (2.7)	30 (40.0)	9 (12.0)	21 (28.0)	3 (2)
D8 - I educate patients on the use of antimicrobials and resistance-related issues	18 (24.0)	3 (4.0)	25 (33.0)	9 (12.0)	20 (26.0)	3 (4)
D9 - I make efforts to prevent or reduce the transmission of infections within the community	28 (37.0)	0	13 (17.0)	11 (15.0)	23 (31.0)	3 (4)
D10 - I ask patients about their knowledge of prescribed antimicrobials and their usage	23 (31.0)	0	4 (5.0)	9 (12.0)	39 (52.0)	1 (4)
D11 - I will communicate with prescribers if I am not sure about the appropriateness of an antibiotic prescription	34 (45.0)	0	0	5 (6.0)	37 (49.0)	2 (4)

IQR=Interquartile range

Table 5: Nonprescription antibiotic dispensing practices of participants

Variables	Correlation *r*	Significance *P*
Knowledge versus attitude	−0.087	0.03*
Knowledge versus practice	−0.145	0.022*
Attitude versus practice	0.666	0.04*

*Statistical significance at $P<0.05$

KAPs of antibiotic dispensing without prescription. The years of experience were classified as less than and above 10 years. There was no significant association between the years of experience and the KAP median scores ($P > 0.05$). This indicates that years of experience had no impact on their knowledge of antibiotic usage and antibiotic resistance and their nonprescription dispensing practice of antibiotics.

Table 6: Experience of the participants versus their knowledge, attitude, and practice of nonprescription antibiotic dispensing

Domains	Experience (years)	*N*	Mean±SD	*t*	Significance *P*
Knowledge	<10	32	22.7±2.4	0.237	0.813 (NS)
	≥10	41	22.5±2.0		
Attitude	<10	32	26.2±2.2	1.316	0.192 (NS)
	≥10	41	25.5±2.3		
Practice	<10	32	33.0±6.0	0.623	0.636 (NS)
	≥10	41	33.9±6.0		

NS=Not significant, SD=Standard deviation

Discussion

Antibiotic dispensing in community pharmacies without a prescription poses a major challenge in developing countries. There is a definite relationship between irrational antibiotic usage and the development of antibiotic resistance. This study aimed to evaluate the community pharmacists' knowledge of antibiotics, their attitude toward antibiotic use and antibiotic resistance, and their dispensing practices of antibiotics. Most studies have reported that more than 50% of antibiotics worldwide are sold without a prescription, especially in developing countries where access to antibiotics is not well regulated.[20,21]

The pharmacists who participated in the study had a basic qualification of a Diploma in Pharmacy, and the majority of them were in the age range of 40–49 years. Though a majority of the pharmacists had a work experience of above 10 years, their knowledge of antibiotic usage was not updated.

Amoxicillin, cephalexin, and cefixime were the most commonly dispensed antibiotics without a prescription and mainly dispensed for clinical symptoms associated with upper respiratory infections such as cough, cold and sore throat. Azithromycin and erythromycin were also dispensed by the pharmacists for the same clinical conditions. Metronidazole was commonly dispensed for clinical conditions associated with gastrointestinal infections like diarrhea. A study was done in Jordan by Almaaytah *et al.*[22] reported that 97.6% of antibiotics were dispensed without prescription for sore throat, and 83% were for urinary tract infection and diarrhea (83%). A similar report was also given by the study done in Riyadh in which sore throat and diarrhoea resulted in an antibiotic being dispensed in 90% of encounters and 75% for urinary tract infections.[23] An Indian study by Ahmad *et al.*[24] also reported a similar finding.

Antibiotics are not indicated in the treatment of upper respiratory tract infections as most of these are caused by viruses. The second common clinical condition is diarrhoea, which also does not require an antibiotic in most cases.[25] Unfortunately, many pharmacists believe that metronidazole is the treatment of choice to manage acute watery diarrhea. In a study from Moshi, Tanzania, 80.6% of children with diarrhea were given metronidazole, indicating an indiscriminate antibiotic use in diarrhea treatment instead of zinc and rehydration therapy. These study findings suggest that irrational antibiotic dispensing is deep-rooted and requires an equally massive educational campaign among community pharmacists.[26]

In the present study, when asked for the reasons for dispensing antibiotics without a prescription, the majority (51%) stated that they always dispensed for the local/regular customers due to the fear of losing their customers. Studies have reported that reasons for pharmacists to dispense nonprescription antibiotics were pressure from the customers, to prevent customers from seeking counseling from other pharmacies, lack of education, and lack of legal enforcement.[27,28]

When asked about the usage of antibiotics for bacterial infections, 60% agreed to it, and the remaining responded neutrally. Similarly, 64% agreed that antibiotics are used for viral infections, and 35% believed antibiotics could be given for pain and inflammation. These findings are concordant with similar studies on this topic. The Euro barometer report[29] on antibiotic resistance was published in 2013 based on a study conducted on an Italian Population. It is evident from the studies mentioned above that irrational use of antibiotics for nonindicated conditions like viral flu, diarrhea, fever, and inflammation is still a major problem that needs to be addressed. Community pharmacies are the most approached health care facility by the common public for the minor ailments like sore throat, flu, and diarrhea. Community pharmacists contribute majorly towards irrational use of the antibiotics by dispensing them without a prescription. This is also evident from the findings of the study done in Pune, India, by Salunkhe *et al.*,[30] which reported the OTC sales of antibiotics as 94.56%.

Around 30% of the pharmacists were aware that antibiotics can kill the normal gut flora and can result in secondary infections, but about 20%– 30% disagreed with these statements, which reflects their lack of knowledge of the consequences of inappropriate antibiotic usage. In the present study, the assessment made on the community pharmacists' knowledge, attitude, and dispensing practices revealed a total median score of 3.5 (IQR 1), indicating an average KAP on antibiotic usage. However, there was a considerable percentage of pharmacists still not aware of antibiotic use and antibiotic resistance.

In the present study, the attitude of the pharmacists toward antibiotic resistance and the need for awareness and training programs on rational antibiotic usage was assessed using eight questions. There were 41% of pharmacists agreed that antibiotic resistance has become a major health issue, and dispensing antibiotics without a prescription can increase the risk of antibiotic resistance. But only 27% of pharmacists agreed that stringent steps are to be taken to limit or eliminate the practice of dispensing antibiotics without a prescription, and the remaining 69% were neutral, and 4% disagreed. Only 30%–40% of the pharmacists agreed to the need to implement awareness programs on antibiotic resistance and training on antimicrobial usage for community pharmacists. However, 72% of pharmacists agreed that they have a responsibility to take a prominent role in antimicrobial resistance and infection-control programs in health. These findings suggest that although these community pharmacists are practicing in a metropolitan city, with easy access to resources for updating their knowledge, there is a 30%–40% of pharmacists who lack adequate knowledge on antibiotic usage and the consequences of inappropriate antibiotic use. A study was done by Ansari[31] also stated that lack of updating their understanding of antibiotic use was another main drawback among pharmacy staff and 28% of the dispensing staff did not use any resource for medicine information. These findings also emphasize the need for continuing professional development and on-job training of community pharmacists to mitigate these problems.

In the present study, the dispensing practice of the community pharmacists was assessed using 11 questions. Fifty-four percentage of pharmacists dispensed without prescription and 56% administered antibiotics for a duration longer than that prescribed. When asked for the reasons for dispensing antibiotics without prescription, 51% of pharmacists stated the fear of losing the patients as they may try to get it from another pharmacy. Around 44% stated that they always check whether the antibiotics are prescribed appropriately for infections before dispensing. In contrast, only 20% admitted that they always ask for additional clinical information before deciding to dispense the antibiotics without prescription. Only 17% of pharmacists admitted that they readily take part in antimicrobial-awareness campaigns to promote the optimal use of antimicrobials, and only 24% said that they always educate patients on the use of antimicrobials and resistance-related issues. Around 30% of pharmacists never took part in antimicrobial awareness campaigns and never made attempts to educate their patients on antimicrobial usage and resistance issues. A study by Sarwar *et al*.[19] in Pakistan also reported similar trends in dispensing practices of the community pharmacists in their region. A study was done by Cotta *et al*.[32] also reported that antibiotics were dispensed by community pharmacists for a duration longer than that prescribed, and most community pharmacists were unaware and were not interested in antibiotic awareness/stewardship programs.

Most of the pharmacists in the present study had more than 10 years of experience as community pharmacists, but the years of experience did not have a significant association with their KAP on antibiotic usage and antimicrobial resistance. It is evident that community pharmacists must be given adequate training to update their knowledge and belief on antibiotic usage, consequences of inappropriate antibiotic dispensing leading to antibiotic resistance, and the emergence of drug-resistant bacteria.

To our best of knowledge, this is the first study to be conducted in a metropolitan city in South India by taking the reference samples from all the zones of the city. In a country like India, with a vast population and variations in the educational and economic status across the country, there are many challenges in implementing regular educational programs for community pharmacists. It is also recommended that drug regulatory authorities enforce stringent laws on practicing community pharmacists so that violation of Pharmaceutical Code and Ethics may be minimized wherever possible in the the future and must insist prescription medications be dispensed by legally qualified pharmacists only on a prescription basis.

This study was conducted in an urban city. The findings of this study are not a complete reflection of the entire scenario of community pharmacies across the country. Similar studies are to be conducted in different rural and remote settings to assess the KAP of community pharmacists and to predict the exact reasons for nonprescription dispensing practices of community pharmacists in varied geographical and socioeconomic settings.

The present study identified an average knowledge, attitude, and nonprescription dispensing practices of the community pharmacists, reflecting on a major proportion of pharmacists lacking awareness of the appropriate usage of antibiotics. This emphasizes the need for educating the community pharmacists on the impact of inappropriate antibiotic use on the emergence of antimicrobial resistance and the responsibility of community pharmacists in combating these issues. The study recommends the periodic conduct of continuing education and professional development programs for the practicing community pharmacists, which the professional and drug regulatory bodies could effectively implement by emphasizing the involvement of pharmacy schools and pharmacy professionals in academics toward the conduct of refresher programs for practicing pharmacists.

Authors' Contribution

Vanitha Rani Nagasubramanian designed the study, prepared the initial proposal and critically reviewed the proposal. K.Sarath Kumar and S. Saranya gathered and analyzed the data. All authors read the manuscript and agreed for the final version of the submitted manuscript.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

References

1. World Health Organization. Worldwide Country Situation Analysis: Response to Antimicrobial Resistance Geneva: WHO Press; 2015. p. 1-50.
2. Roque F, Soares S, Breitenfeld L, López-Durán A, Figueiras A, Herdeiro MT. Attitudes of community pharmacists to antibiotic dispensing and microbial resistance: A qualitative study in Portugal. Int J Clin Pharm 2013;35:417-24.
3. World Health Organization (WHO). WHO publishes list of bacteria for which new antibiotics are urgently needed. 2017. Available from: https://www.who.int/news/item/27-02-2017-who-publishes-list-of-bacteria-for-which-new-antibiotics-are-urgently-needed [Last cited on 2019 Sep 13].
4. World Health Organization (WHO). Antimicrobial resistance. 2018. Available from: https://www.who.int/news-room/fact-sheets/detail/antimicrobial-resistance [Last cited on 2019 Sep 04].
5. Piddock LJ. The crisis of no new antibiotics-what is the way forward? Lancet Infect Dis 2012;12:249-53.
6. Llor C, Bjerrum L. Antimicrobial resistance: Risk associated with antibiotic overuse and initiatives to reduce the problem. Ther Adv Drug Saf 2014;5:229-41.
7. Elong Ekambi GA, Okalla Ebongue C, Penda IC, Nnanga Nga E, Mpondo Mpondo E, Eboumbou Moukoko CE. Knowledge, practices and attitudes on antibiotics use in Cameroon: Self-medication and prescription survey among children, adolescents and adults in private pharmacies. PLoS One 2019;14:e0212875.
8. World Health Organization (WHO). Antibiotic Resistance: Global Report on Surveillance 2014. WHO Report. Geneva: WHO; 2014.
9. Jain S, Malvi R, Purviya JK. Concept of self-medication; a review. IJPBA 2011;2:831-6.
10. Shah SJ, Ahmad H, Rehan RB, Najeeb S, Mumtaz M, Jilani MH, *et al*. Self-medication with antibiotics among non-medical university students of Karachi: A cross-sectional study. BMC Pharmacol Toxicol 2014;15:74.
11. Mumtaz Y, Jahangeer SA, Mujtaba T, Zafar S, Adnan S. Self-medication among university students of Karachi. JLUMHS 2011;10:102-5.
12. Damisie G, Hambisa S, Yimam M. Over the counter sale of antibiotics at drug stores found in Mizan-Aman Town, Southwest Ethiopia: A cross-sectional simulated client visit study. J Pharm (Cairo) 2019;2019:3510659.
13. Ayukekbong JA, Ntemgwa M, Atabe AN. The threat of antimicrobial resistance in developing countries: Causes and control strategies. Antimicrob Resist Infect Control 2017;6:47.
14. Auta A, Hadi MA, Oga E, Adewuyi EO, Abdu-Aguye SN, Adeloye D, *et al*. Global access to antibiotics without prescription in community pharmacies: A systematic review and meta-analysis. J Infect 2019;78:8-18.
15. Van Boeckel TP, Gandra S, Ashok A, Caudron Q, Grenfell BT, Levin SA, *et al*. Global antibiotic consumption 2000 to 2010: An analysis of national pharmaceutical sales data. Lancet Infect Dis 2014;14:742-50.
16. Viale P, Giannella M, Bartoletti M, Tedeschi S, Lewis R. Considerations about antimicrobial stewardship in settings with epidemic extended spectrum β-lactamase-producing or carbapenem-resistant Enterobacteriaceae. Infect Disease Ther 2015;4:65-83.
17. McNulty CA, Lecky DM, Farrell D, Kostkova P, Adriaenssens N, Koprivová Herotová T, *et al*. Overview of e-Bug: An antibiotic and hygiene educational resource for schools. J Antimicrob Chemother 2011;66 Suppl 5:v3-12.
18. Gupta S, Gupta P. Prevalence of self-medication: A review. J Manage Sci Tech 2014;2:35-9.
19. Sarwar MR, Sadia Ittikhar AS, Sadiq T. Knowledge of community pharmacist about antibiotics and their perceptions and practices regarding antimicrobial stewardship. Infect Drug Resist 2018;11:133-45.
20. Nga DT, Chuc NT, Hoa NP, Hoa NQ, Nguyen NT, Loan HT, *et al*. Antibiotic sales in rural and urban pharmacies in northern Vietnam: An observational study. BMC Pharmacol Toxicol 2014;15:6.
21. Sengupta S, Chattopadhyay MK, Grossart HP. The multifaceted roles of antibiotics and antibiotic resistance in nature. Front Microbiol 2013;4:47.
22. Almaaytah A, Mukattash TL, Hajaj J. Dispensing of non-prescribed antibiotics in Jordan. Patient Prefer Adherence 2015;9:1389-95.
23. Bin Abdulhak AA, Altannir MA, Almansor MA, Almohaya MS, Onazi AS, Marei MA, *et al*. Non prescribed sale of antibiotics in Riyadh, Saudi Arabia: A cross sectional study. BMC Public Health 2011;11:538.
24. Ahmad A, Patel I, Mohanta G, Balkrishnan R. Evaluation of self medication practices in rural area of town sahaswan at northern India. Ann Med Health Sci Res 2014;4:S73-8.
25. Shet A, Sundaresan S, Forsberg BC. Pharmacy-based dispensing of antimicrobial agents without prescription in India: Appropriateness and cost burden in the private sector. Antimicrob Resist Infect Control 2015;4:55.
26. Gwimile JJ, Shekalaghe SA, Kapanda GN, Kisanga ER. Antibiotic prescribing practice in management of cough and/or diarrhoea in Moshi Municipality, Northern Tanzania: cross-sectional descriptive study. Pan Afr Med J 2012;12:103.
27. Sabry NA, Farid SF, Dawoud DM. Antibiotic dispensing in Egyptian community pharmacies: An observational study. Res Soc Adm Pharm 2014;10:168-84.
28. Vazquez-Lago J, Gonzalez-Gonzalez C, Zapata-Cachafeiro M, Lopez-Vazquez P, Taracido M, López A, *et al*. Knowledge, attitudes, perceptions and habits towards antibiotics dispensed without medical prescription: A qualitative study of Spanish pharmacists. BMJ Open 2017;7:e015674.
29. European Commission. Special Eurobarometer 407 report: Antimicrobial Resistance. 2013. Available from: https://health.ec.europa.eu/publications/antimicrobial-resistance-special-eurobarometer-407_en. [Last cited on 2019 Sep 08].
30. Salunkhe SD, Pandit VA, More CS. Study of over the counter sale of antimicrobials in pharmacy outlets in Pune, India?: A cross sectional study. Int J Pharma Bio Sci 2013;4:616-22.
31. Ansari M. Evaluation of community pharmacies regarding dispensing practices of antibiotics in two districts of central Nepal. PLoS One 2017;12:e0183907.
32. Cotta MO, Robertson MS, Tacey M, Marshall C, Thursky KA, Liew D, *et al*. Attitudes towards antimicrobial stewardship: Results from a large private hospital in Australia. Healthc Infect 2014;19:89-94.W