

Original Research

Pharmacists' knowledge, attitudes, and practices of dispensing antibiotics without a prescription

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Received (first version): 17-May-2025,

Accepted: 17-Jul-2025,

Published online: 15-Nov-2025

Abstract

Background: Antibiotics have become some of the most widely used and essential tools in the healthcare system, with the advantage of saving millions of lives. However, the overuse and misuse of antibiotics led to the emergence of resistant microorganisms. **Objective:** To assess community pharmacists' knowledge, attitude, and practice in relation to dispensing antibiotics without prescription. **Methods:** In this cross-sectional study, a validated survey was distributed in person as Google Forms to community pharmacists across different regions in Jordan using convenience sampling. A quantile regression was conducted to explore the factors associated with attitude and practice of antibiotics dispensing without prescription. **Results:** Pharmacists (N=351) exhibited moderate knowledge regarding antibiotic use and resistance, with a median score of 4 (range 3-5) out of a possible 7 points. The median attitude score was 22 (20-24), out of maximum possible score of 25, indicating favourable attitudes towards antibiotics prescription. Regression analysis demonstrated that higher knowledge scores were associated with higher attitude scores (coefficient = 0.106, 95%CI: 0.007 - 0.206, p = 0.036). Additionally, higher attitude scores were linked to a reduced likelihood of dispensing antibiotics without a prescription (coefficient = -0.302, 95%CI: 0.588 - 0.929, p = 0.010). **Conclusion:** The study indicated moderate knowledge of antibiotics among pharmacists and a generally favourable attitude toward their prescription. Greater knowledge was associated with a more positive attitude, which was linked to a lower likelihood of dispensing antibiotics without a prescription. Future initiatives should aim to enhance pharmacists' understanding of antibiotic use and resistance, as well as implement stricter dispensing regulations to reduce the use of antibiotics without prescriptions and address antimicrobial resistance.

Keywords: antibiotic, dispensing, prescription, knowledge, attitude, practice, pharmacist

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INTRODUCTION

The antimicrobial agents known as antibiotics are used to treat bacterial infections by either eradicating the bacteria or preventing their growth¹. These medications have become some of the most widely used and essential tools in healthcare, significantly reducing the burden of common infectious diseases and saving countless lives². Microorganisms have become increasingly resistant to antibiotics due to their overuse and misuse. Antimicrobial resistance (AMR) is the term used to describe the ability of microorganisms, such as bacteria, viruses, fungi, and parasites, to survive and proliferate in the presence of medications intended to eradicate them. In addition to being difficult to treat, infections caused by antimicrobial-resistant organisms always carry a higher risk of developing into serious illnesses and possibly fatalities³. In 2019, an estimated 1.27 million deaths worldwide were directly attributed to bacterial AMR⁴. Besides causing death and disability, AMR carries substantial economic costs. According to the World Bank estimates, AMR could lead to an additional US\$ 1 trillion in healthcare expenses by 2050 and result in annual gross domestic product losses ranging from US\$ 1 trillion to



US\$ 3.4 trillion by 2030⁵.

According to the World Health Organization, AMR affects every country regardless of location or income level. However, low- and middle-income countries, such as Jordan, are particularly impacted, with poverty and inequality exacerbating both the causes and consequences of AMR⁶. Given that AMR is often driven by the overuse and misuse of antibiotics, examining the dispensing practices of community pharmacists is crucial in the fight against AMR. Research has shown that in developed countries, between 3% and 68% of antibiotics are sold without a prescription, whereas in developing countries, the percentage is between 30% and 85%⁷⁻¹¹. Obtaining antibiotics without a prescription is prohibited in the majority of nations. Over 50% of antibiotics, however, are thought to be purchased over-the-counter (OTC) in most parts of the world without a prescription¹², highlighting the urgent need to evaluate community pharmacists' perspectives regarding dispensing antibiotics without a prescription.

Community pharmacies are among the most important and accessible components of the healthcare system. Patients often find it easier to obtain antibiotics from a pharmacy rather than scheduling an appointment with a physician, which can require more time, money, and effort. As a result, community pharmacists may contribute to the issue of AMR by dispensing antibiotics without a prescription. This study, which aims at assessing community pharmacists' knowledge, attitude, and practice concerning the non-prescription dispensing of antibiotics, is extremely important for the development of future interventions that would raise pharmacists' awareness of this practice and subsequently reduce the AMR.

MATERIALS AND METHODS

Study design and subjects

In this cross-sectional study, the research pharmacist distributed a validated self-administered survey in person via Google Forms to community pharmacists across various regions in Jordan using convenience sampling in the period from April to June 2022. In addition to its fitness with this research purpose, convenience sampling allows researchers to collect data more quickly and at a lower cost compared to random sampling. To be eligible, participants had to be licensed community pharmacists in Jordan, possess a valid pharmacy license, and have graduated from institutions recognized by the Ministry of Higher Education. After verifying eligibility, the research pharmacist briefly informed the participants about the study's objectives and assured that their involvement would be voluntary, anonymous, and confidential. By agreeing to participate, pharmacists were required to check a box confirming that they had read the study details and were ready to proceed with the survey questionnaire. This checkbox served as their informed consent to participate in the study. The study received ethical approval from the Institutional Review Board (IRB) at Jordan University of Science and Technology.

Study instrument

The present study questionnaire was developed after a review of relevant literature¹³. A panel of experts, comprising

professors of public health and pharmacy practice, evaluated the survey for its relevance and comprehensiveness. Ten community pharmacists took part in a pilot study to assess the survey's relevance, clarity, and completion time. The final analysis did not include data from the pilot test. The first section of the survey gathered information on sociodemographic and work-related factors, whether antibiotics were dispensed without a prescription, the medical conditions prompting such dispensing, the reasons for dispensing antibiotics without a prescription, and the sources of drug information used. The second section consisted of seven items that evaluated pharmacists' knowledge of antibiotic use and resistance, with response options including "Yes," "No," and "Unsure." Each correct answer was awarded one point, resulting in a maximum possible score of seven points. The final section, consisting of five items, assessed pharmacists' attitudes toward antibiotic prescribing using a five-point Likert scale, where responses ranged from "strongly disagree" (1 point) to "strongly agree" (5 points), with a maximum possible score of 25 points. The survey took around ten minutes to complete.

Sample Size Calculations

The Green's rule, which states that " $n = 50 + 8 * \text{predictors}$," was utilized to calculate the required sample size. The largest model in this study included 10 predictors. Therefore, according to Green's rule, the minimum required sample size for this study is 130.

Statistical Analysis

Data analysis was conducted using the Statistical Package for the Social Sciences (SPSS), version 28. Descriptive statistics were presented, with medians and 25–75 percentiles for continuous variables, while percentages and frequencies were used for categorical variables. Taking into consideration the non-normal distribution of the data, quantile regression was conducted to investigate the factors associated with the dependent variable of the present study, which was dispensing antibiotics without prescription. The independent variables included were age, gender, pharmacy type and location, primary position at practice setting, average number of patients served a day, having a space area for patient counseling in the community pharmacy, knowledge about antibiotics uses and resistance, and attitudes towards antibiotic prescription. Significance was set at a threshold of $p < 0.05$.

RESULTS

In total, 351 pharmacists participated in this study, with a median age of 27 (25-30) years. As shown in Table 1, most of the pharmacists were female (76.9%), worked in independent community pharmacy (70.1%), were pharmacists in charge (79.8%), served more than 40 patients a day (42.7%), had a space area for patient counselling (82.3%), and reported dispensing antibiotic without prescription (87.7%).

Figure 1 represents the common medical conditions for which pharmacists dispensed antibiotics without prescription, where tonsillitis (83.1%), urinary tract infection (76.9%), and acute sore throat (71.4%) represented the most common conditions,



while gastroenteritis (23.4%) was the least common.

Figure 2 explores the reasons for dispensing antibiotics without prescription. The most commonly reported reasons were "pharmacist knowledgeable enough to give patient antibiotic without prescription" (71.40%), "patient pressure" (66.90%), "patient's trust and relationship" (58.80%), and "low socioeconomic status of the patient" (54.5%). The least reported reasons were "to increase pharmacy income"

(28.90%) and "pharmacy owner pressure"

As shown in Figure 3, the most commonly used source of drug information was "Lexicomp" (55.6%) followed by "drug index" (52.4%) and "research article" (49.3%), while the least used source was "Martindale" (7.7%).

Pharmacists' knowledge about antibiotics use and resistance are displayed in Table 2. The participants need substantial

Table 1. Sociodemographic and job-related characteristics of the study pharmacists (n=351).

		Frequency (%)
Gender	Female	270 (76.9%)
	Male	81 (23.1%)
Pharmacy type	Chain Community Pharmacy	105 (29.9%)
	Independent Community Pharmacy	246 (70.1%)
Location of pharmacy	Amman	141 (40.2%)
	Others*	210 (59.8%)
Job role	Owner pharmacist	36 (10.3%)
	Owner pharmacist and Pharmacist-in-charge	35 (10.0%)
	Pharmacist-in-charge	280 (79.8%)
Average number of patients served a day	<10	28 (8.0%)
	10-20	103 (29.3%)
	21-40	70 (19.9%)
	>40	150 (42.7%)
Having a space area for patient counseling in the community pharmacy	No	62 (17.7%)
	Yes	289 (82.3%)
Do you dispense antibiotics without a prescription?	No	43 (12.3%)
	Yes	308 (87.7%)

*Others include Irbid, Jerash, Ajloun, Mafraq, Zarqa, Salt, Madaba, Kerak, Ma'an and Aqaba

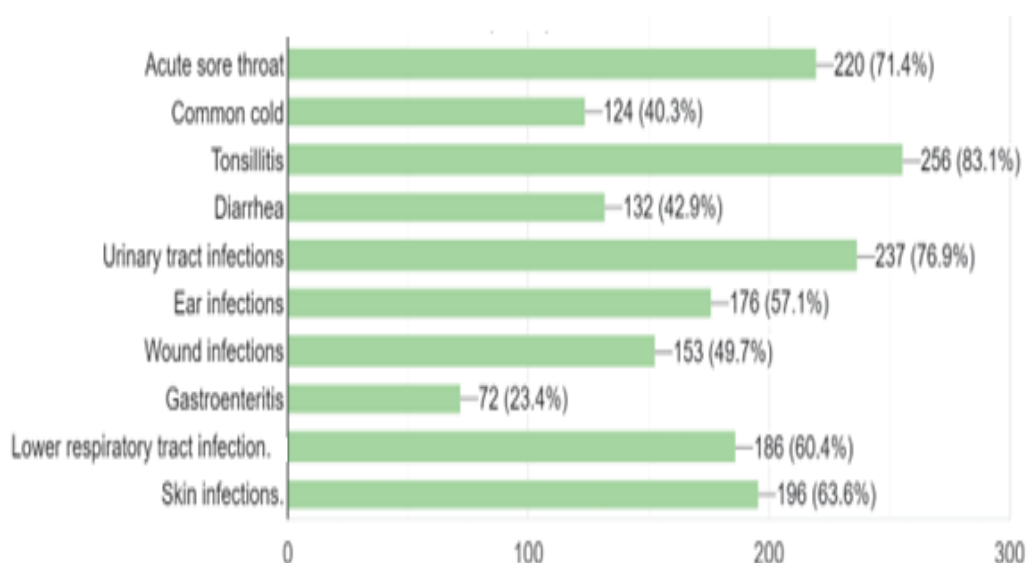


Figure 1. Medical conditions that prompt antibiotic dispensing without a prescription



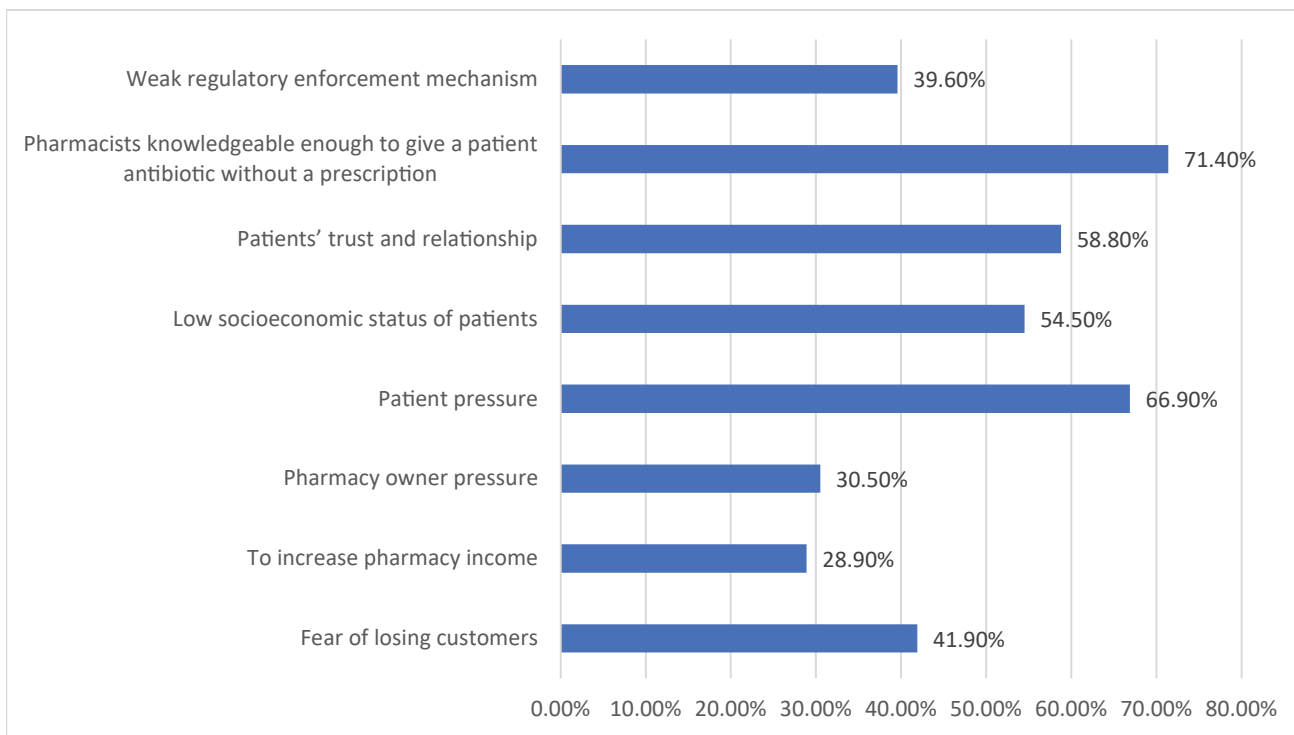


Figure 2. Reasons for dispensing antibiotics without prescription.

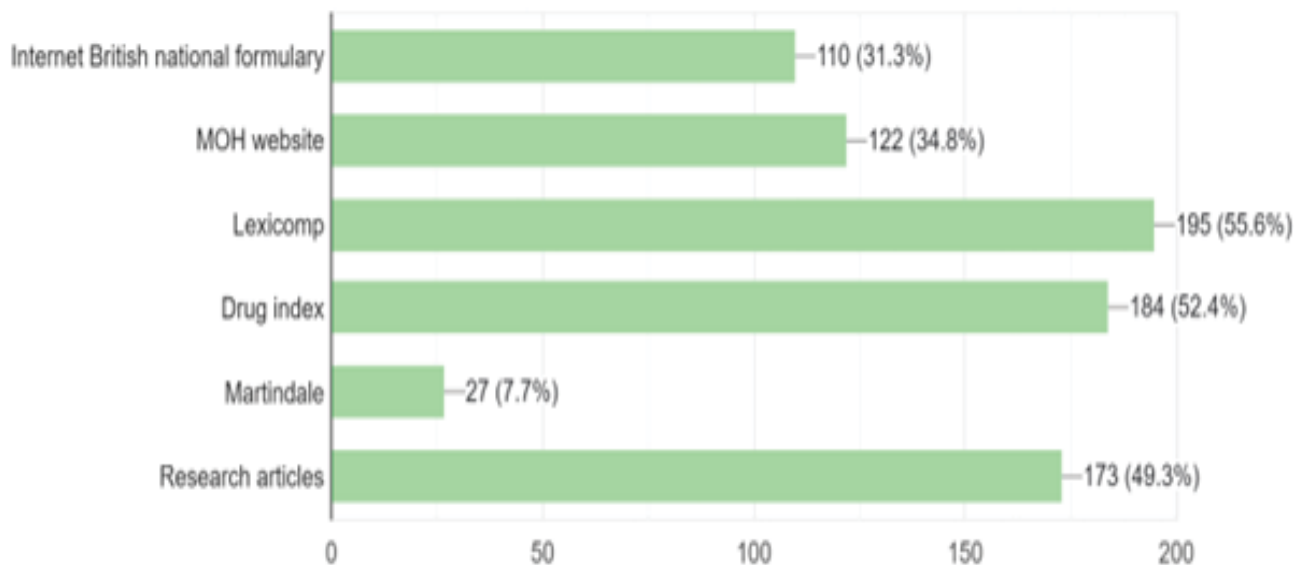


Figure 3. Sources of drug information.

	No	Unsure	Yes
Antibiotics are indicated to treat inflammations. **	96 (27.4%)	26 (7.4%)	229 (65.2%)
In most cases, antibiotics can be dispensed for prophylaxis of future infections. **	182 (51.9%)	72 (20.5%)	97 (27.6%)
Cross-resistance is the condition in which bacteria are able to resist particular types of antibiotic that often result in resistance to another type of antibiotic, usually from a similar chemical class.*	14 (4.0%)	62 (17.7%)	275 (78.3%)
Resistant bacteria cannot be spread in healthcare institutions and communities **.	225 (64.1%)	78 (22.2%)	48 (13.7%)
The occurrence of antibiotic resistance is mainly a problem in hospital settings. **	56 (16.0%)	72 (20.5%)	223 (63.5%)
Inappropriate use of antibiotics increases the emergence of bacterial resistance to antibiotics.*	6 (1.7%)	25 (7.1%)	320 (91.2%)
Pharmacists may advise patients to stop taking antibiotics when their symptoms improve. **	208 (59.3%)	45 (12.8%)	98 (27.9%)

*yes is the correct answer
 **no is the correct answer

improvement in their understanding that antibiotics are not intended to treat inflammation (27.4%) and that antibiotic resistance is not predominantly a hospital-based issue (16%). The results also highlighted areas where knowledge could be improved, such as the fact that antibiotics are typically not used for the prophylaxis of future infections (51.9%), that resistant bacteria can spread both in healthcare settings and within the community (64.1%), and that pharmacists should not advise patients to stop taking antibiotics once symptoms improve (59.3%). The median knowledge score was 4 (3-5) out of possible 7 points, indicating potential for improvement.

The median attitude score was 22 (20-24) out of a maximum possible score of 25, reflecting generally favorable attitudes. The positive attitudes were most likely demonstrated in terms of pharmacists have a responsibility to take an effective role in reducing antibiotic resistance" (94%) and that antibiotics are overprescribed in the community (93.7%), and disagreement that patients could easily get antibiotics from another pharmacy if the pharmacist did not prescribe unnecessary antibiotic (93.4%). Table 3 represents the pharmacists' attitudes towards antibiotics prescription.

Regression analysis revealed that a higher knowledge score was associated with increased attitude score (coefficient = 0.106, 95%CI: 0.007 - 0.206, p = 0.036). Conversely, a higher attitude score was associated with a reduced likelihood of responding "yes" to the question: "Do you dispense antibiotics without a prescription?" (coefficient = -0.302, 95%CI: 0.588 - 0.929, p = 0.010).

DISCUSSION

In the current study, the most common medical conditions for which antibiotics were dispensed without a prescription included tonsillitis (83.1%), urinary tract infections (76.9%), and acute sore throat (71.4%). Similarly, a study conducted in Iraq found that dispensing antibiotics without a prescription was a common practice in community pharmacies. The pharmacists reported dispensing antibiotics without prescriptions for various medical conditions, including respiratory tract infections, tonsillitis, otitis media, urinary tract infections, diarrhea, skin infections, toothaches, sore throats, common cold, and flu¹⁴. According to research done in Jordan, 83% of antibiotics were dispensed without a prescription for urinary tract infections and diarrhea, while 97.6% were given out without a prescription for sore throats¹⁵. In Ethiopia, upper respiratory tract infection was recognized as the most common condition for which antibiotics were dispensed without prescription¹⁶, while in Italy, toothache, earache, and diarrheal diseases were the most common conditions¹⁷. When asked about the reasons for dispensing antibiotics without prescriptions, the majority of participants in the current study cited the pharmacist's perceived knowledge to provide antibiotics without a prescription, pressure from patients, trust and relationships with patients, and the low socioeconomic status of patients as the most common reasons. Antibiotic-resistant bacteria can proliferate more quickly when antibiotics are continuously overused and misused. This might cause common infections to become incurable, resulting in an international health crisis.

Attitude items	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
I think antibiotics are overprescribed in the community	1 (0.3%)	5 (1.4%)	16 (4.6%)	121 (34.5%)	208 (59.3%)
Pharmacists have a responsibility to take an effective role in reducing antibiotic resistance	1 (0.3%)	4 (1.1%)	16 (4.6%)	121 (34.5%)	209 (59.5%)
Once culture and sensitivity results are available, we should change empiric therapy to narrow- spectrum therapy	1 (0.3%)	9 (2.6%)	42 (12.0%)	120 (34.2%)	179 (51.0%)
Prevention of dispensing antibiotics without medical prescription will decrease sales and profits of the pharmacy*	128 (36.5%)	139 (39.6%)	53 (15.1%)	25 (7.1%)	6 (1.7%)
If you refuse to give antibiotics to a patient, as they do not require antibiotics, they can easily get them from another pharmacy*	222 (63.2%)	106 (30.2%)	18 (5.1%)	4 (1.1%)	1 (0.3%)

*Reverse coded items



Targeted health initiatives are desperately needed to inform medical professionals about the risks associated with antibiotic misuse and raise their awareness regarding the importance of dispensing antibiotics appropriately.

The current study found that the most commonly used sources of drug information by the study participants were Lexicomp (55.6%), Drug Index (52.4%), and research articles (49.3%), highlighting the necessity to use diverse and updated sources of drug information to obtain the most accurate and updated information on antibiotics.

Pharmacists' knowledge of antibiotics' uses and resistance in the current study was moderate. Similar results were reported in previous studies conducted in Sudan¹⁴ and India¹⁸, while better knowledge levels were reported in studies conducted in Ethiopia¹⁶, Pakistan¹⁹, and Libya²⁰. The pharmacists in the current study exhibited knowledge gaps and information needs in various aspects of antibiotic use and resistance, indicating clear opportunities for improvement. Specifically, their understanding that antibiotics are not intended to alleviate inflammation, that antibiotic resistance is not primarily limited to hospital settings, that antibiotics are generally not prescribed for the prophylaxis of future infections, that resistant bacteria can spread both in healthcare institutions and within communities, and that pharmacists should not advise patients to stop taking antibiotics once their symptoms improve. A lack of knowledge about the role of antibiotics can result in improper prescription practices, which can increase antibiotic misuse and accelerate the emergence of resistance. Additionally, lack of awareness on antibiotic resistance can reduce the implementation of infection control efforts. Furthermore, advising patients to stop taking antibiotics when their symptoms improve rather than completing the course runs the risk of incomplete elimination of the infection and encourages the development of resistant strains. Therefore, it is essential to implement ongoing education and training initiatives created especially to fill in these knowledge gaps among pharmacists. Furthermore, it is crucial to improve pharmacy school curricula to cover antibiotic use and resistance in greater details.

In the present study, pharmacists showed favourable attitude towards antibiotic prescriptions. Earlier research reported positive pharmacists' attitude towards dispensing antibiotics without prescription^{13,19,21}. On the other hand, a study conducted in Iraq reported poor pharmacists' attitudes towards dispensing antibiotics without prescription¹⁴. However, despite the fact that the majority of the current study participants believed that pharmacists should take an effective role in reducing antibiotic resistance and the antibiotics are overprescribed in the community, they dispensed antibiotics without a prescription (87.7%). Consistent results were reported in previous studies^{16,22}. Other studies conducted in Jordan and Palestine reported that the majority of community pharmacists thought it was legal to dispense antibiotics without a prescription^{23,24}. As previously mentioned, low socioeconomic status and patient pressure were frequently cited as justifications for dispensing antibiotics without a prescription. Thus, even though they were aware of their crucial role in combating antibiotic

resistance, pharmacists may feel pressured to comply with patients' demands by giving antibiotics without a prescription in order to ensure their satisfaction and maintain their loyalty. Improved public and pharmacist education about antibiotic resistance is desperately needed, as are stricter regulatory guidelines regarding the dispensing of antibiotics. By aligning pharmacists' practices with their beliefs, these interventions may help reduce the dispensing of antibiotics and, thus, lower bacterial resistance.

The current study revealed that higher knowledge of antibiotics was significantly associated with a more favourable attitude towards antibiotic prescribing. This relationship is understandable, as pharmacists who had a deeper understanding of antibiotics and the risks of antibiotic resistance are likely to hold more responsible opinions regarding their dispensing practices. On the other hand, a better attitude towards antibiotic prescription was significantly associated with a reduced tendency to dispense antibiotics without a prescription. A significant association between attitude and practice of dispensing antibiotics without prescription was reported in earlier studies^{21,25,26}. This association can be justified by the fact that pharmacists with a more responsible attitude towards antibiotic prescription are likely more aware of the risks of inappropriate use and, therefore, avoid dispensing antibiotics without a prescription.

The findings of this study, showing pharmacists' moderate knowledge and favourable attitudes towards antibiotic prescription, are consistent with global trends in AMR, where healthcare professionals often have knowledge gaps and favourable attitudes that may contribute to overprescribing of antibiotics. The positive relationship between knowledge and attitudes further emphasizes the global recognition that improving education and training for healthcare workers is crucial in combating AMR. Additionally, the finding that more favourable attitudes associated with a lower likelihood of dispensing antibiotics without prescriptions supports global efforts to regulate and minimize inappropriate antibiotic use. To effectively address antimicrobial resistance, international collaboration is essential in areas such as education initiatives, data sharing on resistance patterns, strengthening antibiotic dispensing regulations, and conducting cross-border research on best practices. This collaborative approach will enhance knowledge, promote responsible prescribing, and help mitigate the spread of AMR worldwide.

The current study has several limitations. The median age of the pharmacists was 27 (25-30) years, which may not accurately represent the typical age of pharmacists. The use of a convenient sampling technique could introduce selection bias, affecting the generalizability of the findings. Additionally, the cross-sectional design prevents the establishment of a cause-and-effect relationship. Moreover, the reliance on self-reported surveys may lead to social desirability bias, potentially compromising the accuracy of the responses.

CONCLUSION

The current study revealed moderate knowledge of antibiotics



and a favourable attitude towards their prescription. Greater knowledge of antibiotics was linked to a more positive attitude towards prescribing, while a better attitude was associated with a lower likelihood of dispensing antibiotics without a prescription. Future interventions should focus on enhancing pharmacists' awareness of antibiotic use and resistance, which would improve their attitudes and, in turn, reduce the nonprescription dispensing of antibiotics. Additionally, stricter regulatory guidelines for antibiotic dispensing are necessary. Implementing these strategies could help decrease nonprescription antibiotic use and thereby reduce antibiotic resistance.

AUTHORS' CONTRIBUTION

ASJ conceived and designed the study, conducted research, provided research materials, supervised the project, and wrote initial and final draft of article. WA conceived and designed the study, validated instruments, organized, analysed and interpreted data and reviewed the manuscript. KHA conceived and designed the study, organized, analysed and interpreted

data, and wrote initial and final draft of article. SRA designed the study, collected, organized, analysed and interpreted data, and wrote initial and final draft of the article. YNA conceived and designed the study, analysed data and reviewed the final draft of the manuscript. AHA conceived and designed the study, wrote initial and final draft of article, and provided logistic support. SWA conceived and designed the study, wrote initial and final draft of article, and provided logistic support. YAM conceived and designed the study, reviewed the first and the final draft. REG conceived and designed the study, analysed data and reviewed the final draft of the manuscript. MK conceived the study and research methods, interpreted data, reviewed the final draft of the manuscript and co-supervised the project. All authors have critically reviewed and approved the final draft of the study and agreed to be accountable for all aspects of the work.

CONFLICT OF INTEREST

The authors declare that they have no conflict of interest to declare.

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