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Study of Antibiotic Use Without a Prescription and Its Misuse by Pharmacists in Sana'a City in 2024

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Abstract:

Antibiotic resistance is a critical global health threat, particularly in low-resource settings. This study investigated non-prescription antibiotic dispensing practices among community pharmacists in Sana'a, Yemen. A cross-sectional survey was conducted over 30 days in 299 purposively sampled pharmacies. Data collected via structured questionnaires revealed that 73.9% of pharmacists frequently dispense antibiotics without a prescription, primarily based on patient-reported symptoms. Amoxicillin with Clavulanic Acid (27.4%) and Azithromycin (17.7%) were the most commonly dispensed agents. Key drivers for this practice included patients' low economic status (60.9%) and lack of public awareness (17.1%). While 98.3% of pharmacists acknowledged the dangers of misuse, their practices were often swayed by patient demand. These findings highlight an urgent need for stricter regulatory enforcement, enhanced pharmacist training, and public awareness campaigns to promote rational antibiotic use and combat antimicrobial resistance in Yemen.

Keywords:

Antibiotic resistance; Self-medication; Community pharmacy; Dispensing practices; Yemen



ترجمة الى العربية

دراسة استخدام المضادات الحيوية دون وصفة طبية وإساءة استخدامها من قبل الصيادلة في مدينة صنعاء عام ٢٠٢٤

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الملخص

تعد مقاومة المضادات الحيوية تهديداً صحياً عالمياً خطيراً، خاصة في المناطق محدودة الموارد. هدفت هذه الدراسة إلى تقصي ممارسات صرف المضادات الحيوية دون وصفة طبية بين صيادلة المجتمع في مدينة صنعاء، اليمن. أُجري مسح مقطعي على مدار 30 يوماً، وشمل عينة قصدية مكونة من 299 صيدلية. كشفت البيانات، التي جُمعت عبر استبيانات منظمة، أن 73.9% من الصيادلة يصرفون المضادات الحيوية بشكل متكرر دون وصفة طبية، معتمدين بشكل أساسي على الأعراض التي يبلغ عنها المرضى. وكان الأموكسيسيلين مع حمض الكلافولانك (27.4%) والأزيتروميسين (17.7%) هما الأكثر صرفاً. العوامل الرئيسية الدافعة لهذه الممارسة تضمنت الوضع الاقتصادي المنخفض للمرضى (60.9%) ونقص الوعي العام (17.1%). ورغم أن 98.3% من الصيادلة أقرروا بخاطر سوء الاستخدام، إلا أن ممارستهم كانت غالباً ما تتأثر بطلب العملاء. تسلط هذه النتائج الضوء على الحاجة الماسة لتطبيق رقابي أكثر صرامة، وتحسين تدريب الصيادلة، وإطلاق حملات توعية عامة لتعزيز الاستخدام الرشيد للمضادات الحيوية ومكافحة مقاومة مضادات الميكروبات في اليمن.

الكلمات المفتاحية

مقاومة المضادات الحيوية؛ التطبيب الذاتي؛ صيدليات المجتمع؛ ممارسات الصرف؛ اليمن

1. Introduction

Antibiotics are a class of antimicrobial agents that target bacteria, these substances can be either cytotoxic, meaning they kill bacterial cells, or cytostatic, meaning they inhibit the growth of microorganisms, by doing so, antibiotics enable the body's natural defenses, such as the immune system, to effectively eliminate the targeted bacteria (Taher & Saeed, 2024). Antibiotics have been around since 1928, when penicillin was discovered by Alexander Fleming, in the 1980s, antibiotics that were deemed medically important for the treatment of animals could be approved under veterinary oversight, any drug that kills germs in your body is technically an antibiotic. However, most people use the term specifically when referring to medicines intended to kill bacteria (Levy & Marshall, 2004).

Antibiotic resistance is rising to dangerously high levels worldwide. New resistance mechanisms are emerging and spreading globally, threatening our ability to treat common infectious diseases. A growing list of infections - such as pneumonia, tuberculosis, blood poisoning, gonorrhea, and foodborne diseases are becoming harder, and sometimes impossible, to treat as antibiotics become less effective (Dunachie et al., 2022). The main problem with the use of antibiotics without a prescription is the emergence of pathogenic resistance (Chalker, 2001).

Bacterial resistance is the ability of bacterial cells to prevent the bacteriostatic or bactericidal effects of antibiotics. The excessive and unintended use of antibiotics contributes to the development of resistance in bacteria (Thualfakar Hayder et al., 2020). Study in the Middle East: A study conducted in Saudi Arabia found that 43% of individuals surveyed in community pharmacies had purchased antibiotics without a prescription. The study highlighted that most individuals believed antibiotics were the best treatment for common cold and flu symptoms, despite these conditions being viral and not requiring antibiotics (Alhomoud et al., 2018). In Sub-Saharan African countries, the overall pooled proportion of non-prescription antibiotic requests or consultations that led to the supply of antibiotics without a prescription was 69% (Belachew et al., 2021). In China, a survey conducted with 854 individuals in rural areas revealed that 62% of parents had administered antibiotics to their

children in the previous year without a physician's advice (Taher & Saeed, 2024).

Study in Europe: A survey conducted in Spain with 1,200 participants revealed that 35% of respondents had used antibiotics without a prescription in the previous year. The study also indicated that 57% of participants had not received any education regarding the risks of antibiotic resistance or the importance of proper antibiotic use (Alghanim, 2011). Study in Latin America: In Brazil, a study found that 50% of individuals with upper respiratory tract infections obtained antibiotics from pharmacies without a medical prescription. This behavior was more prevalent in rural areas compared to urban regions (ten Haken et al., 2018). Study in India: A study in Bangalore found that 70% of pharmacies dispensed antibiotics without a prescription. The research emphasized that this practice was often driven by patient demand for quick treatment, despite the associated risk of increasing antibiotic resistance (Nafade et al., 2019). This study aimed to investigate the use and misuse of antibiotics in community pharmacies across Sana'a City. The research focused on understanding pharmacists' dispensing practices, their awareness of antibiotic misuse, and the preventive measures they adopt within their pharmacies.

2. Research Methodology

2.1. Study Design

This study employed a cross-sectional descriptive design to investigate the use and misuse of antibiotics in community pharmacies in Sana'a City, Yemen. The research aimed to assess pharmacists' practices regarding antibiotic dispensing, their awareness of misuse, and preventive measures undertaken in daily operations.

2.2. Study Setting and Duration

The study was conducted in Sana'a City, covering both urban and suburban areas. Data collection was carried out over a 30-day period using structured, self-administered questionnaires.

2.3. Study Population

The target population consisted of licensed community pharmacists operating in registered pharmacies across Sana'a City. The study specifically

focused on those directly involved in dispensing antibiotics to the public.

2.4. Sampling Technique and Sample Size

A purposive non-random sampling method was used to select community pharmacies that were relevant to the research objectives. This approach ensured that only pharmacies capable of providing significant and reliable data regarding antibiotic use and misuse were included.

The sample consisted of 299 pharmacies, selected from six main regions in Sana'a to ensure a diverse and representative sample:

- Hadda area: 50 pharmacies
- Bait Boos area: 20 pharmacies
- Shumaila area: 30 pharmacies
- Hail Street area: 60 pharmacies
- Sa'uan area: 40 pharmacies
- Al-Hasaba area: 39 pharmacies

2.5. Data Collection Instrument

Data were collected using a structured questionnaire developed by the research team. The questionnaire included both closed and open-ended questions designed to capture:

- Pharmacists' practices regarding antibiotic dispensing with or without a prescription
- Their awareness and understanding of antibiotic misuse
- Measures taken to control misuse in their pharmacies

2.6. Data Collection Procedure

The data collection was carried out in two distinct phases:

- Phase 1 focused on identifying the prevalence of antibiotic use among the surveyed population.
- Phase 2 examined the misuse of antibiotics and its correlation with pharmacists' demographic characteristics (e.g., age, education, years of experience).

2.7. Data Analysis

All questionnaire responses were entered into the Statistical Package for the Social Sciences (SPSS) software for analysis. Descriptive statistics were used to summarize demographic variables and

general trends, while inferential statistics were applied to explore associations between misuse patterns and pharmacists' characteristics.

3. Results and Discussion

Several characteristics were assessed, and the following are the results. Cronbach's alpha is a measure used to evaluate the internal consistency or reliability of a set of items. For the group of antibiotics users, the square root of Cronbach's alpha was calculated and found to be 0.88, indicating a high level of reliability. Additionally, general data were collected about pharmacists who dispense antibiotics without a prescription.

3.1. Socio-demographics distribution of sample

3.1.1. Sex distribution of selected sample

The distribution of participants by sex shows a significant imbalance (Table 1), with males comprising the majority at 87.6% (n = 262), while females represent only 12.4% (n = 37). This disparity suggests a male-dominated sample, which may be due to the nature of the study population or the sampling method used.

Table 1: Socio-Demographic characteristics of the study population (n=299)

Variable	Frequency	Percentage
Sex		
<i>Male</i>	262	87.6
<i>Female</i>	37	12.4
Age		
<i>15-39</i>	176	58.9
<i>40-49</i>	117	39.1
<i>50-60</i>	6	2.0
Education		
<i>Diploma</i>	70	23.4
<i>Collage</i>	220	73.6
<i>Advanced studies</i>	9	3.0

3.1.2. Age distribution of selected sample

The majority of the participants fall within the 15-39 age group, accounting for 58.9% of the sample (Table 1). This indicates that the study largely involves young adults. The next largest group is the

40-49 age bracket, representing 39.1%, while only a small fraction of participants are aged 50-60, comprising 2.0%. This age distribution suggests that the sample is predominantly young to middle-aged.

3.1.3. Education distribution of selected sample

The most participants have a college degree, making up 73.6% of the sample. Participants with diploma-level education represent 23.4%, while those with advanced studies (such as master's or doctoral degrees) are a small minority at 3.0%. This indicates a relatively well-educated sample, with a strong representation of individuals who have received higher education. The dominance of college-educated participants may reflect the context of the study, such as being conducted in an academic or professional setting. However, the small proportion of individuals with advanced degrees may limit the depth of analysis concerning highly educated subgroups.

3.2. Pharmacists' awareness to Likert-style questions

The findings reveal a concerning trend in antibiotic dispensing practices among pharmacists in Sana'a. A large majority (73.9%) reported that they mostly dispense antibiotics without a prescription, and 79.6% stated they also do so based on their own diagnosis rather than a physician's. Despite this, nearly all respondents (98.3%) acknowledged awareness of the risks associated with random antibiotic dispensing. Most pharmacies (87.6%) do not allow non-pharmacists to dispense medication, yet 11.7% admitted that this occurs often, which could lead to unsafe practices. While 78.3% rejected dispensing antibiotics based solely on customer self-diagnosis, 21.7% still admitted to mostly allowing it. The knowledge base of pharmacists appeared relatively strong in some areas—94.3% correctly identified that antibiotics treat bacterial infections, and 67.9% rejected their use for viral illnesses; however, 29.4% were still unsure. A significant portion (54.2%) also believed antibiotics help with colds and coughs, which are mostly viral in origin, suggesting a common misconception (Table 2).

Regarding perceptions of effectiveness, 41.1% mostly believed that more expensive antibiotics work better, and 2.3% agreed outright—highlighting

the influence of cost on perceived efficacy. Encouragingly, 95.7% had heard of bacterial resistance, and 98.0% understood that it can result from not completing an antibiotic course. In terms of dispensing habits, 69.2% of pharmacists reported they mostly provide a time frame for antibiotic usage, and 28.4% do so consistently, which reflects

fairly good practice. Meanwhile, 90.0% stated they usually read the medication leaflet, and 97.3% claimed to understand the effects of antibiotics on immunity. Most pharmacists (90.3%) also acknowledged a general lack of public awareness regarding the misuse of antibiotics without prescriptions.

Table 2 : Pharmacists' awareness answers to the Likert-style questions

Questions	Yes		No		Mostly	
	N	%	N	%	N	%
Do you dispense antibiotics without prescription?	0	0	78	26.1	221	73.9
Do you dispense antibiotics based on your diagnosis?	0	0	61	20.4	238	79.6
Do you know what are the risks of random dispensing of antibiotics?	0	0	5	1.7	294	98.3
Do you have non-pharmacists that dispense drugs in the pharmacy?	2	0.7	262	87.6	35	11.7
Do you allow antibiotics dispensing based on their diagnosis?	0	0	234	78.3	65	21.7
Does antibiotics treat diseases caused by bacteria?	3	1.0	14	4.7	282	94.3
Does antibiotics treat diseases caused by viruses?	8	2.7	203	67.9	88	29.4
Do you think antibiotics help in recovering from cold and cough?	9	3.0	128	42.8	162	54.2
Do you think the antibiotic works better if it was more expensive?	7	2.3	169	56.5	123	41.1
Have you heard about Bacterial Resistance?	0	0	13	4.3	286	95.7
did you know that Bacterial Resistance emerge in case the entire antibiotic regimen is not completed?	0	0	5	1.7	293	98.0
Do you set a time frame for the usage of antibiotic upon dispensing?	85	28.4	7	2.3	207	69.2
Have you read the leaflet that comes with the antibiotic?	0	0	30	10.0	269	90.0
Do you know the dangers that come with antibiotics usage, and their effects on immunity?	0	0	8	2.7	291	97.3
Do you think there is a shortage in awareness about using drugs without prescription?	0	0	29	9.7	270	90.3
"In most cases, is it difficult to access a specialist doctor?"	0	0	52	17.4	247	82.6
Do you usually dispense antibiotics for children without prescription?	210	70.2	44	14.7	45	15.1
Do you dispense antibiotics in low doses (one or two strips)?	1	0.3	155	51.8	143	47.8

Accessibility to specialized medical care was identified as a challenge by 82.6% of pharmacists, possibly explaining the tendency for patients to seek antibiotics over the counter. Of particular concern, 70.2% admitted to dispensing antibiotics to children without prescriptions, a practice that poses serious risks. Additionally, 47.8% said they mostly dispense antibiotics in low doses (such as one or two strips),

a behavior that may contribute to bacterial resistance and treatment failure.

3.3. Pharmacists' awareness answers to the Multiple-choice questions

Regarding the most commonly dispensed antibiotics without a prescription, the data shows that Amoxicillin combined with Clavulanic Acid is the

most frequently reported, accounting for 27.4% of responses. This is followed by Azithromycin at 17.7%, while Amoxicillin alone was reported by only 4.7% of participants. Notably, a significant portion of pharmacists (50.2%) selected "Other," indicating that a wide range of antibiotics are being dispensed without prescription and suggesting variation based on pharmacy location or patient demands. As for the perceived main contributors to antibiotic misuse, the majority of pharmacists (60.9%) identified economic status as the primary factor.

Table 3 : Pharmacists' awareness answers to the Multiple-choice questions

Variables	Frequency	Percent
What is the most dispensed antibiotic without prescription?		
Amoxicillin	14	4.7
Amoxicillin+ Clavulanic Acid	82	27.4
Azithromycin	53	17.7
Other	150	50.2
In your opinion, what's the main contributor in antibiotics misuse?		
Economic status	182	60.9
Previous experience	58	19.4
Difficulty in getting medical care	8	2.7
Lack of medical awareness	51	17.1

This highlights how financial limitations drive people to seek cheaper, quicker alternatives such as self-medicating rather than consulting healthcare professionals. Previous experience with antibiotics was considered a cause by 19.4%, suggesting that familiarity can lead to repeated unsupervised use. Lack of medical awareness was cited by 17.1%, underscoring the role of health education in addressing misuse. Only 2.7% pointed to difficulty accessing medical care, indicating that while access is a factor, economic and behavioral elements play a more dominant role in irrational antibiotic use.

3.4. The means and S. D for the public's awareness questions

The data presented in Table 4 provides insights into the public's awareness and behaviors regarding antibiotic use, based on mean scores and standard deviations across four key questions. For the

purpose of calculating the mean, the responses are coded as follows: 'No' = 1, 'Mostly' = 2, and 'Yes' = 3. Overall, the total mean score of 2.6 with a standard deviation of 0.75809 falls under the "Mostly" category, indicating a moderate level of awareness and appropriate practices among respondents, though with significant room for improvement.

The first question, "Does antibiotics treat all diseases?", yielded a mean score of 2.6 and a relatively low SD of 0.50032, suggesting that most respondents tend to mostly reject the misconception that antibiotics are a cure-all. However, the mean still reflects a partial misunderstanding, pointing to a persistent belief among some individuals that antibiotics can treat illnesses regardless of origin (e.g., viral infections).

Table 4 : The means and S. D for the public's awareness questions

Question	Mean	SD	Semantic
Does antibiotics treat all diseases?	2.6	0.50032	Mostly
Do you give proper advice to patients on the correct uses of antibiotic(s)?	2.8	0.90157	Mostly
Do you relay the side effects/risks upon dispensing antibiotics?	2.8	0.20427	Mostly
What's your level of dispensing antibiotics?	2.3	0.41316	No
Total	2.6	0.75809	Mostly

The second and third questions— "Do you give proper advice to patients on the correct uses of antibiotic(s)?" and "Do you relay on the side effects/risks upon dispensing antibiotics?" both scored a mean of 2.8, indicating a relatively higher level of awareness and better practices. However, the large SD in question 2 (0.90157) implies variability in responses, possibly reflecting inconsistent counseling practices among pharmacists. In contrast, the very low SD in question 3 (0.20427) suggests strong consensus in acknowledging the risks, though it could also imply socially desirable responding.

The fourth question, "What's your level of dispensing antibiotics?", had a lower mean score of 2.3 with a SD of 0.41316, interpreted as "No", indicating a deviation from recommended dispensing practices. This suggests that despite awareness of antibiotic risks and a tendency to offer advice, pharmacists may still engage in inappropriate dispensing behavior, possibly due to external pressures such as patient demand or financial incentives.

4. Discussion

The findings of this study reveal significant insights into the misuse of antibiotics and the role of pharmacists in dispensing these medications without prescriptions in Sana'a. These results are discussed in relation to the study objectives and compared to previous literature to provide a comprehensive understanding of the issue.

4.1. Demographic Profile of Pharmacists in Sana'a

The findings indicate that the pharmacy workforce in Sana'a is predominantly composed of younger male pharmacists with moderate educational backgrounds. This demographic trend aligns with previous research conducted in comparable low-resource settings, where younger and less-experienced pharmacists frequently lack sufficient training and supervision, increasing the risk of improper antibiotic dispensing (Zawahir et al., 2019).

4.2. Prevalence and Drivers of Antibiotic Misuse

The results reveal a complex relationship between economic pressures and individual health behaviors as key factors driving antibiotic misuse, echoing findings from other developing countries (Dogheim & Werida, 2023). Economic challenges faced by the population in Sana'a were particularly significant, underscoring the broader socioeconomic context influencing misuse. Additionally, pharmacists' reliance on prior experience and limited awareness further stresses the urgent need for targeted educational initiatives to raise public understanding of the dangers linked to improper antibiotic use.

4.3. Pharmacists' Awareness and Dispensing Practices

A notable gap between pharmacists' knowledge and actual practice emerged, consistent with studies from other low- and middle-income countries (Okeke et al., 2007). External pressures—such as financial incentives and customer demands—likely contribute to the reluctance to adhere to proper dispensing protocols. Despite 97.3% of pharmacists acknowledging the risks of antibiotic misuse, including resistance development, this awareness did not translate into safer dispensing behaviors. This contradiction highlights the critical need for stronger regulatory enforcement and enhanced pharmacist training programs.

4.4. Public Knowledge and Attitudes Toward Antibiotics

Pharmacists reported widespread misconceptions among the public regarding antibiotic use. For example, 94.3% observed that customers mistakenly believed antibiotics could treat viral infections, and 54.2% thought antibiotics were effective for colds and coughs. These misunderstandings, combined with pharmacists' readiness to dispense antibiotics without adequate guidance, contribute significantly to misuse. These findings align with global evidence emphasizing the essential role of public education in combating antibiotic resistance (World Health, 2015).

The high rate of antibiotic misuse identified in this study is consistent with findings from similar low-resource settings. For instance, research conducted in Egypt reported that 78% of pharmacists dispensed antibiotics without prescriptions, often driven by economic pressures and the desire to satisfy customers (Dogheim & Werida, 2023). Likewise, a study in Nigeria revealed a comparable gap between pharmacists' knowledge and their actual dispensing behaviors (Okeke et al., 2007). These parallels highlight the systemic and widespread nature of antibiotic misuse challenges in resource-limited environments.

4.5. Implications for Policy and Practice

This study offers vital evidence for policymakers aiming to curb antibiotic misuse in Sana'a. The results emphasize the urgent need for stricter enforcement of regulations prohibiting the sale of

antibiotics without prescriptions. Additionally, it calls for enhanced pharmacist training programs to close the gap between awareness and practice, alongside public education campaigns to raise awareness about the risks of antibiotic misuse and antimicrobial resistance.

5. Conclusion

This study provides important insights into the misuse of antibiotics and the critical role of pharmacists in Sana'a in dispensing these medications without prescriptions. Despite a general awareness among pharmacists about the risks of inappropriate antibiotic use, this knowledge has not consistently translated into responsible dispensing practices. The findings reveal that economic factors, previous patient experience, and lack of medical awareness are major contributors to antibiotic misuse. Amoxicillin combined with Clavulanic Acid emerged as the most commonly dispensed antibiotic without prescription, underscoring the extent of misuse in the community. Public misconceptions, particularly regarding the effectiveness of antibiotics against viral infections, further exacerbate the problem. These results highlight a significant gap between knowledge and practice among pharmacists, necessitating urgent interventions. To address this issue, the study calls for the implementation of strict regulatory enforcement to ensure antibiotics are dispensed only with valid prescriptions, coupled with targeted education and training programs for pharmacists. Additionally, comprehensive public awareness campaigns are essential to correct misconceptions and promote responsible antibiotic use. Together, these measures can help curb antibiotic misuse, reduce the risk of bacterial resistance, and improve overall community health.

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