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Original Article

Libyan community pharmacists' knowledge, attitude, and practice concerning non-prescription dispensing of antibiotics

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Abstract:

Antibiotics are prescription only medications, but their dispensing as over the counter drugs constitutes one of the main causes of antibiotic resistance. Antibiotic resistance threatens the life of people around the world, as indicated by world and Health Organization. Therefore, a global effort and collaboration are required to decrease and control the development and spread of antibiotic resistance. The purpose of this study is to evaluate the knowledge, attitude, and practice of community pharmacists regarding dispensing of antibiotics without prescription (DAWP) in Libya. Self- administered questionnaire has been created with a cross sectional design and statistical package for social sciences(SPSS) version 27.0 was used for descriptive statistics analysis. The vast majority of respondents were female (82.2%) and (79.4%) of respondents were less than 30 years old. About 43% of community pharmacists reported that they dispense antibiotics without prescription. Feeling competent to dispense antibiotics as over the counter drug was the most common reason for antibiotic dispensing without prescription. Amoxicillin, Azithromycin and Metronidazole were the most commonly dispensed antibiotics without a prescription respectively. In summary, dispensing antibiotics without a prescription is widespread in Libya, especially When patient asks for a particular antibiotic.

Keywords: Antibiotic resistance; Libya; DAWP; knowledge; practice; pharmacist

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Introduction:

One of the most fundamental methodologies utilized in contemporary medicine to treat infections is antibiotic therapy. The cutting-edge period of anti-bacterial agents began with the discovery of penicillin by Sir Alexander Fleming in 1928 and from that point forward, antibiotics have saved lots of lives [1,2].

In the period between the 1930s and the 1960s, known as the "golden era" of antibiotics, several antibiotics were developed [1] but over the past few decades, the excessive and improper use of antibiotics, along with various socio-economic factors, have speeded up the spread of bacteria that are resistant to antibiotics, rendering drug treatments

ineffective. Moreover, the lack of progress in creating novel antibiotic compounds in recent years has further complicated the challenge of combating these resistant organisms [3,4].

The impact of antimicrobial resistance (AMR) is significant, affecting both individual patients and society. It can lead to death, rising treatment expenses and transmission of resistant bacteria to others thereby compromising public health. Furthermore, long-term disease leads to longer hospitalization period and the need for more expensive therapeutic interventions [5,6].

The World Health Organization (WHO) has indicated the antimicrobial resistance as a significant global public health concern which considered among the ten leading threats facing people around the world. Presently, AMR is responsible for 700,000 deaths annually worldwide and by 2050, the prevalence is expected to reach approximately 10 million [7]. AMR develops due to number of causes, the most prevalent of which is antibiotic over use and misuse, which speed up the antimicrobial resistance process [7]. Irrational antibiotic use which includes unneeded and inappropriate antibiotic consumption (incorrect dosing, duration, frequency, and indication), as well as the excessive utilization of broad-spectrum antibiotics, are the main drivers behind the global spread of antimicrobial resistance [8]. It has been approximated that in the most regions of the world, over fifty percent of the antibiotics are bought without a prescription and utilized as over-the-counter drug [9]. Therefore, it is crucial to use antibiotics only when necessary, as around 90% of their consumption in human medicine takes place in outpatient settings [10]. In addition, the community pharmacist is a critical driver of antibiotic use and their dispensing practical skills are important determinants in antibiotic consumption patterns [11].

The dispensing of antibiotics without a prescription is still a widespread practice in developing countries, despite the limitations on the use of antibiotics and advise for their consumption only under a prescription [12]. Antibiotics can be acquired without a prescription from pharmacies in Libya, like in many other developing nations. In the Euro-Mediterranean region, a study was conducted from 2004 to 2005 to examine the practice of self-medication with antibiotics in the ambulatory care setting involving eight countries. The study revealed that 19.1% of the healthy individuals interviewed admitted to self-medication, with the percentage ranging from ≤ 0.1% in Cyprus to 37% in Lebanon. In Libya, the percentage accounting for 24%. The study additionally revealed that approximately fifty percent of the Libyan respondents stated that they would take antibiotics without a prescription if they thought they required them [13]. The objective of the current study is to evaluate the knowledge, attitude and practice of pharmacists in Libya in relation to DAWP.

Materials and Methods:

Study design and setting:

A cross-sectional descriptive study was conducted to evaluate the knowledge of community pharmacists about antibiotic use and antibiotic resistance and to assess their attitude and practice towards dispensing of antibiotics without prescription. The study was carried out between March and July 2023 among

community pharmacists in Libya. It was carried out with the permission of the ethical committee of the University of Zawia.

Study participants: A total of 180 community pharmacists participated in this study and they are informed about study' goals. Community pharmacy workers graduated from other health care sectors are excluded from the study.

Study tools:

A structured self-administered questionnaire was designed based on similar previous studies [6,7, 8,15]. The language of questionnaire was in English and in this study, the questionnaire was filled in both online and through visiting community pharmacies.

Ten pharmacists participated in a pilot study of the questionnaire, the results of this study were not included in the final analysis. The questionnaire consisted of 19 items that were divided into four sections. Section one is related to social-demographic characteristics of respondents such as age, gender and years of experience. Section two aimed to evaluate pharmacist 'knowledge and attitude. Third section was designed to assess community pharmacists' practice towards dispensing of antibiotics without prescription. The fourth section of questionnaire displayed the reasons for dispensing antibiotics without prescription and reasons for stopping DAWP in future.

Data analysis:

The collected data was analyzed by statistical package for social sciences (SPSS version 27) which include: frequency tables, bar charts, to summarize the descriptive statistics.

Results:

Section 1, Socio-demographic characteristics:

Table (1) displays the sample distribution according to the age, gender, and years of experience of the respondents. The sample consists of 180 individuals. Among them, (17.8%) are male, while (82.2%) are female. About 65.0% of the participants have less than 5 years of community practice experience, while 23.3% have 5-10 years of experience. Additionally, 11.7% of the participants have more than 10 years of experience.

The majority of the sample falls into the "Less than 30 years" age category, accounting for 79.4% of the total sample. ''30-40 years" is the second largest age group, accounting for 18.9% of the sample while "More than 40 years" is the smallest age group, accounting for 1.7% of the sample.

Table 1: Socio-demographic characteristics of community pharmacists

Variables	Frequency	Percentage
Gender		
Male	32	17.8%
Female	148	82.2%
Age		
Less than 30 years	143	79.4%
30-40 years	34	18.9%
More than 40 years	3	1.7%

Years of experience		
Less than 5 years	117	65%
5-10 years	42	23.3%
More than 10 years	21	11.7%

Section 2, knowledge and attitude of participants towards antibiotic usage and resistance:

The knowledge and attitude of community pharmacists on antibiotics are presented in table 2. Antibiotics are effective against bacterial infections, according to 98.3% of respondents. However, 81.1% disagreed that antibiotics can be used to treat viral illnesses. Around 77% of pharmacists agreed that antibiotics are indicated to relieve inflammations while 22.8% disagreed with this statement. A ccording to 84.4% of participants, antibiotics can harm natural bacterial flora and 27.2% believed that antibiotics resistant bacteria cannot be spread to healthcare institutions and communities. In addition, 82.2% of pharmacists reported that DAWP is problematic. Based on the provided table, it appears that the majority of respondents, 80.0% (144 out of 180), believed that pharmacists should stop dispensing antibiotics without a prescription.

Table 2: Knowledge and attitudes of participants towards antibiotic usage and resistance

Variables	Yes, n (%)	No, n (%)
Antibiotics are used to treat inflammation.	139 (77.2%)	**41 (22.8%)**
Antibiotics are effective against bacterial infections.	177 (98.3%)	**3 (1.7%)**
Antibiotics are effective for the treatment of viral infections.	34 (18.9%)	**146 (81.1%)**
Our bodies' normal flora can be killed by antibiotics.	152 (84.4%)	**28 (15.6%)**
It is impossible for resistant bacteria to spread into communities and healthcare facilities.	49 (27.2%)	**131 (72.8%)**
Do you believe that dispensing antibiotics without a prescription poses any problem?	149 (82.2%)	**31 (17.2%)**
Is it your opinion that pharmacists should stop dispensing antibiotics without a valid prescription?	144 (80%)	**36 (20%)**

Section 3: Practice of pharmacists regarding DAWP

Table 3 shows practice of pharmacists towards DAWP. About 43% of pharmacists reported that they dispense antibiotics

without prescription while 56.7% were not. The results of asking patients about their medical condition and drug history when dispensing antibiotics without a prescription, 163 (90.6%) responded "Yes", while only 17 (9.4%) responded "No".
It appears from the table that 63.9% of the respondents indicated that they dispense antibiotics without a prescription if a patient specifically requests a particular antibiotic by name. On the other hand, 36.1% of the respondents stated that they do not dispense antibiotics without a prescription in such cases. It also appears that 62.2% of respondents indicated that they dispense antibiotics without a prescription if they are aware of the symptoms, while 37.8% of respondents stated no. In addition, 93.3% of respondents stated that they educate the patients about importance of completing course of treatment. Regarding the results of antibiotics that are frequently dispensed without a prescription were as follow: amoxicillin has the highest count with 62 instances, accounting for 34.4% of the total. Azithromycin follows with 51 instances (28.4%), while Metronidazole has 26 instances (14.4%). Cefixime has 15 instances (8.3%), Erythromycin has 10 instances (5.6%) and Ciprofloxacin has 14 instances (7.8%). Cephalexin has the lowest count with only 2 instances (1.1%).

According to the table, the most common medical situation for which antibiotics are dispensed without a prescription was "Cold and Flu," with a count of 68 cases, accounting for 37.8% of the total cases. Other medical conditions for which antibiotics are dispensed without a prescription include "Rhinitis" (11 cases, 6.1%), "Diarrhea" (21 cases, 11.7%), "Toothache" (27 cases, 15.0%), "Earache" (9 cases, 5.0%), and "UTI" (44 cases, 24.4%).

Table3: Practice of pharmacists towards DAWP

Variables	Yes, n (%)	No, n (%)
Do you dispense antibiotics without a prescription?	78 (43.3%)	102 (56.7%)
Do you ask patients about their health condition and drug history before giving them antibiotics without a prescription?	17 (9.4%)	163 (90.6%)
If a patient specifically requests a certain antibiotic, I dispense it without a prescription.	115 (63.9%)	65 (36.1%)
I dispense antibiotics even if there is no prescription as long as the symptoms are recognized.	112 (62.2%)	68 (37.8%)
I inform patients about the significance of adhering to their treatment plan and finishing their whole antibiotic course.	168 (93.3%)	12 (6.7%)

Table 4: Antibiotics that are frequently dispensed without a prescription:

Amoxicillin	**62 (34.4%)**
Metronidazole	26 (14.4%)
Cephalexin	2 (1.1%)
Cefixime	15 (8.3%)
Azithromycin	51 (28.4%)
Ciprofloxacin	14 (7.8%)
Erythromycin	10 (5.6%)

Table 5: Medical disorders in which antibiotics are provided without a prescription

Cold and flu	**68 (37.8%)**
Rhinitis	11 (6.1%)
Diarrhea	21(11.7%)
Toothache	27 (15%)
Earache	9 (5%)
UTI	44 (24.4%)

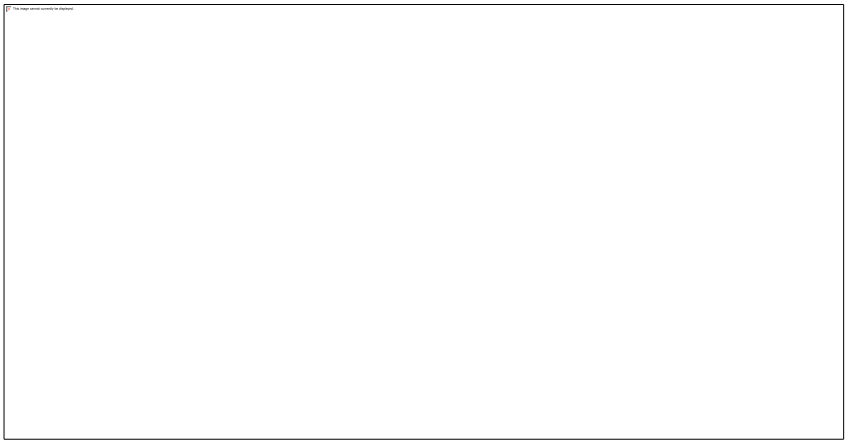

Figure1, Antibiotics that are frequently dispensed without a prescription

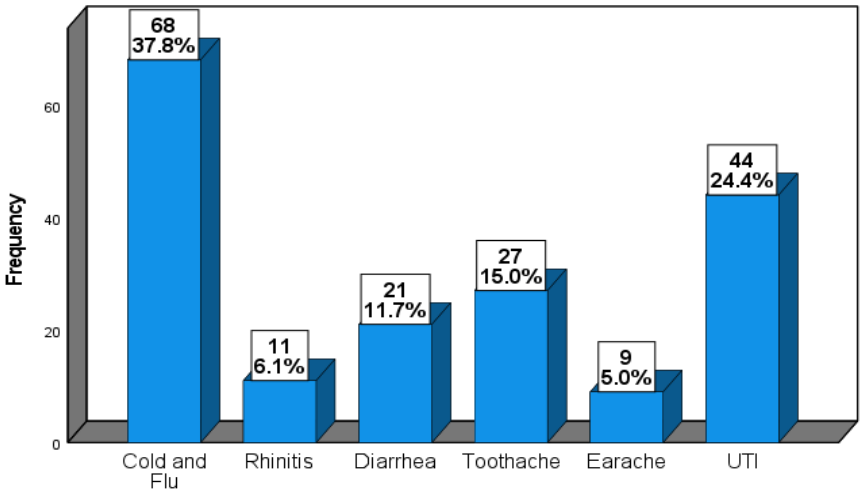

Figure 2: Medical disorders in which antibiotics are provided without a prescription

Section 4: Reasons behind the non-prescription dispensing of antibiotics and reasons behind the discontinuing of antibiotic dispensing without prescription in the future

The following tables presents the reasons behind the non-prescription dispensing of antibiotics and reasons behind the discontinuing of antibiotic dispensing without prescription in the future The most common reason reported for dispensing antibiotics without a prescription is that Pharmacists are knowledgeable about the use of antibiotics, accounting for 38.9% of the responses. Another significant reason, reported by 36.1% of the respondents, is that patient demand. A smaller proportion of respondents (8.3%) reported that dispensing antibiotics without a prescription is done to raise pharmacy profits. Also, fear of losing a customer was reported by 5.0% of the respondents. Similarly, 11.7% of the respondents cited insufficient knowledge regarding laws and regulations as a reason for dispensing antibiotics without a prescription. When asking the pharmacists about reasons behind the discontinuing of antibiotic dispensing without prescription in the future, the most common reason, with a percentage of (73.3%), was to hinder the progression and spread of antibiotic resistance. The second reason, with a percentage of (16.7%), is to support appropriate use of drug. A smaller proportion of respondents, (10.0%), mentioned the presence of stringent regulatory authorities as a reason for stopping the dispensing of antibiotics without a prescription.

Table 6: Reasons behind non-prescription dispensing of antibiotics

Reasons behind the non-prescription dispensing of antibiotics	Count	%
Pharmacists are knowledgeable about the use of antibiotics	70	38.9

Patient demand	65	36.1
To raise pharmacy profits	15	8.3
Fear of losing a customer	9	5.0
Insufficient knowledge regarding laws and regulations	21	11.7

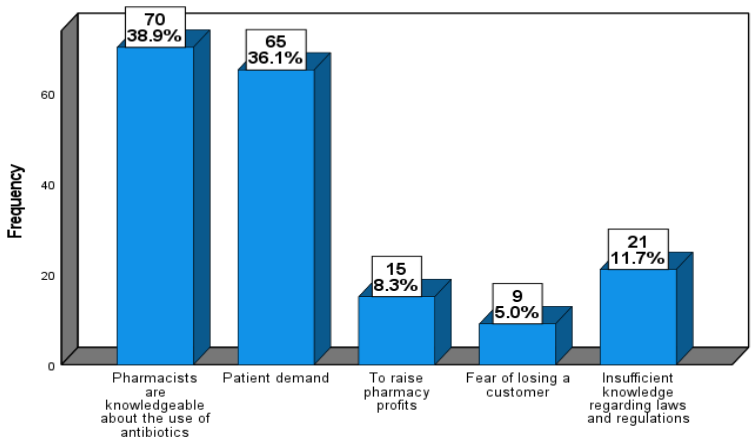

Figure 3; Reasons behind non-prescription dispensing of antibiotics

Table 7: Reasons behind the discontinuing of antibiotic dispensing without prescription in the future

Reasons behind th discontinuing of antibiotic dispensing without prescription in the future	Count	%
In order to hinder the progression and spread of antibiotic resistance	132	73.3
In order to support appropriate use of drug	30	16.7
Presence of strict authorities responsible for enforcing regulations	18	10.0

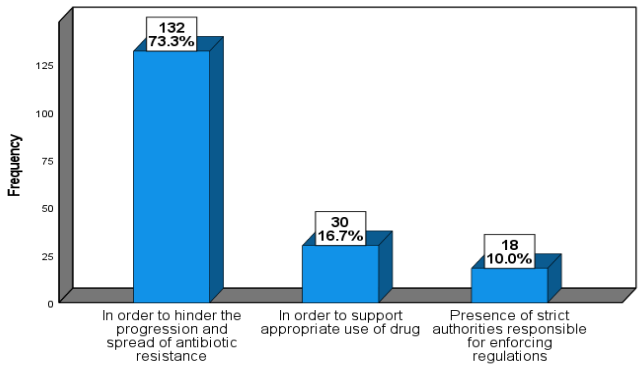

Figure4; Reasons behind discontinuing of antibiotic dispensing without prescription in the future

Discussion:

The practice of dispensing antibiotics without a prescription at community pharmacies puts public health at risk since it promotes the overuse of antibiotics [14]. Numerous research studies have indicated that a majority of antibiotics, exceeding 50% of the global supply, are being purchased without a prescription. This is particularly prevalent in developing nations, where the oversight and regulation of antibiotic access are not adequately enforced [15].

This study showed that the pharmacists have good knowledge regarding antibiotic effect, since the vast majority of respondents (98.3%) reported that the antibiotics are effective against bacteria and the majority of study participants 81.1% were aware that the antibiotics are not effective against viral infection. Furthermore, (84.4%) of respondents believed that the antibiotics can kill normal flora in the body. It is important to note that disregarding the impact of antibiotics on the microflora may result in the disruption of the microbial ecosystem within the human body, leading to the emergence of novel diseases and facilitates the development of antibiotic-resistant pathogens [16]. In addition, antibiotics are typically ineffective in treating viral infections due to their specific mechanism of action against bacteria. Consequently, their usage in such cases may result in unwanted and detrimental side effects and contribute in the evolution of antibiotic-resistant bacteria [17].

On the other hand, when asked the participants whether antibiotics are effective against inflammation, 77.2% of pharmacists agreed with this statement and this was higher than that obtained in Sudan (51%) [7]. This finding highlights that significant portion of study participants (65%) have less than five years of work experience and their knowledge needs to be regularly updated as they confused between infection and inflammation.

However, 72.8% of pharmacists agreed with that the resistant bacteria can be spread in healthcare institutions and communities, but about 27.2% disagreed with this statement which reflects their insufficient knowledge about antibiotic resistance.

Approximately 83% of the study participants indicated that the dispensing of antibiotics without a prescription is problematic and this result is consistent with another study conducted in Libya [18]. In spite of that, 43.3% of study participants reported that dispensing of antibiotics without a prescription is common in their practice, which might be attributable to a variety of factors, including: lack of strict regulations, patient pressure, financial gain, and pharmacists believed that they are qualified to dispense antibiotics without prescription. Furthermore, it is obvious that the practice of antibiotic dispensing without prescription is increased if customer requests a particular antibiotic 63.9% and when pharmacists are aware of the symptoms 62.2%.

In the present study, the most common antibiotics dispensed without prescription were Amoxicillin and Azithromycin. This finding is in agreement with similar study conducted in Saudi Arabia [19]. However, a study conducted in Pakistan revealed that Ciprofloxacin and Azithromycin were the most frequently dispensed, whereas in Ethiopia, the most commonly dispensed antibiotics were Tetracycline and Penicillin [20,21].

Cold and flu, urinary tract infection and toothache were the most cases for which antibiotics were dispensed without prescription respectively. This finding indicated that the pharmacists are confident in their abilities to dispense antibiotics without prescription, specifically when dealing with minor infections [22]. Studies were conducted in Saudi Arabia and Spain showed similar results with a little variation [8,22]. Another study was conducted in Jordan showed that sore throat, urinary tract infection and diarrhea represent the majority of cases [23]. The common cold is generally considered a mild viral illness affecting the upper respiratory system, and it is known that antibiotics are ineffective in treating viral-related upper respiratory infections and dispensing of antibiotics in such cases leads to spreading of antibiotic resistance [24].

When we asked the pharmacists about the reasons behind the non-prescription dispensing of antibiotics, the main reason was pharmacists are knowledgeable about antibiotics which enable them to DAWP. This sense of a higher level of expertise may be deceptive and lead to inappropriate dispensing procedures [25]. Furthermore, this finding emphasizes the importance of community pharmacist to take a role as antibiotic stewards in the promotion of rational use of antibiotics. Another reason was patient demand (36.1%). Actually, there are various causes which tend the patients to request antibiotics without prescription including: long waiting time and high costs of medical examination, patient trust, insufficient knowledge of the risks of antibiotic consumption without a prescription and absence of medical insurance. Similar factors were indicated in studies in Egypt and Sudan [26,7].

On the other hand, insufficient knowledge regarding laws and regulations was represented by (21%) of study participants. Education of pharmacists about regulations and law enforcement play a crucial role in reducing the prevalence of antibiotic

dispensing without a prescription. A Saudi Arabian study revealed a correlation between law enforcement and a decrease in the practice of dispensing antibiotics without a prescription [27].

Interestingly, fear of losing a customer and to raise pharmacy profit were reported only by 8.3% and 5% of respondents respectively and this could be due to low profit pressure from the owner on the pharmacists. In contrast, fear of losing a client was the main reasons according to studies conducted in Hungary and South India [10,15].

According to study participants, the majority of respondents 73.3% reported that the main reason which will tend the community pharmacists to stop this malpractice in future is to prevent the development and spread of antimicrobial resistance. However, the presence of stringent regulatory authorities and promotion of rational use of medicines are reported by 10% and 16.7% of respondents respectively.

Finally, although there are numerous contributing factors related to antibiotic resistance, antibiotic consumption without prescription and consequently hazards of antibiotic resistance can be diminished through enforcement of regulations and laws, adherence to dispensing practice guidelines, enhancement the pharmacist's role in rational drug use, increase the public awareness about the risks of antibiotic consumption without prescription and pharmacist's enrollment in education, training and steward programs.

Conclusion:

This study reveals that dispensing of antibiotics without prescription is common practice in Libya and this malpractice will exacerbate the risks of antibiotic resistance and worsen their consequences. Therefore, collaborative effort from pharmacists, ministry of health, national center for disease control and regulatory authorities are needed to promote good dispensing practice of antibiotics, increase public awareness and overcome the challenge of antibiotic resistance.

References:

1. ASLAM, Bilal, et al. Antibiotic resistance: a rundown of a global crisis. Infection and drug resistance, 2018, 1645-1658

2. Ventola, C. Lee. "The antibiotic resistance crisis: part 1: causes and threats." Pharmacy and therapeutics 40.4 (2015): 277

3. Mancuso G, Midiri A, Gerace E, Biondo C. Bacterial Antibiotic Resistance: The Most Critical Pathogens. Pathogens. 2021; 10(10):1310. https://doi.org/10.3390/pathogens1010131

4. The role of pharmacist in encouraging prudent use of antibiotics and averting antimicrobial resistance: a review of policy and experience. WHO Regional Office for Europe. https://iris.who.int/handle/10665/139702

5.https://cdn.who.int/media/docs/default-source/antimicrobial-resistance/amr-factsheet.pdf?sfvrsn=7c29d6d1_0

6. Poyongo, Baraka P., and Raphael Z. Sangeda. "Pharmacists' knowledge attitude and practice regarding the dispensing of antibiotics without prescription in Tanzania: an explorative cross-sectional study." (2019).

7. Abdelrahman Hussain, Mohamed, et al. "Knowledge, attitude and practice of community pharmacists in relation to dispensing antibiotics without prescription in Sudan: A cross-sectional study." Integrated Pharmacy Research and Practice (2022): 107-116

8. Hadi, Muhammad Abdul, et al. "Community pharmacists' knowledge, attitude, and practices towards dispensing antibiotics without prescription (DAwP): a cross-sectional survey in Makkah Province, Saudi Arabia." International journal of infectious diseases 47 (2016): 95-100.

9. Alhomoud, Faten, et al. "Self-medication and self-prescription with antibiotics in the Middle East—do they really happen? A systematic review of the prevalence, possible reasons, and outcomes." International journal of infectious diseases 57 (2017): 3-12.

10. Gajdács, Márió, Edit Paulik, and Andrea Szabó. "Knowledge, attitude and practice of community pharmacists regarding antibiotic use and infectious diseases: a cross-sectional survey in Hungary (KAPPhA-HU)." Antibiotics 9.2 (2020): 41.

11. Ahmad, Tawseef, et al. "Assessing antibiotic dispensing without prescription through simulated client methodology in developing countries: A comprehensive literature review from 2009 to 2021." Journal of Public Health (2023): 1-23.

12. Zawahir, Shukry, Sarath Lekamwasam, and Parisa Aslani. "A cross-sectional national survey of community pharmacy staff: Knowledge and antibiotic provision." PloS one 14.4 (2019): e0215484.

13. Ghenghesh, Khalifa Sifaw, et al. "Antimicrobial resistance in Libya: 1970-2011." Libyan Journal of Medicine 8.1 (2013).

14. Horumpende, Pius G., et al. "Prescription and non-prescription antibiotic dispensing practices in part I and part II pharmacies in Moshi Municipality, Kilimanjaro Region in Tanzania: A simulated clients approach." PloS one 13.11 (2018): e0207465.

15. Kumar, K. Sarath, S. Saranya, and Nagasubramanian Vanitha Rani. "Community pharmacists' knowledge, attitude, and nonprescription dispensing practices of antibiotics: An explorative study in a selected city of South India." Journal of Research in Pharmacy Practice 11.2 (2022): 51.

16. Abdallah, Emad Mohamed. "An Overview of the Effects of Antibiotics and Medicinal Plant Extracts on the Human Microflora." Nova 5.3 (2016): 1-6.

17. https://www.fda.gov/consumers/consumer-updates/combating-antibiotic-resistance

18. Al-Shami, Hiba A., et al. "Awareness, practices and perceptions of community pharmacists towards antimicrobial resistance and antimicrobial stewardship in Libya: a cross-sectional study." Journal of

Pharmaceutical Policy and Practice 16.1 (2023): 1-10.

19. Alhomoud, Faten, Reem Almahasnah, and Farah Kais Alhomoud. ""You could lose when you misuse"–factors affecting over-the-counter sale of antibiotics in community pharmacies in Saudi Arabia: a qualitative study." BMC Health Services Research 18.1 (2018): 1-9.

20. Ahmad, Tawseef, et al. "Assessment of without prescription antibiotic dispensing at community pharmacies in Hazara Division, Pakistan: A simulated client's study." PLoS One 17.2 (2022): e0263756.

21. Haile, Kaleab Taye, and Abdella Birhan Yabeyu. "Knowledge, Attitude and Practice of Pharmacy Professionals Against Dispensing Antibiotics Without Prescription in Ethiopia." Integrated Pharmacy Research and Practice (2022): 167-176.

22. Zapata-Cachafeiro, Maruxa, et al. "Determinants of antibiotic dispensing without a medical prescription: a cross-sectional study in the north of Spain." Journal of Antimicrobial Chemotherapy 69.11 (2014): 3156-3160.

23. Almaaytah, Ammar, Tareq L. Mukattash, and Julia Hajaj. "Dispensing of non-prescribed antibiotics in Jordan." Patient preference and adherence (2015): 1389-1395

24. https://www.cdc.gov/antibiotic-use/pdfs/Common-Cold-H.pdf

25. Al-Halawa, Diala Abu, Rania Abu Seir, and Radwan Qasrawi. "Antibiotic Resistance Knowledge, Attitudes, and Practices among Pharmacists: A Cross-Sectional Study in West Bank, Palestine." Journal of Environmental and Public Health 2023 (2023

26. Kotb, Maryam, and Marwan ElBagoury. "Sale of antibiotics without prescriptions in Alexandria, Egypt." J Pure Appl Microbiol 12.1 (2018): 287-291.

27. Alrasheedy, Alian A., et al. "The impact of law enforcement on dispensing antibiotics without prescription: a multi-methods study from Saudi Arabia." Expert review of anti-infective therapy 18.1 (2020): 87-97.