# IMPACT OF EDUCATIONAL INTERVENTION ON COMMUNITY PHARMACISTS' KNOWLEDGE, ATTITUDE, AND PRACTICE TOWARDS ANTIBIOTIC RESISTANCE IN BAGHDAD, IRAQ: A MIXED-METHOD APPROACH

# AKRAM HAMEED MAJEED AL KADHIMI

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by

# AKRAM HAMEED MAJEED AL KADHIMI

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## LIST OF ABBREVIATIONS

ABR	Antibiotic Resistance
ABS	Antibiotic Stewardship
HDL	High Density Lipoprotein
CI	Confidence Interval
IP	Independent Pharmacy
KAP	Knowledge, Attitude, and Practice
MCP	Medical Complex Pharmacy
MRSA	Methicillin-resistant staphylococcus aureus
OR	Odd Ratio
SD	Standard Deviation
SPSS	Statistical Package for Social Sciences
UTI	Urinary Tract Infection
WHO	World Health Organization

### **APPENDICES**

Appendix 1	Findings from pilot study
Appendix 2	Interview guide for the dispensing practice of antibiotics in community pharmacy
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# IMPAK INTERVENSI PENDIDIKAN TERHADAP PENGETAHUAN, SIKAP, DAN AMALAN AHLI FARMASI KOMUNITI TENTANG KERINTANGAN ANTIBIOTIK DI BAGHDAD, IRAQ: PENDEKATAN KAEDAH BERCAMPUR

#### ABSTRAK

Ahli farmasi komuniti mempunyai impak yang signifikan terhadap penggunaan antibiotik. Kaedah penyelidikan campuran digunakan untuk menilai corak dan amalan pengeluaran antibiotik di farmasi komuniti di Baghdad, Iraq. Kajian kualitatif dijalankan menggunakan temubual bersemuka untuk memahami secara mendalam tentang corak pengeluaran dan amalan antibiotik di farmasi komuniti. Analisis tematik dilakukan dan lima tema ditemui yang mempengaruhi amalan pengeluaran antibiotik di farmasi komuniti. Persepsi ahli farmasi terhadap pengeluaran antibiotik tanpa preskripsi telah dikaitkan keadaan perubatan, keselamatan dan keberkesanan antibiotik, pesakit meminta antibiotik mengikut namanya, kecemasan pesakit, pelanggan tetap, promosi daripada syarikat farmaseutikal, menjimatkan masa dan kos, ubat-ubatan jenama, dan perkhidmatan kesihatan yang kurang memuaskan. Selain itu, terdapat kekurangan pengetahuan tentang kerintangan antibiotik. Selain itu, kajian kuantitatif dijalankan dengan menjalankan kaji selidik rentas-seksyen untuk menilai pengetahuan, sikap, dan amalan tentang kerintangan antibiotik. Subjek dijemput untuk mengambil bahagian dalam kajian ini dengan menggunakan pendekatan persampelan yang mudah. Kajian kuantitatif pula dilakukan melalui tinjauan keratan rentas untuk menilai pengetahuan, sikap, dan amalan berkenaan kerintangan antibiotik. Seramai 381 ahli farmasi komuniti mengambil bahagian dalam penilaian pra-intervensi dan 338 orang dalam

penilaian pasca-intervensi dengan menggunakan soal selidik yang diisi sendiri. Hasil kajian menunjukkan terdapat kekurangan pengetahuan mengenai kerintangan antibiotik berkenaan "superbugs" (67%); dan kontribusi virus kepada kerintangan antibiotik dengan memindahkan bakteria yang tahan antibiotik-DNA kepada bakteria lain (60%). Kajian ini juga menunjukkan bahawa 47.3% peserta mempunyai sikap negatif terhadap jualan antibiotik yang tidak terkawal akan menyebabkan kerintangan antibiotik; dan 17.3% sangat tidak bersetuju/tidak bersetuju bahawa kerintangan antibiotik berlaku akibat amalan farmasi yang lemah. Pengetahuan yang baik dan sikap positif mengenai kerintangan antibiotik dipengaruhi oleh kumpulan umur 40 tahun ke atas, wanita, memiliki ijazah dalam bidang farmasi dan pengalaman kerja lebih dari 10 tahun. Manakala peserta yang bekerja di farmasi bebas lebih cenderung mempunyai sikap positif terhadap punca kerintangan antibiotik (OR=2.18, 95% CI 1.23-3.83, P<0.001). Walau bagaimanapun, kajian ini menunjukkan bahawa terdapat amalan yang kurang baik berkaitan dengan kerintangan antibiotik apabila hanya 44.1% peserta melaporkan bahawa mereka selalu/selalu bertanya sama ada pesakit mengalami demam; dan 44.6% daripada mereka selalu/selalu memberi nasihat kepada pesakit untuk menyelesaikan penuh kitaran antibiotik. Demikian juga, 41.2% daripada mereka mengatakan bahawa mereka selalu/selalu mendidik pesakit tentang arahan dos; dan 50.4% daripada mereka menunjukkan bahawa mereka selalu/selalu menghentikan pengepulangan antibiotik untuk keadaan yang tidak memerlukan antibiotik. Skor amalan yang lebih tinggi diramalkan oleh kumpulan umur 31-40 tahun (OR = 3.24, 95% CI 1.98-3.68, P = 0.019), mempunyai sekurang-kurangnya ijazah sarjana dalam farmasi (OR = 1.77, 95% CI 0.74-2.24, P = 0.025), pengalaman 3-5 tahun (OR = 2.15, 95% CI 1.09-4.23, P = 0.027), dan bekerja dalam farmasi bebas (OR = 1.26, 95% CI 1.74-2.14, P = 0.038). Kajian ini menunjukkan bahawa terdapat perbezaan yang signifikan dalam jumlah skor pengetahuan, sikap, dan amalan antara pra-intervensi dan pasca-intervensi (P ≤0.001).

Purata skor pengetahuan, sikap, dan amalan meningkat secara ketara pada pascaintervensi untuk mencapai  $9.76 \pm 0.70$ ,  $30.98 \pm 3.49$ , dan  $30.79 \pm 4.90$  masing-masing. Strategi untuk kempen latihan berterusan yang mempunyai sasaran farmasi komuniti dan pelanggan mereka diperlukan dengan segera untuk meningkatkan pengetahuan ahli farmasi tentang kerintangan antibiotik.

# IMPACT OF EDUCATIONAL INTERVENTION ON COMMUNITY PHARMACISTS' KNOWLEDGE, ATTITUDE, AND PRACTICE TOWARDS ANTIBIOTIC RESISTANCE IN BAGHDAD, IRAQ: A MIXED-METHOD APPROACH

#### ABSTRACT

Community pharmacists have a significant impact on the use of antibiotics. Mixed research methods were used to assess the dispensing pattern and practice of antibiotic in community pharmacy in Baghdad, Iraq. A qualitative study was conducted using face-to-face interviews to get in-depth understanding about the dispensing pattern and practice of antibiotics in community pharmacy. Thematic analysis was done and five themes were found to influence the dispensing practice of antibiotics in community pharmacy. Pharmacists' perception towards dispensing antibiotics without prescription was associated with medical condition, safety and efficacy of antibiotics, patients request antibiotics by name, emergency cases, regular customer, promotions from pharmaceutical companies, saving time and cost, medication brands, and poor healthcare services; in addition to inadequate knowledge about antibiotic resistance. Besides, quantitative study was conducted by performing a cross-sectional survey to assess knowledge, attitude, and practice regarding antibiotic resistance. Subjects were invited to participate in this study by using a convenience sampling approach. A self-administered questionnaire was used to obtain the data from 381 community pharmacists who took part in the preintervention assessment; and 338 in the post-intervention assessment. The findings revealed that there was inadequate knowledge about antibiotic resistance among community pharmacists in terms of the meaning of superbugs (67%); and the

contribution of viruses to antibiotic resistance by transferring the resistant bacteria-DNA to other bacteria (60%). This study also showed that 47.3% of participants have negative attitude towards the uncontrolled sale of antibiotics leads to antibiotic resistance; and 17.3% strongly disagreed/disagreed that antibiotic resistance happens as a result of poor pharmacy practice. Good knowledge and positive attitude regarding antibiotic resistance were influenced by age group of 40 years and above, being female, having degree in pharmacy and more than 10 years of experience. While participants who working in independent pharmacy were more likely to have positive attitude toward the causes of antibiotic resistance (OR=2.18, 95% CI 1.23-3.83, p<0.001). However, this study showed that there was poor practice regarding antibiotic resistance when only 44.1% of participants reported that they always/often ask the patient whether fever was present; and 44.6% of them always/often advise the patient to complete the full course of antibiotics. Similarly, 41.2% of them said that they always/often educate the patient about dosage instructions; and 50.4% of them indicated that they always/often stop dispensing of antibiotics for conditions not requiring antibiotics. Higher practice score was predicted by age group of 31-40 years (OR=3.24, 95% CI 1.98-3.68, p=0.019), having at least bachelor degree in pharmacy (OR=1.77, 95% CI 0.74-2.24, p=0.025), 3-5 years of experience (OR=2.15, 95% CI 1.09-4.23, p=0.027), and being working in independent pharmacy (OR=1.26, 95% CI 1.74-2.14, p=0.038). This study indicated that there was a significant difference in the total score of knowledge, attitude, and practice between pre-intervention and post-intervention (p <0.001). The mean score of knowledge, attitude, and practice was obviously improved in post-intervention to reach 9.76  $\pm 0.70$ , 30.98  $\pm 3.49$ , and 30.79  $\pm 4.90$  respectively. Strategies for continuing training

campaigns that target community pharmacies and their clients are urgently needed to increase pharmacists' knowledge about antibiotic resistance.

#### **CHAPTER 1**

#### **INTRODUCTION**

#### 1.1 Background

Antibiotics have saved people's lives since their discovery in the 20th century (Murray et al., 2022). Since infectious diseases continue to be one of the leading causes of death, antibiotics are absolutely essential especially in low- and middleincome countries (Khan et al., 2022). The misuse and overuse of antibiotics in both the medical and agricultural sectors contributed to the development of antibiotic resistance (Dadgostar, 2019). Antibiotic resistance is a biological phenomenon, according to the World Health Organization (WHO), that happens when microorganisms (bacteria, fungi, viruses, or parasites) are exposed to antibiotics and undergo changes. Due to this modification, the microbe becomes resistant to the previously effective antibiotic (World Health Organization, 2019). Inappropriate use of antibiotics, particularly in the treatment of acute upper respiratory tract infections, whether by healthcare professionals through unnecessary prescription and dispensing or by patients self-medicating, is one of the major causes of antibiotic resistance (Al-Azzam, Al-Husein, Alzoubi, Masadeh, & Al-Horani, 2007; Ameko, Achio, & Alhassan, 2012). Antibiotics are being used inappropriately due to the insufficient regulations and easy access to non-prescription antibiotics (Morgan, Okeke, Laxminarayan, Perencevich, & Weisenberg, 2011), in addition to other factors such as health illiteracy, ignorance, and poverty (Gebeyehu, Bantie, & Azage, 2015). Antibiotic resistance is a concerning issue caused by inappropriate use of antibiotics, and it poses a serious challenge to healthcare professionals (Ahmad, Khan, Moorthy, Jamshed, & Patel, 2015). At healthcare professional level, the most prominent concerns with antibiotic therapy are their appropriate selection, dosage, and duration (Ruvinsky et al., 2011). Inappropriate prescribing of antibiotics is due to the lack of experience, workload, incentive, setting, and accessibility to consultant and/or diagnostic procedures for infectious diseases (Calbo, Álvarez-Rocha, Gudiol, & Pasquau, 2013). These lead to low standard for the indication of antibiotics, a delay in beginning therapy when it is necessary, poor knowledge of local antibiotic resistance, mistakes in the final dose, administration, or medication choice trends by the prescribing doctor. However, inappropriate dispensing of antibiotics is prevalent in community pharmacies due to the lack of training of pharmacy staff, which leads to poor therapeutic outcome and antibiotic resistance (Asghar, Atif, Mushtaq, Malik, & Hayat, 2020). Antibiotic resistance can be avoided by restricting the sale of antibiotics without a prescription, stopping sharing antibiotics with others, and following the prescribed course of antibiotic even if the patient feels better (World Health Organization, 2014a). Antibiotic resistance has caused a variety of complicated problems that are impacting all the countries around the world which leading to health and economic consequences (Dadgostar, 2019). Antibiotic resistance has also come to be seen as a sign of a post-antibiotic era, in which mild infections that were previously treatable for decades could become dangerous (Boucher et al., 2009; World Health Organization, 2014a). Furthermore, inappropriate use of antibiotics is linked to an increase in the incidence of antibioticrelated adverse events in the general population (Harris et al., 2016). Community pharmacies are considered as patients' first points of contact when seeking medical advice in various low- and middle-income countries (Ahmad, Atique, Balkrishnan, & Patel, 2014). In low- and middle-income countries, many people seek immediate health advice from community pharmacists rather than physicians for a variety of reasons; including ease of access, lower costs, and save time (Hoa et al., 2011; Sharma et al., 2009). When it comes to antibiotics, patients or healthcare professionals are part of the problem. There are several Middle Eastern countries with no strict regulations concerning the sale of antibiotics at community pharmacy which are reported in Saudi Arabia (Abdelaziz et al., 2019), Iraq (Mikhael, 2014), Lebanon (Farah, Lahoud, Salameh, & Saleh, 2015), United Arab Emirates (Dameh, Green, & Norris, 2010). Reports from various Middle Eastern countries have shown a substantial correlation between antibiotic misuse and poor pharmacy practice (Abdelaziz et al., 2019; Abdulhak et al., 2011; Al-Faham, Habboub, & Takriti, 2011; Bahnassi, 2015; Gebretekle & Serbessa, 2016). Dispensing antibiotics when they are not necessary required for the treatment is an example of the widespread misuse of them (Chaw, Höpner, & Mikolajczyk, 2018; Chokshi, Sifri, Cennimo, & Horng, 2019). Numerous studies conducted globally reveal that many patients firmly believe that antibiotics would treat viral infections like flu or the common cold (World Health Organization, 2019). In addition, in low- and middle-income countries where there are challenges with appropriate diagnostic tools, patient care is dependent on the prescription of medication, particularly antibiotics (Chaw et al., 2018). Dispensing antibiotics when they are not necessary required for the treatment is another example of the widespread misuse of them (Chaw et al., 2018; Chokshi et al., 2019). Recent studies have demonstrated a variety of significant issues exist, including a lack of awareness towards health-related issues, an absence of surveillance programs, a lack of antibiotic stewardship in health facilities serving the community, a lack of infection control and prevention strategy, a restricted ability to identify novel antibiotics, a lack of global surveillance (Iskandar et al., 2021; Jamshed et al., 2018). In community pharmacy, several reasons can contribute to the

inappropriate use of antibiotics including a lack of knowledge, patient demand, and financial incentives from pharmaceutical companies (Hadi et al., 2016). In Iraq, antibiotic resistance has been greatly increased by the inability to quickly diagnose infectious diseases (Iraq Ministry of Health/Environment and Ministry of Agriculture, 2018). In addition, the conditions for prescribing and using antibiotics in community pharmacy are generally uncontrolled (Al-Jumaili, Hussein, Al-Rekabi, Raheem, & Ernst, 2017). Therefore, investigating the relationship between knowledge, attitude, and practice regarding antibiotics use and resistance is very important to understand the non-prescription sale of antibiotics in community pharmacy in Iraq. The findings of this research can potentially improve community pharmacists' understanding about antibiotic use and antibiotic stewardship practice in Iraq.

#### 1.2 Role of pharmacists in antibiotic stewardship

Pharmacists can have a substantial influence on the consumption and resistance of antibiotics in both hospital and community pharmacy because each setting contribute differently to antibiotic resistance. It is generally acknowledged that hospital pharmacists may enhance patients' clinical outcomes through the use of multidisciplinary approaches, whereas community pharmacists can decrease the inappropriate use of antibiotics by increasing public awareness and adherence (Bishop, Yacoob, Knobloch, & Safdar, 2019). Community pharmacy is the first point of contract to patients who have a minor illness. They could provide appropriate evaluation, refer patients as necessary, and support optimizing the use of antibiotics in terms of adherence and safety (International Pharmaceutical Federation, 2015; World Health Organization, 2018). It is clear that community pharmacists are

essential in the overall strategy of combating antibiotic resistance. Consequently, community pharmacists must be prepared with knowledge of the intervention methods appropriate to their practice setting, as well as knowledge and skills are required to implement and maintain these interventions (Bishop et al., 2019). This is especially encouraged because several studies have shown that community pharmacists have the essential knowledge, a positive attitude, and the acceptable practices when it comes to the use of antibiotics and resistance (Khan et al., 2016; Mustafa et al., 2022; Roque, Soares, Breitenfeld, Figueiras, & Herdeiro, 2015). However, there may be diverse duties for pharmacists in connection to antibiotic stewardship depending on the legal and professional pharmacy framework in each country by encouraging the adherence to antibiotics and ensuring the safety, particularly in developing world like Iraq. This study described the community pharmacists' knowledge, attitude, and practice of antibiotics use and resistance in Iraq, as well as to pay attention to the role of community pharmacists in Iraq in the overall picture of antibiotic stewardship strategies.

#### **1.3 Problem Statement**

Globally, antibiotics are used in 20% - 80% of primary care settings, either with or without a prescription (Gasson, Blockman, & Willems, 2018; Kotwani & Holloway, 2011). Antibiotic use among people is significantly grown by 36% between 2000 to 2010 (Van Boeckel et al., 2014). It was revealed that between 2000 and 2015, antibiotic use rates in low-to-middle income countries are significantly increased. The total amount of antibiotics consumed in these countries was approximately 2.5 times that in high-income countries in 2015 (Klein et al., 2018). Half of the antibiotics dispensed to the people are used inappropriately, which contributes to antibiotic resistance (Shankar, Piryani, & Piryani, 2016). In Iraq, around half of community pharmacists (45%) dispensed antibiotics for viral infection such as common cold. They also dispensed a variety of antibiotics without a prescription (Mikhael, 2014). Antibiotics are frequently dispensed without a prescription, especially in developing countries. This might lead to antibiotic resistance, increased expenses, and potential therapeutic side effects (Hadi et al., 2016; Mahmoud, Aldhaeefi, Sheikh, & Aljadhey, 2018).

Community pharmacists have engaged in irresponsible behaviour that encourages the public to misuse antibiotics (Aljadhey et al., 2014). Furthermore, inappropriate prescribing and dispensing practices can also lead in the overuse and misuse of antibiotics (Fleming-Dutra et al., 2016). Dispensing antibiotics without prescription is a widespread phenomenon seen in many community pharmacies (Dillip et al., 2015; Gebretekle & Serbessa, 2016). Community pharmacists commonly ignore the restrictions on dispensing antibiotics without a prescription and exposing patients' health to serious risk (Aljadhey et al., 2014).

Global action plan on antibiotic resistance by WHO revealed that antibiotic resistance has both direct and indirect impacts. The direct impact includes an increase in infection severity, which prolongs illness, raises mortality, lengthens hospital stays, and reduces the efficacy of preventive medical procedures. The indirect impact includes an increase in health risks for humans and animals, as well as increase the economic burden by lost increasing treatment and preventative expenses (World Health Organization, 2019).

Several studies highlighted a gap in knowledge, attitude and practice regarding antibiotic resistance among community pharmacy staff (Hadi et al., 2016; Rehman et al., 2018; Waseem et al., 2019). In addition, antibiotic dispensing practices in developing countries are often inappropriate due to the lack of knowledge regarding antibiotics use and resistance (Asghar et al., 2020). However, many studies have been conducted to assess the knowledge, attitude and practice regarding antibiotics in general public, but little is known about this issue in community pharmacy.

#### 1.4 Aim of the Study

This study aimed to investigate the dispensing patterns of antibiotics in community pharmacy in Baghdad, Iraq. This study is very important in describing how antibiotics are being dispensed in community pharmacy. Firstly, exploring the dispensing of antibiotics without a prescription helps to explain the accessibility of antibiotics in the community, as well as provide insight into the most important factors contributing to the dispensing of antibiotic resistance through the appropriateness of dispensing practice. However, few studies have been conducted in developing countries to describe the dispensing practice of antibiotics in community pharmacy but little is known about this issue in Iraq (Abdelaziz et al., 2019; Farah et al., 2015).

Secondly, pharmacists have exclusive knowledge of antibiotics, making them responsible for improving patients' health and ensuring the safety of patients and the general public. To identify the problems of antibiotic use, it is crucial to assess the knowledge, attitudes, and practices regarding antibiotic resistance among community pharmacists. This will provide an insight into the current dispensing practice of antibiotics in community pharmacy and it will be particularly useful to enhance the role of pharmacists in relation to antibiotics resistance.

Thirdly, this study provides an initial assessment of community pharmacists' understanding about antibiotic resistance. This research can help to design future interventions for pharmacists to participate in professional development programs and antibiotic stewardship training, which could be developed based on the study findings on community pharmacists' knowledge, attitude, and practice. Pharmacists' knowledge can influence their dispensing practice of antibiotics. Many researchers argue that inadequate knowledge is associated with inappropriate use of antibiotics. In addition, pharmacists' attitude towards antibiotics resistance may influence their practice. Lack of knowledge and negative attitude can lead to inappropriate dispensing practice of antibiotics.

Lastly, healthcare professionals especially pharmacists have the core responsibility of antibiotics stewardship and raising antibiotics resistance awareness, improving infection prevention and control and educating the general public about antibiotic use. The findings of this study will provide a clear picture for policy makers to design better strategy for antibiotic stewardship practice at the community level in Iraq.

#### **1.5 Objectives**

1. To explore the dispensing of antibiotics without prescription in community pharmacy. (CHAPTER 4)

- 2. To assess the knowledge and attitude and practice regarding antibiotics resistance among community pharmacists. (CHAPTER 5)
- 3. To assess the impact of educational intervention on pharmacists' knowledge, attitude, and practice regarding antibiotic resistance. (CHAPTER 5)
- 4. To assess the dispensing pattern of antibiotics in community pharmacy based on pharmacists' characteristics. (CHAPTER 6)
- 5. To assess the role of community pharmacists and their perception regarding antibiotics stewardship. (CHAPTER 7)

#### 1.6 Thesis overview

This study was conducted at the community pharmacy in the main city of Baghdad, Iraq. This study included both qualitative and quantitative research methods. The main objectives of this thesis were to assess the knowledge and attitude and practice regarding antibiotics resistance among community pharmacists; as well as to assess the impact of educational intervention on KAP regarding antibiotic resistance. In addition, this study also aimed to explore the dispensing of antibiotics without prescription in community pharmacy.

Chapter 2 presented the literature review, and exploring the current dispensing patterns of antibiotics at community pharmacy, knowledge, attitude and practice regarding antibiotic resistance, the role of pharmacists and their perception towards antibiotic stewardship.

Chapter 3 described the qualitative and quantitative methods related to the work in this thesis.

Chapter 4 explored the findings from face-to-face interviews conducted on community pharmacists in the city of Baghdad to get in depth understanding about the patterns and practices of dispensing antibiotics in community pharmacy.

Chapter 5 assessed the knowledge, attitude and practice regarding antibiotic resistance as well as assessed the impact of educational intervention on knowledge, attitude and practice regarding antibiotic resistance among community pharmacists in the city of Baghdad.

Chapter 6 assessed the dispensing pattern of antibiotics in community pharmacy in the city of Baghdad.

Chapter 7 assessed the role of community pharmacists and their perception toward antibiotic stewardship.

Chapter 8 highlighted the overall conclusions and provided recommendations in the concept of antibiotic resistance.

#### **CHAPTER 2**

#### LITERATURE REVIEW

This chapter exploring the current literature review relating to the dispensing of antibiotics at the community pharmacy, in addition to the knowledge, attitude and practice regarding antibiotic resistance among community pharmacists; and the role of pharmacists and their perception towards antibiotic stewardship. According to the World Health Organization, antibiotic resistance is a major public health concern that is widespread throughout the world. Antibiotic resistance can be avoided by restricting the sale of antibiotics without a prescription, stopping sharing antibiotics with others, and following the prescribed course of antibiotic even if the patient feels better (World Health Organization, 2014a). In Iraq, antibiotics are dispensing in government sector includes primary healthcare facilities, public hospitals and outpatient clinics. In private sector, antibiotics are only dispensing in community pharmacies because private hospitals do not have own pharmacies. Private hospitals are referring their patients to obtain prescription medicines from community pharmacies. While, there are no community pharmacy chains in Iraq. Community pharmacies are private independent pharmacies which are usually managed by licensed pharmacists to dispense prescribed medicines (Al-Jumaili, Hussain, & Sorofman, 2013; Al-Jumaili et al., 2017) Antibiotics are only prescription medicines in Iraq, but dispensing them without a prescription is very common practice in community pharmacies. In other words, the dispensing of antibiotics in community pharmacies is not regulated well. While the prescribing and dispensing of antibiotics in governmental sector is better controlled due to the official rules, the regular

reviews of antibiotics' stocks and records by governmental inspectors; in addition to pharmacists' tendency to protect themselves from any legal accountability (Al-Jumaili et al., 2017). Misuse of antibiotics is common, particularly in countries where there is a lack of strict regulation on the sale of antibiotics; in addition to other factors such as health illiteracy, ignorance, and poverty (Gebeyehu et al., 2015). Inappropriate dispensing of antibiotics is widespread in community pharmacy due to the lack of knowledge and awareness about antibiotic resistance among pharmacy staff (Asghar et al., 2020).

#### **2.1 Dispensing pattern of antibiotics in community pharmacy**

Antibiotic misuse, whether by patients or healthcare personnel, is a key contributor to antibiotic resistance. In Middle Eastern countries, the dispensing of antibiotics by community pharmacy is not subject to any strict regulations. In Iraq, around half of community pharmacists (45%) dispensed antibiotics for viral infection such as common cold. They also dispensed a variety of antibiotics without a prescription such as amoxicillin, amoxicillin/clavulanate, ciprofloxacin and azithromycin (Mikhael, 2014). In Saudi Arabia, antibiotics were dispensed without a prescription in 77.6% of community pharmacies (Abdulhak et al., 2011). Another study conducted on community pharmacy in Lebanon reported that 32% of the antibiotics were dispensed out without a prescription (Farah et al., 2015). In addition, a survey from the United Arab Emirates showed that 68.4% of antibiotic were dispensed without a prescription (Dameh et al., 2010). Other studies in African countries have found that dispensing antibiotics without a prescription was a prevalent practice in community pharmacies (Hounsa & De Mol, 2009; Mukonzo et al., 2013); and similar results have been reported in various European countries (Llor

& Cots, 2009; Plachouras et al., 2010). In Egypt, a study by Abdelaziz et al., (2019), examined antibiotic dispensing patterns in community pharmacies by using two simulated patient scenarios of viral respiratory tract infection requiring no antibiotic treatment to assess the actual antibiotics dispensing practice. The findings reported that 98.3% of pharmacy providers dispensed amoxicillin. Most pharmacy providers (63%) dispensed amoxicillin without asking the presenting simulated patients for more details. Results indicated that community pharmacies had significant rates of antibiotic misuse (Abdelaziz et al., 2019). Another study in Zambia reported that all pharmacy staff dispensed non-prescription antibiotics. The majority of them (97%) claimed that customers routinely asked for antibiotics without a prescription. They were frequently dispensed antibiotics including amoxicillin (52%), cotrimoxazole (25%) and metronidazole (23%). However, this study showed that 94% of pharmacy staff often asked about symptoms, 96% of them advised patients on dosage; and 97% of them offered other antibiotics (Kalungia, Burger, Godman, Costa, & Simuwelu, 2016).

In Saudi Arabia, a qualitative study by Mahmoud et al., (2018) showed that non-prescription antibiotics were common in community pharmacy. Community pharmacists have dispensed antibiotics without a prescription for common cold, cough, sore throat, tonsillitis, fever, and urinary tract infections. The growing public demand, financial reasons, advertising by pharmaceutical companies, pharmacy management, and time constraints were among the factors that led to dispense antibiotics without a prescription. However, pharmacists also stated that they did not dispense antibiotics without a prescription for serious conditions or individuals with an unclear medical history (Mahmoud et al., 2018). In Greece, a study by Plachouras et al., (2010) examined the dispensing of antibiotics in community pharmacies in Athens metropolitan region when pharmacies requested to dispense antibiotics without a prescription in 2008. According to this study, 174 pharmacies were contacted and asked for either dispense ciprofloxacin or amoxicillin/clavulanate acid without giving a prescription or any other supporting documentation. In Greece, fluoroquinolone prescriptions went into effect since 2003 in which the physician needs to fill out a special prescription form to explain the use of any fluoroquinolone. In every instance, amoxicillin/clavulanate acid was given out. Additionally, despite the law prohibiting the prescription of ciprofloxacin, 53% of pharmacies still dispensed this medication (Plachouras et al., 2010).

In Turkey, a study by Okuyan et al., (2017) conducted in 70 community pharmacies utilizing a stimulated patient scenario for a simple rhinosinusitis. This study found that 67.1% of pharmacists sent the fictitious patient to a doctor while 45.7% of them suggested other prescription regimens, including antibiotics. Fewer of pharmacists (25.7%) inquired about the duration of the patient's symptoms. Only 15.7% of pharmacists took a history of the patient's prescriptions for chronic illnesses, while the majority of pharmacists (82.9%) did not inquire about the patient's presence of any chronic diseases. Just 18.6% of the pharmacists inquired about the signs and symptoms of the stimulated patients. While 70.0% of them inquired whether there was a fever. However, only 21.4% of the pharmacists inquired about the therapy of the patient's rhinosinusitis prior to their visit to the community pharmacy (Okuyan, Savan, Izzettin, & Sancar, 2017).

Community pharmacists are generally demonstrated acceptable awareness regarding the consequences of non-prescription antibiotics, and they all recognized this as a significant public health concern (Gebretekle & Serbessa, 2016; Hadi et al., 2016; Roque et al., 2013; Roque et al., 2016). This may have an impact on the effectiveness of antibiotics and leading to treatment failure and increasing antibiotic resistance (Hadi et al., 2016). According to Dillip and colleagues, the majority of pharmacists believed that their locations served as a venue for clients to get medical services and equipment, which encourages them to provide customers with antibiotics (Dillip et al., 2015). However, it has been noted that pharmacists at community pharmacies dispense antibiotics without first obtaining a thorough medical or drug history from patients, and they also provide patients insufficient information about the medications they are taking (Okuyan et al., 2017). Another research from Spain reported that patient satisfaction is prioritized over possible antibiotic stewardship, and pharmacists chose to dispense antibiotics despite their good perception of antibiotic stewardship (Zapata-Cachafeiro et al., 2014). Other studies reported that community pharmacists place the burden of customers to dispense non-prescription antibiotics regardless of their socioeconomic status (Dillip et al., 2015; Gebretekle & Serbessa, 2016). Community pharmacists also emphasized that those who had previously recovered by using antibiotics and believed that antibiotics are required for every illness or those couldn't afford to pay for medical consultations were often more interested in obtaining non-prescription antibiotics (Dillip et al., 2015; Gebretekle & Serbessa, 2016; Roque et al., 2015). Few researches also claimed that patients' satisfaction served as a driving force behind the decision of non-prescription dispensing of antibiotics (Roque et al., 2015; Roque et al., 2013). Studies also reported that community pharmacy believed that stop

dispensing antibiotics may affect their sales and profit negatively, which may lead to stockpiling of expensive medications (Dillip et al., 2015; Gebretekle & Serbessa, 2016; Shet, Sundaresan, & Forsberg, 2015).

From the above literature, it indicates that community pharmacies frequently dispense antibiotics without a prescription, which contributes to the misuse and overuse of antibiotics (Plachouras et al., 2010). Inappropriate use of antibiotics is one of the key factors contributing to the rise of antibiotic resistance and that all medical professionals should apply common sense and avoid prescribing and dispensing antibiotics unnecessarily. It will be crucial to close these gaps and enhance community pharmacists' antibiotic stewardship practices through the development of tailored interventions (Sarwar, Saqib, Iftikhar, & Sadiq, 2018).

#### 2.2 The role of pharmacists in antibiotic stewardship

Pharmacy's contribution to patient care is quite limited in developing countries (M'Aiber et al., 2022). However, in developed countries, the role of pharmacists has increased to offer a variety of services to patients, leading to enhanced patient care relating to health outcomes and lowering health care costs. Success examples of initiatives led by pharmacists in the fight against Antibiotic Resistance (ABR) show that this problem may be solved with the help of adequately educated pharmacists (Sakeena, Bennett, & McLachlan, 2018). In Iraq, there were signs of inappropriate use of antibiotics by healthcare professionals, as well as ineffective prevention efforts that allowed resistant bacteria to spread quickly (M'Aiber et al., 2022). Recent studies conducted in various developing countries examined community pharmacists' knowledge of antibiotics and their perceptions and practices regarding antibiotic stewardship (Rehman et al., 2018; Sarwar et al., 2018; Waseem et al., 2019). The findings demonstrated that pharmacists had good knowledge about antibiotics when the majority of them (84.5%) knew that antibiotics are indicated for bacterial infections and around 30% knew that antibiotics kill the normal flora of the human body. On the other hand, 37.8% of pharmacists knew that antibiotics are not indicated for viral infections. All pharmacists had a strong sense of obligation to play a significant part in infection-control and (Antibiotic Stewardship) ABS initiatives inside the healthcare system; and they perceived that healthcare professionals other than prescribers need to comprehend ABS. However, 78% of pharmacists agreed that AMS should be implemented at the level of community pharmacies; and AMS program could be useful for health care professionals for enhancement of patient care. While 87.8% of pharmacists reported that they seldom or never took part in AMS awareness campaigns. Male gender, age of 20 to 29 years, and experience of less than one year were all associated to bad AMS practices. However, there were some gaps in perceptions and practices of community pharmacists regarding antibiotic stewardship (Sarwar et al., 2018). Adequate knowledge of antibiotics that pharmacists learn during years of experiences can be linked to their information about antibiotic resistance (Jamshed et al., 2018). Another study reported that the most community pharmacists were unaware of ABR, antibiotic stewardship programs, and guidelines. However, all of the pharmacists firmly agreed that various appropriate strategies should be implemented to minimize the future consumption of antibiotics. The findings also showed that community pharmacists irrational dispensing and overusing of antibiotics are common in community pharmacies (Saleem, Hassali, Hashmi, Godman, & Saleem, 2019).

In Australia, a study was carried out among community pharmacists to investigate their perceptions and practices regarding antibiotic stewardship in Tasmania. The majority of pharmacists (86%) claimed to have advised patients on side effects, medication interactions (94%), and allergy (96%). However, 43% of pharmacists communicated with the prescribers about the choice of antibiotics. The engagement of community pharmacists in ABS has been significantly constrained by a number of factors, including a lack of training, no access to patient's record, insufficient interactions with the prescribers, and the unavailability of a reimbursement plan (Rizvi, Thompson, Williams, & Zaidi, 2018). To coordinate and optimize the use of medications among healthcare professionals, patients, and the general public, practicing pharmacists can play a crucial role in the proper use of antibiotics (Sakeena et al., 2018).

#### 2.3 Knowledge, attitude and practice regarding antibiotic use and resistance

Since antibiotic resistance spreads throughout all the countries, it seemed relevant to evaluate the level of knowledge about appropriate use of antibiotics and causes of antibiotic resistance in community. Several studies have been conducted to evaluate the knowledge, attitude and practice regarding antibiotics in general public, but little is known about this issue in community pharmacy. A study by Darwish et al, (2014) investigated the awareness of antibiotic use and resistance among Iraqi people residing in Jordon. This study found that people strongly supported obtaining antibiotics without a prescription (62%), getting antibiotics from friends or family (29%), and using leftover antibiotics for similar symptoms (46%). However, 90% of them identified viral infections as a reason using antibiotics, and 60% disagreed with

discontinuing an antibiotic treatment. Only 44 % of individuals followed doctors' instructions about antibiotic usage; and almost 50 % of them indicated that pharmacists always provide instructions on using antibiotics, whereas 29% of them believed that doctors did so. Law enforcement to impose access restrictions is a crucial aspect of combating antibiotic misuse (Darwish, Abdelmalek, Dayyih, & Hamadi, 2014). A study in Pakistan was carried out to evaluate the knowledge and practice of pharmacists regarding antibiotic resistance showed that 87.8% of pharmacists agreed that they should be trained on the use of antibiotics; and around 80% of them believed that antibiotic stewardship is important for improving patient care. Concerning the practice, 39.8% of pharmacists frequently make steps to prevent or decrease the transmission of infections within the community, and only 32% of them did not dispense antibiotic without a prescription. Similarly, 32% of pharmacists speak to the doctor if they were confused about the appropriateness of an antibiotic prescription. Pharmacists should play a significant role in antibiotic stewardship by improving their knowledge and continuing professional training programs in accordance with current standards guidelines (Rehman et al., 2018). Another study also found that more than half of pharmacy staff (55.6%) had poor knowledge about antibiotic resistance; and 74.4% of them dispensed antibiotics without a prescription based on patient's request. In addition, only one-fourth of the community pharmacy staff knew that antibiotics cannot be used for viral infections such as common cold and flu. This study highlighted a gap in knowledge and attitude regarding antibiotic resistance among community pharmacy staff (Waseem et al., 2019).

In Saudi Arabia, a study by Hadi et al, (2016) was carried out to assess the community pharmacists' knowledge, attitude, and practice regarding the dispensing

of antibiotics without a prescription. Community pharmacists have a poor awareness of the legislation that ban the non-prescription sale of antibiotics. This lack of awareness among community pharmacists may contribute to the high incidence of non-prescription sale of antibiotics. It was reported that 70.5% of pharmacists were unaware that dispensing antibiotics without a prescription is a prohibited and 55% of them believed that this practice is common in community pharmacy in Saudi Arabia. In addition, around 77% of pharmacists were knowledgeable that non-prescription sale of antibiotics is leading to irrational antibiotic usage and 85.2% of them knew that this will contribute to resistance development. With regard to attitude, 78.3% of pharmacists said that pharmacies should stop dispensing antibiotics without a prescription, while 93.7% of them stated that they advised patients to visit a doctor before receiving antibiotics. Regarding the practice, 76.9% of pharmacists said they always asked the patient about medication allergies and 70.4% for renal condition before dispensing antibiotic. Furthermore, 88.9% of pharmacists reported informing patients about the importance of completing the course of antibiotics, and 81% reported that they asked the patients if they were currently using other medications for the same health problem before dispensing antibiotics (Hadi et al., 2016). Another study in Hungary found that pharmacists have good knowledge about antibiotics and antibiotic treatment, and they are aware of the growing antibiotic resistance effects on public health. It was reported that 25% of pharmacists dispensed antibiotics without a prescription at least once in the previous year. It was also shown that the age and the presence of specialist pharmacists had significant influence on self-perceived knowledge and professional attitudes (Gajdács, Paulik, & Szabó, 2020).

In Syria, a study was conducted on community pharmacies showed that 85.5% of antibiotics were dispensed without a prescription. Less than one-third of them (30.8%) had a positive attitude, and only 37% had good knowledge about antibiotic resistance. In addition, age, years of experience, the pharmacy's setting, and the number of customers were significantly associated with positive attitude.

With regard to antibiotic resistance, approximately 50% of community pharmacists have a negative attitude and limited knowledge which highlights the necessity for awareness-raising efforts to prepare community pharmacists taking active role in their community (Mansour & Al-Kayali, 2017). In Sri Lanka, a study was conducted among community pharmacy staff to assess their knowledge about antibiotics and their dispensing practice. This study showed that around quarter of the community pharmacists (24%) and only 2% of the pharmacy assistants correctly defined antibiotic resistance. In addition, 57% of community pharmacists knew that resistant bacteria can spread in healthcare setting and in community; and 34% of them knew that antibiotic resistance occurred as a result of dispensing antibiotic shorter than the recommended course. However, 44% of the pharmacists and 47% of the pharmacy assistants did not know that viral infections cannot be treated by antibiotics. With regard to dispensing practice, 30% of pharmacy staff dispensed antibiotics without a prescription for various infections including acute sore throat, common cold, diarrhoea, wound infections, or UTI in a week prior to the survey. There was no significant difference between pharmacists and pharmacy assistant in the dispensing practice of antibiotics. While pharmacy assistants were more likely to dispense antibiotics without a prescription comparing to pharmacists (Zawahir, Lekamwasam, & Aslani, 2019).

To minimize the practice-knowledge gap and enhance antibiotic dispensing practices in community pharmacies, it is necessary to enforce the laws restricting the use of antibiotics and to conduct education or awareness campaigns regarding antibiotic misuse (Abdelaziz et al., 2019). Antibiotic prescribing practices in developing countries are often inappropriate and illegal due to a lack of knowledge about antibiotics, antibiotic resistance, and legal considerations (Apisarnthanarak, Tunpornchai, Tanawitt, & Mundy, 2008; Barker, Brown, Ahsan, Sengupta, & Safdar, 2017; Hadi et al., 2016). Consequently, knowledge of antibiotics use and resistance, and supply regulation has a substantial influence on their dispensing practice (Zawahir et al., 2019). The limited knowledge and poor attitudes of the pharmacists require urgent efforts for ongoing awareness initiatives both on community pharmacists and the general public. It is crucial to train pharmacy staff members about the risks of antibiotic resistance and to enhance their contribution to minimizing the prevalence of resistance (Hoxha et al., 2018; Mansour & Al-Kayali, 2017). These difficulties must be tackled by pharmacists to make sure that antibiotics are taken appropriately in public, even through self-medication (Mansour & Al-Kayali, 2017). Healthcare professional especially pharmacists should receive proper training in antibiotics and antibiotic resistance. As a result, they will facilitate an educational program rather than taking part in it (Irawati, Hassali, & Saleem, 2015).

#### 2.4 Interventions to improve antibiotic use in the community

The complexity and variety of the outpatient setting presents difficulties for community stewardship programs. To date, efforts have primarily focused on developing treatment guidelines and educating the general public about how antibiotics should be used (Klepser, Adams, & Klepser, 2015). The healthcare system can benefits from looking into how community pharmacists who are available to the general public might contribute to improve antibiotic stewardship efforts, particularly with regard to upper respiratory infections (Erku & Mersha, 2017). Collaboration between doctors and community pharmacists may be appropriate since patients typically obtain symptomatic relief from over-the-counter medicines which are accessible in community pharmacy (Klepser et al., 2015). Several interventions have been implemented on community pharmacy included collaboration between physician and pharmacist based on collaborative practice agreements. These agreements making community pharmacists more independence in patient care by providing medication care and implementing antibiotic stewardship activities (Bishop et al., 2019). "Collaborative practice agreements" are a planned approach whereby a licensed clinician diagnoses patients, monitors their treatment, and recommends them to a pharmacist in accordance with a procedure that permits the pharmacist to carry out particular patient care tasks. Patient care tasks include vaccinations, pharmaceutical drug management services, collaborative drug management services, and chronic disease management for high cholesterol, diabetes, and hypertension (Klepser, 2016). In a previous study conducted at two healthcare centres, pharmacists who in collaborative practice agreements were responsible for managing positive cultures results which were requiring follow-up. In this case, a third of the prescriptions had changed by the assessing pharmacist. However, according to a research, 23% of patients who presented to the emergency room with a urinary tract infection were initially given the wrong antibiotic. In addition, 83% of these patients were reachable by an authorized pharmacist, who effectively modified the treatment plan in collaboration with the doctor (Lingenfelter et al., 2016).

On the other hand, "point-of-care testing" is another approach that can be utilized to guide treatment choices (Klepser, 2016). Currently, pharmacists do a wide range of point-of-care tests, including blood glucose, blood pressure, total cholesterol, HDL cholesterol, and triglyceride (Buss, Deeks, Shield, Kosari, & Naunton, 2019). Point of care testing is carried out to confirm or reject a diagnosis. When combined with collaborative practice agreements, these tests are useful in pharmacy-based antibiotic stewardship programs, especially for early diagnosis of certain disease result in more successful treatment. One study in 2012 was discovered that pharmacists could diagnose and treat pharyngitis more affordable than doctors by following the clinical guideline which recommended diagnosis through rapid antigen detection test (Klepser, Bisanz, & Klepser, 2012).

With regard to consultation role of pharmacist, pharmacists in community settings can take action to offer appropriate advise on the duration of antibiotics, emphasizing the necessity of not sharing antibiotics with others and gathering detailed medication history to ascertain how many medications that the patient is taking (Bishop et al., 2019). A team of researchers from Baylor College of Medicine found that antibiotic usage without a prescription is common in the United States. The findings showed that antibiotics were stored at home by 14.7% of participants and claimed to be used by 25.4% of them. Antibiotics can be obtained from retailers or pharmacies, purchased overseas, leftover prescription medicines, and received from family or friends. The most frequent indication for using non-prescription antibiotics was respiratory symptoms (Zoorob, Grigoryan, Nash, & Trautner, 2016). Another research by Angoulvant et al., (2013) found that parents' knowledge of antibiotic stewardship increased significantly as a result of a brief face-to-face session on antibiotic usage with a pharmacist (Angoulvant et al., 2013).