

Dispensing of Antibiotics without Prescription in Community Pharmacy in Baghdad, Iraq

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Abstract

This study aimed to evaluate the pattern of dispensing antibiotics without a prescription in a community pharmacy in Baghdad, as well as to understand the factors influencing the dispensing of antibiotics without a prescription. A cross-sectional study was conducted among community pharmacists to describe the dispensing of antibiotics in community pharmacies. The convenience sampling method was applied to select the required sample from a community pharmacy in Baghdad. A self-administered questionnaire was used to obtain the data from the participants. The majority of community pharmacists (94.2%) dispensed antibiotics without a prescription in their community pharmacy. Most of them (59.6%) reported that oral antibiotics were the most common form dispensed without a prescription. In addition, 23.6% of participants reported that they also dispensed parenteral antibiotics without a prescription. The highest percent of antibiotics dispensed without prescription were for UTIs (94.2%), sore throat (70.9%), and earache (70.3%). The most common dispensed antibiotics without prescription were Amoxicillin (96.9%), Amoxicillin/ Clavulanate (88.2%), Cephalexin (70.6%), Ceftriaxone (61.2%), Cefixime (67.7%), Ciprofloxacin (87.4%), Azithromycin (94.2%), and Metronidazole (85.6%). This study showed that community pharmacists were commonly dispensing antibiotics without a prescription at community pharmacies. Therefore, rigorous rules are needed to control the sale of antibiotics in community pharmacies.

Keywords: Antibiotics, Dispensing, Pattern, Prescription

INTRODUCTION

Dispensing of antibiotics without a prescription is a significant contributor to the inappropriate use of antibiotics that results in the emergence of antibiotic resistance [1]. The irrational use of antibiotics is a multifaceted problem that includes unnecessary and inappropriate antibiotic usage in terms of indication, improper dose, duration, and frequency; in addition to the overuse of broad-spectrum antibiotics which is considered the main cause of the emergence of antibiotic resistance on a worldwide [2]. Antibiotic resistance has been significantly related to the rise of uncontrolled sale of antibiotics [3, 4]. It is challenging to assess the total impact of antibiotic resistance, but in middle- and lower-income regions the non-prescription sale of antibiotics is always questioned [5-10]. Reports also showed that community pharmacists have acceptable knowledge of and perception relating to dispensing of non-prescription antibiotics, considering it to be a serious public health concern [5, 6, 9, 10]; which results in reducing antibiotic effectiveness and therapeutic failure [11]. However, other community pharmacists stated that patients who had previously taken antibiotics and thought it was needful for their illness, or who were unable to afford the doctor's consultation costs, were often more concerned about obtaining antibiotics [5, 9-11]. In addition, patient pressure is a significant contributor influencing physicians to prescribe antibiotics, especially for viral infections increasing the rates of antibiotic resistance

[12, 13]. In general, ineffective regulation, lack of pharmacist knowledge regarding infectious diseases, customer demand, the commercial impact of pharmacies, and financial incentives from pharmaceutical companies are the major contributors to the widespread dispensing of antibiotics without a prescription [6, 14, 15]. In Iraq, antibiotic usage is common among Iraqi people, especially during the winter season. Many people believe that the use of antibiotics can treat any respiratory infections, even those caused by viruses like cough and flu [16]. A study by Darwish *et al.* reported that 62% of Iraqis tend to use antibiotics without a doctor's prescription; and 29% of them agreed to use antibiotics based

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on suggestions from relatives and friends [17]. Antibiotics are dispensed at public hospitals and outpatient clinics in Iraq, as well as community pharmacies. Private hospitals do not have their pharmacies and their prescriptions are often dispensed by the nearer community pharmacies. There are no chain community pharmacies in Iraq; all community pharmacies are privately owned by licensed pharmacists as independent pharmacies [18]. Antibiotics are frequently dispensed without a prescription, even though this is not legally allowed. In addition, many community pharmacies have technician staff who commonly sell non-prescription antibiotics. In line, prescribing and using antibiotics in public are suboptimal and generally uncontrolled. On the other hand, community pharmacists should monitor the daily antibiotics dispensed; this is necessary to stop the inappropriate distribution of antibiotics in the private sector [16]. Besides, almost all community pharmacies, hospitals, and outpatient clinics in Iraq do not have electronic dispensing systems or electronic health records, and they continue to use paper-based prescriptions and records. As a result, there is a lack of annual statistical health data about antibiotic usage in Iraq. However, very few studies have been conducted on antibiotic usage at the community level.

MATERIALS AND METHODS

Study Design

A cross-sectional study was conducted to describe the pattern of antibiotics dispensed without a prescription in a community pharmacy in Baghdad, Iraq.

Sampling and Sample Size

A convenience sampling method was used to select the pharmacists from a community pharmacy in Baghdad, the capital city of Iraq. All community pharmacists in Baghdad were eligible to take part in this study. Community pharmacists who declined to participate were excluded from the study. Raosoft sample-size calculator was used to generate the required sample based on the total number of registered pharmacists in Baghdad which was 6220. The calculated sample size was 362 subjects. For the possibility of missing data or non-response, 20% was added to the sample size to be in total of 435 subjects.

Questionnaire Development

The questionnaire was developed based on relevant published studies on antibiotic dispensing in community pharmacy settings. After consulting experts in pharmacy practice, the questions were then reviewed and included in the questionnaire. A pretest assessment was carried out among five pharmacists to ensure the suitability of the questions and to obtain their suggestions for improving the questionnaire. The content validity of the questionnaire was assessed by two lecturers to ensure the measurement was related to the concept of the study. For the reliability of the questions, a pilot study was carried out to ensure the inter-correlation between questions and the feasibility of data collection. The

participants who were included in the pilot study were excluded from the main study. The final version of the questionnaire included two parts including demographic characteristics of participants and the pattern of dispensing of antibiotics.

Data Collection

A self-administered questionnaire was used to obtain the data from community pharmacists throughout their working hours at the community pharmacy. Before any data collection, all participants were informed of the study's purpose in order to get their verbal consent for participation in the survey.

Data Analysis

The data was analyzed using the Statistical Package for Social Sciences (SPSS) program version 18.0 and relevant descriptive and inferential statistics tests. A bar chart was used to explain the distribution of participants' responses. The chi-square test was computed to find the association between variables. All statistical calculations were done with a 95% confidence level and an alpha level of 0.05.

RESULTS AND DISCUSSION

Demographic Characteristics of the Participants

Out of 435 community pharmacies visited 381 community pharmacists successfully participated in the survey, giving a response rate of 87.85%. From **Table 1**, the socio-demographic characteristics of the participants showed that 73% of the participants were from the age group of under 31 years. More than half of the participants were male (55.9%), whereas 44.1% of them were female. The majority of the participants (86.6%) had a bachelor's degree in pharmacy and 1.8% of them had completed their postgraduate studies, whereas 5.8% of them had a diploma in pharmacy and 5.8% had other degrees. The majority of participants' positions were pharmacists (88.5%); while 11.5% of them were assistant pharmacists. Related to the experience years of the participants in community pharmacy, 31.8% of them have less than three years of experience, and 32.5% of them have 3-5 years of experience in community pharmacy. In addition, 56.7% of the participants were working in a medical complex pharmacy and 43.3% of them were working in an independent pharmacy.

Table 1. Socio-demographic characteristics of the participants

	Variable	N (%)
Age	Mean±(SD)	30.82±(8.37)
	Median	28.0
Gender	Male	213 (55.9)
	Female	168 (44.1)
Education	Diploma of pharmacy	22 (5.8)
	B.Sc of pharmacy	330 (86.6)
	Postgraduate (MSc or Ph.D)	7 (1.8)

	Others	22 (5.8)
Position	Pharmacist	337 (88.5)
	Assistant pharmacist (non-pharmacist)	44 (11.5)
Years of experience	< 3 years	121 (31.8)
	3 – 5 years	124 (32.5)
	6 – 10 years	70 (18.4)
	> 10 years	66 (17.3)
Type of pharmacy	Medical complex pharmacy	216 (56.7)
	Independent pharmacy	165 (43.3)

Dispensing of Antibiotics in Community Pharmacy

The participants were asked whether they dispensed antibiotics without a prescription or not in their community pharmacy, the majority of the participants (n=359, 94.2%) dispensed antibiotics without a prescription in their community pharmacy, and only 22 (5.8%) did not dispense antibiotics without prescription. **Figure 1** shows the distribution of dispensing of antibiotics without prescription.

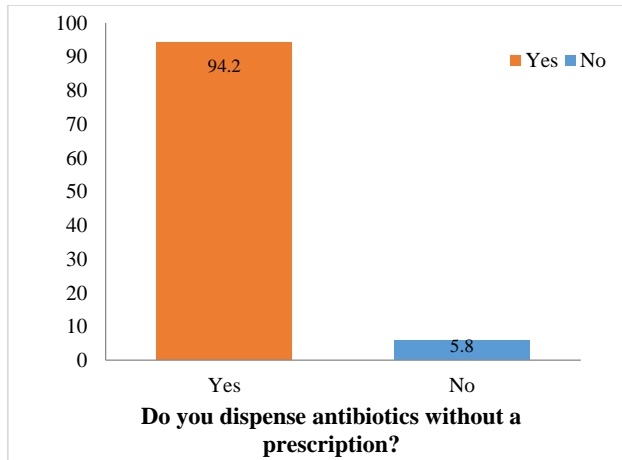


Figure 1. Dispensing of antibiotics without a prescription

From **Table 2**, dispensing of antibiotics without a prescription was statistically associated with older age groups and more experienced years. Participants from younger age groups and fewer years of experience do not dispense antibiotics without a prescription. However, there was no association between gender, qualification, position, and type of pharmacy relating to the dispensing of antibiotics without a prescription.

Table 2. Dispensing of antibiotics without prescription

Dispensing of antibiotics without prescription		Yes (N=359) 94.2%	No (N= 22) 5.8%	P-value
Age group	≤30	96.0	4.0	0.000 *
	31-40	77.1	22.9	

Gender	≥41	100	0	0.660
	Male	94.8	5.2	
Qualification	Female	93.5	6.5	0.307
	Diploma of pharmacy	100	0	
	B.Sc of pharmacy	93.3	6.7	
	Postgraduate (MSc or Ph.D)	100	0	
Position	Others	100	0	0.092
	Pharmacist	93.5	6.5	
Years of experience	Assistant pharmacist (non-pharmacist)	100	0	0.000*
	< 3 years	83.3	16.7	
	3 – 5 years	91.1	8.9	
	6 – 10 years	100	0	
Type of pharmacy	> 10 years	100	0	0.516
	Medical complex pharmacy	94.9	5.1	
	Independent pharmacy	93.3	6.7	

Forms of Antibiotics Dispensed Without Prescription

Most of the participants (59.6%, n=227) reported that oral antibiotics (tablet, capsule, and suspension) were the most common forms dispensed without prescription in their community pharmacy. Whereas dispensing of topical antibiotics (47.2%, n=180) and drop antibiotics (35.2%, n=134) were also frequently dispensed without a prescription. In addition, 23.6% (n=90) of participants reported that the dispensing of parenteral antibiotics without a prescription was common in their community pharmacy. **Figure 2** shows the most common dosage form dispensed without a prescription in community pharmacy.

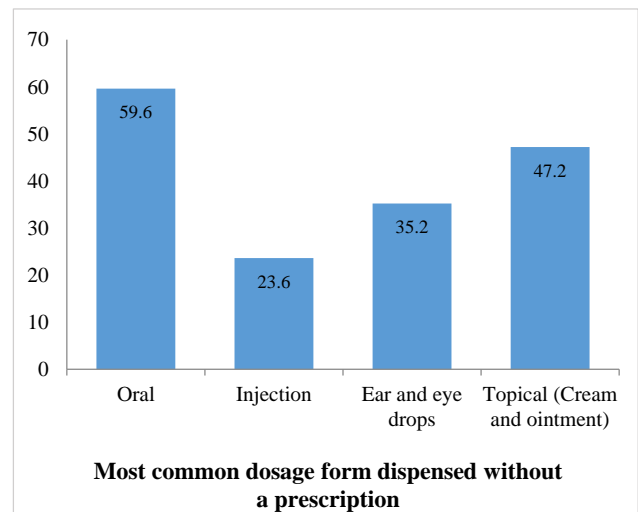


Figure 2. The most common dosage form dispensed without a prescription in community pharmacy

Dispensing of Antibiotics Without Prescription Based on Medical Conditions

From **Table 3**, the participants showed that antibiotics were dispensed without prescription for various medical conditions. The highest percent of antibiotics were dispensed without prescription for UTIs (94.2%), sore throat (70.9%), and earache (70.3%) conditions. On the other hand, other participants were also dispensed antibiotics without prescription for viral infections such as common cold or flu (34.9%).

Table 3. Dispensing of antibiotics without prescription based on medical conditions

Medical condition	N (%)
Cold or Flu	133 (34.9)
Sore throat	270 (70.9)
Diarrhea	167 (43.8)
Toothache	210 (55.1)
Otitis media	268 (70.3)
UTIs	359 (94.2)
Skin infections	227 (59.6)

Types of Antibiotics Dispensed Without Prescription

From **Table 4**, the most dispensed antibiotics without prescription in the community pharmacy were Amoxicillin (96.9%) Amoxicillin/ Clavulanate (88.2%), Cephalexin (70.6%), Ceftriaxone (61.2%), Cefixime (67.7%), Ciprofloxacin (87.4%), Azithromycin (94.2%), and Metronidazole (85.6%). However, participants showed that other antibiotics were also dispensed without a prescription in their community pharmacy.

Table 4. Most common antibiotics dispensed without a prescription

Class of antibiotics	Antibiotics	N (%)
Beta lactam ^a	Ampicillin	122 (32.0)
	Amoxicillin	369 (96.9)
	Amoxicillin/Clavulanate	336 (88.2)
	Cephalexin	269 (70.6)
	Cefuroxime	143 (37.5)
Cephalosporins	Cefotaxime	101 (26.5)
	Ceftriaxone	233 (61.2)
	Cefixime	258 (67.7)
Aminoglycoside	Gentamycin	200 (52.5)
	Amikacin	156 (40.9)
Tetracycline	Doxycycline	167 (43.8)
	Tetracycline	145 (38.1)
Quinolones	Ciprofloxacin	333 (87.4)

Macrolides	Levofloxacin	222 (58.3)
	Erythromycin	121 (31.8)
	Azithromycin	359 (94.2)
Other antibacterials	Metronidazole	326 (85.6)
	Trimethoprim	181 (47.5)

The majority of community pharmacists dispense antibiotics without a prescription by ignoring the rules and regulations of dispensing antibiotics in their community pharmacy. Recent studies reported similar findings that dispensing antibiotics without a prescription was highly prevalent in community pharmacies [6, 19, 20]. A study by Feng *et al.* demonstrated that almost half of the pharmacists agreed to sell antibiotics to patients without a prescription [19]. Another study showed that pharmacists who reported knowing the restrictions of the dispensing of antibiotics with a prescription, as well as being aware of antibiotic use and resistance were less inclined to dispense antibiotics without a prescription [21]. A study in Saudi Arabia indicated that 55% of community pharmacists assumed that dispensing antibiotics without a prescription is a widespread behavior in community pharmacies; even though the majority of them were aware that dispensing antibiotics without a prescription leadsto misuse of antibiotics and the emergence of antibiotic resistance [6]. Lack of implementing the national regulations may be the cause of the high observed percentage of non-prescription sales of antibiotics [22, 23]. In addition, community pharmacists may dispense antibiotics without a prescription due to their desire for financial gain and business goals [6]; in addition to the stock buildup of pricey medications [5]. Therefore, estimate the number of antibiotics that are often prescribed in community pharmacies in order to improve the use of antibiotics [24]. Furthermore, more researches are needed in relation to the financial advantages and the current dispensing practice of antibiotics in community pharmacies [25].

With regard to the dosage form dispensed without a prescription, this study reported that oral antibiotics (tablet, capsule, and suspension) were the most common dosage forms dispensed without a prescription in their community pharmacy. A study in Saudi Arabia reported a similar finding that around 86% of antibiotics dispensed without a prescription were oral dosage forms [6]. Whereas dispensing of topical antibiotics (47.2%) and drop antibiotics (35.2%) was also common in the community pharmacy. In addition, 23.6% of participants reported that dispensing parenteral antibiotics without a prescription was common in their community pharmacy.

This study also showed that a high percentage of community pharmacies dispensed antibiotics without prescription for UTIs (94.2%), sore throat (70.9%), and earache (70.3%) conditions. On the other hand, other participants were also dispensed antibiotics without prescription for viral infections such as common cold or flu (34.9%). A similar finding was

reported by a study in Portugal which reported that community pharmacists dispense antibiotics to their patients suffering from urinary tract infections and tooth infections because they believe that physicians will prescribe the same antibiotic for such conditions [9]. However, dispensers are driven to increase antibiotic sales in order to increase profits. This puts the sustainability of this business model into question in light of multiple antibiotic stewardship initiatives and law enforcement [26]. This study indicated that pharmacists' behavior contributed to the irrational dispensing of antibiotics. The lack of clinical experience and knowledge about antibiotic resistance may increase the non-prescription dispensing of antibiotics. There may be additional factors that account for the dispensing of antibiotics including public pressure to supply antibiotics, profit incentives, lack of legal requirements related to antibiotic supply, poor regulatory law enforcement, lack of awareness of antibiotic dispensing laws, and the possibility of losing customers [6].

With regard to the most dispensed antibiotics without prescription in community pharmacy, amoxicillin and amoxicillin/clavulanate, ciprofloxacin, cephalexin, ceftriaxone and cefixime, and azithromycin were frequently dispensed without a prescription. This is in agreement with other studies that showed that Beta-lactam antibiotics, including penicillins and cephalosporins, were the most frequently dispensed antibiotics at community pharmacies [27]. High rates of beta-lactam antibiotic dispensing were a factor in the rising incidence rates of bacteria that produce beta-lactamase [28].

Limitations

This study has several limitations. The pattern of dispensing antibiotics without a prescription is based on the common antibiotics class dispensed in community pharmacies; no information was obtained about the dose and duration of dispensed antibiotics. So this study cannot assess the defined daily dose according to per antibiotic dispensed. In addition, this study focused on the most common antibiotics dispensed without a prescription for medical conditions presented in community pharmacies. The high percentage of antibiotics dispensed without a prescription may not reflect the actual number of antibiotics dispensed for other medical conditions.

CONCLUSION

This study showed that community pharmacists commonly dispense antibiotics without a prescription at a community pharmacy in Baghdad, Iraq. Therefore, rigorous rules are needed to control the sale of antibiotics in community pharmacies. Community pharmacists were either ignored or misinformed of the rules and laws that restricted the sale of antibiotics without a prescription. Ignorance may be the cause of the high rates of irrational dispensing of antibiotics. Initiatives that focus on education should be created to motivate community pharmacists to adhere to professional norms. Furthermore, expanding access to affordable healthcare in Iraq may reduce the prevalence of irrational

dispensing of antibiotics and self-medication, which will minimize the occurrence of antibiotic resistance in the country.

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REFERENCES

- Goossens H, Ferech M, Vander Stichele R, Elseviers M; ESAC Project Group. Outpatient antibiotic use in Europe and association with resistance: A cross-national database study. *Lancet*. 2005;365(9459):579-87.
- Tenover FC. Mechanisms of antimicrobial resistance in bacteria. *Am J Med*. 2006;119(6 Suppl 1):S3-10.
- Jamshed S, Padzil F, Shamsudin SH, Bux SH, Jamaluddin AA, Bhagavathula AS, et al. Antibiotic Stewardship in community pharmacies: A scoping review. *Pharmacy (Basel)*. 2018;6(3):92.
- Ventola CL. The antibiotic resistance crisis: Part 1: Causes and threats. *Pharm Ther*. 2015;40(4):277-83.
- Gebretekle GB, Serbessa MK. Exploration of over the counter sales of antibiotics in community pharmacies of Addis Ababa, Ethiopia: Pharmacy professionals' perspective. *Antimicrob Resist Infect Control*. 2016;5(1):2.
- Hadi MA, Karami NA, Al-Muwalid AS, Al-Otobi A, Al-Subahi E, Bamomen A, et al. Community pharmacists' knowledge, attitude, and practices towards dispensing antibiotics without prescription (DAWP): A cross-sectional survey in Makkah Province, Saudi Arabia. *Int J Infect Dis*. 2016;47:95-100.
- Zapata-Cachafeiro M, González-González C, Vázquez-Lago JM, López-Vázquez P, López-Durán A, Smyth E, et al. Determinants of antibiotic dispensing without a medical prescription: A cross-sectional study in the north of Spain. *J Antimicrob Chemother*. 2014;69(11):3156-60.
- Almaaytah A, Mukattash TL, Hajaj J. Dispensing of non-prescribed antibiotics in Jordan. *Patient prefer adherence*. 2015;1389-95.
- Roque F, Soares S, Breitenfeld L, López-Durán A, Figueiras A, Herdeiro MT. Attitudes of community pharmacists to antibiotic dispensing and microbial resistance: A qualitative study in Portugal. *Int J Clin Pharm*. 2013;35(3):417-24.
- Roque F, Soares S, Breitenfeld L, Figueiras A, Herdeiro MT. Influence of community pharmacists' attitudes on antibiotic dispensing behavior: A cross-sectional study in Portugal. *Clin Ther*. 2015;37(1):168-77.
- Dillip A, Embrey M, Shekalaghe E, Ross-Degnan D, Vialle-Valentin C, Kimatta S, et al. What motivates antibiotic dispensing in accredited drug dispensing outlets in Tanzania? A qualitative study. *Antimicrob Resist Infect Control*. 2015;4(1):1-8.
- Saleem Z, Hassali MA, Hashmi FK, Godman B, Saleem F. Antimicrobial dispensing practices and determinants of antimicrobial resistance: A qualitative study among community pharmacists in Pakistan. *Fam Med Community Health*. 2019;7(3):e000138.
- Llor C, Bjerrum L. Antimicrobial resistance: Risk associated with antibiotic overuse and initiatives to reduce the problem. *Ther Adv Drug Saf*. 2014;5(6):229-41.
- Mbonye AK, Buregyeya E, Rutebemberwa E, Clarke SE, Lal S, Hansen KS, et al. Prescription for antibiotics at drug shops and strategies to improve quality of care and patient safety: A cross-sectional survey in the private sector in Uganda. *BMJ Open*. 2016;6(3):e010632.
- Hoxha I, Malaj A, Kraja B, Bino S, Oluka M, Marković-Peković V, et al. Are pharmacists' good knowledge and awareness on antibiotics taken for granted? The situation in Albania and future implications across countries. *J Glob Antimicrob Resist*. 2018;13:240-5.
- Al-Jumaili AA, Hussein AH, Al-Rekabi MD, Raheem SA, Ernst EJ. Antimicrobial utilization in an Iraqi province: A comprehensive

- evaluation of antibiotic source and cost. *Int J Pharm Pract.* 2017;25(1):81-8.
17. Darwish DA, Abdelmalek S, Dayyih WA, Hamadi S. Awareness of antibiotic use and antimicrobial resistance in the Iraqi community in Jordan. *J Infect Dev Ctries.* 2014;8(05):616-23.
 18. Al-Jumaili AA, Hussain SA, Sorofman B. Pharmacy in Iraq: History, current status, and future directions. *Am J Health-Syst Pharm.* 2013;70(4):368-72.
 19. Feng Z, Hayat K, Huang Z, Shi L, Li P, Xiang C, et al. Knowledge, attitude, and practices of community pharmacy staff toward antimicrobial stewardship programs: A cross-sectional study from Northeastern China. *Expert Rev Anti-Infect Ther.* 2021;19(4):529-36.
 20. Asghar S, Atif M, Mushtaq I, Malik I, Hayat K. Factors associated with inappropriate dispensing of antibiotics among non-pharmacist pharmacy workers. *Res Soc Adm Pharm.* 2020;16(6):805-11.
 21. Zawahir S, Lekamwasam S, Aslani P. A cross-sectional national survey of community pharmacy staff: Knowledge and antibiotic provision. *PloS one.* 2019;14(4):e0215484.
 22. Farah R, Lahoud N, Salameh P, Saleh N. Antibiotic dispensation by Lebanese pharmacists: A comparison of higher and lower socio-economic levels. *J Infect Public Health.* 2015;8(1):37-46.
 23. Mansour O, Al-Kayali R. Community pharmacists' role in controlling bacterial antibiotic resistance in Aleppo, Syria. *Iran J Pharm Res.* 2017;16(4):1612-20.
 24. Khan MU, Hassali MA, Ahmad A, Elkalmi RM, Zaidi ST, Dhingra S. Perceptions and practices of community pharmacists towards antimicrobial stewardship in the State of Selangor, Malaysia. *PLoS One.* 2016;11(2):e0149623.
 25. Sarwar MR, Saqib A, Iftikhar S, Sadiq T. Knowledge of community pharmacists about antibiotics, and their perceptions and practices regarding antimicrobial stewardship: A cross-sectional study in Punjab, Pakistan. *Infect Drug Resist.* 2018;11:133-45.
 26. Outtersson K. New business models for sustainable antibiotics. Centre on Global Health Security Working Group Papers, Chatham House (The Royal Institute of International Affairs), Working Groups on Antimicrobial Resistance, Paper. 2014;1:10-4.
 27. AlRukban M, AlRuthia Y, Almasaoud M, Al-Owairdhi M, Alsouan A, Alrabiah A, et al. Community pharmacists' views of the enforced antibiotics dispensing law and its impact on oral antibiotics sales in Saudi Arabia. *Risk Manag Healthc Policy.* 2020;13:2899-907.
 28. Aly M, Balkhy HH. The prevalence of antimicrobial resistance in clinical isolates from Gulf Corporation Council countries. *Antimicrob Resist Infect Control.* 2012;1(1):26.