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Assessment of community pharmacists' knowledge, barriers, and practices in detecting antibiotic prescribing errors in Erbil city

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Abstract

Background and objective: Antibiotic prescribing errors are one of the major contributors to antimicrobial resistance and treatment failure, especially in low-resource places like Erbil, Iraq. This study sought to assess community pharmacists' knowledge in detecting antibiotic prescribing errors, identify the most common types of errors encountered in practice, and explore key barriers that hinder error detection and prevention.

Methods: A cross-sectional study was conducted in community pharmacies in Erbil city between November 2024 and March 2025. A structured, self-administered questionnaire was used to collect data from 342 pharmacists selected via convenience sampling. The questionnaire assessed demographics, knowledge, factors that affect prescription errors detection, and types of prescription errors in antibiotics prescription.

Results: Data from 342 graduated pharmacists indicated that the workforce is predominantly young, with 74.4% under the age of 30, and largely female (66.8%). The majority were employed in private pharmacies. Only 7.9% demonstrated high knowledge scores regarding antibiotic prescribing errors, the most commonly incorrect responses were related to dosage-related questions. Additionally, 31.2% of participants had received training in antimicrobial stewardship. Statistical analysis showed a significant association between knowledge level and belief in the effectiveness of automated prescribing systems (P = 0.004). A higher proportion of older pharmacists were found in the high knowledge category.

Conclusion: The study highlights significant knowledge gaps and limited formal training among community pharmacists regarding antibiotic prescribing errors. Strengthening pharmacist education and implementing structured antibiotic stewardship programs are essential to improving prescribing safety and reducing antimicrobial resistance

Keywords: Antibiotic prescribing errors, Community pharmacists, Antimicrobial resistance.

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Introduction

Medication errors, especially those involving antibiotics, pose a serious risk to patients' safety and public health worldwide. Prescription error, which is a type of medication error, occurs when the selected antibiotics, dosage, route, or duration is inappropriate for the patient's condition (1). Antibiotics are particularly problematic in this context due to their widespread use and risk of resistance (2). Mostly Inappropriate prescribing practices makes Antimicrobial resistance (AMR) as one of the top ten global public health issues as classified by World Health Organization (WHO) (3).

Gaps in prescriber knowledge, poor patient assessment, deviation from guidelines, and technical problems such as illegible handwriting are multiple factors that contribute to prescribing errors. These errors can lead to adverse reactions, prolonged illness, or treatment failure. In low- and middle-income countries (LMICs) like Iraq, the situation is worsen by limited regulatory enforcement, underutilization of pharmacist knowledge, and insufficient inter-professional collaboration (4, 5).

Inappropriate antibiotic prescribing worsens resistance development and increases healthcare costs, duration of hospitalization, and mortality. A recent multicenter survey in Kurdistan found that 65% of inpatients were on antibiotics and often given empirically. Most prescriptions fell into the WHO Watch group, reflecting high load of prescription are broad-spectrum antibiotics and weak stewardship toward antibiotics use (6).

In Erbil and the broader Kurdistan region, another risk factors such as self-medication, over-the-counter antibiotic sales in pharmacies, and lack of prescription review by pharmacist further worsen the issue (7). Community pharmacists well-placed to counter such errors as accessible healthcare professionals. Their responsibilities can include reviewing prescriptions, identifying contraindications, educating patients, and reporting errors (8-10). However, limited authority, heavy workload, and lower communication with prescribers are barriers that reduce their ability to make this role effective (11, 12).

Computerized order entry systems (COES) and pharmacist-led stewardship programs is used to prevent errors in developed countries. They have implemented these interventions but such measures are lacking in Erbil. They are engulfed by persistent medication safety challenges such as Technological gaps, poor enforcement, and high rates of handwritten prescriptions which contribute to the issue (13, 14). Despite international evidence supporting pharmacists' impact in reducing prescription errors, their role in

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Erbil remains underexplored and underutilized (15, 16).

Given these concerns, it is mandatory to assess the capacity of community pharmacists in Erbil to detect antibiotic prescribing errors. This study aims to assess pharmacists' knowledge, identify common types of antibiotic prescribing errors encountered by pharmacists in community practice, and explore the key barriers that limit their role in detecting prescribing errors.

Subject and Methods

Design of the Study

A descriptive cross-sectional study was conducted to assess the ability of community pharmacists to detect antibiotic prescription errors.

Setting of the Study

The study took place in licensed community pharmacies located in the Erbil city center, Kurdistan Region, Iraq.

Time of the Study

Data collection was carried out over a five-month period, from November 2024 to March 2025.

Sample Size and Sampling Method

Using Epi Info version 7.2, the required sample size was calculated to be 316 pharmacists, assuming a 95% confidence level, 5% margin of error, and 50% expected frequency. To ensure adequate participation, 350 pharmacists were approached, and 342 completed questionnaires were included in the final analysis, only fully completed questionnaires were accepted for analysis. Convenience sampling was used. Eligible participants were licensed pharmacists with at least a Bachelor's degree in Pharmacy, actively practicing in pharmacies within Erbil city center. Pharmacy students, technicians, those working outside the city center, and incomplete questionnaires were excluded.

Data Collection

Data were gathered using a self-administered, paper-based questionnaire in English. The questionnaire was developed based on relevant literature and was reviewed by experts for content validity. A pilot test was also conducted with a small group of pharmacists to ensure clarity and relevance. Data from the pilot were not included in the final analysis. The questionnaire consisted of four sections. Section one collected demographic and background data (e.g., age, gender, education, pharmacy type, experience, employment status, prescription volume, and prior antibiotic stewardship training). Section two assessed knowledge of antibiotic prescription errors using 10 multiple-choice questions on topics like incorrect dosing, duplication, inappropriate duration, and viral infections. Correct answers received one point, and total scores were categorized as low (0–4), moderate (5–7), or high (8–10) based on

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thresholds adapted from a recent study (17). Section three explored commonly detected prescription errors—such as omissions, wrong doses, drug interactions, and allergies—via Yes/No questions. Section four identified perceived barriers through eight statements rated on a three-point Likert scale (Agree, Neutral, Disagree).

Data Analysis

Data were analyzed using SPSS version 26. Descriptive statistics were used to summarize findings. Chi-square tests assessed categorical variables associations, with statistical significance set at $p \leq 0.05$.Incomplete responses were excluded; thus, no missing data handling was required.

Ethical Consideration of the Study

The study was approved by the Ethics Committee of Hawler Medical University. verbal informed consent was obtained after explaining the study purpose and ensuring voluntary participation. All responses were anonymous, and confidentiality was fully maintained throughout data collection.

Results

A total of 342 community pharmacists participated in the study. The majority were under the age of 30 (74%), followed by those aged 30–45 (24%), and above 45 (2%). Most participants were female (66.4%) and single (51.5%). Regarding educational background, 92.4% held a bachelor's degree, while 7.6% had postgraduate qualifications.

Pharmacists primarily worked in private pharmacies (66.4%), with fewer in public pharmacies (33.6%). The majority had ≤10 years of experience (86.8%), and employment status was predominantly part-time (57.9%), followed by full-time (27.2%) and unemployed (14.9%). Only 31% had received antibiotic stewardship training as shown in Table 1.

Pharmacists' knowledge was assessed via ten multiple-choice questions. The highest correct response rate was recorded for the question on WHO's role in antibiotic guidelines (76.6%), followed by the AWaRe classification (78.9%) and access to antibiotics without prescriptions as a local issue (78.7%). The lowest correct response was for identifying the most common prescribing error in primary care (17.8%) as shown in Table 2.

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Table 1. Sociodemographic Characteristics of Community Pharmacists in Erbil (n = 342)

Characteristics	Category	No.	Percentage (%)
Age (years)	<30	253	(74.0)
	30–45	82	(24.0)
	>45	7	(2.0)
Gender	Male	115	(33.6)
	Female	227	(66.4)
Marital Status	Single	176	(51.5)
	Married	166	(48.5)
Education Level	Bachelor's	316	(92.4)
	Post-graduated	26	(7.6)
Pharmacy Type	Public	115	(33.6)
	Private	225	(66.4)
Experience (years)	≤10	297	(86.8)
	>10	45	(13.2)
Employment Status	Full-time	93	(27.2)
	Part-time	198	(57.9)
	Unemployed	51	(14.9)
Stewardship Training	Yes	106	(31.0)
	No	236	(69.0)

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Table 2. Pharmacists' Knowledge on Antibiotic Prescribing Errors (n = 342)

No.	Question	Correct Answer	Frequency (n)	Percentage (%)
1	Understanding of the term 'antibiotic prescribing error' and its impact on patient safety	Errors in selection, dose, or duration causing harm[1]	233	68.1
2	Organization that provides global antibiotic treatment guidelines	World Health Organization (WHO)	262	76.6
3	WHO AWaRe group recommended for first-line use in common infections	Access group	270	78.9
4	Major contributor to antibiotic misuse in Erbil, according to local studies	Non-prescription antibiotic access	269	78.7
5	Most frequently overprescribed antibiotic class in Erbil hospitals	Third-generation cephalosporins	149	43.6
6	Most common antibiotic prescribing error in primary care settings	Incorrect dosage or duration	61	17.8
7	Prescriber group most commonly associated with antibiotic prescribing errors	Junior doctors (interns, residents)	191	55.8
8	Patient group most vulnerable to antibiotic prescribing errors	Pediatric patients	136	39.8
9	Antibiotic class prone to errors due to narrow therapeutic index and monitoring needs	Aminoglycosides	153	44.7
10	Significant consequence of inappropriate antibiotic prescribing	Development of resistant bacteria	190	55.6

[1] Note: Acceptable answers included errors in antibiotic selection, dosage, or duration that deviate from clinical guidelines and result in harm or reduced effectiveness.

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Out of 342 pharmacists surveyed, the majority (245; 71.6%) demonstrated a moderate level of knowledge, with scores ranging from 5 to 7. A smaller group (27; 7.9%) achieved high scores between 8 and 10, while 70 pharmacists (20.5%) were categorized as having low knowledge levels, scoring between 0 and 4, as presented in Table 3. This distribution is further illustrated in Figure 1, which visually highlights the predominance of moderate scores among respondents.

Table 3. Distribution of Knowledge Score among Pharmacists

Knowledge Level	Score Range	No.	Percentage (%)
High	8-10	27	(7.9)
Moderate	5-7	245	(71.6)
Low	0-4	70	(20.5)
Total Response		342	100%

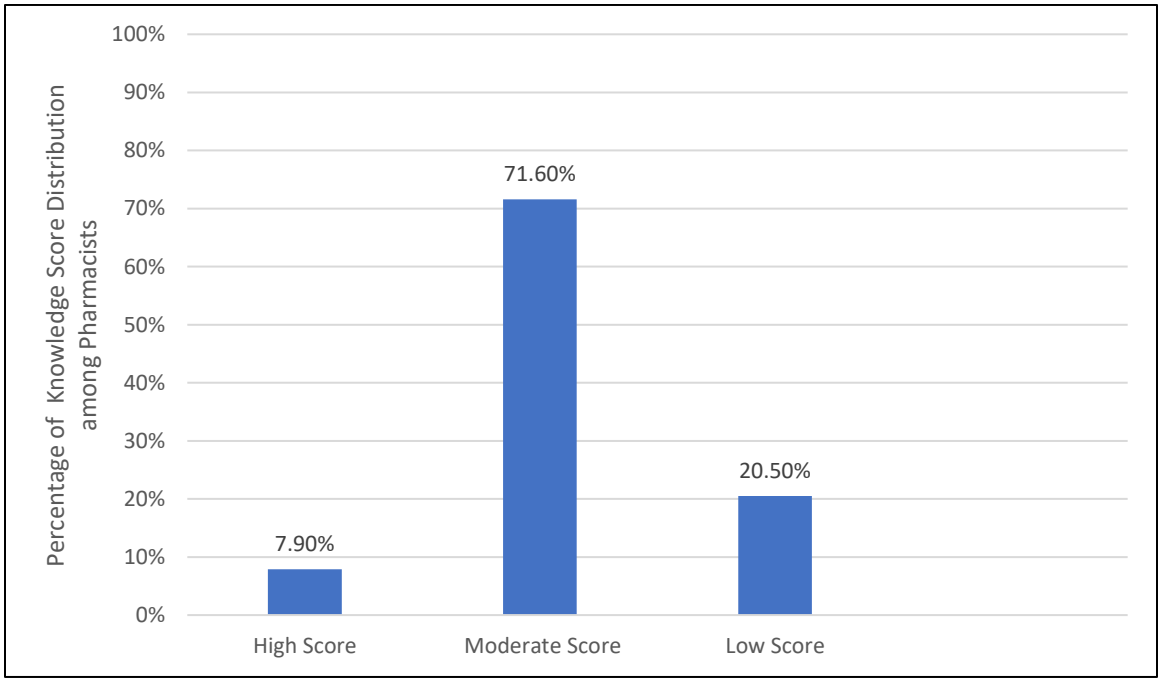

Figure 2. Percentage of Knowledge Score Distribution among Pharmacists

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A statistically significant association was found between age and knowledge level (P = 0.010), with older pharmacists (>45) showing a higher proportion of high knowledge seen in table 4. No significant association was found between knowledge and gender, marital status, education level, pharmacy type, experience, employment status, or stewardship training.

The association between knowledge level and various factors affecting the detection of prescribing errors. The distribution of responses across knowledge levels (low, moderate, high) is reported for each factor, along with corresponding P-values as shown in Table 5. For most factors, such as education and experience, workload and staffing, prescription clarity, missing prescription details, communication with prescribers, patient pressure, and time constraints, the p-values were greater than 0.05, indicating no statistically significant association with knowledge level. However, the factor "The use of automated prescribing systems effectively reduces medication errors" showed a statistically significant association with knowledge level (P = 0.004).

Table 4. Association between knowledge level and sociodemographic characteristics

Characteristic	Category	Low No. (%)	Moderate No. (%)	High No. (%)	P-value
Age groups	<30	52 (20.6)	182(71.9)	19(7.5)	0.010
	30–45	16 (19.5)	61(74.4)	5(6.1)	
	>45	2 (28.6)	2(28.6)	3(42.9)	
Gender	Male	27 (23.5)	80 (69.6)	8 (7)	0.587
	Female	43 (18.9)	165 (72.7)	19 (8.4)	
Marital Status	Single	40 (22.7)	121 (68.8)	15 (8.5)	0.471
	Married	30 (18.1)	124 (74.7)	12 (7.2)	
Education Level	Bachelor's degree	61 (19.3)	229 (72.5)	26 (8.2)	0.154
	Post-graduate	9 (34.6)	16 (61.5)	1 (3.8)	
Pharmacy Type	Public	27 (23.5)	81 (70.4)	7 (6.1)	0.468
	Private	43 (18.9)	164 (72.2)	20 (8.8)	
Experience (Years)	≤10	62 (20.9)	213 (71.7)	22 (7.4)	0.649
	>10	8 (17.8)	32 (71.1)	5 (11.1)	
Employment Status	Full-time	22 (23.7)	65 (69.9)	6 (6.5)	0.636
	Part-time	35 (17.7)	146 (73.7)	17 (8.6)	
	Unemployed	13 (25.5)	34 (66.7)	4 (7.8)	
Training in Antibiotic Stewardship	Yes	20 (18.9)	81 (76.4)	5 (4.7)	0.266
	No	50 (21.2)	164 (69.5)	22 (9.3)	

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Table 5. Association between knowledge level and Factors affecting detection of prescribing error

Factors	Category	Low No. (%)	Moderate No. (%)	High No. (%)	P-value
My level of education and experience helps me identify prescription errors.	Disagree	9 (31.0)	18 (62.1)	2 (6.9)	0.241
	Neutral	5 (21.7)	14 (60.9)	4 (17.4)	
	Agree	56 (19.3)	213 (73.4)	21 (7.2)	
High workload and limited staffing affect my ability to detect prescription errors.	Disagree	16 (22.2)	49 (68.1)	7 (9.7)	0.467
	Neutral	4 (10.3)	31 (79.5)	4 (10.3)	
	Agree	50 (21.6)	165 (71.4)	16 (6.9)	
The clarity and legibility of prescriptions affect my ability to process them correctly.	Disagree	14 (20.9)	49 (73.1)	4 (6.0)	0.224
	Neutral	8 (23.5)	20 (58.8)	6 (17.6)	
	Agree	48 (19.9)	176 (73.0)	17 (7.1)	
Prescriptions often lack necessary details like dosage, frequency, or duration.	Disagree	17 (23.6)	52 (72.2)	3 (4.2)	0.625
	Neutral	6 (15.4)	29 (74.4)	4 (10.3)	
	Agree	47 (20.3)	164 (71.0)	20 (8.7)	
Communication with prescribers is readily available when clarification is needed.	Disagree	29 (23.4)	84 (67.7)	11 (8.9)	0.581
	Neutral	5 (12.8)	30 (76.9)	4 (10.3)	
	Agree	36 (20.1)	131 (73.2)	12 (6.7)	
Patients pressure me to dispense antibiotics even when errors are suspected.	Disagree	14 (17.3)	62 (76.5)	5 (6.2)	0.393
	Neutral	4 (11.1)	29 (80.6)	3 (8.3)	
	Agree	52 (23.1)	154 (68.4)	19 (8.4)	
The use of automated prescribing systems effectively reduces medication errors	Disagree	15 (32.6)	28 (60.9)	3 (6.5)	0.004
	Neutral	8 (24.2)	18 (54.5)	7 (21.2)	
	Agree	47 (17.9)	199 (75.7)	17 (6.5)	
Time constraints limit my ability to thoroughly verify prescriptions.	Disagree	31 (31.3)	62 (62.6)	6 (6.1)	0.28
	Neutral	9 (13.0)	53 (76.8)	7 (10.1)	
	Agree	30 (17.2)	130 (74.7)	14 (8.0)	

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Discussion

This study reveals that young (74.4% under 30) and predominantly female (66.8%) individuals encapsulate most of the community pharmacy workforce, aligning with global shifts in pharmacy demographics (18). The rate of antimicrobial stewardship (AMS) training (31.2%) is low which is concerning, especially since only 7.9% scored high on knowledge assessment. as seen in studies done in Jordan, where pharmacists showed fundamental knowledge yet lack readiness for complex clinical decisions. This is consistent with a related survey of community pharmacists in Erbil, which similarly reported generally favourable perceptions toward antimicrobial stewardship that did not consistently translate into practice, particularly regarding dispensing antibiotics without a valid prescription (21). While awareness of WHO guidelines (76.6%) and AWaRe classification (78.9%) was relatively high but understanding of antibiotic prescribing errors, particularly dosage-related issues was poor (17.8%). This aligns with the study that knowledge alone is insufficient without practice-based learning (19).

And the association between knowledge level and various factors affecting the detection of prescribing errors, such as education and experience, workload and staffing, prescription clarity, missing prescription details, communication with prescribers, patient pressure, and time constraints, the P-values were greater than 0.05 thus indicating no statistically significant association with knowledge level. However, the factor "The use of automated prescribing systems effectively reduces medication errors" showed a statistically significant association with knowledge level ($P = 0.004$) which complies with the AVOID study that showed that computerized system enhanced medication safety in pediatric care (13). Notably, older pharmacists showed better knowledge, indicating experience enhances competence— These competencies are often the result of cumulative professional experience, repeated exposure to complex prescribing scenarios, and long-term engagement with clinical guidelines and patient care (20).

These results highlight the need for enhanced practical and continuous training focused on antimicrobial stewardship to improve pharmacists' clinical decision-making skills. Integrating interactive learning and mandatory AMS programs could better prepare pharmacists for real-world challenges.

Improved communication between pharmacists and prescribers is also essential to reduce errors. Implementing structured dialogue and electronic prescribing may foster better collaboration and safer antibiotic use.

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Despite good guideline awareness, applying these recommendations in daily practice remains limited, indicating the need for targeted mentorship and peer support to bridge this gap.

This study has several limitations. It was limited to licensed community pharmacists practicing in central Erbil, which may limit the generalizability of the findings to other geographic or institutional settings. Furthermore, the use of convenience sampling and reliance on self-reported data may lead to selection and reporting biases. Moreover, the cross-sectional design captures a single time point, which precludes the assessment of trends or causality.

Conclusion

This study revealed major knowledge gaps among community pharmacists in Erbil regarding antibiotic prescribing errors, especially related to dose and duration. Despite awareness of WHO and AWaRe guidelines, few pharmacists showed high proficiency in error detection. Limited antimicrobial stewardship training and underused clinical roles contribute to these deficiencies. Older pharmacists had better knowledge, suggesting experience enhances prescribing safety. A strong link between knowledge and support for automated systems points to a role for technology. These results call for practical training and policy reforms to strengthen pharmacists' role in antibiotic safety.

Competing interest

The authors declare that they have no competing interests.

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