ASIAN JOURNAL OF PHARMACEUTICAL AND CLINICAL RESEARCH

INNOVARE ACADEMIC SCIENCES
Knowledge to Innovation

Vol 18, Issue 11, 2025

Online - 2455-3891
Print - 0974-2441

Research Article

MEASURING COMMUNITY PHARMACISTS' KNOWLEDGE AND ATTITUDE OF PRESCRIBING ERRORS

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Received: 29 May 2025, Revised and Accepted: 29 September 2025

ABSTRACT

Objectives: This study aimed to investigate knowledge, attitudes, and practices among community pharmacists regarding prescribing errors (PEs) in Jordan.

Methods: This was a cross-sectional survey-based study conducted in Jordan among community pharmacists over 8 weeks. A structured questionnaire was designed, validated, and sent to community pharmacists to assess their knowledge, attitudes, and practices (KAP) toward PEs.

Results: Of 752 participants approached, 398 were included in the data analysis. The mean scores of KAP were: 6.9, 8.1, and 8.5, respectively, all out of 10. Among participants included in this study, 126 (31.7%) showed good knowledge about PEs, 268 (67.3%) demonstrated a positive attitude toward PEs, and 291 (73.1%) showed good practice regarding PEs. Among the participants, 380 (95.5%) showed knowledge about contraindication errors, 369 (92.7%) exhibited knowledge about duplicate errors, and 371 (93.2%) were knowledgeable about wrong strength errors. Furthermore, 67 (16.8%) reported that prescribing a drug at a dose inappropriate for the patient's renal function was considered an omission error. In addition, approximately one-third of the participants (34.2%) were unable to differentiate between wrong dose errors and wrong frequency errors. More than half of the participants agreed (55.5%) and strongly agreed (17.1%) that pharmacists had an important role to play in identifying and preventing PEs.

Conclusion: Pharmacists who participated in this study had a moderate knowledge about PEs; however, their attitude and practice levels seemed positive and good, respectively.

Keywords: Community pharmacists, Knowledge, Attitude, Prescribing errors.

 DOI: http://dx.doi.org/10.22159/ajpcr.2025v18i11.55303. Journal homepage: https://innovareacademics.in/journals/index.php/ajpcr

INTRODUCTION

Prescribing errors (PEs) are a global healthcare concern, and community pharmacies, which are part of the primary healthcare sector, are no exception. To quantify the scale of this issue, a review of PEs found that incidence rates can vary dramatically, ranging from as low as 7.1% to as high as 94%, with the most common errors including incorrect dosage, strength, and duration of therapy [1]. Community pharmacies are at risk of encountering PEs for several reasons. These include the presence of complex medication regimens in prescriptions, poor communication between physicians and pharmacists, lack of a closed-loop system between the primary and secondary care sectors, insufficient training or support for both physicians and pharmacists, and patient-related factors, such as language barriers and low health literacy [2]. As a result, understanding attitudes, knowledge, and practices among pharmacists for managing such errors effectively is vitally important [2]. Pharmacists play an instrumental role in preventing and managing PEs at community pharmacies, with their knowledge, attitudes, and practices (KAP) regarding such errors having an immense effect on patient safety. Studies have revealed that pharmacists generally understand PEs well and are willing to report and learn from mistakes; yet other research uncovered knowledge or attitude gaps with respect to errors related to communication with healthcare providers or patient counseling [3,4].

Jordan lacks research relating to PEs in primary care; however, a study conducted in secondary care revealed high rates of PEs due to communication breakdown. Derar Abdel-Qader and colleagues have investigated PEs in Jordanian hospitals and found a high incidence of errors with relatively concerning severity [5]. These results imply that PEs are also likely an issue within the primary healthcare sector in Jordan; thus mandating further study in this field. This gap is significant, as studies in other settings, such as a survey among community pharmacists in Nigeria, have highlighted variable perceptions and certainty regarding error knowledge, underscoring the need for region-specific investigations [6].

Overall, pharmacists' knowledge and attitudes play a pivotal role in mitigating PEs effectively. Jordan needs further investigation of PEs intervened by community pharmacists to better understand their incidence, impact, and possible strategies that would improve patient safety within this setting. Thus, this study sought to investigate knowledge, attitudes, and practices among community pharmacists regarding PEs in Jordan.

By understanding their behaviors and attitudes toward PEs, this research could identify potential educational and training programs designed to prevent and manage them more efficiently, such as providing education on medication safety practices or clinical decision support tools, as well as strategies that would enhance communication with prescribers and patients.

METHODS

Study design

A cross-sectional survey was used to investigate pharmacists' KAP regarding PEs intercepted in community pharmacies.

Participants and sample size

Community pharmacists served as our target population. Inclusion criteria required pharmacists to be licensed and currently working in community pharmacies in Jordan.

Using Raosoft's sample size calculator, a minimum sample size of at least 379 pharmacists was required for our research, given that Jordan has approximately 31,408 pharmacists, according to data provided by the Jordanian Pharmacists Association. To account for potential non-response and further increase statistical power, we aimed to collect responses from a total of 400 pharmacists.

Data were collected through convenience sampling of pharmacies, selected due to their practicality and ease of access for potential participants. Reaching potential participants required multiple methods of communication, including emails, WhatsApp messaging, and face-to-face interactions. The researcher first approached community pharmacies, outlining the purpose, importance, and confidentiality of the study to individual pharmacists who expressed interest. Participants who agreed to participate were provided with a survey instrument.

Study flow and settings

A self-administered questionnaire's aim was to collect data regarding PEs from community pharmacists over 2 months. The questionnaire was designed based on extensive review of existing literature [7-9]. Moreover, current pharmacy practices in Jordan and face and content validity were established through review by a panel of three experts (two in clinical pharmacy practice and one in medication safety research). The experts were asked to assess the relevance, clarity, and appropriateness of each item in the questionnaire.

After carefully considering each comment or recommendation made by experts, revisions and refinements were completed several times to ensure the final version measured all intended constructs correctly.

A pilot study involving 15 community pharmacists was conducted to assess the clarity, comprehensibility, and feasibility of the questionnaire. Minor adjustments to wording were made based on their feedback. The internal consistency and reliability of the final instrument were assessed using data from the main study sample (N=398). Cronbach's alpha coefficients were calculated for each domain of the questionnaire, yielding values of 0.79 for the knowledge section, 0.83 for the attitude section, and 0.81 for the practice section, all of which indicate good internal consistency.

Data analysis

Data analysis was performed using SPSS version 26 from IBM Corp (Armonk, NY, USA) to explore responses provided from a structured questionnaire. Descriptive statistics, including frequencies and percentages, were calculated to summarize demographic features.

The p value of Shapiro–Wilk test was 0.086, which meant the study data were normally distributed. Hence, mean and standard deviation were used to represent continuous data.

To calculate the scores for knowledge, attitude, and practice, responses were first coded as 1 for correct or favorable answers and 0 for incorrect or unfavorable answers. The total knowledge mean score was calculated based on the number of correct responses, while for attitudes and practice, the mean score was calculated based on favorable answers.

For categorization, KAP scores were classified based on a 10-point scale: scores <5 were considered poor/negative, scores between 5 and 7 were considered moderate/neutral, and scores >7 were considered good/positive.

To assess relationships among participant demographics and KAP toward PEs, inferential statistics were employed. Chi-square tests of independence were utilized as well to examine categorical variables' associations; using them allowed us to establish whether there existed a significant association between two categorical variables or not.

Logistic regression was employed to examine predictors of pharmacists' practices in detecting and preventing PEs. The dependent variable for analysis was PE practices as evaluated against predefined criteria; independent variables included demographic factors, such as years of experience, educational level, prior hospital pharmacy work history as well as participation in educational workshops or research papers related to patient medication safety. All variables found to be significant in univariable analysis ($p<0.1$) were included in the final multivariable model to calculate adjusted odds ratios (AORs). A significance level of $p<0.05$ was selected to assess statistical significance, with AORs and their 95% confidence intervals (CIs) calculated to assess both strength and direction of associations; ORs greater than 1 indicated an increased likelihood for practicing PEs while odds ratios less than 1 indicated decreased chances.

RESULTS

Of the 752 participants approached, 400 (53.2% response rate) completed the questionnaire, of which 398 were included in the data analysis. Among participants included in the data analysis, 184 (46.2%) aged between 26 and 40 years and 116 (29.1%) aged between 22 and 25 (Table 1). More than half of the participants were female (64.8%), and around one-third of them were living in Amman (32.4%). Approximately, one-quarter of the participants (25.6%) reported having 6 to 10 years of experience. Among participants, around two-thirds (69.1%) were pharmacists in charge, and most of them never attended a patient safety workshop (91.5%) or read research papers on medication safety (83.9%).

The mean scores of knowledge, attitude, and practice were 6.9, 8.1, and 8.5, out of 10, respectively, whereas median scores were 7.0, 8.0, and 9.0, respectively (Table 2).

Table 1: Socioeconomic information of participants in the second study (N=398)

Parameter	Total, n (%)
Age (years)	
22–25	116 (29.1)
26–40	184 (46.2)
41–55	69 (17.3)
>55	29 (7.3)
Gender	
Female	258 (64.8)
Male	140 (35.2)
Place of residence	
Amman	129 (32.4)
Northern region (Irbid, Jerash, Ajloun, Mafraq)	184 (46.2)
Middle region (Zarqa, Madaba, Balqa)	62 (15.6)
Southern region (Karak, Aqaba, Maan)	23 (5.8)
Years of experience	
<2	56 (14.1)
2–5	165 (41.5)
6–10	102 (25.6)
>10	75 (18.8)
Educational level	
Bachelor degree	336 (84.4)
Master's degree	34 (8.5)
PhD	2 (0.5)
Diploma	26 (6.5)
Professional position	
Pharmacist in-charge	275 (69.1)
Manager	63 (15.8)
Owner	60 (15.1)
Type of pharmacy	
Chain	114 (28.6)
Independent	284 (71.4)
Worked in a hospital before	
Yes	58 (14.6)
No	340 (85.4)
Attended a patient safety workshop	
Yes	34 (8.5)
No	364 (91.5)
Read research papers on medication safety	
Yes	64 (16.1)
No	334 (83.9)

Participants' knowledge and perceptions regarding the nature and types of PEs are summarized in Table 3. A majority of pharmacists (65.8%) recognized that PEs occur in primary care, while fewer (41.7%) identified the dispensing stage as a point of occurrence for PEs.

The results indicate a high level of knowledge for several fundamental error types. A vast majority of respondents correctly identified the definitions for contraindication errors (95.5%), duplicate therapy errors (92.7%), wrong strength errors (93.2%), and omission of necessary drug therapy (91.7%). Similarly, most participants (79.4%) correctly identified prescribing a drug to which a patient has a known allergy as a wrong drug PE.

Table 2: Scores of KAP

Parameter	Score (SD)	Median (IQR)
Knowledge	6.9 (2.8)	7.0 (5-9)
Attitude	8.1 (1.1)	8.0 (7-9)
Practice	8.5 (1.3)	9.0 (8-10)

All scores are out of 10. KAP: Knowledge, attitudes, and practices, SD: Standard deviation, IQR: Interquartile range

Table 3: Pharmacists' knowledge about PE types (N=398)

Knowledge statement	Yes responses, n (%)
PEs occur in Primary care	262 (65.8)
PEs occur at the dispensing stage of the medication delivery process.	166 (41.7)
A contraindication error occurs when a patient is prescribed a medication that is contraindicated for their condition or medical history.	380 (95.5)
A duplicate therapy error occurs when a patient is prescribed two or more medications that have the same therapeutic effect.	369 (92.7)
A wrong strength error occurs when a patient is prescribed a medication with a strength that is not appropriate for their condition.	371 (93.2)
The failure of prescribing a necessary drug therapy, which can lead to untreated medical conditions and cause adverse health outcomes for the patient is considered a PE.	365 (91.7)
Prescribing a drug in a dose that, according to the British National Formulary or data sheet recommendations, is inappropriate for the patient's renal function is considered an omission error.	67 (16.8)
Prescription of a drug to which the patient has a documented clinically significant allergy is considered a wrong drug PE	316 (79.4)
Wrong dose error occurs when the prescribed frequency of medicine is different from the current evidence-based treatment guidelines	136 (34.2)
Wrong frequency error occurs when a drug is prescribed for a patient for whom, as a result of a co-existing clinical condition, that drug is contraindicated	117 (29.4)

PE: Prescribing error

Conversely, significant knowledge gaps and misconceptions were evident in more nuanced areas. Specifically, a notable minority of participants (16.8%) incorrectly classified an inappropriate dose for a patient with renal impairment as an "omission error." Furthermore, a substantial portion of the pharmacists demonstrated confusion between dose- and frequency-related errors. Approximately one-third of the participants incorrectly identified a statement describing a wrong frequency error as the definition for a wrong dose error (34.2%), and a similar proportion (29.4%) misidentified a statement about contraindications as the definition for a wrong frequency error. These findings highlight specific areas where pharmacist knowledge could be improved.

Pharmacists' attitudes toward the causes, management, and professional responsibilities related to PEs are detailed in Table 4. A significant majority of participants identified interpersonal and environmental factors as key causes of PEs. Specifically, 75.9% agreed that PEs are often caused by inadequate communication between healthcare professionals, and an even higher percentage (76.9%) believed that PEs are more likely to occur when professionals are under high levels of stress.

Regarding systemic factors, a majority of pharmacists agreed that inadequate training and education (59.8%) and a lack of standardization in prescribing practices (53.5%) were contributing factors. However, it is noteworthy that a substantial minority disagreed with these statements, with 36.2% and 36.7% respectively challenging the impact of these systemic issues.

The findings also highlight a strong sense of professional responsibility. The vast majority of participants (79.1%) agreed that pharmacists should be actively involved in developing and implementing strategies to prevent PEs. Similarly, most believed that healthcare professionals should be held accountable for errors resulting in patient harm (74.6%) and that pharmacists have a responsibility to report PEs when they occur (70.4%).

Pharmacists' self-reported practices, confidence levels, and perceptions regarding PEs are presented in Table 5. Regarding self-assessed knowledge, responses were divided, with slightly more than half of the participants (53.5%) reporting that they were not familiar with common types of PEs. In contrast, a substantial majority (74.6%) felt confident in their ability to identify and prevent these errors. While a majority (59.8%) agreed that PEs represent a serious problem in healthcare, a notable portion (28.9%) disagreed with this assessment.

The frequency of specific professional behaviors aimed at preventing PEs varied considerably. Communicating with prescribers about

Table 4: Pharmacists' attitude toward causes and management of PEs (N=398)

Attitude statement	Strongly agree/agree, n (%)	Neutral, n (%)	Strongly disagree/ disagree, n (%)
Causes of PEs			
PEs are often caused by inadequate communication between healthcare professionals.	302 (75.9)	11 (2.8)	85 (21.4)
PEs are more likely to occur when healthcare professionals are under high levels of stress.	306 (76.9)	10 (2.5)	82 (20.6%)
PEs are often caused by inadequate training and education for healthcare professionals.	238 (59.8)	16 (4.0)	144 (36.2)
PEs are more likely to occur when there is a lack of standardization in prescribing practices.	213 (53.5)	39 (9.8)	146 (36.7)
Pharmacist's role and responsibility			
Pharmacists should be actively involved in developing and implementing strategies to prevent PEs.	315 (79.1)	15 (3.8)	68 (17.1)
Healthcare professionals should be held accountable for PEs that result in patient harm.	297 (74.6)	17 (4.3)	84 (21.1)
Pharmacists have a responsibility to report PEs when they occur.	280 (70.4)	22 (5.5)	96 (24.1)

potential errors and double-checking high-risk medications were the practices most frequently performed "always" (26.4% and 22.4%, respectively). However, for most practices, the most common response was "sometimes." For instance, over half of the pharmacists (50.5%) reported that they only "sometimes" seek clarification from prescribers about medication orders. A concerning finding was related to patient interaction, where 10.8% of pharmacists reported "never" asking patients about their medical history or other medications to screen for potential drug interactions.

Table 5: Pharmacists' practices and perceptions regarding PEs (N=398)

Practice and perception statement	Category	Response, n (%)
Perceived knowledge and confidence		
Familiarity with common types of PEs	Very/Somewhat Familiar	185 (46.5)
	Not very/Not at all Familiar	213 (53.5)
Confidence in the ability to identify and prevent PEs	Very/Somewhat Confident	297 (74.6)
	Not very/Not at all Confident	101 (25.4)
Perception of seriousness		
PEs are a serious problem in healthcare	Strongly Agree/ Agree	238 (59.8)
	Neutral	45 (11.3)
	Strongly Disagree/ Disagree	115 (28.9)
Frequency of specific professional practices		
How often do you seek clarification from prescribers about medication orders?	Never	17 (4.3)
	Rarely	106 (26.6)
	Sometimes	201 (50.5)
	Always	74 (18.6)
How often do you ask patients about their medical history/ other medications?	Never	43 (10.8)
	Rarely	103 (25.9)
	Sometimes	151 (37.9)
	Always	101 (25.4)
How often do you routinely double-check high-risk medications or dosages?	Never	40 (10.1)
	Rarely	91 (22.9)
	Sometimes	178 (44.7)
	Always	89 (22.4)
How often do you communicate with prescribers about potential errors?	Never	61 (15.3)
	Rarely	88 (22.1)
	Sometimes	144 (36.2)
	Always	105 (26.4)

The results of the univariable and multivariable logistic regression analyses identifying predictors of good knowledge, attitude, and practice are presented in Table 6.

For knowledge, the univariable analysis found that gender, place of residence, prior hospital experience, and having more than 10 years of experience were all significantly associated with good knowledge. However, after including these variables in the multivariable model, only three remained as independent predictors. Female pharmacists (AOR: 1.7), those residing in Amman (AOR: 2.3), and those with prior hospital experience (AOR: 3.1) were significantly more likely to possess good knowledge. Having over 10 years of experience was no longer a significant predictor after adjusting for these other factors (p=0.250).

For attitude, both having worked in a hospital and having attended a patient safety workshop were significant predictors in the univariable analysis. In the multivariable model, however, only prior hospital experience remained an independent predictor of a positive attitude (AOR: 1.4; 95% CI: 1.1–1.8). The effect of attending a workshop did not retain statistical significance after adjustment (p=0.180).

For practice, reading research papers and holding the position of pharmacist-in-charge were both associated with good practice in the univariable analysis. After adjustment in the multivariable model, only reading research papers on medication safety remained a strong and independent predictor of good practice (AOR: 2.1; 95% CI: 1.6–3.4), while the effect of professional position was no longer significant (p=0.310).

DISCUSSION

Pharmacists are uniquely positioned to prevent PEs in primary care because they are responsible for dispensing prescriptions and have direct contact with patients. To achieve this goal, pharmacists need to possess extensive knowledge and maintain a positive attitude toward PEs. In addition, they must adopt the best practices associated with PEs. However, the knowledge, attitude, and practice of pharmacists in community settings in the Middle East have rarely been investigated. This study was the first to address the perspectives of pharmacists on PEs in primary care in Jordan.

In this study, we established a structured questionnaire after extensively reviewing the literature. Then, we validated and distributed it, using convenience sampling, to pharmacists throughout Jordan. The data collection included both online and face-to-face methods and lasted for around 2 months.

Table 6: Logistic regression of KAP

Dependent variable	Predictors (independent variables)	Crude odds ratio (COR) (95% CI)	p-value	Adjusted odds ratio (AOR) (95% CI)	p-value
Knowledge (Good/Poor)	Gender (Female vs. Male)	1.9 (1.4–2.8)	0.001	1.7 (1.3–2.5)	0.004
	Place (Amman vs. Other)	2.5 (1.9–4.5)	<0.001	2.3 (1.8–4.2)	<0.001
	Previously worked in a hospital (Yes vs. No)	3.4 (2.3–5.8)	<0.001	3.1 (2.1–5.3)	<0.001
	Years of Experience (>10 vs. <2 years)	1.8 (1.1–3.1)	0.042	1.3 (0.8–2.2)	0.250
Attitude (Positive/Negative)	Previously worked in a hospital (Yes vs. No)	1.6 (1.2–1.9)	0.002	1.4 (1.1–1.8)	0.015
	Attended a patient safety workshop (Yes vs. No)	2.0 (1.1–3.8)	0.031	1.5 (0.8–2.9)	0.180
Practice (Good/Poor)	Read research papers on medication safety (Yes vs. No)	2.3 (1.7–3.8)	<0.001	2.1 (1.6–3.4)	<0.001
	Professional Position (Pharmacist-in-charge vs. Staff)	1.7 (1.0–2.9)	0.045	1.2 (0.7–2.1)	0.310

KAP: Knowledge, attitudes, and practices. Univariable analysis was conducted for all demographic and professional variables. Variables with a P<0.1 in the univariable analysis were included in the multivariable models. The table displays variables that were significant in the univariable analysis, highlighting which remained significant after adjustment. P<0.05 are considered statistically significant.

This study included 398 pharmacists; most of them were less than 40 and lived in Amman. In addition, the vast majority of the study sample never attended a patient safety workshop or read research papers on medication safety. This indicated that there might be a gap in the educational opportunities available to pharmacists in terms of patient safety training and a potential lack of engagement with current research in the field, which could impact the adoption of best practices and the integration of evidence-based approaches into daily pharmacy practice.

The findings of this study indicated that community pharmacists in Jordan had moderate knowledge about PEs. In addition, around two-thirds showed a positive attitude and good practice regarding PEs. It was challenging to compare our results with those of other studies due to a lack of existing literature specifically addressing the KAP of pharmacists in the community setting toward PEs. Nonetheless, we tried to contextualize our findings by discussing relevant studies with similar objectives or conducted in alternative settings, such as the hospital setting.

There are several studies that showed consistent results with ours. A study investigated the knowledge and attitude of pharmacy students in Jordan toward PEs [8]. They found that pharmacy students had an overall positive attitude toward PEs. However, their knowledge level was limited. Azizah AL-Mutairi and colleagues investigated KAP of hospital pharmacists in Saudi Arabia toward medication safety and found that pharmacist's knowledge was poor, but they had a positive attitude and good practice behaviors [9].

Some studies did not measure the KAP of pharmacists, but instead assessed their opinions on prescription writing in community settings. Saad Saeed Alqahtani investigated the opinion and attitudes of community pharmacists toward poor prescription writing [10]. In his study, a significant majority of the pharmacists (72.29%) decided to refer the patient back to the prescriber when faced with challenges in deciphering information from an illegible prescription. Although this study did not directly measure the KAP of pharmacists toward PEs, it provided insights into the behaviors and decision-making processes of community pharmacists in similar contexts.

Overall, while there is a scarcity of literature specifically addressing the KAP of community pharmacists toward PEs, our comparisons with studies conducted in alternative settings, such as hospitals, suggested a consistent pattern of limited knowledge but positive attitudes and good practice behaviors among pharmacists. These findings highlighted the need for targeted educational interventions and training programs to enhance the knowledge of community pharmacists regarding PEs, while also reinforcing their positive attitudes and promoting best practices in patient safety.

Our findings showed that gender, place of residence, previous workplace, and reading research papers on medication safety were predictors for the KAP of pharmacists. First, females were more likely to have good knowledge about PEs, which was consistent with the findings of other studies, which have shown that women were more likely to be interested in health and safety issues [11]. This observed gender difference is consistent with some studies, which have shown women may exhibit greater health and safety awareness [11]. The finding warrants further investigation but could be related to previously documented trends in communication styles or risk perception in healthcare settings, rather than being attributable to a single factor. Moreover, this finding that demographic and professional factors serve as key predictors aligns with other research; for instance, a study in IJAP assessing pharmacists' attitudes toward interprofessional communication also found that gender, age, and educational level were significant predictors of outcomes [7]. Second, pharmacists residing in Amman were more likely to have good knowledge about PEs. This finding aligned with previous studies that suggested that urban pharmacists were more likely to have access to training and resources about PEs than their rural counterparts [12]. Third, pharmacists who worked previously in a hospital are more likely to possess good knowledge about PEs. This suggests that pharmacists with prior hospital experience may have been exposed to higher-level patient safety practices and protocols, which may have strengthened their knowledge and perceptions about PEs. Lastly, reading research papers about medication safety was also found to be a predictor of good practice among PEs. This highlighted the significance of keeping up-to-date on recent research and evidence-based practices regarding medication safety; furthermore, it suggested that pharmacists engaging with scientific literature or research in this area are more likely to implement best practices in their daily practice, leading to improved patient safety outcomes.

Our findings aligned with previous studies that addressed factors associated with the KAP of pharmacists toward various issues. For example, a systematic review found that factors associated with pharmacists' KAP may include age, educational degree, additional qualification, income, years of practice, practice setting, and experience in patient care service [13].

In terms of pharmacists' knowledge, our findings demonstrated that community pharmacists in Jordan possessed a good understanding of PEs as well as their various types. There were however, several areas in which their knowledge might have been lacking. For instance, 16.8% of the pharmacists reported prescribing drugs at doses that are considered inappropriate to patient's renal function according to recommendations in the British National Formulary or drug's data sheet as being an omission error. This statement is incorrect; an omission error refers to when a medication is not taken when indicated. About one-third (34.2%) of participants could not distinguish between wrong dose and frequency errors, which could have very different impacts for patients: wrong dose errors can lead to overdosage or underdosage. There were several potential reasons for these knowledge gaps. These included variations in the quality and extent of pharmacy education and training programs. It is critical that pharmacy students and practicing pharmacists alike receive appropriate education on various forms of PEs, including definitions, potential consequences, and strategies for prevention.

Concerning their attitude, pharmacists seemed to have a good understanding of the importance of preventing PEs. The majority of the participants agreed that PEs were a common problem in healthcare, that pharmacists have an important role to play in identifying and preventing PEs, and that PEs can lead to serious harm for patients. Nonetheless, in some areas, their attitude sounded negative. For example, one-fifth of them disagreed that PEs are usually caused by poor communication among healthcare providers; an alarming result given how inadequate communication contributes to PEs [14]. For instance, a cross-sectional study assessing outpatient prescriptions in Saudi Arabia found significant deficiencies that create risks for patients and challenges for pharmacists. The study reported that 26% of prescriptions were written illegibly, while crucial patient data such as age (48%) and sex (46%) were frequently missing [15]. Such incomplete and illegible prescriptions represent a direct communication failure from prescriber to pharmacist and place a heavy burden on community pharmacists to intercept these potential errors, reinforcing the critical importance of their knowledge and proactive practice.

In addition, our findings suggested that more than one-third of participants disagreed with the statement that inadequate healthcare professional training and education frequently contribute to PEs. This finding was alarming; inadequate training is a primary contributor to PEs. Continual pharmacotherapy training can play a vital role in enhancing pharmacist competencies, improving their skills, and enabling them to overcome various challenges, such as time constraints, staffing issues, and interprofessional relationships. In the United States, Bright *et al.* discovered that most pharmacists would be more likely to provide medication therapy management if they received more training and would not feel comfortable providing the services without additional training [16]. Domiati *et al.* from Lebanon reported that

64.5% of pharmacists were willing to attend advanced training sessions to become actively involved in medication review, even if they would not be compensated [17].

Regarding pharmacists' practice of PEs, most participants reported not having a reporting system for PEs, indicating a potential gap in creating a structured mechanism to capture, document, and learn from PEs. The reasons for the lack of a reporting system may vary and could include organizational or system-level factors, such as limited resources, lack of awareness about the importance of reporting, or challenges in the implementation and integration of reporting processes. Interestingly, in the United Arab Emirates, community pharmacies are part of a system that facilitates reporting of medication errors to the Department of Health and other relevant health officials on a daily basis [18]. In Saudi Arabia, pharmacists consider medication errors reporting an important task; however, they indicated that lack of time and poor training hinder their ability to perform efficient reporting [9].

This study had several limitations that should be acknowledged. First and foremost, self-reporting surveys might introduce bias. Participants might not always provide entirely accurate or impartial responses, which could affect the reliability and validity of study results. Second, this study used a convenience sampling method, which is a significant limitation. The geographical distribution of the sample was skewed, with a high proportion of participants from the more urbanized Amman (32.4%) and Northern (46.2%) regions, and a severe under-representation of the Southern region (5.8%). Therefore, the findings may not be generalizable to all community pharmacists in Jordan, particularly those in rural and southern areas. Furthermore, the response rate of 53.2%, while acceptable, introduces a potential for non-response bias, as pharmacists with a greater interest or concern in patient safety may have been more inclined to participate. These factors limit the external validity of our findings.

CONCLUSION

Pharmacists involved in this study displayed varying levels of KAP toward PEs. While many demonstrated good knowledge and positive attitudes, there were gaps in their understanding of certain aspects, such as distinguishing error types. There was general agreement regarding the role of pharmacists in recognizing and preventing PEs, but opinions on their severity differed among participants. Factors, such as inadequate communication and high stress levels, were recognized as potential contributors. Accountability and reporting responsibilities for healthcare professionals, especially pharmacists, varied widely. Notably, reviewing prescriptions for potential PEs was uncommon, and the implementation of reporting systems was rare. Confidence in identifying and preventing PEs varied among participants. Overall, while pharmacists demonstrated positive/good attitudes and practices, there is clear room for improvement in knowledge to elevate it from a moderate to a good level. Targeted educational interventions are needed to address-specific knowledge gaps identified in this study.

ACKNOWLEDGMENTS

The authors would like to thank all participants who took part in the study. The author thanks all participants who volunteered to take part in the study, and all sub-investigators and site staff who contributed to the conduct of this study.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

FUNDING

This research received no external funding.

INSTITUTIONAL REVIEW BOARD STATEMENT

The study was approved by the Institutional Review Board of the University of Petra

INFORMED CONSENT STATEMENT

Informed consent was obtained from all subjects involved in the study.

AVAILABILITY OF DATA AND MATERIAL

Data are available upon reasonable request.

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