DOI: https://doi.org/10.54361/LJMR.20.2.112

Libyan Journal of Medical Research

www.lmjr.ly/ eISSN: 2413-6096

Original Article

Awareness of Drug–Drug Interactions and Prescription-Handling Practices Among Community Pharmacists in Tripoli, Libya: A Cross-Sectional Study

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***Received:**18-09-2026-**Accepted:** 03-11-2026 -**Published:** 14-11-2026*

Abstract

Background: Drug–drug interactions (DDIs) are a preventable source of medication-related harm, and community pharmacists provide the last professional check before medicines reach patients. Data on pharmacists' awareness of DDIs in Libya are limited. **Objective:** To describe self-reported awareness of DDIs and prescription-handling practices among community pharmacists in Tripoli, Libya, and to explore factors associated with DDI identification.**Methods:** A cross-sectional survey was conducted in community pharmacies in Tripoli from October 2025 to January 2026. Of 86 pharmacists approached, 78 completed a structured paper questionnaire (response rate 90.7%). Data collection also involved simulated prescriptions containing potential interactions. Data were analyzed descriptively in SPSS version 26, with a two-sided significance level of 0.05.**Results:** Most participants were aged 25–34 years (59.0%) and 55.1% were women; 38.5% held a diploma and 38.5% a Bachelor of Pharmacy degree, and 48.7% had 1–5 years of experience. Overall, 78.2% reported noticing prescription errors before dispensing, and 30.8% reported dispensing despite noticing an error. Only 24.4% (19/78; 95% CI 16.2–34.9) reported identifying DDIs, and 76.9% could not state the severity of an interaction. After identifying an error or DDI, 35.9% contacted the prescriber, 33.3% refused to dispense, 11.5% adjusted therapy without consulting the prescriber, and 6.4% dispensed as written. DDI identification was more frequent among pharmacists with more than 10 years of experience (10/20, 50.0%) than among those with 10 years or less (9/58, 15.5%); experience categories differed significantly between pharmacists who did and did not identify DDIs (Mann–Whitney U test, p = 0.015; odds ratio for >10 vs ≤10 years of experience 5.4, 95% CI 1.8–16.8).**Conclusion:** Self-reported DDI identification and knowledge of interaction severity were low among community pharmacists in Tripoli, despite frequent detection of other prescription errors. The cross-sectional design, self-reported outcomes, and non-random sampling limit generalizability. Targeted continuing education and access to interaction-checking tools merit evaluation.

Keywords: drug–drug interactions; community pharmacists; medication safety; pharmacy practice; prescription errors; Libya; cross-sectional study

Introduction

A drug–drug interaction (DDI) occurs when the effect of one drug is altered by the concurrent administration of another. Interactions may enhance toxicity or reduce efficacy, and they contribute to preventable adverse drug events in hospitalized and ambulatory patients.[1] The risk increases with the number of concurrently prescribed medicines, a concern that is especially relevant for older adults and for patients with chronic conditions who receive long-term multidrug regimens.[2] Interactions arise through pharmacokinetic mechanisms, such as inhibition or induction of cytochrome P450 enzymes,[3] and through pharmacodynamic mechanisms, in which drugs act additively, synergistically, or antagonistically.

Community pharmacists are often the final professional check before a prescription is dispensed, and are therefore well placed to detect and resolve clinically important interactions. Several well-recognized combinations illustrate the clinical stakes: concurrent use of renin–angiotensin–aldosterone system inhibitors and potassium-sparing diuretics can cause hyperkalemia,[4] nonsteroidal anti-inflammatory drugs (NSAIDs) impair renal function and may blunt the effect of antihypertensive therapy,[5] and aspirin use in children is associated with Reye syndrome.[6] Whether such risks are intercepted at the point of dispensing depends on the pharmacist's knowledge, access to reference tools, and willingness to communicate with the prescriber.

Evidence from the region indicates that pharmacists' DDI knowledge is variable. A multicenter study of Egyptian hospital and community pharmacists assessed knowledge using 19 common drug pairs and examined pharmacist characteristics associated with detection.[7]In Libya, an evaluation of prescriptions from community pharmacies reported that more than half of the drug combinations examined involved interactions and that the interviewed pharmacists reported no source of DDI knowledge,[8] and a survey of Libyan

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community pharmacists found counseling knowledge to be insufficient.[9]

However, little is known about how community pharmacists in Tripoli recognize prescription errors and DDIs, how they judge the severity of interactions, and what they do when a problem is identified. This information is needed to target training and practice interventions. This study therefore aimed to assess self-reported awareness of DDIs and prescription-handling practices among community pharmacists in Tripoli, Libya, and to explore whether DDI identification differed by professional experience and academic qualification.

Material and Methods

Study Design and Setting

This cross-sectional study was conducted in community pharmacies in Tripoli, the capital of Libya, between October 2025 and January 2026. Community pharmacies were selected because they are the main point of contact between pharmacists and patients and are where prescriptions are evaluated and dispensed.

Study Population and Sampling

The study population comprised licensed pharmacists practicing in community pharmacies in Tripoli. The data collector visited selected pharmacies and approached pharmacists in person; 86 pharmacists were invited to participate. A formal sample-size calculation and the sampling frame are not reported. Pharmacists were eligible if they were licensed, working in a community pharmacy in Tripoli, willing to participate voluntarily, and completed the questionnaire in full. Pharmacists who declined to participate and those who returned incomplete questionnaires were excluded.

Data Collection

Data collection combined simulated prescriptions with a structured, paper-based questionnaire. The data collector presented participating pharmacists with a simulated prescription containing potential DDIs, and the pharmacist's response was observed. Pharmacists then completed the questionnaire independently and returned it on completion. Participation was voluntary and no incentives were offered. The five simulated prescriptions, each containing one or more potential interactions, are summarized in Table 1; the interactions listed are those specified by the investigators.

Table 1. Simulated prescriptions used during data collection

No.	Patient age	Medications	Interactions of interest
1	60 y	Enalapril 10 mg OD; spironolactone 50 mg OD; amlodipine 5 mg OD; atorvastatin 20 mg OD; ibuprofen 400 mg as needed	Enalapril + spironolactone (hyperkalemia, arrhythmia); enalapril + ibuprofen (reduced antihypertensive effect, acute kidney injury); atorvastatin + amlodipine (myopathy, rhabdomyolysis)
2	45 y	Amoxicillin 100 mg BID × 7 d; digoxin 125 µg OD × 30 d; aspirin 75 mg OD × 30 d	Digoxin + amoxicillin (raised digoxin levels via altered gut flora); digoxin + aspirin (increased bleeding risk)
3	33 y	Metoprolol (dose not specified); insulin glargine; insulin aspart	Metoprolol + insulin (masked hypoglycemia symptoms); glargine + aspart (hypo- or hyperglycemia if not adjusted)
4	40 y	Clarithromycin 500 mg BID × 7 d; ibuprofen 400 mg BID × 5 d; simvastatin 20 mg OD × 30 d	Clarithromycin + simvastatin (rhabdomyolysis); ibuprofen + simvastatin (hepatotoxicity); clarithromycin + ibuprofen (gastrointestinal and hepatic risk)
5	5 y	Aspirin 75 mg OD × 30 d; amoxicillin–clavulanate syrup 457 mg TID × 5 d; multivitamin syrup 10 mL BID × 30 d; paracetamol syrup 10 mL QID × 2 d	Aspirin in a child (Reye syndrome); aspirin + paracetamol (hepatotoxicity)

BID, twice daily; OD, once daily; QID, four times daily; TID, three times daily. The reference source used to classify the interactions is not stated.

Questionnaire, Variables, and Outcomes

The questionnaire collected socio-demographic characteristics (age group: <25, 25–34, 35–44, 45–54, ≥55 years; gender; academic qualification: diploma, BPharm, PharmD, master's, PhD, or other; years of experience: <1, 1–5, 6–10, >10 years; and country of qualification) and prescription-handling practices. The practice items covered whether the pharmacist had noticed errors before dispensing, the type of error observed (incorrect dosage, duplication, potential DDI, incomplete information, or other), whether a prescription had been dispensed despite a noticed error, whether a DDI had been identified in prescriptions, the perceived severity of the identified interaction (severe, moderate, minor, or not sure), the action taken on identifying an error or DDI (dispensed as written, adjusted therapy, contacted the physician, refused to dispense, or other), and whether the physician had previously been contacted about an error. The primary outcome was self-reported identification of a DDI (yes/no). Professional experience and academic qualification were examined as explanatory variables. Completed questionnaires were

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checked for completeness before data entry, and entered data were checked to minimize entry errors.

Statistical Analysis

Data were analyzed using SPSS version 26. Categorical variables are presented as frequencies and percentages using the 78 analyzed participants as the denominator, with 95% confidence intervals calculated by the Wilson method. Because experience was recorded in four ordered categories, it was compared between pharmacists who did and did not identify DDIs using the Mann–Whitney U test, with the rank-biserial correlation as the effect size, in preference to a t-test on numerically coded categories. As a supplementary analysis, experience was dichotomized (>10 vs ≤10 years; a post hoc cut-off), and the odds ratio with a 95% confidence interval (Woolf method) and the Fisher exact test were reported. An inverse association between experience and failure to notice prescription errors was reported in the original analysis ($p = 0.001$); the coefficient and test were not recorded. Qualification groups were summarized descriptively because of small cell sizes. Two-sided p-values below 0.05 were considered statistically significant. No multivariable analysis was performed.

Ethical Considerations

Ethical approval was obtained from the Department of Pharmacy, Faculty of Medical Technology, Tripoli [approval reference and date to be inserted by the authors]. Pharmacists were informed of the purpose and objectives of the study in person, participation was voluntary, and no incentives were offered. Questionnaires were anonymous, and confidentiality was maintained throughout.

RESULTS

Participants

Of 86 pharmacists approached, 78 completed and returned the questionnaire (response rate 90.7%) and 8 declined. All questionnaires were complete, with no missing data except the error type for two pharmacists (Section 3.2). Only two participants reported qualifying outside Libya. Characteristics of the participants are shown in Table 2 and Figure 1. Most were aged 25–34 years (59.0%), 55.1% were women, equal proportions held a diploma or a BPharm degree (38.5% each), and 48.7% had 1–5 years of experience.

Table 2. Characteristics of community pharmacists (N = 78)

Characteristic	n	%	95% CI
Age group (years)			
<25	9	11.5	6.2–20.5
25–34	46	59.0	47.9–69.2
35–44	15	19.2	12.0–29.3
45–54	6	7.7	3.6–15.8
≥55	2	2.6	0.7–8.9
Gender			
Female	43	55.1	44.1–65.7
Male	35	44.9	34.3–55.9
Academic qualification			
Diploma	30	38.5	28.4–49.6
BPharm	30	38.5	28.4–49.6
PharmD	5	6.4	2.8–14.1
Master's	2	2.6	0.7–8.9
PhD	2	2.6	0.7–8.9
Other	9	11.5	6.2–20.5
Professional experience (years)			
<1	6	7.7	3.6–15.8
1–5	38	48.7	37.9–59.6
6–10	14	17.9	11.0–27.9
>10	20	25.6	17.3–36.3

BPharm, Bachelor of Pharmacy; CI, confidence interval (Wilson); PharmD, Doctor of Pharmacy.

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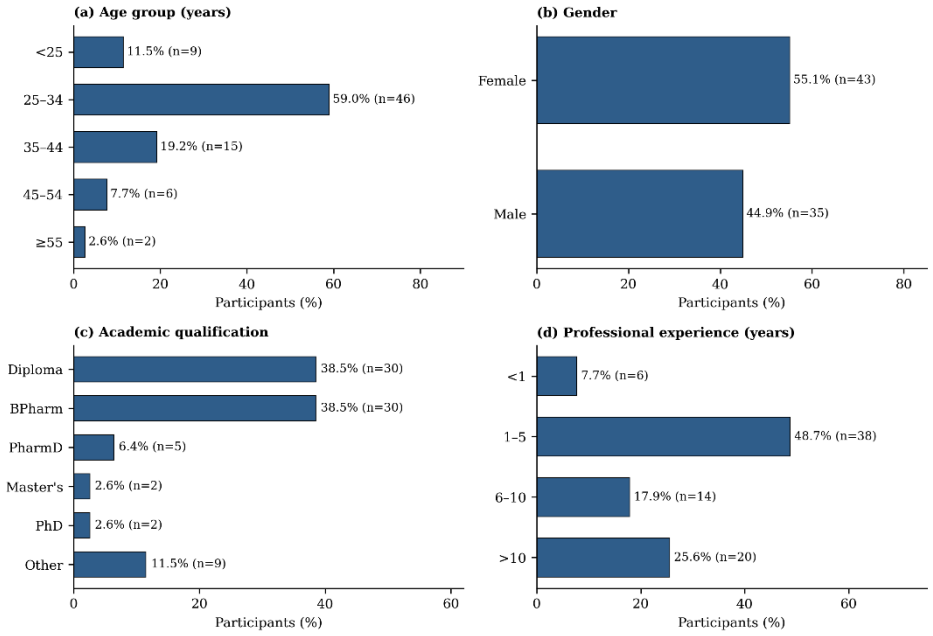


Figure 1. Characteristics of participating community pharmacists (N = 78): (a) age group, (b) gender, (c) academic qualification, and (d) professional experience. Labels show percentage and number of pharmacists.

Prescription Errors and Dispensing Practices

Most pharmacists (61/78, 78.2%) reported having noticed prescription errors before dispensing, and 17 (21.8%) had not (Table 3). The most frequently reported error types were incorrect dosage (28.2%) and incomplete or unclear prescription information (26.9%), followed by potential DDIs (12.8%) and unjustified duplication (7.7%) (Figure 2a). Among the 61 pharmacists who noticed errors, the error type was specified by 59; for two pharmacists (2.6% of all participants) the type was missing and was not imputed, so the error-type categories, including the 17 pharmacists who noticed no error, account for all 78 participants. In total, 24 pharmacists (30.8%) reported having dispensed a prescription despite noticing an error, and 54 (69.2%) reported not doing so (Figure 2b).

Identification and Perceived Severity of DDIs

Nineteen pharmacists (24.4%; 95% CI 16.2–34.9) reported having identified DDIs in prescriptions, whereas 59 (75.6%) had not. Regarding severity, 3.8% identified severe interactions, 14.1% moderate, and 5.1% minor interactions, while 76.9% (60/78) did not know the severity (Figure 3a).

Table 3. Self-reported prescription-error and DDI practices of community pharmacists (N = 78)

Variable	n	%	95% CI
Noticed prescription errors before dispensing			
Yes	61	78.2	67.8–85.9
No	17	21.8	14.1–32.2
Type of error reported*			
Incorrect dosage	22	28.2	19.4–39.0
Incomplete or unclear information	21	26.9	18.3–37.7
Potential DDI	10	12.8	7.1–22.0
Unjustified duplication	6	7.7	3.6–15.8
No error noticed	17	21.8	14.1–32.2
Type not specified (missing)	2	2.6	0.7–8.9
Dispensed a prescription despite noticing an error			
Yes	24	30.8	21.6–41.7
No	54	69.2	58.3–78.4
Identified a DDI in prescriptions			
Yes	19	24.4	16.2–34.9
No	59	75.6	65.1–83.8
Perceived severity of DDIs			

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Severe	3	3.8	1.3–10.7
Moderate	11	14.1	8.1–23.5
Minor	4	5.1	2.0–12.5
Not known	60	76.9	66.4–84.9
Action on identifying an error or DDI			
Contacted the physician	28	35.9	26.1–47.0
Refused to dispense	26	33.3	23.9–44.4
Adjusted dose or medication without consulting the physician	9	11.5	6.2–20.5
Dispensed as written	5	6.4	2.8–14.1
Other action	10	12.8	7.1–22.0
Previously contacted a physician about a prescription error			
Yes	58	74.4	63.7–82.7

* Error-type categories (including "no error noticed") sum to all 78 participants. "Type not specified" denotes two of the 61 pharmacists who noticed errors whose error type was missing; these values were not imputed. CI, confidence interval (Wilson); DDI, drug–drug interaction.

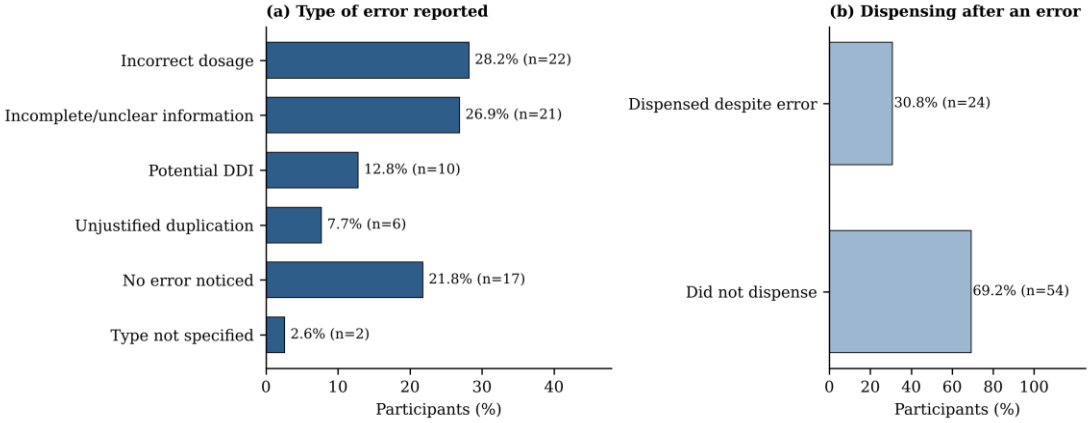


Figure 2. Prescription errors and dispensing practices (N = 78): (a) type of error reported and (b) dispensing after noticing an error. In panel (a), "Type not specified" denotes two pharmacists who reported noticing an error but whose error type was missing (not imputed); percentages use all 78 participants as the denominator.

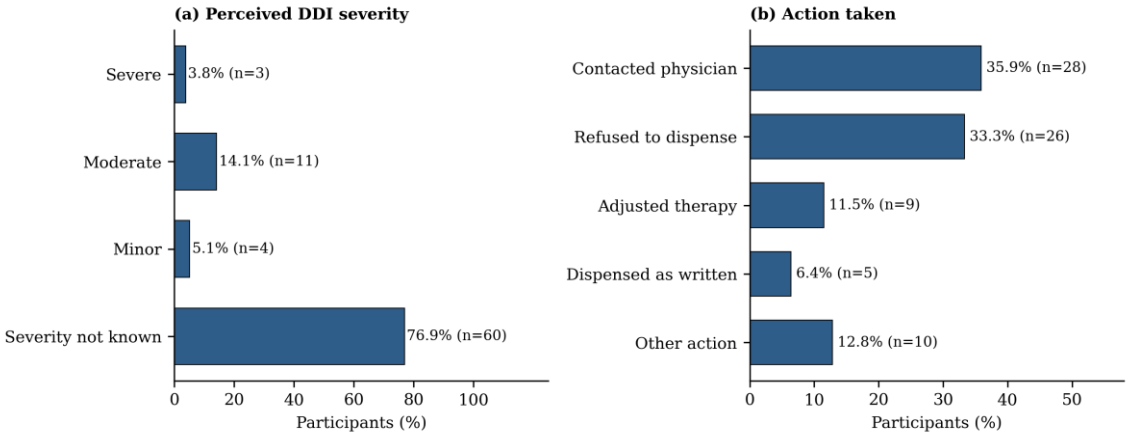


Figure 3. Perceived severity of DDIs (a) and action taken on identifying a prescription error or DDI (b) (N = 78).

Actions After Identifying an Error or DDI

After identifying a prescription error or DDI, 35.9% of pharmacists contacted the prescribing physician, 33.3% refused to dispense, 11.5% adjusted the dose or medication without consulting the physician, 6.4% dispensed the prescription as written, and 12.8% reported other actions (Figure 3b). In addition, 74.4% (58/78) reported having previously contacted a physician about a prescription error.

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Factors Associated With DDI Identification

DDI identification varied with professional experience (Table 4, Figure 4). Half of the pharmacists with more than 10 years of experience (10/20) reported identifying DDIs, compared with 15.5% (9/58) of those with 10 years or less. Experience category differed significantly between pharmacists who identified DDIs and those who did not (Mann–Whitney U test: U = 754.5, p = 0.015; rank-biserial correlation r = 0.35). When dichotomized at 10 years (a post hoc cut-off), the odds of identifying a DDI were higher among pharmacists with more than 10 years of experience (odds ratio 5.4, 95% CI 1.8–16.8; Fisher exact p = 0.005). An inverse association between years of experience and failure to notice prescription errors was also reported (p = 0.001).

By academic qualification (Table 4, Figure 5), the proportion identifying DDIs was 13.3% (4/30) among diploma holders, 36.7% (11/30) among BPharm holders, 2/5 among PharmD holders, 0/2 among master's holders, 1/2 among PhD holders, and 1/9 among those with other qualifications. No significance test was performed for qualification because most groups were very small.

Table 4. Self-reported identification of DDIs by professional experience and academic qualification

Characteristic	Pharmacists (n)	Identified a DDI (n)	Identified (%)
Professional experience (years)			
<1	6	1	16.7
1–5	38	6	15.8
6–10	14	2	14.3
>10	20	10	50.0
Academic qualification			
Diploma	30	4	13.3
BPharm	30	11	36.7
PharmD	5	2	40.0
Master's	2	0	0.0
PhD	2	1	50.0
Other	9	1	11.1
All participants			
Total	78	19	24.4

Counts were derived from the cross-tabulation figures of the source analysis. DDI, drug–drug interaction; BPharm, Bachelor of Pharmacy; PharmD, Doctor of Pharmacy.

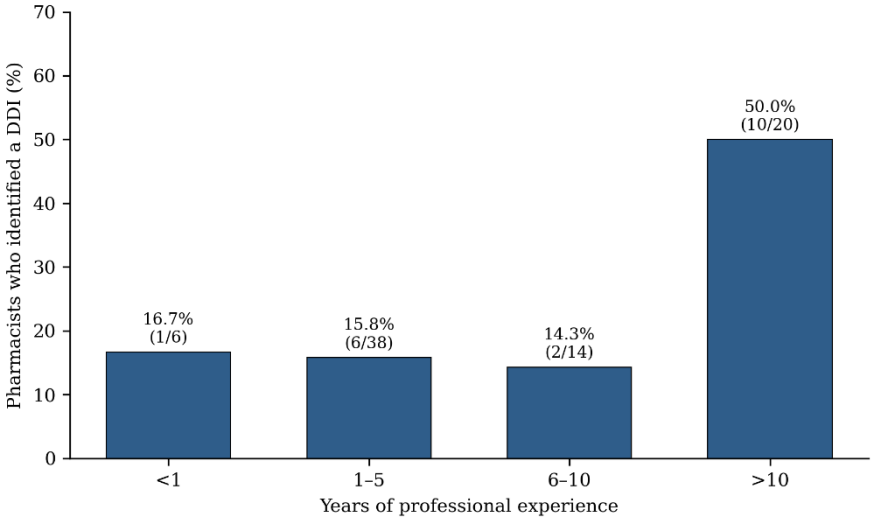


Figure 4. Proportion of pharmacists reporting identification of DDIs by years of professional experience. Labels show percentage and number identifying/number in group.

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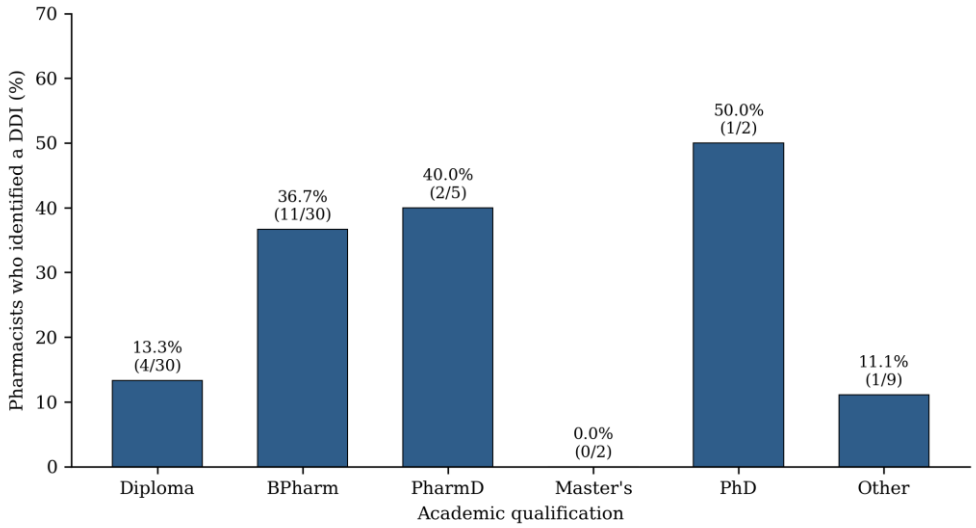


Figure 5. Proportion of pharmacists reporting identification of DDIs by academic qualification. Groups other than diploma and BPharm contain few participants (2–9), so proportions are imprecise.

Discussion

In this survey of 78 community pharmacists in Tripoli, more than three-quarters (78.2%) reported noticing prescription errors before dispensing, yet only one in four reported identifying DDIs and more than three-quarters could not state the severity of an interaction. Potential DDIs accounted for only 12.8% of the error types reported, compared with 28.2% for incorrect dosage and 26.9% for incomplete information. A plausible explanation is that dosage and legibility problems can be recognized from the prescription itself, whereas interactions require pharmacological knowledge or a reference tool; the present data do not test this explanation.

The reported responses to identified problems were mixed. About one-third contacted the prescriber and one-third refused to dispense, which are generally appropriate responses. However, 11.5% adjusted the dose or medication without consulting the prescriber, and 30.8% reported having dispensed despite noticing an error. The 6.4% who dispensed as written when an error or DDI was identified is lower than the 30.8% who reported dispensing despite a noticed error; these items probably captured different situations, and social desirability may have affected answers, but the data cannot resolve this.

DDI identification was more frequent among more experienced pharmacists, with half of those with more than 10 years of experience reporting identification versus 15.5% of the remainder. Greater exposure to prescriptions and clinical cases may contribute, but this is an inference rather than a finding of the study. Experience is likely correlated with age and possibly with qualification, no adjustment was possible, and the cross-sectional design precludes causal interpretation. Notably, half of the most experienced pharmacists did not report identifying DDIs, so experience alone does not appear sufficient. Direct comparison with the Egyptian multicenter study is limited because that study measured knowledge using 19 predefined drug pairs, and its principal reported association was with the habit of considering potential interactions when prescribing.[7]

Qualification showed no clear gradient: identification was lowest among diploma holders (13.3%) and higher among BPharm (36.7%) and PharmD holders (2/5), whereas few master's (0/2) and PhD (1/2) holders took part. With such small groups, no conclusion can be drawn about the effect of postgraduate training.

The low identification and severity knowledge are consistent with earlier Libyan reports that pharmacists reported no source of DDI knowledge and that counseling knowledge was insufficient.[8,9] The combinations that the simulated prescriptions were designed to include, such as angiotensin-converting enzyme inhibitors with spironolactone,[4] NSAIDs with antihypertensive therapy,[5] and aspirin in a child,[6] have well-documented harms, which illustrates why gaps in recognition matter for patient safety. This study did not measure whether such harms occurred or whether pharmacists detected these specific combinations.

Strengths and Limitations

Strengths include a high response rate (90.7%), complete data for all variables, and a focus on a setting in which local data are scarce. Several limitations should be considered. Outcomes were self-reported and may be affected by recall and social desirability bias. Pharmacies were selected by the investigators rather than randomly, no sampling frame or sample-size calculation is reported, and the study was confined to one city, which limits generalizability; the small sample yields wide confidence intervals and small subgroups. Validation or piloting of

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Libyan Journal of Medical Research

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the questionnaire is not reported. The item on DDI identification does not specify whether it referred to the simulated prescriptions or to routine practice. Responses to the individual simulated prescriptions were not analyzed in this report, and the reference source for classifying the interactions is not stated. The comparison by experience was not adjusted for confounders, the 10-year cut-off for the odds ratio was chosen post hoc, and inconsistencies in the error-type data (the error type was missing for two of the 61 pharmacists who reported noticing errors and was not imputed) could not be resolved. Workload, time pressure, and access to decision-support tools were not assessed.

Conclusion

Among community pharmacists in Tripoli, self-reported identification of DDIs was low (24.4%) and most could not state the severity of an interaction, although most reported noticing other prescription errors. Identification was more frequent among pharmacists with more than 10 years of experience. Because of the self-reported, cross-sectional design and non-random sampling, these findings indicate a need for targeted training and decision support in community pharmacy practice rather than a definitive estimate of pharmacist competence.

Recommendations and Implications

Education and continuing professional development. Pharmacy curricula and continuing education should include case-based training on clinically important interactions and their severity, with priority for early-career pharmacists, who formed most of this sample and reported the lowest identification.

Practice tools. Access to electronic interaction-checking resources in community pharmacies should be encouraged and its effect on identification evaluated.

Practice standards. Because 11.5% reported adjusting therapy without consulting the prescriber and 30.8% reported dispensing despite a noticed error, clear local guidance on when to contact the prescriber and when to withhold dispensing is warranted.

Interprofessional communication. Routine pharmacist–prescriber communication pathways should be supported, building on the 74.4% who reported having contacted a physician about an error.

Research. Larger multi-city studies with randomly selected pharmacies, a validated questionnaire, and an explicit interaction reference standard should be undertaken, with per-prescription analysis of simulated-prescription responses and multivariable adjustment for experience, age, and qualification.

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