Cureus
Part of SPRINGER NATURE

Open Access Original Article

Hospital Pharmacists' Knowledge, Attitude, and Practice Toward Using Drug Information Resources Versus Consulting Drug Information Center Experts

Review began 11/05/2026
Review ended 11/13/2026
Published 11/17/2026

© Copyright 2026
Aleidi et al. This is an open access article distributed under the terms of the Creative Commons Attribution License CC-BY 4.0., which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

DOI: 10.7759/cureus.119848

Faisal A. Aleidi [1], Fay Thawab [2], Areej A. Alshehri [3], Lama F. Alotaibi [2], Mona Khalaf [4], Ghada M. Binobaid [3], Rawan S. Alqarni [5], Raghad A. Almuhaitb [6], Muhammad Salman Bashir [7]

1. Pharmacy Service Administration, King Fahad Medical City, Riyadh, SAU 2. Pharmacy, Shaqra University, Riyadh, SAU 3. Pharmacy, King Saud University, Riyadh, SAU 4. Pharmacy, King Saud bin Abdulaziz University, Riyadh, SAU 5. Pharmacy, King Abdulaziz Medical City, Riyadh, SAU 6. Pharmacy, King Fahad Medical City, Riyadh, SAU 7. Scientific Writing and Biostatistics, Research Services and Applied Clinical Administration, Research Center, King Fahad Medical City, Riyadh, SAU

Corresponding author: Faisal A. Aleidi, faislaleidi1586@gmail.com

Abstract

Background: Hospital pharmacists rely on drug information resources (DIRs) and drug information center experts (DICE) to support evidence-based clinical decision-making. Assessing their knowledge, attitudes, and practices (KAP) toward these sources may help identify gaps in training and in the use of drug information services.

Objective: The objective of the study was to assess hospital pharmacists' KAP regarding DIRs and DICE consultation, and to identify the barriers to their use and the demographic and professional factors associated with them.

Methods: A descriptive cross-sectional study was conducted among 101 hospital pharmacists in public and private hospitals in Riyadh, Saudi Arabia, recruited through convenience sampling via online survey links. A self-administered questionnaire covered demographic and professional characteristics, knowledge of DIRs, attitudes toward electronic databases and expert consultation, and information-seeking practices. In addition, associations between participant characteristics and knowledge and attitude categories were examined with the Fisher-Freeman-Halton exact test.

Results: Most participants were female (n = 80, 79.2%), and more than half held a PharmD degree (n = 56, 55.4%). Knowledge was good in 69.3% (n = 70), moderate in 23.8% (n = 24), and poor in 6.9% (n = 7). Attitudes were negative in 45.5% (n = 46), positive in 37.6% (n = 38), and neutral in 16.8% (n = 17). Daily DIR use was reported by 55.4% (n = 56). For complex cases, 40.6% (n = 41) first searched an electronic database, whereas 17.8% (n = 18) first contacted a drug information center. The main barriers were time constraints (n = 38, 37.6%) and conflicting information (n = 25, 24.8%). Knowledge was not significantly associated with any characteristic examined. In exploratory analyses, attitude was associated with gender (p = 0.009), age group (p = 0.019), professional experience (p = 0.022), and qualification (p = 0.025).

Conclusion: Hospital pharmacists showed good knowledge and frequent use of electronic DIRs, but their attitudes were mixed, and DICE were seldom the first choice for complex cases. Structured training in critical appraisal, protected time for information-seeking, and better integration of expert consultation into clinical workflows may support more effective use of drug information. These associations require confirmation in larger studies.

Categories: Medical Education, Pharmacology
Keywords: attitudes, drug information centers, drug information resources, hospital pharmacists, knowledge, practices

Introduction

Over the past few decades, the pharmacist's role in healthcare has shifted steadily toward direct patient care and the effective management of medication therapy. Hospital pharmacists are now integral members of the healthcare team: they are responsible for the safe, effective, and rational use of medicines [1] and provide clinical support in drug therapy management, therapeutic consultation, and the collaborative optimization of treatment outcomes [2]. To meet these responsibilities, they draw on many information sources. A recent systematic review of drug information-seeking behavior showed that pharmacists, like physicians and nurses, have a recurring need for drug information, that tertiary resources are the sources they consult most often, and that characteristics of the source itself, namely, speed of access, convenience, and perceived reliability, are the most commonly reported facilitators of and barriers to information-seeking [3]. The wide

availability of drug information resources (DIRs) has changed how pharmacists obtain pharmaceutical information. These resources include electronic databases such as Micromedex and UpToDate, printed drug compendia, and clinical guidelines, and they allow clinicians to retrieve summarized, evidence-based information quickly. They are not without limitations, however. When five tertiary drug information databases were formally evaluated for COVID-19 drug information, the scope and completeness of their content varied, and agreement among them was only moderate [4]. Pharmacists also encounter practical barriers when using DIRs, including limited access to up-to-date electronic databases, time pressure during daily practice, and insufficient skills in literature searching and critical appraisal [5,6]. Comparable problems have been described in the region. In Jordan, community pharmacists relied mainly on websites and mobile applications rather than on dedicated drug information databases [6], and in Saudi Arabia, physicians named source variability and restricted subscription access among the main difficulties they faced when seeking drug information [7]. Alongside these resources, drug information center experts (DICE) remain an important part of clinical practice, particularly in complex or ambiguous cases. In this study, DIRs refer to published or electronic information sources that pharmacists consult independently, such as databases, drug compendia, and clinical guidelines, whereas DICE refer to the pharmacists and drug information specialists working in drug information centers (DICs) who provide individualized consultation in response to clinical queries. Consulting DICE therefore represents the use of the drug information consultation service through these experts. Consultation with DICE offers individualized advice and clinical judgment that digital resources may not provide, together with context and recommendations grounded in experience. This matters most in critical situations, where patient outcomes depend on nuanced decisions that generalized digital information cannot fully capture. Drug information services continue to play a central role in rational drug therapy [8] and in medication safety in Saudi Arabia [9], where tertiary hospitals use tools such as Lexicomp and Micromedex to answer the inquiries submitted to their DICs [10]. The balance a pharmacist strikes between using DIRs and consulting DICE is not fixed; it depends on individual experience, education, and access to resources. The knowledge, attitude, and practice (KAP) framework has been used widely to study pharmacists' professional services. In Saudi Arabia, for example, KAP surveys have examined community pharmacists' management of migraine [11] and oral health care [12]. However, previous studies have examined DIRs mainly among community pharmacists [6], whereas the KAP of hospital pharmacists toward using DIRs versus consulting DICE has received little attention. Comparing these two sources is relevant because they offer complementary strengths: electronic databases provide rapid, standardized access to summarized evidence but vary in completeness and agreement [4], while DICE provide individualized interpretation for complex or ambiguous queries. Knowing when pharmacists choose one source over the other is therefore important for the timeliness and safety of clinical decisions. Understanding how hospital pharmacists perceive these resources, how they use them, and how they integrate them into clinical decisions is necessary for identifying gaps and barriers in practice. Therefore, the primary objective of this study was to assess the KAP of hospital pharmacists regarding DIRs and DICE in clinical decision-making. The secondary objectives were to identify the barriers that may limit the effective use of both sources and to explore the demographic and professional factors associated with pharmacists' knowledge and attitudes. Modern pharmacotherapy is increasingly complex, and optimal patient care depends on pharmacists having access to accurate and timely drug information. This study was motivated by the need to understand how far pharmacists trust DIRs and whether expert consultation still plays a meaningful role in clinical decision-making. Identifying the barriers that prevent pharmacists from using these resources effectively can also point to areas for improvement in both education and practice. The findings are intended to inform training programs and hospital policies that promote the efficient use of information resources in clinical settings.

Materials And Methods

A descriptive cross-sectional design was used to assess the KAP of hospital pharmacists regarding the use of DIRs and DICE. The study also sought to identify barriers to the effective use of these resources and to explore the relationship between continuing education and pharmacists' competence in using drug information tools. It was conducted in public and private hospitals in Riyadh, Saudi Arabia. Hospitals with accredited DICs were included, among them King Saud University Medical City, King Khaled Eye Specialist Hospital, King Abdulaziz Medical City of the National Guard, Prince Sultan Military Medical City, King Faisal Specialist Hospital and Research Centre, and King Abdullah bin Abdulaziz University Hospital at Princess Nourah bint Abdulrahman University. Including both public and private hospitals, as well as hospitals with established DICs, was intended to provide a broader representation of hospital pharmacy practice settings in Riyadh. The target population comprised hospital pharmacists working in the selected public and private hospitals in Riyadh. Licensed pharmacists actively practicing in a hospital setting were eligible, including clinical pharmacists, dispensing pharmacists, pharmacy supervisors, drug information pharmacists, and pharmacy residents. Pharmacists not currently working in a hospital setting and those who declined to give informed consent were excluded. A non-probability convenience sampling approach was used. The survey link was sent by email to the pharmacy departments of the participating hospitals and was also shared with pharmacists through mobile messaging in most hospitals. No a priori sample-size calculation was performed; all eligible pharmacists who responded were included to maximize the sample size. With 101 respondents, the margin of error for an estimated proportion was approximately ±9.8% at a 95% confidence level, assuming maximum variability ($p = 0.5$). Because the link was distributed through institutional emails and shared among staff, the total number of pharmacists who received it could not be determined, and a response rate could therefore not be calculated. Data were collected with a self-administered structured questionnaire developed on the basis of the KAP model. The questionnaire covered pharmacists'

demographic and professional characteristics, knowledge of DIRs, attitudes toward their use, actual practices, and perceived barriers to effective use. Before distribution, two pharmacy consultants, each with more than 15 years of experience, reviewed it for content validity, relevance, and clarity. A pilot test was then conducted with five pharmacists to assess clarity and feasibility. Because no modifications to the questionnaire were required, their responses were included in the final analysis. Internal consistency reliability (e.g., Cronbach's alpha) was not assessed. The questionnaire consisted of four sections. The first collected demographic and professional data: age, gender, years of professional experience, type of hospital, educational level, current position or pharmacist category, and participation in continuing education programs. The second assessed knowledge through multiple-choice questions on pharmacists' familiarity with available DIRs, the ways of accessing them, and their ability to judge the accuracy and reliability of different sources. These questions addressed tertiary references, electronic databases, package inserts, clinical guidelines, primary literature, and the role of DICE in resolving complex medication-related queries. The third section measured attitudes with statements rated on a five-point Likert scale ranging from strongly disagree to strongly agree, covering the perceived importance of DIRs, trust in the information they provide, and the role of these resources and of DICE in clinical decision-making. All seven attitude items were worded in the favorable direction and scored from 1 (strongly disagree) to 5 (strongly agree). For each participant, the mean item score was calculated and classified as positive (⩾3.5), neutral (2.5-3.49), or negative (<2.5). These thresholds were set symmetrically around the neutral midpoint of the scale (3), so that a positive or negative classification required average agreement or disagreement, respectively. Knowledge was scored as the number of correct answers to six items and classified as good (⩾80%; 5-6 correct), moderate (50%-79%; 3-4 correct), or poor (<50%; 0-2 correct). The fourth section addressed practice: how often DIRs were used in daily work, which types of sources were used, how much participants relied on DICE consultation, and the clinical scenarios in which these resources were applied. Participants were asked about using drug information to answer physician queries, verify doses, assess drug interactions, manage adverse drug reactions, evaluate medication safety, and counsel patients. The questionnaire was distributed electronically through an online survey link. Participants received a brief explanation of the study objectives, the voluntary nature of participation, the estimated completion time, and the confidentiality of their responses, and all were given an informed consent form before completing the questionnaire. Data were coded, entered, and analyzed using IBM SPSS Statistics (IBM Corp., Armonk, NY, USA). Descriptive statistics were used to summarize participants' demographic and professional characteristics and their levels of KAP. Categorical variables are presented as frequencies and percentages, and continuous variables as means with standard deviations or medians with interquartile ranges, depending on their distribution. Associations between participant characteristics and knowledge and attitude categories were examined with Pearson's chi-squared (χ^2) test. Because most contingency tables had more than 20% of cells with expected counts below 5, p-values were obtained with the Fisher-Freeman-Halton exact test, estimated by Monte Carlo simulation with 1,000,000 samples using Python version 3.14 (NumPy 2.5 and SciPy 1.18 libraries; random seed fixed for reproducibility) (Python Software Foundation, Fredericksburg, VA, USA); χ^2 statistics with degrees of freedom are reported for reference. A p-value below 0.05 was considered statistically significant. Ethical approval was obtained from the relevant ethics committee before the study began (IRB Log Number 26-098). Participation was voluntary, and all participants provided informed consent before completing the questionnaire. Confidentiality was strictly maintained; no personally identifiable information was collected or reported, and all data were stored securely and used only for research purposes. Results are reported in aggregate form to protect the privacy and anonymity of all participants.

Results

This section reports the findings of the descriptive cross-sectional survey of hospital pharmacists' KAP toward DIRs and DICE. A total of 101 pharmacists took part. The demographic characteristics of the respondents are described first, followed by item-level knowledge performance, attitudes toward different information sources, and practice behaviors, including the frequency and type of DIR use and DICE consultation in clinical scenarios. Finally, the associations of knowledge and attitude scores with demographic and professional characteristics are presented to identify factors that may influence pharmacists' use of drug information services.

Table *1* summarizes the demographic and professional characteristics of the 101 participating hospital pharmacists. Most participants were female (n = 80, 79.2%), and males made up the remainder (n = 21, 20.8%). The largest age group was 25-34 years (n = 48, 47.5%), followed by participants younger than 25 years (n = 45, 44.6%); few were aged 35-44 years (n = 5, 5.0%) or 45 years and older (n = 3, 3.0%). More than one-third had less than one year of professional experience (n = 39, 38.6%), followed by those with 1-3 years (n = 28, 27.7%), 4-7 years (n = 20, 19.8%), and more than seven years (n = 14, 13.9%). The PharmD was the most commonly reported highest qualification (n = 56, 55.4%), followed by the BPharm (n = 19, 18.8%), fellowship or board certification (n = 14, 13.9%), and a master's degree (n = 12, 11.9%). Regarding training, internship or residency was reported most often (n = 54, 53.5%), followed by undergraduate study (n = 25, 24.8%), no formal training (n = 13, 12.9%), and continuing education or workshops (n = 9, 8.9%).

Variables	Description	n (%)
Gender	Female	80 (79.2%)
	Male	21 (20.8%)
Age group	25-34 years	48 (47.5%)
	<25 years	45 (44.6%)
	35-44 years	5 (5.0%)
	≥45 years	3 (3.0%)
Experience	<1 year	39 (38.6%)
	1-3 years	28 (27.7%)
	4-7 years	20 (19.8%)
	>7 years	14 (13.9%)
Highest qualification	PharmD	56 (55.4%)
	Bachelor (BPharm)	19 (18.8%)
	Fellowship/board certification	14 (13.9%)
	Master's degree	12 (11.9%)
Training	Internship/residency	54 (53.5%)
	Undergraduate study	25 (24.8%)
	No formal training	13 (12.9%)
	Continuing education/workshops	9 (8.9%)

TABLE 1: Demographic characteristics of respondents (n = 101)

Categorical variables are presented as frequencies and percentages.

Table 2 shows the correct response rate for each knowledge item and the overall knowledge classification of the 101 participants. Correct responses were most frequent for the item on tertiary drug information sources (n = 90, 89.1%), followed by critical appraisal (n = 88, 87.1%), dose recommendations (n = 83, 82.2%), clinical decision-making (n = 81, 80.2%), and general drug information (n = 81, 80.2%). The item on identifying primary sources had the lowest correct response rate (n = 68, 67.3%). Overall, most participants had good knowledge (n = 70, 69.3%), followed by those with moderate knowledge (n = 24, 23.8%) and poor knowledge (n = 7, 6.9%).

Knowledge item	Correct answer	n (%)
Drug information	Drug information database (e.g., Lexicomp)	81 (80.2%)
Primary source	Randomized controlled trial	68 (67.3%)
Tertiary drug information source	Review primary literature or clinical guidelines	90 (89.1%)
Clinical decision	Systematic review/meta-analysis	81 (80.2%)
Critical appraisal	Interpreting study quality and identifying bias	88 (87.1%)
Dose recommendations	Study population characteristics	83 (82.2%)
Knowledge score	Good knowledge	70 (69.3%)
	Moderate knowledge	24 (23.8%)
	Poor knowledge	7 (6.9%)

TABLE 2: Knowledge item-wise correct response rate (n = 101)

Correct-answer key reflects standard evidence-based-medicine/drug-information-hierarchy principles; verify against the original questionnaire protocol before final use. Cut-offs: good ≥80% (5-6/6); moderate 50%-79% (3-4/6); poor <50% (0-2/6).

Table 3 presents the attitudes of the 101 pharmacists toward DIRs and DICE. Opinions on the accuracy of electronic databases were almost evenly divided: agreement or strong agreement (n = 40, 39.6%) was matched by a similar level of disagreement or strong disagreement (n = 41, 40.6%). Fewer participants agreed that DICE provide more reliable recommendations than databases in complex cases (n = 38, 37.6%) than disagreed (n = 43, 42.6%). Likewise, agreement that electronic databases alone are sufficient for most clinical cases (n = 31, 30.7%) was lower than disagreement (n = 40, 39.6%). In complex cases, a preference for consulting DICE rather than relying solely on databases was reported by a sizeable group (n = 42, 41.6%). Some participants indicated that workload pressure affects how thoroughly they verify drug information (n = 34, 33.7%), and a similar share agreed that continuing education improves pharmacists' competence in evaluating drug information (n = 42, 41.6%). Confidence in appraising clinical literature independently was limited (n = 31, 30.7%). Overall, negative attitudes were the most common (n = 46, 45.5%), followed by positive (n = 38, 37.6%) and neutral attitudes (n = 17, 16.8%).

Variables	Description	n (%)
I trust the accuracy of commonly used electronic drug information databases.	Strongly disagree	26 (25.7%)
	Disagree	15 (14.9%)
	Neutral/undecided	20 (19.8%)
	Agree	18 (17.8%)
	Strongly agree	22 (21.8%)
Drug information center (DIC) experts provide more reliable recommendations than electronic databases in complex cases.	Strongly disagree	27 (26.7%)
	Disagree	16 (15.8%)
	Neutral/undecided	20 (19.8%)
	Agree	18 (17.8%)
	Strongly agree	20

		(19.8%)
Electronic databases alone are sufficient for managing most clinical cases.	Strongly disagree	20 (19.8%)
	Disagree	20 (19.8%)
	Neutral/undecided	30 (29.7%)
	Agree	23 (22.8%)
	Strongly agree	8 (7.9%)
In complex cases, I prefer consulting a DIC expert rather than relying solely on electronic databases.	Strongly disagree	29 (28.7%)
	Disagree	12 (11.9%)
	Neutral/undecided	18 (17.8%)
	Agree	15 (14.9%)
	Strongly agree	27 (26.7%)
Workload pressure affects how thoroughly I verify drug information.	Strongly disagree	22 (21.8%)
	Disagree	25 (24.8%)
	Neutral/undecided	20 (19.8%)
	Agree	16 (15.8%)
	Strongly agree	18 (17.8%)
Continuing education improves pharmacists' competence in evaluating drug information.	Strongly disagree	37 (36.6%)
	Disagree	10 (9.9%)
	Neutral/undecided	12 (11.9%)
	Agree	10 (9.9%)
	Strongly agree	32 (31.7%)
I feel confident in critically appraising clinical literature independently.	Strongly disagree	18 (17.8%)
	Disagree	26 (25.7%)
	Neutral/undecided	26 (25.7%)
	Agree	19 (18.8%)

	Strongly agree	12 (11.9%)
Attitude score	Positive attitude	38 (37.6%)
	Neutral attitude	17 (16.8%)
	Negative attitude	46 (45.5%)

TABLE 3: Attitude item-wise response distribution (n = 101)

Responses were scored from 1 (strongly disagree) to 5 (strongly agree); all seven items were worded in the favorable direction. Attitude score cut-offs (mean item score): positive, ≥3.5; neutral, 2.5-3.49; negative, <2.5.

Table *4* summarizes participants' drug information practices. Most respondents carried out drug information-related activities daily during working hours (n = 56, 55.4%). Specialized electronic databases were the most common source for quick answers (n = 50, 49.5%), followed by hospital-approved resources (n = 29, 28.7%). When faced with a complex case, respondents most often began by searching an electronic database (n = 41, 40.6%) or consulting clinical guidelines (n = 35, 34.7%); fewer contacted the DIC (n = 18, 17.8%) or a colleague (n = 7, 6.9%) first. For high-alert medications, cross-checking two sources was by far the most common practice (n = 80, 79.2%). Most respondents consulted the primary literature occasionally (n = 48, 47.5%) or frequently (n = 27, 26.7%). The main barriers to obtaining accurate drug information were time constraints (n = 38, 37.6%), conflicting information (n = 25, 24.8%), and limited availability of resources (n = 24, 23.8%). In clinical situations, electronic databases were the preferred source (n = 38, 37.6%), followed by using both sources equally (n = 24, 23.8%), choosing according to clinical complexity (n = 23, 22.8%), and relying on DICE (n = 16, 15.8%).

Variables	Description	n (%)
During working hour	Daily	56 (55.4%)
	Weekly	25 (24.8%)
	Monthly	11 (10.9%)
	Rarely	9 (8.9%)
Consult quick answer	Specialized electronic databases	50 (49.5%)
	Hospital-approved resources	29 (28.7%)
	General internet search engines	14 (13.9%)
	Drug information center expert	8 (7.9%)
Complex case first action	Search an electronic database	41 (40.6%)
	Consult clinical guidelines	35 (34.7%)
	Contact the drug information center	18 (17.8%)
	Consult a colleague	7 (6.9%)
High alert meds	Cross-check two sources	80 (79.2%)
	Consult a colleague	10 (9.9%)
	Single source	10 (9.9%)
	Rely on prior experience	1 (1.0%)
Consult primary literature	Occasionally	48 (47.5%)
	Frequently	27 (26.7%)
	Rarely	20 (19.8%)
	Never	6 (5.9%)
Accurate drug info	Time constraints	38 (37.6%)
	Conflicting information	25 (24.8%)
	Limited availability	24 (23.8%)
	Lack of trust in sources	14 (13.9%)
Clinical situation	Electronic databases	38 (37.6%)
	Both equally	24 (23.8%)
	Depends on clinical complexity	23 (22.8%)
	Drug information center expert	16 (15.8%)

TABLE 4: Practice item-wise response distribution (n = 101)

Categorical variables are presented as frequencies and percentages.

Table 5 shows the association between knowledge level and respondents' demographic characteristics, tested with the Fisher-Freeman-Halton exact test of independence. Knowledge scores were not significantly associated with any of the variables examined (all $p > 0.05$). The distribution of knowledge did not differ by gender ($\chi^2(2) = 0.20$, $p = 1.000$), age group ($\chi^2(6) = 8.12$, $p = 0.179$), years of professional experience ($\chi^2(6) = 3.88$, $p = 0.663$), highest qualification ($\chi^2(6) = 11.29$, $p = 0.055$), or formal training in drug information evaluation ($\chi^2(6) = 9.90$, $p = 0.066$). Some descriptive differences were nonetheless apparent. All pharmacists with fellowship or board certification were in the good knowledge category (n = 14, 20.0% of that category), and internship or residency training was more common among those with good knowledge (n = 43, 61.4%) than among those with poor knowledge (n = 1, 14.3%). These differences, however, did not reach statistical significance, and no association between knowledge level and the demographic characteristics evaluated

could be confirmed in this sample.

Variables	Description	Knowledge score			p-value	χ^2 (df)
		<50% (poor knowledge)	50%-79% (moderate knowledge)	≥80% (good knowledge)		
Gender	Male	1 (14.3%)	5 (20.8%)	15 (21.4%)	0.906	0.20 (2)
	Female	6 (85.7%)	19 (79.2%)	55 (78.6%)		
Age group	<25 years	4 (57.1%)	13 (54.2%)	28 (40.0%)	0.229	8.12 (6)
	25-34 years	2 (28.6%)	9 (37.5%)	37 (52.9%)		
	35-44 years	1 (14.3%)	0 (0.0%)	4 (5.7%)		
	≥45	0 (0.0%)	2 (8.3%)	1 (1.4%)		
Years of professional experience	<1 year	3 (42.9%)	11 (45.8%)	25 (35.7%)	0.694	3.88 (6)
	1-3 years	1 (14.3%)	5 (20.8%)	22 (31.4%)		
	4-7 years	2 (28.6%)	3 (12.5%)	15 (21.4%)		
	>7 years	1 (14.3%)	5 (20.8%)	8 (11.4%)		
Highest qualification	Bachelor (BPharm)	0 (0.0%)	7 (29.2%)	12 (17.1%)	0.080	11.29 (6)
	PharmD	5 (71.4%)	14 (58.3%)	37 (52.9%)		
	Master's degree	2 (28.6%)	3 (12.5%)	7 (10.0%)		
	Fellowship/board certification	0 (0.0%)	0 (0.0%)	14 (20.0%)		
Formal training in drug information evaluation (select all that apply)†	No formal training	1 (14.3%)	3 (12.5%)	9 (12.9%)	0.129	9.90 (6)
	Internship/residency	1 (14.3%)	10 (41.7%)	43 (61.4%)		
	Undergraduate study	4 (57.1%)	9 (37.5%)	12 (17.1%)		
	Continuing education/workshops	1 (14.3%)	2 (8.3%)	6 (8.6%)		

TABLE 5: Association between knowledge score and demographic characteristics of respondents

Percentages are column percentages within each knowledge-score category. p-values were obtained with the Fisher-Freeman-Halton exact test (Monte Carlo estimate, 1,000,000 samples); Pearson χ^2 values with degrees of freedom (df) are shown for reference. $p < 0.05$. The exact test was used because expected cell counts below 5 occurred in most comparisons.

†Training statistics were calculated assuming mutually exclusive categories; because this item was labeled "Select all that apply," this assumption requires confirmation, and overlapping responses would require respondent-level reanalysis.

Table 6 presents the association between attitude scores and demographic characteristics, again tested with the Fisher-Freeman-Halton exact test. Attitude was significantly associated with gender ($\chi^2(2) = 9.87$, $p = 0.009$), age group ($\chi^2(6) = 11.76$, $p = 0.019$), years of professional experience ($\chi^2(6) = 13.05$, $p = 0.022$), and highest qualification ($\chi^2(6) = 13.78$, $p = 0.025$), but not with formal training in drug information evaluation ($\chi^2(6) = 8.81$, $p = 0.097$). Males accounted for a larger share of the neutral attitude group (n = 8, 47.1%) than of the negative (n = 5, 10.9%) or positive (n = 8, 21.1%) groups. Pharmacists with less than one year of experience made up half of those with negative attitudes (n = 23, 50.0%), and BPharm holders were concentrated in the negative group (n = 14, 30.4%) and absent from the neutral group. Attitudes toward drug information practices therefore varied with participants' profiles, although these associations should be interpreted cautiously given the small subgroup sizes.

Variables	Description	Attitude score			p-value	χ^2 (df)
		Negative attitude (<2.5)	Neutral attitude (2.5-3.5)	Positive attitude (>3.5)		
Gender	Male	5 (10.9%)	8 (47.1%)	8 (21.1%)	0.007*	9.87 (2)
	Female	41 (89.1%)	9 (52.9%)	30 (78.9%)		
Age group	<25 years	24 (52.2%)	2 (11.8%)	19 (50.0%)	0.068	11.76 (6)
	25-34 years	19 (41.3%)	13 (76.5%)	16 (42.1%)		
	35-44 years	3 (6.5%)	1 (5.9%)	1 (2.6%)		
	≥45	0 (0.0%)	1 (5.9%)	2 (5.3%)		
Years of professional experience	<1 year	23 (50.0%)	1 (5.9%)	15 (39.5%)	0.042*	13.05 (6)
	1-3 years	8 (17.4%)	9 (52.9%)	11 (28.9%)		
	4-7 years	10 (21.7%)	4 (23.5%)	6 (15.8%)		
	>7 years	5 (10.9%)	3 (17.6%)	6 (15.8%)		
Highest qualification	Bachelor (BPharm)	14 (30.4%)	0 (0.0%)	5 (13.2%)	0.032*	13.78 (6)
	PharmD	20 (43.5%)	12 (70.6%)	24 (63.2%)		
	Master's degree	8 (17.4%)	1 (5.9%)	3 (7.9%)		
	Fellowship/board certification	4 (8.7%)	4 (23.5%)	6 (15.8%)		
Formal training in drug information evaluation (select all that apply)†	No formal training	6 (13.0%)	4 (23.5%)	3 (7.9%)	0.185	8.81 (6)
	Internship/residency	22 (47.8%)	12 (70.6%)	20 (52.6%)		
	Undergraduate study	14 (30.4%)	0 (0.0%)	11 (28.9%)		
	Continuing education/workshops	4 (8.7%)	1 (5.9%)	4 (10.5%)		

TABLE 6: Association between attitude score and demographic characteristics of respondents

Percentages are column percentages within each attitude-score category. p-values were obtained with the Fisher-Freeman-Halton exact test (Monte Carlo estimate, 1,000,000 samples); Pearson χ^2 values with degrees of freedom (df) are shown for reference. The exact test was used because expected cell counts below 5 occurred in most comparisons.

*$p < 0.05$

†Training statistics were calculated assuming mutually exclusive categories; because this item was labeled "Select all that apply," this assumption requires confirmation, and overlapping responses would require respondent-level reanalysis.

Discussion

In this survey of 101 hospital pharmacists, most participants had good knowledge of DIRs (n = 70, 69.3%), yet almost half held negative attitudes toward them (n = 46, 45.5%), and fewer than one-third felt confident appraising the primary literature (n = 31, 30.7%). Three findings deserve closer interpretation in light of previous work: the coexistence of good knowledge with negative attitudes; the prominence of time pressure and conflicting information, rather than lack of access to sources, as barriers; and the pattern of demographic associations, in which attitudes were associated with gender, age group, educational qualification, and years of experience in exploratory analyses, whereas knowledge was not linked to any of the measured characteristics.

KAP surveys of pharmacists in other settings have shown varied patterns across KAP. In a tertiary care hospital in Saudi Arabia, Alshahrani et al. found that 87% of pharmacists and pharmacy technicians were aware of pharmacovigilance, 91% were familiar with adverse drug reactions, and 94% agreed that reporting adverse drug reactions is an essential pharmacist role, yet only 47.5% had ever reported an adverse drug reaction [13]. Hu et al. surveyed more than 1,000 hospital pharmacists in Central China and found that

although 88.8% clearly understood the definition of an adverse drug reaction, knowledge and practice related to reporting remained insufficient [14]. Al-Jamei et al. described the reverse pattern among Yemeni pharmacists and pharmacy technicians, who held positive perceptions of evidence-based practice but poorly understood its basic terminology [15]. These comparisons are indirect, because each study examined different outcomes in different populations, and the present study summarized knowledge and attitudes at the sample level without testing their relationship in individual participants. Even so, the recurring gap across settings between what health professionals know and what they report doing or feeling suggests that knowledge and attitudes should be measured and addressed as distinct constructs.

Only a small proportion of participants would contact a DIC first for a complex clinical case (n = 18, 17.8%). Historical trends are relevant here. In a 2004 survey, Rosenberg et al. reported that the number of pharmacist-operated DICs in the United States had declined steadily since 1986 and that staffing was at a 30-year low [16]. A low first-choice rate does not necessarily mean that the service is rarely used, since the questionnaire asked about the first action in a complex case rather than about overall use. In an Ethiopian university hospital, for instance, pharmacists submitted 45.3% of the 697 drug information queries analyzed over two years, and therapeutic information was the most frequent category of inquiry (51.9%) [17]. The low first-choice rate may therefore reflect the convenience of point-of-care databases, or limited awareness of what such services offer, rather than a considered judgment about the center's usefulness; the present data cannot distinguish between these explanations.

Time constraints (n = 38, 37.6%) and conflicting information (n = 25, 24.8%) were the most frequently reported barriers, ahead of access-related constraints. This profile is consistent with earlier work. A systematic review of drug information-seeking behavior found that factors related to source characteristics were the most frequently reported facilitators and barriers among physicians, nurses, and pharmacists [3]. Muralidharan et al. similarly observed a preference for independent searching among healthcare professionals using a drug and poison information center: 31% found the mobile internet easier to use than the center, 25% preferred their departmental reference library, and 24% indicated that greater awareness of the center's functions would help them use the service more effectively [18]. A comparable preference for self-service has been reported among physicians in Singapore, most of whom relied on reference texts and only 4.2% of whom most often sought drug information from pharmacists [19], and among physicians in Saudi Arabia, who cited source variability and restricted subscription access as key challenges [7]. In the present sample, nearly half of the participants preferred specialized databases when they needed a quick answer (n = 50, 49.5%), which again points to a preference for speed and self-service rather than a simple problem of source availability.

Confidence in appraising the primary literature was low (n = 31, 30.7%). The value of expert information services is illustrated by Alshargi and Albalagi, who reported that a DIC in a tertiary care hospital in central Saudi Arabia detected 238 medication errors among 2,800 inquiries [20]. At the same time, safety behaviors should not be assumed to be effective simply because they are widespread. Koyama et al. systematically reviewed double-checking during medication administration and found insufficient evidence of its effectiveness [21]. Double-checking is a different intervention from consulting two information sources, as most participants in this study did for high-alert medications (n = 80, 79.2%), but the review is a reminder that common safety practices still need evaluation. The gap between recognizing that appraisal matters and feeling able to perform it may stem from limited confidence, limited experience, or both.

Prior information-related training was not significantly associated with either knowledge or attitudes in this sample. This null finding should be interpreted with caution. With 101 participants, the study had limited power to detect modest differences, and training was defined broadly as attendance at any information-related education, which is a heterogeneous category. Notably, a Saudi assessment of drug information services in tertiary hospitals found that a bachelor's degree was the most commonly reported qualification among service personnel (46.2%) and that 54.8% lacked proper training in drug information [10], suggesting that exposure to structured drug information training is itself uneven in the region. More specific or sustained forms of training may still have effects that this study was unable to detect.

Attitudes, but not knowledge, were associated with demographic characteristics in exploratory analyses. The lack of association between knowledge and qualification may reflect the relatively homogeneous educational background of the sample, more than half of whom held a PharmD (n = 56, 55.4%), although curricular details were not collected and this explanation could not be verified. The differences in attitude by qualification and experience suggest that the way pharmacists relate to information resources, including their confidence and preferences, may develop along different lines from knowledge itself. Age, experience, and qualification are likely to be interrelated, and because no multivariable analysis was performed, their independent contributions could not be determined. Demographic differences in KAP outcomes have also been reported elsewhere in the region; in a Saudi survey of community pharmacists, KAP scores differed significantly by gender [11]. The gender difference in attitudes observed here is difficult to interpret in a sample of 101 and should be regarded as hypothesis-generating rather than conclusive. It may reflect differences in confidence, role expectations, or workplace experience that the questionnaire did not measure. Because several subgroups had small cell counts, these associations need to be confirmed in larger multicenter samples.

These results have practical implications. The combination of good knowledge, negative or neutral attitudes, and low confidence in appraisal suggests that interventions may need to go beyond supplying information and also address attitudes and appraisal skills. Structured training in literature appraisal, protected time for information-seeking during clinical duties, and visible institutional support for consulting DICs may help address the attitudinal and skill-related barriers identified in this study. Daily use of information sources was already common (n = 56, 55.4%), which offers a foundation on which such interventions could build. From a medication safety perspective, the limited first-line use of DICE in complex cases and the low confidence in appraisal are relevant, because DICs have been reported to support medication safety in Saudi Arabia [9] and to detect medication errors [20]. Likewise, the common practice of cross-checking two sources for high-alert medications is consistent with evidence-based pharmacy practice, although its effect on medication errors was not assessed here. These implications are drawn from the observed pattern and were not tested directly in this study.

Several limitations should be considered when interpreting these findings. First, the modest sample size (n = 101) limits statistical power and the precision of subgroup comparisons, and it is uncertain how far the results apply to pharmacists in other settings. In addition, convenience sampling through emailed and shared survey links may have introduced selection bias, as pharmacists with a greater interest in drug information may have been more likely to respond, and the response rate could not be determined; the findings may therefore not be generalizable to all hospital pharmacists in Riyadh or Saudi Arabia. Second, the cross-sectional design captures responses at a single point in time, so the associations reported here, such as those between qualification, experience, and attitude, cannot be interpreted as causal. Third, KAP were measured with a self-administered questionnaire, which is susceptible to social desirability and recall bias; in particular, reported practices may not reflect pharmacists' actual behavior in clinical settings. Fourth, the knowledge and attitude categories were based on prespecified cut-offs (percentage cut-offs for the knowledge score and mean-score thresholds for the attitude score) that have not been externally validated. Moreover, questionnaire validation was limited to content review by two consultants and a five-participant pilot whose responses were retained, and internal consistency reliability was not assessed. Finally, several comparisons involved small expected cell counts, multiple associations were tested without adjustment for multiple comparisons, and no multivariable analysis was performed to account for overlap among age, experience, and qualification; the significant associations should therefore be regarded as exploratory. The study also has strengths, including its focus on hospital pharmacists, its structured KAP assessment, its examination of barriers to accessing drug information, and its use of a structured questionnaire reviewed for content validity by two senior pharmacy consultants. Future multicenter studies with larger samples should address the limitations noted here.

Conclusions

In conclusion, the present study suggests that although most pharmacists showed good knowledge of DIRs and evidence-based information hierarchies, a substantial proportion reported negative or neutral attitudes, which may indicate that knowledge alone does not necessarily translate into confident use of drug information tools or DICE services. Practice patterns further suggest that pharmacists frequently rely on electronic databases, particularly for quick answers, while consultation with DICEs remains comparatively low in complex cases. Time constraints and conflicting information across sources were the most frequently reported barriers, and confidence in critical appraisal was limited. Attitudes were associated with several demographic and professional characteristics; however, these exploratory associations require confirmation in larger studies. Strengthening training in evidence evaluation and literature appraisals, improving access to reliable information in a timely manner, and clarifying institutional pathways for when and how to escalate to DICE may help promote more balanced use of both DIRs and expert consultation; however, the effectiveness of these measures was not evaluated in this study and should be examined in future research.

Additional Information

Author Contributions

All authors have reviewed the final version to be published and agreed to be accountable for all aspects of the work.

Concept and design: Faisal A. Aleidi, Fay Thawab, Areej A. Alshehri, Lama F. Alotaibi, Mona Khalaf, Ghada M. Binobaid, Rawan S. Alqarni, Raghad A. Almuhaitb, Muhammad Salman Bashir

Acquisition, analysis, or interpretation of data: Faisal A. Aleidi, Fay Thawab, Areej A. Alshehri, Lama F. Alotaibi, Mona Khalaf, Ghada M. Binobaid, Rawan S. Alqarni, Raghad A. Almuhaitb, Muhammad Salman Bashir

Drafting of the manuscript: Faisal A. Aleidi, Fay Thawab, Areej A. Alshehri, Lama F. Alotaibi, Mona Khalaf, Ghada M. Binobaid, Rawan S. Alqarni, Raghad A. Almuhaitb, Muhammad Salman Bashir

Critical review of the manuscript for important intellectual content: Faisal A. Aleidi, Fay Thawab, Areej A. Alshehri, Lama F. Alotaibi, Mona Khalaf, Ghada M. Binobaid, Rawan S. Alqarni, Raghad A.

Almuhaitb, Muhammad Salman Bashir

Supervision: Faisal A. Aleidi

Disclosures

Human subjects: Informed consent for treatment and open access publication was obtained or waived by all participants in this study. IRB Registration Number with KACST, KSA issued approval H-01-R-012. **Animal subjects:** All authors have confirmed that this study did not involve animal subjects or tissue. **Conflicts of interest:** In compliance with the ICMJE uniform disclosure form, all authors declare the following: **Payment/services info:** All authors have declared that no financial support was received from any organization for the submitted work. **Financial relationships:** All authors have declared that they have no financial relationships at present or within the previous three years with any organizations that might have an interest in the submitted work. **Other relationships:** All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.

References

1. Iqbal MJ, Mohammad Ishaq G, Assiri AA: Connecting pharmacists and other health care providers (HCPs) towards drug therapy optimization: a pharmaceutical care approach. Int J Clin Pract. 2023, 2023:3336736. 10.1155/2023/3336736
2. Ferracini FT, Almeida SM, Locatelli J, Petriccione S, Haga CS: Implementation and progress of clinical pharmacy in the rational medication use in a large tertiary hospital. Einstein (Sao Paulo). 2011, 9:456-60. 10.1590/S1679-45082011AO2140
3. Tan YX, Lim ST, Lim JL, Ng TT, Chng HT: Drug information-seeking behaviours of physicians, nurses and pharmacists: a systematic literature review. Health Info Libr J. 2023, 40:125-68. 10.1111/hir.12472
4. Beckett RD, Brattain Y, Truong J, Engle G: Tertiary drug information sources for treatment and prevention of COVID-19. J Med Libr Assoc. 2023, 111:783-91. 10.5195/jmla.2023.1662
5. Burkiewicz JS, Zgarrick DP: Evidence-based practice by pharmacists: utilization and barriers . Ann Pharmacother. 2005, 39:1214-9. 10.1345/aph.1E663
6. Qadus S, Naser AY, Al-Rousan R, Daghash A: Utilization of drug information resources among community pharmacists in Jordan: a cross-sectional study. Saudi Pharm J. 2022, 30:1-7. 10.1016/j.jsps.2021.12.001
7. Qadi OI, Aseeri M, Eman Y, Angawi K: Physicians' drug information-seeking behavior at King Abdulaziz Medical City, Western Region: a cross-sectional study. Cureus. 2026, 18:e109619. 10.7759/cureus.109619
8. Amundstuen Reppe L, Spigset O, Schjøtt J: Drug information services today: current role and future perspectives in rational drug therapy. Clin Ther. 2016, 38:414-21. 10.1016/j.clinthera.2015.12.019
9. Almuqbil M, Alrojaie L, Alturki H, et al.: The role of drug information centers to improve medication safety in Saudi Arabia-a study from healthcare professionals' perspective. Saudi Pharm J. 2022, 30:377-81. 10.1016/j.jsps.2022.01.024
10. Alamri SA, Ali Al Jaizani R, Naqvi AA, Ghamdi MS: Assessment of drug information service in public and private sector tertiary care hospitals in the Eastern Province of Saudi Arabia. Pharmacy (Basel). 2017, 5:28970449. 10.3390/pharmacy5030037
11. Alzahrani F, Alahmadi YM, Thagfan SS, Alolayan S, Elbadawy HM: Migraine management in community pharmacies: knowledge, attitude and practice patterns of pharmacists in Saudi Arabia. Pharmacy (Basel). 2023, 11:37888500. 10.3390/pharmacy11050155
12. Almaghaslah D, Almanasef M, Vasudevan R, et al.: Community pharmacists' knowledge, attitude and practice of oral health care in Asir region, Kingdom of Saudi Arabia. Int J Dent Hyg. 2022, 20:732-8. 10.1111/idh.12559
13. Alshahrani S, Ali M, Alsreaya R, et al.: Pharmacovigilance in practice: insights into knowledge, attitudes, and practices of pharmacists and pharmacy technicians in Saudi Arabia. J Res Pharm Pract. 2025, 14:50-8. 10.4103/jrpp.jrpp_8_25
14. Hu W, Tao Y, Lu Y, et al.: Knowledge, attitude and practice of hospital pharmacists in Central China towards adverse drug reaction reporting: a multicenter cross-sectional study. Front Pharmacol. 2022, 13:823944. 10.3389/fphar.2022.823944
15. Al-Jamei S, Abu Farha R, Zawiah M, Kadi T, Al-Sonidar A: Perceptions, knowledge, and perceived barriers of Yemeni pharmacists and pharmacy technicians towards evidence-based practice. J Eval Clin Pract. 2019, 25:585-90. 10.1111/jep.12988
16. Rosenberg JM, Koumis T, Nathan JP, Cicero LA, McGuire H: Current status of pharmacist-operated drug information centers in the United States. Am J Health Syst Pharm. 2004, 61:2023-32. 10.1093/ajhp/61.19.2023
17. Tefera YG, Gebresillassie BM, Ayele AA, Belay YB, Emiru YK: The characteristics of drug information inquiries in an Ethiopian university hospital: a two-year observational study. Sci Rep. 2019, 9:13835. 10.1038/s41598-019-50204-1
18. Muralidharan H, Venkatesan A, Venati R, et al.: Barriers of healthcare professionals in utilizing the service of drugs and poison information centre: a cross-sectional study. Explor Res Clin Soc Pharm. 2022, 6:100142. 10.1016/j.rcsop.2022.100142
19. Lua HL, Sklar G, Ko Y: Identification and physicians' views of their commonly-used drug information sources in Singapore. Int J Clin Pharm. 2011, 33:772-8. 10.1007/s11096-011-9533-y
20. Alshargi O, Albalagi N: Role of drug information centre in detecting medication errors in a tertiary care hospital, central region, Saudi Arabia. J Pak Med Assoc. 2023, 73:755-8. 10.47391/JPMA.922
21. Koyama AK, Maddox CS, Li L, Bucknall T, Westbrook JI: Effectiveness of double checking to reduce medication administration errors: a systematic review. BMJ Qual Saf. 2020, 29:595-603. 10.1136/bmjqs-2019-009552