



Research article

Hospital pharmacists' knowledge, attitudes and practice of pharmaceutical care and the barriers for its implementation at the hospital setting

Anan S. Jarab^{a,b}, Suhaib Muflih^a, Rawan Almomani^a, Shrouq Abu Heshmeh^a,
Khawla Abu Hammour^c, Tareq L. Mukattash^a, Walid Al-Qerem^d, Eman
A. Alefishat^{e,f,g,*}

^a Department of Clinical Pharmacy, Faculty of Pharmacy, Jordan University of Science and Technology. P.O. Box 3030. Irbid, 22110, Jordan

^b College of Pharmacy, AL Ain University, P. O. Box: 122612, Abu Dhabi, United Arab Emirates

^c Department of Biopharmaceutics and Clinical Pharmacy, Faculty of Pharmacy, the University of Jordan, Jordan

^d Department of Pharmacy, Faculty of Pharmacy, Al-Zaytoonah University of Jordan. P.O. Box 130, Amman, 11733, Jordan

^e Department of Medical Sciences, College of Medicine and Health Science, Khalifa University of Science and Technology, Abu Dhabi, 127788, United Arab Emirates

^f Department of Biopharmaceutics and Clinical Pharmacy, Faculty of Pharmacy, the University of Jordan, Jordan

^g Center for Biotechnology, Khalifa University of Science and Technology, Abu Dhabi, 127788, United Arab Emirates



ARTICLE INFO

Keywords:

Pharmaceutical care

Pharmacy practice

Knowledge

Attitude

Barriers

ABSTRACT

Objective: To assess hospital pharmacists' understanding of pharmaceutical care and their attitudes regarding the adoption of the patient-centered model, as well as investigate Jordan's current state of pharmaceutical care implementation and the associated barriers.

Methods: A validated survey was distributed to hospital pharmacists in different major tertiary hospitals in Jordan. The study questionnaire contained five sections to assess sociodemographic characteristics, pharmacists' understanding of pharmaceutical care, attitudes towards pharmaceutical care, potential barriers that may limit the delivery of pharmaceutical care, and the extent of pharmaceutical care implementation in the hospital setting.

Results: The survey was completed by 152 hospital pharmacists. Participants in this study demonstrated adequate levels of knowledge about pharmaceutical care (Mean = 9.36 out of 11, SD = 1.23) and expressed favorable perceptions of pharmaceutical care (mean = 3.77 out of 5; SD = 0.7). Although more than one-third of the pharmacists practiced pharmaceutical care, the study revealed a number of impediments to the delivery of pharmacological care services. Regression analysis revealed that age ($P < 0.05$) and years of experience ($P < 0.05$) were significant predictors of knowledge, while age ($P < 0.05$), gender ($P < 0.05$), the graduation university (governmental vs. private) ($P < 0.05$), and years of experience ($P < 0.05$) were significant predictors of attitude. Furthermore, Doctor of Pharmacy degree holders had fewer barriers to pharmaceutical care implementation but were more actively involved in pharmaceutical care practice than those with a Bachelor of Pharmacy degree ($P < 0.01$ and $P < 0.05$ respectively).

* Corresponding author. Department of Medical Sciences, College of Medicine and Health Science, Khalifa University of Science and Technology, Abu Dhabi, 127788, United Arab Emirates.

E-mail addresses: asjarab@just.edu.jo (A. S. Jarab), smmuflih@just.edu.jo (S. Muflih), rawanalmomani60@yahoo.com (R. Almomani), srabuheshmeh19@ph.just.edu.jo (S. Abu Heshmeh), k.hammour@ju.edu.jo (K. Abu Hammour), tmukattash@just.edu.jo (T. L. Mukattash), waleed.qirim@zuj.edu.jo (W. Al-Qerem), eman.alefishat@ku.ac.ae (E.A. Alefishat).

<https://doi.org/10.1016/j.heliyon.2024.e28227>

Received 27 February 2023; Received in revised form 8 March 2024; Accepted 13 March 2024

Available online 25 March 2024

2405-8440/© 2024 Published by Elsevier Ltd.

This is an open access article under the CC BY-NC-ND license

(<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Pharmacists with a Master's degree or higher in pharmacy were more actively involved in pharmaceutical care practice than those with a Bachelor of Pharmacy degree ($P < 0.05$). Pharmacists working in the Ministry of Health and the Royal Medical Services experienced more barriers than those working in teaching hospitals ($P < 0.05$).

Conclusions: Although the current study indicated high knowledge and perceptions regarding pharmaceutical care among hospital pharmacists, the provision of pharmaceutical care is not widely practiced in Jordan. Moreover, several barriers to the practice of pharmaceutical care were identified, highlighting the need for effective strategies to be put in place to overcome these obstacles. These strategies should include increasing the number of pharmacy staff, resolving timing issues, providing adequate financial initiatives, improving communication skills, changing the layout of pharmacies to include a private counseling room, developing specific policies that support the role of the pharmacist in patient care, and providing effective training and continuing professional education programs.

1. Introduction

Pharmacy practice has changed over the past decades as the enforcement of adhering to the concepts of good practice led to a revolution in the field of pharmacy [1]. The high prevalence of mortality and morbidity associated with preventable medication errors has pushed patient safety and safe medication use to become a global priority [2]. Several efforts have been made to reshape the role of pharmacists so that they become engaged in patient-centered health care instead of focusing on dispensing medications [3]. In patient-centered care, an individual's specific health needs and desired health outcomes are the driving force behind all health care decisions and quality measurements" [4], which corresponds with the definition of pharmaceutical care, known as "the pharmacist's contribution to the care of individuals in order to optimize medicine use and improve health outcomes" [5].

Hospital pharmacists have substantially contributed to the advancement of pharmacy practice worldwide, and they continue to make significant contributions that elevate the entire profession [6]. This contribution can be illustrated in hospital pharmacists' capability of providing high-quality patient care services that are concerned in bringing expertise on medicines to the healthcare team, ensuring the safe and effective use of medications, counseling patients about their medications and ensuring their understanding of the appropriate use of them, and involving patients in the decision-making process related to their health and medications [7].

Despite the enormous benefits that hospital pharmacy services can provide, many barriers to the advancement of pharmacy practice have been recognized. Among the barriers identified were inadequate skills, insufficient confidence, a lack of communication, superiority complexes among health care providers, inadequate training, and a lack of guidelines [8].

It has been found that hospital pharmacists' interventions played a significant role in reducing medication-related errors, improving therapeutic outcomes such as blood pressure, blood glucose, and lipid control, and improving humanistic outcomes such as patients' knowledge, adherence, and health-related quality of life [9]. However, the success of hospital pharmacy services depends on the skills, knowledge, and attitudes of hospital pharmacists towards providing patient-centered care because they constitute a significant part of the health care team and work together to provide the best care for the patients. Furthermore, understanding how the attitudes, skills, and knowledge of pharmacists influences the uptake of practice change will potentially guide future implementation strategies for changes to pharmacy practice. Due to the pressing importance of providing pharmaceutical services at tertiary hospitals, which is uncommonly practiced in other clinical settings, this study aimed to assess hospital pharmacists' knowledge and attitudes toward the adoption of that patient-centered care model, as well as the status of pharmaceutical care implementation in the tertiary hospitals in Jordan and the associated barriers. This study should provide valuable data to stakeholders and university professors to modify the academic curricula according to the current pharmaceutical care practice, and it will pave the way for future research in this field, as scarce data exists regarding the pharmacists' knowledge and attitudes towards pharmaceutical care in Jordan.

2. Materials and methods

2.1. Study design and settings

In this current cross-sectional study, the study questionnaire was distributed to hospital pharmacists who had a wide range of academic education and qualifications, such as Bachelor of Pharmacy, Doctor of Pharmacy, Master's, and higher degrees, and were employed at different tertiary hospital sites, including the Royal Medical Services, the Ministry of Health, King Abdallah University Hospital, and the University of Jordan Hospital.

2.2. Data collection procedure

"Eligible pharmacists working in tertiary hospitals were enrolled using a convenient sampling approach. The research pharmacist (RA) explained the objectives of the study as well as the risks and benefits of participation to seek the pharmacists' voluntary intention to participate in the study. The pharmacists were assured about the confidentiality of responses and were informed that no incentives would be provided for participation. Pharmacists who signed the consent form were asked to complete an anonymous, self-administered questionnaire within the estimated completion time of 15 min"

2.3. Sample size calculation

The overall number of hospital pharmacists who worked in Jordan during the data collection period was 300. Raosoft® was utilized to calculate the appropriate sample size that should be included in this study. Using a significance level of 0.05, a response distribution of 50%, and a 5% error margin, the minimum sample size was determined to consist of 169 observations [10].

2.4. Study instrument

Given the dimensions of pharmaceutical care, including assessment of current and potential drug-related problems, designing an individualized care plan, and monitoring for outcome achievement and potential adverse effects, the study survey was developed after an extensive review of relevant literature and previously published questionnaires [5,11–15]. Due to the lack of validated scales measuring the constructs of interest, including knowledge and attitudes towards pharmaceutical care, the barriers to the provision of pharmaceutical care, and the extent of its implementation, a group of experts in the field assessed whether the initial questionnaire covered all aspects of pharmaceutical care and measured what they intended to measure, and changes were made where appropriate. After reading and carefully evaluating the literature-based items and the newly developed items, the content validity ratio (CVR), was calculated using Lawshe's quantitative approach [16]. The experts determined whether each item is "essential," "useful but not necessary," or "not necessary." Then the CVR ratio was calculated for each item based on the number of "essentials" for an item (N_e) and the number of experts (N) according to the following equation: $CVR = (N_e - (N/2)) / (N/2)$ [16]. Items with CVR values above zero that were included in the survey indicated that more than 50% of the experts agreed on the validity of the item.

Based on the critical value of CVR reported by Lawshe, the items that should be deleted could be determined by the number of panel members who agreed with a particular item by selecting "essential." The greater the number of panel experts who selected "essential", the greater the content validity would be reflected. According to Polit et al. (2007), good content validity of individual items rated by three or more experts should have a minimum CVR of 0.78. The average CRV of all items included in the instrument should also have a content validity index (CVI) of at least 0.8. In this study, a total of 5 experts evaluated the single items of knowledge, attitudes, barriers, and practices toward pharmaceutical care. Based on the CRV critical values and the minimum number of experts recommended by Lawshe (1975) and Pilot et al. (2007) [17,18], the items perceived as "essential" by all experts were included in the final instrument. As a result, 2 items in the knowledge scale, 3 items in the attitude scale, 1 item in the barrier scale, and 2 items in the practice scale were deleted from the final survey.

Ten community pharmacies, from which actual participants were recruited, were invited to participate in the study's pilot phase. The majority of the pilot participants (60%) were female, with an average age of 31. They were selected to ensure the interrelatedness of the items and the requirement to discard redundant or unessential items without significantly affecting the acceptable value of Cronbach's alpha of each scale before actual data collection while assuming the unidimensionality of the study concepts [19,20]. After calculating Cronbach's coefficient alpha with the option "if item deleted," five items were removed from the whole questionnaire, resulting in Cronbach's alpha values of greater than 0.7 for the attitudes, perceived barriers, and practices scales [21]. Five pharmacists provided additional information about the clarity of questions, relevance of items, and time for completion. Findings from the pilot study were not included in the final analysis. As the English language is the official language of textbooks, teaching, and learning in pharmacy schools in Jordan, this survey was developed and administered in English.

The study questionnaire included five sections: The first was to assess the sociodemographic characteristics, including age, gender, academic degree, university of graduation, years of experience, working setting, and employment status. The second section included eleven items that evaluated pharmacists' knowledge and understanding of pharmaceutical care. The total knowledge score was calculated by summing the scores for all correct answers to yield a maximum possible score of 11. Pharmacists who scored mean and above the mean score of the correctly answered questions were classified as having adequate knowledge, while those who scored less than the mean were deemed to have inadequate knowledge. In the third section, thirteen items evaluated pharmacists' attitudes using the Pharmaceutical Care Attitude Survey (PCAS). The next 17-item part included seventeen items that explored the barriers that may limit the delivery of pharmaceutical care. The attitudes and the barriers were evaluated using a 5-point Likert scale (1 = strongly disagree, 5 = strongly agree), and were categorized as high or low according to the score ranking of the overall mean (overall mean > 3.67 was considered high). Finally, twelve items were used to assess the extent of pharmaceutical care implementation in the current practice using a 5-point Likert scale (1 = never; 5 = all the time). The pharmacists pharmaceutical were categorized as active or inactive according to the score ranking of the overall mean (overall mean > 3.67 was considered active).

2.5. Statistical analysis

The statistical package IBM SPSS® version 25.0 was utilized to analyze the data. Descriptive statistics were used to describe the demographics of the research participants. Means, ranges, and standard deviations were used for continuous variables, while percentages and frequencies were used for grouped measures. Logistic regression models were performed to analyze the relationship between dichotomous dependent and independent variables.

3. Results

3.1. Sociodemographic characteristics of the sample

A total of 152 pharmacists completed the survey. The majority of them were female (85.5%). Most of the participants were in the age group of 30–39 (42.8%), had a Doctor of Pharmacy degree (40.8%), had a duration of experience of 1–5 years (40.8%), and worked in Royal Medical Services (47.4%). See [Table 1](#).

3.2. Knowledge about pharmaceutical care

As shown in [Table 2](#), the mean of the total knowledge score was 8, and 75% of the pharmacists demonstrated adequate knowledge manifested by knowledge scores above the mean value. Although the majority of the participants showed adequate levels of knowledge regarding pharmaceutical care, including the concepts, functions, aims, and pharmacists' role, more than 80% of them failed to recognize that pharmaceutical care extends beyond providing medication counseling services (81.6%), and around 39.5% were not able to differentiate between pharmaceutical care and other terms such as clinical pharmacy.

3.3. Pharmacists' attitude toward pharmaceutical care

As shown in [Table 3](#), hospital pharmacists agreed or strongly agreed with most of the statements that reflect favorable attitudes towards pharmaceutical care. The mean scores and ratings were above the midpoint of 3.0 for all PCAS items. The only exception was the item related to the additional workload needed for providing pharmaceutical care (mean (SD) responses of 2.73 (1.119)). This item is negatively worded in the PCAS questionnaire; lower mean responses reflect a favorable disposition towards pharmaceutical care.

3.4. Pharmacists' perceived barriers

The most common barriers to the integration of pharmaceutical care into pharmacy practice ([Table 4](#)) included inadequate staff (75.7 %) and a lack of financial compensation for activities related to patient care (75%). Other common barriers were lack of private counseling areas or inappropriate pharmacy layout (69.1%), organizational obstacles such as the absence of health care policy to support the role of the pharmacist in patient care (67.7%), lack of pharmacists' time (67.1%), and poor training and continuing professional education of practitioners (65.1%).

Table 1
Frequency distribution of the sociodemographic characteristics of the study sample (n = 152).

Variables	Frequency (%)			
	Teaching Hospitals	Ministry of Health	Royal Medical Services	Overall
Age				
23-29	8(12.9)	1(5.6)	47(65.3)	56(36.8)
30-39	42(67.7)	8(44.4)	15(20.8)	65(42.8)
≥40	12(19.4)	9(50)	10(13.9)	31(20.4)
Gender				
Male	8(12.9)	15(83.3)	11(15.3)	22(14.5)
Female	54(87.1)	1(5.6)	61(84.7)	130(85.5)
Qualification in Pharmacy				
Bachelor of Pharmacy	30(48.4)	1(5.6)	22(30.6)	53(34.9)
Doctor of Pharmacy	19(30.6)	13(72.2)	30(41.7)	62(40.8)
Master's degree or higher in Pharmacy	13(21)	4(22.2)	20(27.8)	37(24.3)
Graduating University				
JUST	30(48.4)	14(77.8)	39(54.2)	83(54.6)
University of Jordan	20(32.3)	0(0)	11(15.3)	31(20.4)
Others	12(19.4)	4(22.2)	22(30.6)	38(25)
Duration of Experience as practitioner				
≤1 year	2(3.2)	2(11.1)	13(18.1)	17(11.2)
1–5 years	22(35.5)	3(16.7)	37(51.4)	62(40.8)
6–10 years	14(22.6)	7(38.9)	8(11.1)	29(19.1)
≥10 years	24(38.7)	6(33.3)	14(19.4)	44(28.9)
Primary work setting				
Teaching hospitals	62(40.8)			62(40.8)
Ministry of health		18(11.8)		18(11.8)
Royal medical services			72(47.4)	72(47.4)
Employment status				
Part-time	12(19.4)	10(55.6)	9(12.5)	31(20.4)
Full-time	50(80.6)	8(44.4)	63(87.5)	121(79.6)

Table 2
knowledge about pharmaceutical care (n = 152).

	Frequency of Correct Answer (%)
1 Pharmaceutical care providers are directly responsible for the patient's health outcomes	134 (88.7)
2 The primary aim of pharmaceutical care is to improve and maintain the patient's quality of life:	147 (96.7)
3 Pharmaceutical care is just a medication counseling service:	28 (18.4)
4 The term clinical pharmacy is interchangeable with pharmaceutical care:	92 (60.5)
5 Pharmaceutical care is an extension of the current pharmacy services:	131 (89.7)
6 In pharmaceutical care the pharmacist identifies and manages a patient's existing and other potential drug therapy problems:	147 (96.7)
7 Pharmaceutical care involves a defined process of activities, all steps of which must be completed in order to provide this service:	137(90.7)
8 All patients prescribed medicines require pharmaceutical care services	125 (82.8)
9 Pharmaceutical care requires availability of drug information resources:	140 (95.2)
10 To provide pharmaceutical care a consultation room or private area must be available:	131 (87.3)
11 Provision of pharmaceutical care offers a feedback mechanism that optimizes the use of medicinal products:	141 (94)

Table 3
Attitudes toward pharmaceutical care.

	Strongly disagree/ disagree	Neutral	Agree/strongly agree	Mean	SD
1 All pharmacists should perform pharmaceutical care	15(9.9)	17 (11.2)	120(78.9)	3.39	1.075
2 The primary responsibility of pharmacists in all healthcare settings should be to prevent and solve medication-related problem	13(8.6)	21 (13.8)	118(77.6)	3.95	1.051
3 Pharmacists' primary responsibility should be to practice pharmaceutical care.	14(9.2)	22 (14.5)	116(76.3)	3.88	1.012
4 Pharmacy students can perform pharmaceutical care during their experiential training (placements)	21(13.8)	34 (22.4)	97(63.8)	3.59	1.032
5 I think the practice of pharmaceutical care is valuable.	15(9.9)	15(9.9)	122(80.2)	4.01	1.061
6 Providing pharmaceutical care takes consumes much time and effort.	34(22.4)	33 (21.7)	85(55.9)	3.43	1.113
7 I would like to perform pharmaceutical care as a pharmacist practitioner.	12(7.9)	23 (15.1)	117(77)	3.99	0.973
8 Providing pharmaceutical care is professionally rewarding.	17(11.2)	30 (19.7)	105(69.1)	3.79	1.03
9 I feel that pharmaceutical care is the right direction for the profession to be headed.	12(7.9)	17 (11.2)	123(80.9)	3.98	0.917
10 I feel that the pharmaceutical care movement will benefit pharmacist	12(7.9)	16 (10.5)	124(81.6)	3.99	0.976
11 I feel that the pharmaceutical care movement will improve patients' health.	10(6.6)	14(9.2)	128(84.2)	4.14	0.993
12 I feel that practicing pharmaceutical care would benefit my professional career as a pharmacy practitioner	12(7.9)	11(7.2)	129(84.8)	4.09	1.01
13 Providing pharmaceutical care is not worth the additional workload that it places on pharmacist.	75(49.3)	36 (23.7)	41(27)	2.73	1.119

3.5. The status of pharmaceutical care implementation

As shown in Table 5, the extent of reported pharmaceutical care provided in the current practice is still limited. Identifying the available therapeutic alternatives was the most frequently implemented pharmaceutical care activity (65.2%), followed by identifying patient-specific health or drug therapy-related problems, and assessing the patient, and obtaining all information if any intervention has to be made (54% and 47.3%, respectively). However, activities related to drug therapy monitoring were "sometimes" implemented, such as monitoring patients' adherence to the therapeutic plan (32.5%) and following up on the patients' progress toward achieving the desired outcomes (31.6%), while offering feedback to the patients' physicians was a rarely implemented activity (28.9%).

3.6. Association between sociodemographic characteristics and hospital pharmacists' knowledge, attitude, barriers, and status of pharmaceutical care implementation

As shown in Table 6, older pharmacists had lower knowledge and a less favorable attitude towards pharmaceutical care than younger pharmacists did (OR: 0.34, 95% CI: 0.12–0.92, $P < 0.05$, and OR: 0.25, 95% CI: 0.09–0.66, $P < 0.05$ respectively). Female pharmacists were more likely to have favorable attitudes toward pharmaceutical care (OR = 3.91, 95% CI: 1.51–10.13, $P < 0.05$). Doctor of Pharmacy degree holders were less likely to report impediments to pharmaceutical care implementation but more actively involved in pharmaceutical care practice than those with a Bachelor of Pharmacy degree (OR = 0.32, 95% CI: 0.14–0.71, $P < 0.01$ and

Table 4
Barriers to the provision of pharmaceutical care.

		Strongly disagree/ disagree	Neutral	Agree/strongly agree	mean	SD
1	Lack of private counseling area, space or inappropriate pharmacy layout	14(9.2)	33 (21.7)	105(69.1)	3.86	1.051
2	Organizational obstacles: e.g., lack of support from administration, absence of healthcare policy for pharmacists' patient care role	7(4.6)	42 (27.6)	103(67.7)	3.86	0.887
3	Inadequate staffing, e.g., deficient number of pharmacy technicians	12(7.9)	25 (16.4)	115(75.7)	3.94	0.971
4	Lack of pharmacist time to provide pharmaceutical care	15(9.8)	35(23)	102(67.1)	3.87	1.034
5	Inadequate computer system/software and/or inadequate computer training	32(21)	40 (26.3)	80(52.6)	3.46	1.097
6	Inadequate teamwork of the healthcare members	18(11.9)	49 (32.2)	85(55.9)	3.6	0.998
7	Inadequate pharmaceutical care training or continuing professional education of practitioners	23(15.1)	30 (19.7)	99(65.1)	3.62	1.029
8	Lack of communication/coordination with physicians	22(14.5)	39 (25.7)	91(59.9)	3.64	1.08
9	Pharmacists being physically distinct from patient care area	29(19.1)	42 (27.6)	81(53.2)	3.45	1.087
10	Lack of physicians' trust in the pharmacists' abilities	31(20.4)	37 (24.3)	84(55.2)	3.53	1.145
11	Lack of patient awareness about the role of pharmacist in patient care	25(16.4)	33 (21.7)	94(61.8)	3.67	1.109
12	Physicians will not accept pharmacists' new role.	31(20.4)	38(25)	83(54.6)	3.47	1.204
13	Deficient clinical knowledge of pharmacists	26(17.1)	40 (26.3)	86(56.6)	3.49	1.054
14	Lack of patient interest	32(21)	31 (20.4)	89(58.5)	3.47	1.151
15	Deficient communication skills of pharmacists.	27(17.8)	38(25)	87(57.2)	3.51	1.082
16	Negative attitudes of pharmacists towards pharmaceutical care.	32(21)	30 (19.7)	90(59.2)	3.46	1.106
17	Lack of financial compensation for the activities related to patient care.	16(10.5)	22 (14.5)	114(75)	3.81	0.995

Table 5
Pharmaceutical care practice.

		Never	Rarely	Sometimes	Most of the time	All the time	mean	SD
1	Carefully assess the patient and obtain all information required if any intervention or recommendation has to be made.	6 (3.9)	23 (15.1)	51 (33.6)	54 (35.5)	18 (11.8)	3.36	1.007
2	Identify patient-specific health or drug therapy related problem(s).	5 (3.3)	21 (13.8)	44 (28.9)	60 (39.5)	22 (14.5)	3.48	1.01
3	Identify available therapeutic alternatives.	7 (4.6)	11 (7.2)	35 (23)	67 (44.1)	32 (21.1)	3.7	1.03
4	Consider whether non-pharmacological therapy may help prevent or solve the health or therapy related problem(s).	11 (7.2)	22 (14.5)	53 (34.9)	52 (34.2)	14 (9.2)	3.24	1.047
5	Formulate a patient-specific action plan together with the patient.	16 (10.5)	29 (19.1)	58 (38.2)	30 (19.7)	19 (12.5)	3.05	1.147
6	Take a comprehensive approach to patient care (i.e., consider the patient's medical, social, and financial needs in establishing the action plan).	17 (11.2)	19 (12.5)	54 (35.5)	43 (28.3)	19 (12.5)	3.17	1.171
7	Monitor the patient's adherence to the therapeutic plan	15 (9.9)	35 (23.2)	49 (32.5)	34 (22.5)	18 (11.9)	3.03	1.157
8	Follow up on the patient's progress to assure the achievement of desired Outcome.	17 (11.1)	38 (25)	48 (31.6)	36 (23.7)	13 (8.6)	2.93	1.135
9	Offer feedback to the patient's physician about his or her progress with the action plan and ultimately its outcome.	24 (15.8)	44 (28.9)	34 (22.4)	37 (24.3)	13 (8.6)	2.82	1.215
10	Systematically document all processes involved in items as stated above.	19 (12.5)	27 (17.8)	55 (36.2)	35 (23)	16 (10.5)	3.0	1.149
11	Monitor adverse drug reactions and drug compliance among patients.	16 (10.5)	31 (20.4)	48 (31.6)	40 (26.3)	17 (11.2)	3.07	1.157
12	Engage in health screening activities, such as blood pressure measurement.	23 (15.1)	24 (15.8)	51 (33.6)	39 (25.7)	15 (9.9)	2.99	1.193

Table 6

Logistic regression examining the association between socio-demographic variables and hospital pharmacists' knowledge, attitude, barriers, and current status of pharmaceutical care.

Statements	Knowledge (Adequate vs Inadequate)		Attitude (High vs Low)		Barriers (High vs Low)		Current status (Active vs Inactive)	
	OR(95% CI)	P	OR(95% CI)	P	OR(95% CI)	P	OR(95% CI)	P
Age								
23-29	1		1		1		1	
30-39	0.34 (0.12–0.92)	0.032	0.77(0.33–1.79)	0.543	0.63(0.31–1.31)	0.211	1.75 (0.79–3.85)	0.166
≥40	0.62(0.17–2.24)	0.463	0.25(0.09–0.66)	0.018	0.65(0.27–1.58)	0.342	0.72 (0.25–2.11)	0.565
Gender								
Male	1		1		1		1	
Female	1.45(0.48–4.37)	0.501	3.91 (1.51–10.13)	0.011	1.24(0.49–3.13)	0.644	0.76 (0.28–2.05)	0.589
Qualification in Pharmacy								
Bachelor of Pharmacy	1		1		1		1	
Doctor of Pharmacy	0.47(0.17–1.27)	0.143	1.25(0.57–2.7)	0.572	0.32(0.14–0.71)	0.001	2.83 (1.32–6.05)	0.015
Master's degree or higher in Pharmacy	0.78(0.24–2.56)	0.694	1.6(0.62–4.10)	0.325	0.73(0.30–1.76)	0.481	2.62 (1.11–6.22)	0.021
Graduating University								
JUST	1.76(0.7–4.43)	0.234	0.37(0.14–0.93)	0.035	0.51(0.22–1.15)	0.117	1.52 (0.63–3.68)	0.341
University of Jordan	2.41(0.67–8.62)	0.176	0.22 (0.096–0.53)	0.011	0.56(0.25–1.22)	0.145	1.13 (0.48–2.65)	0.781
Others (Private)	1		1		1		1	
Duration of Experience as practitioner								
≤1 year	4.29 (1.18–15.55)	0.033	4.66 (1.27–17.07)	0.021	0.94(0.31–2.85)	0.931	0.68 (0.21–2.15)	0.521
1–5 years	2.01(0.65–6.22)	0.231	3.22(1.18–8.68)	0.021	0.96(0.28–3.27)	0.924	0.43 (0.11–1.68)	0.233
6–10 years	1.47(0.41–5.33)	0.553	2.4(0.92–6.23)	0.072	0.65(0.21–2.05)	0.416	0.78 (0.24–2.56)	0.678
≥10 years	1		1		1		1	
Primary work setting								
Teaching hospitals	1		1		1		1	
Ministry of health	0.64(0.19–2.13)	0.46	1.14(0.35–3.68)	0.82	7.38 (1.92–28.43)	0.01	0.24 (0.05–1.16)	0.07
Royal medical services	1.64(0.66–4.06)	0.28	1.23(0.59–2.59)	0.57	2.09(1.04–4.18)	0.03	0.65 (0.31–1.36)	0.25
Employment status								
Part-time	1		1		1		1	
Full-time	1.75(0.68–4.48)	0.23	0.64(0.25–1.61)	0.34	1.66(0.75–3.69)	0.21	0.68 (0.29–1.57)	0.37

OR: 2.83, 95% CI: 1.32–6.05, $P < 0.05$ respectively). Furthermore, pharmacists who had a Master's degree or higher in pharmacy were more actively involved in pharmaceutical care practice than those with a Bachelor of Pharmacy degree (OR: 2.62, 95% CI: 1.11–6.22, $P < 0.05$). Pharmacists who graduated from governmental universities such as Jordan University of Science and Technology and the University of Jordan showed significantly lower attitudes when compared with those graduating from private universities (OR: 0.37, 95% CI: 0.14–0.93, $P < 0.05$ and OR: 0.22, 95% CI: 0.096–0.53, $P < 0.05$ respectively). Pharmacists with fewer years of experience were more likely to have enough knowledge and favorable opinions toward pharmaceutical care compared to their counterparts (OR: 4.29, 95% CI: 1.18–15.55, $P < 0.05$, OR: 4.66, 95% CI: 1.27–17.07, $P < 0.05$, and OR: 3.22, 95% CI: 1.18–8.68, $P < 0.05$). Moreover, pharmacists working in governmental health sectors such as the Ministry of Health and the Royal Medical Services experienced more barriers than those working in teaching hospitals (OR: 7.38, 95% CI: 1.92–28.43, $P < 0.05$ and OR: 2.09, 95% CI: 1.04–4.18, $P < 0.05$ respectively).

4. Discussion

The findings of this study revealed that hospital pharmacists had an overall acceptable knowledge and understanding of the concepts of pharmaceutical care. Furthermore, they showed positive attitudes towards pharmaceutical care and a willingness to practice the activities of pharmaceutical care in their services. Nevertheless, the extent of implementing pharmaceutical care in the current practice in hospital pharmacies in Jordan is still limited. Hospital pharmacists identified several barriers that prevent them from practicing pharmaceutical care activities.

Although pharmacists in the current study demonstrated good knowledge about pharmaceutical care, their knowledge was sub-optimal in some areas. Most of the pharmacists in this study did not recognize that pharmaceutical care extends beyond providing

medication counseling (81.6%). Contradictory results were reported in an earlier Jordanian study, where nearly 74.2% of the participants recognized that pharmaceutical care is not just a medication counseling service [22]. The observed disparity in the recognition of the extended scope of pharmaceutical care between the current study and the Jordanian study could be attributed to differences in study tools, assessment criteria, population characteristics, and study circumstances. Additionally, around 39.5% of the current study pharmacists were not able to differentiate between pharmaceutical care and other concepts in pharmacy practice, which was similar to the findings reported in previous studies [22,23].

The current study found that hospital pharmacists' attitudes and preparedness towards implementing pharmaceutical care in their practice were promising. Consistent results were reported in a previous study conducted in Kuwait [24]. Additionally, several studies conducted in Jordan [22], Nigeria [25], and Saudi Arabia [26] have shown positive attitudes and preparedness towards pharmaceutical care implementation among community pharmacists. On the other hand, nearly half of the pharmacists enrolled in an Ethiopian study had an unfavorable attitude toward pharmaceutical care [27].

In order to extend the provision of pharmaceutical care, it is crucial to identify the obstacles that impede the practice of pharmaceutical care activities in hospital pharmacies in Jordan and develop strategic solutions to overcome these barriers. In the present study, hospital pharmacists identified inadequate staff as the major barrier in their practices (75.7%). This finding was in line with that of a New Zealand study, where lack of time due to a shortage of staff was the major reported barrier to pharmaceutical care provision by pharmacists in community pharmacy and hospital pharmacy settings [23]. The second major reported barrier in this study was the lack of sufficient incentives (75%), followed by an inappropriate pharmacy layout (69.1%). These findings were consistent with those of previous studies conducted in European countries and New Zealand [23,28], as well as with the findings of similar studies conducted in hospital settings [24,25,29]. These findings shed light on the necessity for reviewing the staffing policies in hospitals in Jordan, which can be achieved through collaboration between stakeholders such as the administrators from hospitals and the representatives from the Jordanian Pharmacists' Association in order to ensure the required staff and time are sufficient. In addition, there is a need to change the design of hospital pharmacies in a way that ensures the availability of a private counseling area that would enhance patient care and improve pharmacists' roles.

Pharmacists, as the primary providers of pharmaceutical care, are recognizing the importance of pharmaceutical care provision. The present study findings showed that the most frequently implemented pharmaceutical care in the current practice was assessing patients' information and medication history (47.3%), identifying patient-specific health or drug-related problems (54%), and identifying the available therapeutic alternatives (65.2%). However, despite the fact that the clinical pharmacist system has been in place for a long time, it is possible that the slow progress in the percentage of pharmacists who adhere to these roles is due to a lack of consensus among pharmacists on these rules. A Jordanian study conducted a decade ago reported that 64.6% of the participants asked their patients for all necessary information regarding their medications, diseases, and medical history, but only a third of them analyzed the patients' data to detect the presence of any drug-related problem [22]. Another study conducted in Qatar reported that more than half of the hospital pharmacists enrolled in the study assessed patients' information, obtained all necessary data (64%), identified patient-related health or drug-therapy problems (54%), and nearly half of them identified the available therapeutic alternatives (49%) [29]. Nevertheless, consistent with what was reported in a study conducted in Qatar [29], there was a large gap in the activities related to drug therapy monitoring, follow-up, and communication with the physicians, which were sometimes or rarely performed by the current study participants. Similar findings were reported in a Jordanian study, where pharmacists have seldom reported conducting any drug monitoring activities or communication with physicians [22]. The lack of pharmacist-physician communication was explained by the pharmacists' negative perception toward the acceptance of physicians in the provision of pharmaceutical care [22]. This belief was proven wrong by another study conducted in Jordan, where less than 30% of physicians refused the new role of pharmacists in providing pharmaceutical care activities [30]. Thus, attention should be called to the need for advanced training on effective communication skills and drug therapy monitoring activities among hospital pharmacists in Jordan.

In the current study, older pharmacists had lower knowledge and attitudes toward pharmaceutical care practices when compared with younger pharmacists. Consistent results were found in a Saudi study, which showed that younger pharmacy students had a better attitude towards pharmaceutical care than older ones [31]. Furthermore, female pharmacists in this study exhibited more favorable attitudes towards pharmaceutical care services, which was in line with the findings reported in previous studies conducted in Jordan [32], Saudi Arabia [31], and Nigeria [33]. This finding reflects greater job satisfaction and higher awareness about pharmacists' growing role in patient support among young and female pharmacists and calls for more efforts to be exerted to increase older male pharmacists' awareness and willingness to practice pharmaceutical care, such as the implementation of post-graduation educational training programs that have the potential to do so [34].

The current study also found that pharmacists with a higher degree in pharmacy were more actively involved in pharmaceutical care practice and faced fewer barriers to its implementation when compared with those with a lower degree. One possible explanation for this association could be the lack of advanced clinical knowledge among pharmacists with lower educational degrees, which may decrease their motivation to practice pharmaceutical care services. This implies the necessity of enrolling these pharmacists in advanced training programs in order to equip them with the appropriate knowledge and skills needed to practice pharmaceutical care.

The present study found that pharmacists who graduated from governmental universities had a significantly lower attitude towards pharmaceutical care than those who graduated from private universities. On the other hand, an earlier Jordanian study found that the majority of the participating students who were enrolled in five different governmental universities in Jordan showed a positive attitude towards pharmaceutical care practice [32]. Nevertheless, the latter study found that being introduced to pharmaceutical care during the academic program and having a clerkship experience significantly increased the positive attitude towards pharmaceutical care practice [32], which provides a clear emphasis on the importance of incorporating training courses and workshops on pharmaceutical care in pharmacy schools. Furthermore, in our study, pharmacists working in governmental health sectors such as the

Ministry of Health and the Royal Medical Services experienced substantially more impediments than those working in teaching hospitals. These findings suggest that the Jordanian Pharmacists' Association, the Ministry of Health, and the Royal Medical Services should work together to qualify hospital pharmacists for optimal pharmaceutical care practice and to remove the hurdles that they confront when providing such a service.

Pharmacists with fewer years of experience in this study were more prepared and willing to practice pharmaceutical care. Similar results were reported in a recent Jordanian study that showed that less experienced pharmacists had higher involvement in analyzing patient data to ensure the absence of drug-therapy problems than those with greater work experience [22]. In contrast, a Kuwaiti study found that pharmacists who had more experience showed more positive attitudes toward providing pharmaceutical care than less experienced pharmacists [24]. This finding could be attributed to the improved academic curricula now available for recently graduated students, which aim to provide pharmacy students with the necessary skills and confidence to practice pharmaceutical care. In addition, pharmacists with more years of job experience may be reluctant to provide pharmaceutical care services given the obstacles that may have been encountered during their entire work experience that may hinder the implementation of any new service [35]. This highlights the necessity to boost activities related to pharmaceutical care and provide other types of appropriate training in order to assist pharmacists in undertaking activities such as medical consultation and medication monitoring, both of which are carried out on a less frequent basis.

Some limitations may have affected the study outcomes; as this is a cross-sectional study, the data obtained do not reflect potential changes in respondents' beliefs over time. The self-administered questionnaire used for data collection in this study could have overestimated pharmacists' responses. Moreover, the selection bias manifested by recruiting more pharmacists who are female and the low sample size may affect the generalizability of the study findings. Despite these limitations, the study successfully addressed various aspects of pharmaceutical care, including pharmacists' understanding, perspectives, barriers, and degree of implementation. This comprehensive methodology provides a comprehensive perspective on the prevailing situation of pharmaceutical care in Jordan. Furthermore, the study findings have the potential to guide upcoming initiatives in Jordan by highlighting areas where pharmaceutical care can be enhanced and identifying related obstacles. In addition, it lays the foundation for subsequent research endeavors in pharmaceutical care or similar healthcare contexts.

5. Conclusions

Pharmaceutical care in hospital pharmacies is not frequently practiced in Jordan. However, pharmacists had a reasonable understanding of the concepts, functions, and aims of pharmaceutical care. They also showed positive attitudes towards the provision of pharmaceutical care in a hospital setting. However, they reported several factors and barriers that impede pharmaceutical care implementation, with the most frequently reported barriers being insufficient staff, lack of time, lack of incentives, lack of communication skills, and inappropriate pharmacy layout. Several strategies are needed to overcome these barriers and improve the provision of pharmaceutical care in hospital pharmacies in Jordan. Healthcare institutions should invest in workforce planning and development to ensure an adequate number of qualified pharmacy professionals are available to meet patient needs and resolve timing issues. In addition, modifying the current pharmacy curricula at the universities to include training on effective communication skills and advanced knowledge about pharmaceutical care is also recommended. Other strategies include collaboration between the Jordanian Pharmacists' Association and hospital administrators to ensure adequate financial compensation that guarantees the delivery of the best patient care services, as well as evaluating the necessary changes in hospital pharmacy design to accommodate the extended roles of pharmacists.

Ethics statements

The study received ethical approval by the Institutional Review Board at King Abdullah University Hospital (IRB#23/124/2021). All pharmacists who agreed to participate signed a consent form.

Funding statement

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Data availability statement

Data are available on reasonable request from the corresponding author.

CRediT authorship contribution statement

Anan S. Jarab: Writing – review & editing, Writing – original draft, Visualization, Validation, Project administration, Investigation, Conceptualization. **Suhaib Muflih:** Writing – review & editing, Project administration, Investigation, Conceptualization. **Rawan Almomani:** Writing – review & editing, Validation, Software, Methodology, Investigation. **Shrouq Abu Heshmeh:** Writing – review & editing, Methodology, Investigation, Data curation. **Khawla Abu Hammour:** Writing – review & editing, Supervision, Project administration, Investigation, Conceptualization. **Tareq L. Mukattash:** Writing – review & editing, Validation, Formal analysis, Data curation. **Walid Al-Qerem:** Writing – review & editing, Validation, Formal analysis, Data curation. **Eman A. Alefishat:** Writing –

review & editing, Writing – original draft, Visualization, Validation, Supervision, Resources, Project administration, Investigation, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgements

All authors would like to express our gratitude to the Royal Medical Services, Ministry of Health, King Abdallah University Hospital, University of Jordan Hospital, and the Deanship of Scientific Research at Jordan University of Science and Technology for their assistance in carrying out this scientific production.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.heliyon.2024.e28227>.

References

- [1] H. Amawi, S. Al-Azzam, T. Alzanati, N. Altamimi, A. Hammad, K.H. Alzoubi, et al., The validity of Mobile Applications to Facilitate patient care provided to Cancer patients: Opportunities and limitations, *Recent Pat. Anti-Cancer Drug Discov.* 17 (2) (2022 Jul 29) 204–213, <https://doi.org/10.2174/1574892816666210728122304>.
- [2] C. Paradissis, N. Cottrell, I. Coombes, I. Scott, W. Wang, M. Barras, Patient harm from cardiovascular medications, *Ther Adv Drug Saf* 12 (2021 Jan 25) 204209862110274, <https://doi.org/10.1177/20420986211027451>.
- [3] M. Spanakis, S. Sfakianakis, V. Sakkalis, E. Spanakis, PharmActa: Empowering patients to avoid clinical significant drug–Herb Interactions, *Medicines* 6 (1) (2019 Feb 16) 26, <https://doi.org/10.3390/medicines6010026>.
- [4] What is patient-centered care? [Internet], *NEJM Catalyst* (2017) [cited 2023 Sep 13]. Available from: <https://catalyst.nejm.org/doi/full/10.1056/CAT.17.0559>.
- [5] S.S. Allemann, J.W.F. Van Mil, L. Botermann, K. Berger, N. Griesse, K.E. Hersberger, Pharmaceutical care: the PCNE definition 2013, *Int. J. Clin. Pharm.* 36 (3) (2014 Apr 20) 544–555, <https://doi.org/10.1007/S11096-014-9933-X>.
- [6] K. Krizner, Hospital Pharmacist Role Expands in Patient Care [Internet], MHE, 2019 [cited 2024 Feb 1]. Available from: <https://www.managedhealthcareexecutive.com/view/hospital-pharmacist-role-expands-patient-care>.
- [7] About hospital pharmacy, Shpa [cited 2024 Feb 1]. Available from: <https://shpa.org.au/about-shpa/about-hospital-pharmacy>.
- [8] M. Kilonzi, R.F. Mutagonda, H.J. Mlyuka, D.L. Mwakawanga, W.P. Mikomangwa, W.A. Kibanga, et al., Barriers and facilitators of integration of pharmacists in the provision of clinical pharmacy services in Tanzania, *BMC Prim Care* 24 (1) (2023 Mar 17) 72, <https://doi.org/10.1186/s12875-023-02026-4>.
- [9] A. Ahmed, M. Saqlain, M. Tanveer, A.Q. Blebil, J.A. Dujaili, S.S. Hasan, The impact of clinical pharmacist services on patient health outcomes in Pakistan: a systematic review, *BMC Health Serv. Res.* 21 (1) (2021 Dec 1) 1–14, <https://doi.org/10.1186/S12913-021-06897-0/TABLES/2>.
- [10] Sample Size Calculator by Raosoft, Inc. [Internet]. [cited 2022 Jan 31]. Available from: <http://www.raosoft.com/samplesize.html>. <http://www.raosoft.com/samplesize.html>.
- [11] P. Aspden, J. Wolcott, J. Lyle Bootman, L. Cronenwett, *Preventing medication errors: quality Chasm Series*, *HealthteamworksBiz* 480 (2007).
- [12] F. Doloresco, L.C. Vermeulen, Global survey of hospital pharmacy practice, *Am. J. Health Syst. Pharm.* 66 (5 Suppl 3) (2009 Mar 1), <https://doi.org/10.2146/AJHP080674>.
- [13] M. Stephens, *Hospital Pharmacy*, vol. 285, 2003.
- [14] A.S. Roberts, S.I. Benrimoj, T.F. Chen, K.A. Williams, P. Aslani, Practice change in community pharmacy: quantification of facilitators, *Ann. Pharmacother.* 42 (6) (2008 Jun) 861–868, <https://doi.org/10.1345/APH.1K617>.
- [15] W.R. Doucette, Y.D.S. Koch, An exploratory study of community pharmacy practice change, *J Am Pharm Assoc (Washington, DC 1996)* 40 (3) (2000) 384–391, [https://doi.org/10.1016/S1086-5802\(16\)31087-7](https://doi.org/10.1016/S1086-5802(16)31087-7).
- [16] C.H. Lawshe, A quantitative approach to content validity, *Pers Psychol* 28 (4) (1975 Dec) 563–575, <https://doi.org/10.1111/j.1744-6570.1975.tb01393.x>.
- [17] D.F. Polit, C.T. Beck, S.V. Owen, Is the CVI an acceptable indicator of content validity? Appraisal and recommendations, *Res. Nurs. Health* 30 (4) (2007 Aug) 459–467, <https://doi.org/10.1002/NUR.20199>.
- [18] L.L. Davis, Instrument review: Getting the most from a panel of experts, *Appl. Nurs. Res.* 5 (4) (1992 Nov 1) 194–197, [https://doi.org/10.1016/S0897-1897\(05\)80008-4](https://doi.org/10.1016/S0897-1897(05)80008-4).
- [19] J.M. Cortina, What is coefficient alpha? An Examination of theory and Applications [cited 2022 Jan 4], *J Appl Psychol [Internet]* 78 (1) (1993) 98–104.
- [20] M.B. Miller, Coefficient alpha: a basic introduction from the perspectives of classical test theory and structural equation modeling, *Struct Equ Model A Multidiscip J* 2 (3) (1995 Jan 3) 255–273, <https://doi.org/10.1080/10705519509540013>.
- [21] K.S. Taber, The Use of Cronbach’s alpha when developing and reporting research instruments in science education, *Res. Sci. Educ.* 48 (6) (2018 Dec 7) 1273–1296, <https://doi.org/10.1007/s11165-016-9602-2>.
- [22] S. Aburuz, M. Al-Ghazawi, A. Snyder, Pharmaceutical care in a community-based practice setting in Jordan: where are we now with our attitudes and perceived barriers? *Int. J. Pharm. Pract.* 20 (2) (2012 Apr) 71–79, <https://doi.org/10.1111/J.2042-7174.2011.00164.X>.
- [23] J.A. Dunlop, J.P. Shaw, Community pharmacists’ perspectives on pharmaceutical care implementation in New Zealand, *Pharm. World Sci.* 24 (6) (2002 Dec) 224–230, <https://doi.org/10.1023/A:1021526425458>.
- [24] M.G. Katoue, A.I. Awad, T.L. Schwinghammer, S.B. Kombian, Pharmaceutical care education in Kuwait: pharmacy students’ perspectives, *Pharm. Pract.* 12 (3) (2014), <https://doi.org/10.4321/s1886-36552014000300002>, 0–0.
- [25] A.C. Oparah, A.E. Eferakeya, Attitudes of Nigerian pharmacists towards pharmaceutical care, *Pharm. World Sci.* 27 (3) (2005 Jun) 208–214, <https://doi.org/10.1007/S11096-004-2268-2>.
- [26] M.N. Al Arifi, A.A. Al Dhuwaili, O.A. Gubara, H.A. Al Omar, M.S. Al Sultan, R.I. Saeed, Pharmacists’ understanding and attitudes towards pharmaceutical care in Saudi Arabia, *Saudi Pharm J* 15 (2) (2007) 146–159.
- [27] K.M. Mishore, A.N. Mekuria, A. Tola, Y. Ayele, Assessment of knowledge and attitude among pharmacists toward pharmaceutical care in Eastern Ethiopia, *BioMed Res. Int.* 1 (2020 Jan) 2020, <https://doi.org/10.1155/2020/7657625>.

- [28] J.W.F. Van Mil, W.O. De Boer, T.F.J. Tromp, European barriers to the implementation of pharmaceutical care, *Int. J. Pharm. Pract.* 9 (3) (2001) 163–168, <https://doi.org/10.1111/J.2042-7174.2001.TB01044.X>.
- [29] M.S. El Hajj, H.S. AL-Saeed, M. Khaja, Qatar pharmacists' understanding, attitudes, practice and perceived barriers related to providing pharmaceutical care, *Int. J. Clin. Pharm.* 38 (2) (2016 Apr 1) 330–343, <https://doi.org/10.1007/S11096-016-0246-0>.
- [30] L.M. Tahaine, M. Wazaify, A. Albsoul-Younes, Y. Khader, M. Zaidan, Perceptions, experiences, and expectations of physicians in hospital settings in Jordan regarding the role of the pharmacist, *Res. Soc. Adm. Pharm.* 5 (1) (2009 Mar 1) 63–70, <https://doi.org/10.1016/J.SAPHARM.2008.05.003>.
- [31] M.N. Al-Arifi, Pharmacy students' attitudes toward pharmaceutical care in Riyadh region Saudi Arabia, *Pharm. World Sci.* 31 (6) (2009 Dec) 677–681, <https://doi.org/10.1007/S11096-009-9331-Y>.
- [32] M.B. Nusair, H. Alhamad, T. Mukattash, R. Al-Sheyyab, S. Alazzam, Pharmacy students' attitudes to provide rational pharmaceutical care: a multi-institutional study in Jordan, *Jordan J Pharm Sci* 14 (1) (2021) 27–36.
- [33] P.O. Udeogaranya, C. Ukwe, O. Ekwunife, Assessment of attitudes of University of Nigeria pharmacy students toward pharmaceutical care, *Pharm. Pract.* 7 (3) (2009 Jul) 145–149, <https://doi.org/10.4321/S1886-36552009000300003>.
- [34] S. Pawar, A. Pawar, Effect of pharmaceutical care training on knowledge attitude and practices of pharmacists in Maharashtra, *Int J Pharm Sci Res* 59 (9) (2018 Sep 28) 4492–4498.
- [35] D. Kopciuch, A. Paczkowska, T. Zaprutko, P. Ratajczak, E. Nowakowska, K. Kus, A survey of pharmacists' knowledge, attitudes and barriers in pharmaceutical care concept in Poland, *BMC Med. Educ.* 21 (1) (2021 Dec 1) 1–8, <https://doi.org/10.1186/S12909-021-02891-6/TABLES/3>.