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Original article

# Students' experiences and attitudes toward a newly developed simulation-based pharmaceutical care clinical rotation: A pre-post study design



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## ABSTRACT

**Purpose:** This study aims to evaluate Doctor of Pharmacy (PharmD) students' experience with the newly developed simulation-based pharmaceutical care (PC) rotation by evaluating their knowledge and attitudes towards PC before and after the rotation.

**Methods:** A self-administered questionnaire was distributed to sixth year PharmD students enrolled in the clinical training rotation "Comprehensive Pharmaceutical Care" during the 2020/2021 academic semesters at Jordan University of Science and Technology's (JUST) Faculty of Pharmacy. Questionnaires were distributed before and after completing four experiential training weeks and consisted of three sections. The first section collected students' demographic details while the second and third sections evaluated students' knowledge about, and attitudes toward PC, respectively. Descriptive statistics were used to describe and compare changes in students' knowledge and attitudes pre-and post-rotation.

**Results:** A total of 106 valid questionnaires were completed with a response rate of 99.07%. The rates of correct answers increased after the rotation with median total knowledge score increasing from 8 to 10 (out of 13, P value < 0.001). Significant improvements in students' understanding of aspects relating to the concept and process of PC, and the role of clinical pharmacist in PC provision, were shown post the simulation-based clinical rotation. Similarly, their attitudes toward performing PC were either improved or emphasized. In contrast results also revealed that specific aspects of the rotation require further refinement, such as the comprehensiveness of the PC process and responsibilities in providing PC.

**Conclusions:** PharmD students' understanding and attitudes toward PC were either improved or emphasized after the simulation-based PC rotation. This study highlights the value of simulation as a unique instructional technique that can assist educators to develop PC competencies for pharmacy students.

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## 1. Introduction

The profession of pharmacy has changed over the past several decades. In the past pharmacists were only responsible for prepar-

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ing medical products on a small scale; this evolved during the development of manufacturing as the role of pharmacists changed to compounding, dispensing and labelling of medical products. (Pearson 2007) The most remarkable turning point was the development of clinical pharmacy in the mid-1960 s, which adopted a patient-oriented practice rather than a product-oriented one, and allowed pharmacists to interact more with healthcare professionals. (Holland and Nimmo 1999) As the profession evolved pharmacy services expanded into public hospitals and health clinics including provision of drug information and pharmaceutical care (PC) services.

In 1990 the concept of PC was introduced in the scientific literature by Hepler and Strand where it was defined as "the responsible provision of drug therapy for the purpose of achieving definite outcomes that improve a patient's quality of life". (Hepler and

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Strand 1990) Pharmaceutical care services appeared to be beneficial in improving patient adherence and solving drug related problems. (Jarab et al., 2012) Previous studies have shown that application of PC resulted in more favorable health outcomes. (Clifford et al., 2005, Paulos et al., 2005) Furthermore, care provided by pharmacists is more appealing for patients since pharmacists are easily accessible and consultations often require no appointments. (Manolakis and Skelton 2010, Kelling 2015) This allows pharmacists to play a major role in the healthcare system for both treating and preventing diseases. (Eades et al., 2011).

This paradigm shift in pharmacy services transformed the pharmacy education around the world to focus on the acquisition of Doctor of Pharmacy (PharmD) knowledge as well as PC provision skills. PharmD students require problem solving and critical thinking skills in order to be competent in providing PC to patients. In Jordan there are nineteen universities offering Pharmacy education. Separate from the Bachelor Degree in Pharmacy, the 6-year PharmD degree program was first started in 2000 at Jordan University of Science and Technology (JUST). Currently, the PharmD program and the Master Degree in Clinical Pharmacy are offered at two of the main public universities in Jordan. (Basheti et al., 2020) The establishment of a PharmD program, offering a Master's Degree in Clinical Pharmacy, and the introduction of PC courses into the curriculum has improved the level of PC knowledge among Jordanian pharmacists. Despite that, the needs for proper training and clinical problem-solving skills were highlighted in previous research as important barriers for implementing clinical pharmacy services in Jordan. (Basheti et al., 2020, Abu Assab et al., 2022).

Simulation-based learning has been demonstrated to improve clinical knowledge, communication skills, critical thinking and behaviors in pharmacy education. (ElGeed et al., 2021, Korayem et al., 2022) Employing role-play and skills assessment in an adaptable teaching environment enables development of the professional attributes needed for practice. (ElGeed et al., 2021, Korayem et al., 2022) Though successfully integrated in curricula of universities in many developed countries, simulation-based teaching is still limited in developing countries such as Jordan. (Vyas et al., 2013, Cheema 2018).

As part of continues commitment to improve the educational process, the Faculty of Pharmacy at JUST introduced a new simulation-based PC experiential training rotation to sixth year PharmD students. As the application of PC in hospital setting is covered through other hospital based clinical rotations, this rotation is introduced to particularly address the PC application in community based setting and resources. This study was intended to measure the impact of the newly offered clinical rotation "Comprehensive Pharmaceutical Care" among PharmD students and gauge attitudes toward the appropriate environment and human resources needed to correctly apply PC in community pharmacies.

## 2. Methods

### 2.1. Participants

Senior (sixth year) PharmD students who registered in the clinical rotation "Comprehensive Pharmaceutical Care" were invited to participate in this study. The study was conducted at Jordan University of Science and Technology (JUST) Faculty of Pharmacy over four academic semesters (from Spring 2020 to Spring 2021).

### 2.2. Design and settings

This was a pre-post cross-sectional study. A self-administrated survey was used to collect data from PharmD students before and after completing their clinical rotation. The experiential rotation was structured to be 4-weeks in length and conducted in

the simulation pharmacy at JUST. Since the PharmD program at JUST is a six-year program, where the last year is a clerkship period (entirely training-based), the rotation is offered as an elective rotation during students' sixth year of the PharmD program. Ethical approval to conduct this research was granted by the institutional review boards at JUST (Ref number: 46/131/2020); informed consent was obtained from students before participating in the study.

One of the objectives of JUST's simulation pharmacy is to be utilized as a training site for counseling and community pharmacy training. The rotation syllabus was designed to provide students with the opportunity to practice PC skills and activities under the supervision of a qualified preceptor. To achieve this goal, the rotation primarily utilizes role-play simulation cases focusing on providing PC for new / refill prescriptions, non-prescription, alternative products, and medical devices. Role-play simulation cases were framed to train students on enhancing patients' adherence and dealing with drug-related problems. Students were expected to assess and manage drug-related needs through appropriate interventions, education, monitoring plan, documentation, and follow-up care. Due to the occurrence of COVID-19 lockdown period during most of the study period, simulation activities and education were mainly conducted online through Microsoft Teams. A variety of topics were covered in the rotation to develop and emphasize the concept of patient-centered care that is the core of PC practice. Topics included, but were not limited to, medication management services, drug therapy problems, documentation in health care, pharmacovigilance, communication skills, pharmacy practice and management aspects. Furthermore, a pharmacy management software with scientific features was applied in the simulation pharmacy to practically prepare students to real practice in community pharmacies. The accessibility to a wide range of drug information resources (i.e., British National Formulary (BNF), Pharmacotherapy Handbook, Lexicomp online, UpToDate, and World Health Organization (WHO) website) has contributed to enhance students' abilities to use and extract necessary information. Overall JUST's simulation pharmacy was carefully designed to mimic real community pharmacy settings and support the practical education process of PC principles and concepts.

Role-play simulation cases cover a multitude of health issues commonly shown at community pharmacies such as diarrhea, constipation, cough, and other complications that may arise due to pre-existing conditions and medical history. Regarding the role-play process, the rotation preceptor chooses two students; one of them simulates the clinical pharmacist role and the other acts the patient role. Depending on the nature of the case, other roles such as family members or other health care providers also played a part in the simulated case. The conduct of the role-play case simulation was carefully monitored and evaluated by the preceptor and other students.

### 2.3. Instrument and data collection:

This study used a validated paper-based self-administered questionnaire that was designed to assess students' knowledge and perceptions towards PC. (Abu Farha et al., 2021) Minor edits were applied to further suit the study objectives. To examine face and content validity, the edited version was revised by five experts in the field, and all were academicians at JUST Pharmacy school. To further evaluate the simplicity and clarity of the survey items, the survey was piloted on 10 PharmD students who were excluded from the study results. All feedback comments were addressed to improve the final version of the survey. To evaluate reliability, Cronbach's  $\alpha$  tests were conducted across attitude item groups and all revealed good internal consistency; Cronbach's alpha has never been below 0.70. For example, Cronbach's alpha for items 5, 6, 7, 14, 17, 19 and 20 that examined attitudes toward the value

and importance of PC was 0.88 which is good enough to confirm internal consistency. The final version consisted of three sections: 1) students' demographics, 2) knowledge of pharmacy students about PC, and this part consisted of thirteen true / false items, 3) attitudes of pharmacy students toward the importance of PC, and duties, requirements, qualifications, and conditions needed to implement PC correctly. This section consisted of 21 items and responses were collected through the use of a 5- point Likert type scale (from strongly agree to strongly disagree). Data were collected from students by the principal investigator. The estimated time to complete the questionnaire was 10 min.

#### 2.4. Statistical analysis:

Descriptive statistics were applied to summarize demographics and other variables measured in the study. Frequency with percentage and arithmetic mean with standard deviation (SD) were used to describe categorical variables and continuous variables, respectively. Knowledge score was calculated for each student as the number of items answered correctly (total out of 13). Knowledge and attitude responses were described and compared using McNemar test, paired *t* test, and signed rank test as appropriate. All data analyses were conducted using Stata version 17 software (StataCorp. 2021. Stata: Release 17. Statistical Software. College Station, TX: StataCorp LLC.). The statistical significance was set at a 2-sided  $P < 0.05$ .

### 3. Results

#### 3.1. Sociodemographic information

A total of 106 valid questionnaires were collected with a response rate of 99.07%. The majority of the participants (82.08%) were females, and the average age was 23.5 years (SD = 0.79). The majority of participants were distributed across two registration groups (33.5% in batch of 2014 and 52.83% in batch of 2015). The average clerkship grade was 74 (out of 100, SD = 7.55).

#### 3.2. Respondents' understanding of PC

As demonstrated in [Table 1](#), responses of participants for a total of 13 items were assessed before and after completing the rotation. Overall, the rates of correct answers increased after the rotation, especially for items with unsatisfactory knowledge rates before the rotation. The median total knowledge score increased from 8 to 10 (61.5% to 76.9% out of 13);  $p$ -value  $< 0.001$ .

Items 1, 5, and 6 examined the respondents' understanding of both the content and process of PC. A significant increase was observed in the percentage of students who understood that identifying drug therapy problems should precede the care plan in the PC process (item 6; correct rate increased from 2.83% to 40.57%;  $p$  value  $< 0.001$ ). Items 2, 4, and 10 examined the respondents' understanding of the roles and responsibilities of the pharmacist in PC provision. The percentage of students who realized that the aim of PC is not to restore the patient to his normal physiological status increased (item 4; correct rate increased from 22.64% to 38.68%;  $p$ -value = 0.003). The acceptance of the statement that PC providers are directly responsible for patients' clinical outcomes increased significantly after the clerkship (item 10; correct rate increased from 71.7% to 81.3%;  $p$ -value = 0.049). On the other hand, unsatisfactory improvement was found in students understanding of the responsibilities of pharmacists practicing PC process; responsibilities cannot be limited to providing the most effective and the cheapest drug (item 2;  $p$ -value = 0.126).

Items 3, 8, 9 and 11 focused on the definitions and concepts of PC. The percentage of students who identified duplicate therapy as an example of unnecessary drug therapy increased (item 3; correct rate increased from 66.04% to 83.96%;  $P$  value  $< 0.001$ ). The percentage of students who understood that taking too little dose of the correct drug is a problem that cannot be considered as an adherence related issue increased (item 8; correct rate increased from 39.6% to 58.5%;  $p$ -value = 0.005).

Items 7, 12 and 13 addressed supportive resources required for PC provision. The vast majority of participants correctly answered these items before and after the rotation.

#### 3.3. Respondents' attitudes toward PC

[Table 2](#) demonstrates detailed responses toward students' attitudes before and after the rotation. Items 1, 11 and 13 identified attitudes toward the requirements for effective PC process. The agreement level about the attitude "Pharmaceutical care requires major up skilling of clinical knowledge" increased significantly after completing the clerkship (item 11;  $p$ -value = 0.032). In addition, students' attitude toward receiving principles of PC clearly at school was positively impacted by the clerkship (item 13;  $p$  value  $< 0.001$ ). Items 2, 3 and 4 are about duties of pharmacists in PC. Students' agreement about the duties of identifying and managing a patient's existing and potential drug-related problem, increased significantly after taking the clerkship (item 3;  $p$ -value = 0.050).

Items 5, 6, 7, 14, 17, 19 and 20 examined attitudes toward the value and importance of PC. The agreement levels about the attitude "Pharmaceutical care involves a defined process; all steps of which must be completed in order to provide this service" increased significantly (item 5;  $p$ -value  $< 0.001$ ). Furthermore, positive attitudes toward the importance of PC for all patients who take medicines, the importance of learning PC for pharmacy students during college years, and the importance of providing PC in improving patient health, were all strengthened after taking the clerkship (items 7, 14, and 19;  $p$ -values  $< 0.05$ ). However, students' positive attitudes toward the workload in providing PC were not improved significantly (items 17 and 20).

Items 8, 15, 16 and 18 gauge the effects of PC on pharmacy students and pharmacists. Students' attitude toward the future success of pharmacy and the payment for the provision of professional services other than dispensing was positively impacted by the clerkship (item 8;  $p$ -value  $< 0.001$ ). However, they were still doubtful about the attitude that providing PC would benefit pharmacists (item 18,  $p$ -value = 0.129). The rotation enhanced students' attitudes toward their abilities to identify drug-related problems (item 15;  $p$ -value  $< 0.001$ ).

Items 9 and 21 explored the acceptance of "working in PC" and "being a clinical pharmacist" by PharmD students. Students were significantly more supportive to the concept of PC and more proud to be clinical pharmacists (item 21;  $p$ -values  $< 0.05$ ). Items 10 and 12 are connected with the duties of doctors and healthcare providers in PC. The majority of students disagree that PC is the doctors' role before and after the rotation.

### 4. Discussion

This study was designed to analyze PharmD students' experiences with the newly developed rotation by evaluating their knowledge of and attitudes toward PC before and after completing the rotation. The main objective of this simulation-based pharmaceutical care clinical rotation focused on teaching and strengthening PharmD students' knowledge and experience with patient-centered pharmaceutical care. Based on the analysis,

**Table 1**  
Respondents' knowledge about pharmaceutical care before and after the rotation.

Item	Correct rate n (%)		Effect size (%)	P value
	Before clerkship	After clerkship		
1-Pharmaceutical care components can be summarized by obtaining drug related needs and identifying drug therapy problems. (F)	19 (17.92)	17 (16.04)	-1.88	0.683
2- During pharmaceutical care application, the pharmacist is responsible of providing the most effective and the cheapest drug. (F)	14 (13.21)	21 (19.81)	6.6	0.126
3- Duplicate therapy is an example of unnecessary drug therapy.	70 (66.04)	89 (83.96)	17.92	<0.001
4- The aim of pharmaceutical care is to restore the patient to his normal physiological status. (F)	24 (22.64)	41 (38.68)	16.04	0.003
5- Taking the patient medical history is part of the pharmaceutical care assessment process.	106 (100)	104 (98.11)	-1.89	0.157
6- Identifying drug therapy problems is part of the care plan in the pharmaceutical care process. (F)	3 (2.83)	43 (40.57)	37.74	<0.001
7- Any documentation system of drug therapy problems must include the medical condition, the drug therapy involved and the likely cause of the drug therapy problem.	104 (98.11)	104 (98.11)	0	1.00
8- Taking too little dose of the correct drug is a problem that can be considered as an adherence related issue. (F)	42 (39.62)	62 (58.49)	18.87	0.005
9- Pharmaceutical care is same as clinical pharmacy. (F)	54 (50.94)	54 (50.94)	0	1.00
10- Pharmaceutical care providers are directly responsible for patients' clinical outcomes.	76 (71.70)	86 (81.13)	9.43	0.049
11- The primary goal of pharmaceutical care is to maintain and improve patients' quality of life	104 (98.11)	103 (97.17)	-0.94	0.655
12- Carrying out pharmaceutical care necessitates drug information support.	103 (97.17)	103 (97.17)	0	1.00
13- Pharmaceutical care providers need counseling rooms or other private areas to provide pharmaceutical care.	102 (96.23)	104 (98.11)	1.88	0.414

[F] False items; Effect size calculated as the increase of the correct rate of each item after the rotation.

PharmD students' knowledge and attitudes towards PC were improved by the newly developed rotation. Students' understanding of the basic conception, the primary goal and the entire process of PC, and their attitudes towards performing PC were either improved or emphasized. Still, specific aspects of the rotation require either tuning or improvement to address fields such as what are the benefits of focusing on patient-care versus customer service and how pharmacists can properly manage their workloads.

Previous research revealed that a sizable portion of providers possessed a misunderstanding of what and how pharmaceutical care should be. This raised concerns about i) considering dispensing as the core of PC, ii) limiting the goal of PC to solve the drug-related problems raised by the clinicians, and iii) reluctance to practice comprehensive PC among providers due to barriers like lacking support from hospital administrators or clinicians. (Pereira et al., 2022) Lack of knowledge about the basic concept and importance of PC may impair the quality of healthcare provision. Accordingly, enhancing providers' knowledge and attitudes toward PC is essential to overcome conceptual, personal, and logistical barriers.

In Abu Farha et al. study, results showed unsatisfactory knowledge of PC among pharmacy and PharmD students in both public and private universities throughout Jordan with an average knowledge rate of 45%. (Abu Farha et al., 2021). In comparison the average knowledge rate achieved post simulation-based rotation evaluated in the current study was 77%. Findings from the current study demonstrated that this new rotation was effective in improving students' knowledge compared to their pre-rotation scores, especially for items with unsatisfactory pre-rotation knowledge, such as the roles and responsibilities of the pharmacist in PC provision, the definitions and concepts of PC, the process of PC, and supportive resources required for PC provision. For example, this study noted a significant improvement in students' understanding of PC and its focus on a patient's outcome rather than restoring the

patient to normal physiological status. Clearly, our students recognized the differences between curing the disease and improving the patients' quality of life. Consistent with our findings, a Chinese study found the rates of respondents with proper understanding of the primary goal of PC increased from 71.9% to 85.0% after attending clerkship schemes (non-simulation based). (Huang et al., 2019) In the current study, the rates of respondents with correct understanding of the goal of PC that to be directly responsible for patients' clinical outcomes increased significantly following the simulation-based rotation (from 71.7% to 81.3%). Furthermore, students recognized that the components of PC are not just to identify drug therapy problems. Indeed identifying drug therapy problems is one part of the assessment in patient care process. The percentage of students who understood that identifying drug therapy problems should precede the care plan in the PC process increased significantly. Understanding the impotence of encountering patients in a systematic and an ordered process is essential in PC provision. Positive impact of PC clinical rotations were also noted in other studies that utilized clerkship schemes to improve students' understanding of PC. (Ubaka et al., 2012, Tsega et al., 2015, Huang et al., 2019) Yet, findings from the current study showed that adjustments are required in some aspects of the rotation to achieve further improvements in its outcomes. For example, the concept of patient-centered care needs to be further emphasized through the lens of considering patient needs and preferences, and how that is reflected on the assessment process, as well as developing individualized care plan. Knowledge items with satisfactory responses remained at similar levels after the rotation; for example the percentage of students who realized the importance of patient privacy was 96.2% pre-rotation and 98.1% after the completion of the rotation.

The students' attitudes toward the value and importance of PC and the acceptance of working in such an environment turned positively after the rotation. An interesting finding is that PharmD students' attitudes toward choosing clinical pharmacist as their career

**Table 2**  
Respondents' attitudes toward pharmaceutical care before and after the rotation.

Item	Strongly agree n (%)		Agree n (%)		Neutral n (%)		Disagree n (%)		Strongly disagree n (%)		P value
	Before	After	Before	After	Before	After	Before	After	Before	After	
1- Pharmaceutical care requires the use of specialized computer software.	24 (22.64)	34 (32.08)	59 (55.66)	55 (51.89)	13 (12.26)	5 (4.72)	6 (5.66)	10 (9.43)	4 (3.77)	2 (1.89)	0.219
2- Pharmaceutical care is just an extension of current pharmacy services.	6 (5.66)	11 (10.38)	42 (39.62)	39 (36.79)	17 (16.04)	12 (11.32)	34 (32.08)	37 (34.91)	7 (6.60)	7 (6.60)	0.733
3- In pharmaceutical care the pharmacist identifies and manages a patient existing and potential drug-related problem.	31 (29.25)	45 (42.45)	66 (62.26)	54 (50.94)	2 (1.89)	0 (0.00)	2 (1.89)	4 (3.77)	5 (4.72)	3 (2.83)	0.051
4- Pharmacists require a post-graduate qualification to practice pharmaceutical care in Jordan.	29 (27.36)	24 (22.64)	45 (42.45)	53 (50.00)	13 (12.26)	12 (11.32)	14 (13.21)	11 (10.38)	5 (4.72)	6 (5.66)	0.929
5- Pharmaceutical care involves a defined process, all steps of which must be completed in order to provide this service.	23 (21.70)	42 (39.62)	71 (66.98)	61 (57.55)	7 (6.60)	1 (0.94)	2 (1.89)	1 (0.94)	3 (2.83)	1 (0.94)	<0.001
6- The primary aim of pharmaceutical care is to improve the patients' quality of life.	48 (45.28)	51 (48.11)	51 (48.11)	51 (48.11)	3 (2.83)	1 (0.94)	1 (0.94)	2 (1.89)	3 (2.83)	1 (0.94)	0.307
7- All patients taking medicines require pharmaceutical care	32 (30.19)	49 (46.23)	55 (51.89)	50 (47.17)	11 (10.38)	4 (3.77)	6 (5.66)	2 (1.89)	2 (1.89)	1 (0.94)	<0.001
8- The future success of pharmacy will depend on payment for the provision of professional services other than dispensing.	17 (16.04)	30 (28.30)	40 (37.74)	47 (44.34)	31 (29.25)	17 (16.04)	12 (11.32)	9 (8.49)	6 (5.66)	3 (2.83)	<0.001
9- I fully support the concept of pharmaceutical care.	45 (42.45)	68 (64.15)	46 (43.40)	28 (26.42)	6 (5.66)	3 (2.83)	5 (4.72)	2 (1.89)	4 (3.77)	5 (4.72)	0.019
10- Pharmaceutical care is really the doctors' role.	2 (1.89)	5 (4.72)	14 (13.21)	14 (13.21)	13 (12.26)	8 (7.55)	54 (50.94)	46 (43.40)	23 (21.70)	33 (31.13)	0.633
11- Pharmaceutical care requires major up skilling of clinical knowledge.	33 (31.43)	43 (40.57)	56 (53.33)	52 (49.06)	5 (4.76)	6 (5.66)	4 (3.81)	3 (2.83)	7 (6.67)	2 (1.89)	0.032
12- Doctors and other health professionals will not support a pharmaceutical care role for pharmacists.	5 (4.72)	7 (6.60)	19 (17.92)	17 (16.04)	27 (25.47)	33 (31.13)	41 (38.68)	37 (34.91)	14 (13.21)	12 (11.32)	0.407
13- JUST teaches the principles of pharmaceutical care clearly.	13 (12.26)	36 (33.96)	55 (51.89)	51 (48.11)	22 (20.75)	10 (9.43)	13 (12.26)	8 (7.55)	3 (2.83)	1 (0.94)	<0.001
14- Learning pharmaceutical care is important for pharmacy students.	46 (43.40)	58 (54.72)	49 (46.23)	42 (39.62)	3 (2.89)	3 (2.83)	5 (4.72)	2 (1.89)	3 (2.83)	1 (0.94)	0.013
15- I think that I have the ability to identify drug related problems.	16 (15.09)	33 (31.13)	62 (58.49)	63 (59.43)	20 (18.87)	6 (5.66)	5 (4.72)	3 (2.83)	3 (2.83)	1 (0.94)	<0.001
16- Pharmaceutical care services should not be offered for free.	8 (7.55)	12 (11.32)	25 (23.58)	27 (25.47)	22 (20.75)	22 (20.75)	34 (32.08)	31 (29.25)	17 (16.04)	14 (13.21)	0.168
17- Providing pharmaceutical care takes too much time and effort.	6 (5.71)	15 (14.15)	50 (47.62)	51 (48.11)	25 (23.81)	18 (16.98)	22 (20.95)	20 (18.87)	2 (1.90)	2 (1.89)	0.07
18- Providing pharmaceutical care would benefit pharmacists.	28 (26.42)	40 (37.74)	65 (61.32)	55 (51.89)	7 (6.60)	5 (4.72)	0 (0.00)	3 (2.83)	6 (5.66)	3 (2.83)	0.129
19- Providing pharmaceutical care will improve patient health.	45 (42.45)	61 (57.55)	49 (46.23)	36 (33.96)	4 (3.77)	3 (2.83)	2 (1.89)	5 (4.72)	6 (5.66)	1 (0.94)	0.022
20- Providing pharmaceutical care is not worth the additional workload that it places on the pharmacist.	2 (1.89)	7 (6.60)	18 (16.98)	13 (12.26)	15 (14.15)	8 (7.55)	43 (40.57)	48 (45.28)	28 (26.42)	30 (28.30)	0.765
21- I feel proud to be a clinical pharmacist.	50 (47.17)	61 (58.10)	38 (35.85)	33 (31.43)	11 (10.38)	6 (5.71)	2 (1.89)	2 (1.90)	5 (4.72)	3 (2.86)	0.006

moved in a positive direction for a significant number of students who exhibited negative or neutral attitudes before the rotation. Overall, the simulation PC clerkship was successful in improving the professional perspectives of PharmD students. In Huang et al. study, most statements regarding students' attitudes toward PC were improved in general and choosing PC provider as their career after clerkship schemes had increased (10.8% to 14.8%). (Huang et al., 2019) Still the workload in providing PC is perceived as a barrier for implementing PC and this was demonstrated previously in a national sample of pharmacy students in Jordan. (Nusair et al., 2021).

Even though the newly developed rotation evaluated in the current study was completely based on simulation, satisfactory levels of improvement were achieved compared to PC clerkships that were applied in real practice settings. (Kassam 2006, Huang et al., 2019) In fact, applying simulation for learning in community pharmacy settings has the advantage of providing students a safe environment to learn and act more freely without exposing any real patients to harm. A study conducted in India found that one-third of the students expressed that their clinical sites did not pro-

vide them an opportunity to improve PC skills, and more than 40% stated that their mentors were not available in the wards and did not provide patient-centered education. (Bhagavathula et al., 2017) JUST's current iteration of PCsimulation managed to thump most of these challenges. As a simulation pharmacy, the clinical preceptor is continuously available to direct and supervise students; students were very satisfied with simulation as an effective and successful educational instrument. Students' engagement in simulation-based activities contributed largely to having a realistic experience. Overall, this simulation was attractive for its potential of achieving the intended outcomes in a controlled and convenient environment that supports improving skills at no risk to patients. Simulation-based learning was successful in improving students' knowledge and attitudes toward PC, adding to the growing evidence that supports the use of simulation in pharmacy education. (Vyas et al., 2013, ElGeed et al., 2021, Korayem et al., 2022). An interesting study conducted in Saudia Arabia evaluated a new training model of a 5-week clerkship in which senior pharmacy students alternate between hospital wards and simulation rooms. This study showed that both settings were successful in achieving

grades above 90% in all learning outcomes and that introducing simulation might be cost saving. (Korayem and Alboghdady 2020).

This simulation-based rotation is intended to equip students with the needed knowledge, resources and skills to overcome many of the challenges facing community pharmacists in Jordan, especially those related to PC training, pharmacy design, and pharmacy management (Basheti et al., 2020). In the simulation pharmacy students are exposed to the ideal environment and the needed resources that can support the provision of appropriate PC, building and maintaining therapeutic relationships and improving patient's quality of life. Indeed, the Jordan Pharmaceutical Association (JPA) has launched the Good Pharmacy Practice (GPP) initiative that aims at improving the role of community pharmacists in the provision of patient-focused healthcare. JUST's new simulation-based rotation was developed with the ultimate goal of supporting the GPP mission and preparing future pharmacists to carry on their future role in enhancing the quality of healthcare in the country. (Nazer and Tuffaha 2017).

A major limitation for this study was related to the COVID-19 pandemic which unfortunately coincided with most of the study period. In fact, online teaching may negatively affect students' ability to interact and discuss. Accordingly, the current study may underestimate the real impact of the newly developed rotation. However, the clinical preceptor was successful in maintaining the core value of simulation by achieving the major goals of the rotation. Inter-personal communication was conducted through Micro-soft Teams which was supported by JUST during the pandemic. Moreover all students were introduced to the simulation pharmacy environment and settings either online or in-person via periods of partial access to university campus during the COVID-19 pandemic. Another important limitation was utilizing Kirkpatrick's Model's first two levels (Reaction and Learning) only to evaluate the simulation-based rotation's efficacy. (Smidt et al., 2009) We were not able to assess levels 3 and 4 (Behavior and Results, respectively) due to feasibility issues; whether acquired knowledge and skills would be transferable to students' future practice was not evaluated. Finally, simulation based environment and settings are demanding in terms of preceptor time and effort as well as the need for extra costs.

## 5. Conclusion

In conclusion the new PC clinical rotation improved many aspects of PharmD students' understanding and attitudes toward PC. Simulation can be an effective educational method to train PharmD students on the necessary PC competencies. Considering the results from this study support the benefits and applicability of simulation-based education, it is recommended that all academic institutions in Jordan integrate simulation in training pharmacy students on PC practice.

## Ethics approval

This research was approved by the Institutional Review Board (IRB) Committee at King Abdullah University Hospital (KAUH) (Number: 46/131/2020). KAUH is the teaching hospital affiliated with JUST and located within the university campus.

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## CRedit authorship contribution statement

**Shoroq M. Altawalbeh:** Data curation, Writing – original draft, Writing – review & editing, Conceptualization, Methodology, Data curation, Formal analysis, Supervision, Project administration, Funding acquisition. **Minas Al-Khatib:** Data curation, Writing – original draft, Writing – review & editing. **Basima A. Almomani:** Conceptualization, Methodology, Writing – review & editing. **Khawla Nuseir:** Conceptualization, Methodology, Writing – review & editing. **Belal A. Al-Husein:** Conceptualization, Methodology, Writing – review & editing. **Tareq L. Mukattash:** Conceptualization, Methodology, Writing – review & editing.

## 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.

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