Ind. J. Pharm. Edu. Res., 2025; 59(1s):s341-s346.
https://www.ijper.org

Original Article

The Effect of Pharmaceutical Care Practices on Clinical Problem-Solving Decision-Making Competencies and Students' Preparedness: A Cross Sectional Study

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ABSTRACT

Background: As clinical responsibilities continue to grow, it becomes essential for clinical pharmacists to acquire advanced competences, such as patient monitoring, patient-specific drug therapy design and evaluation, and collaboration with healthcare professionals. Pharmacy schools aspire to equip young pharmacists with competencies relevant to their current needs through the clinical practice courses they offer. Therefore, investigating the impact of clinical practice from the students' perspectives is crucial. **Aim:** The study aims to explore the influence of experiential learning provided in Pharmaceutical Care (PC) courses on students' level of perceived professional readiness, clinical problem-solving, reasoning, and decision-making skills. **Materials and Methods:** This study is a cross-sectional survey. Data were collected from a total of 278 students of PC courses using two questionnaires: Perceptions of Preparedness to Provide Pharmaceutical Care (PREP) scale and the Clinical Pharmacist Competencies Self-Evaluation Questionnaire (CPCSE). **Results:** The reliability coefficients of the PREP and CPCSE questionnaires were calculated as 0.95 and 0.98, respectively**.** There was a statistically significant difference between the semesters in the students' readiness perceptions, and the students' perceptions were at the highest level at the end of the PC practices (p<0.00). A statistically significant linear relationship was found between the students' perception of readiness at the end of the 9th semester and their problem-solving and decision-making competencies (r = 0.534 p<0.000). **Conclusion:** The results of the study highlight possible areas for curricular improvement. Given that the students deemed themselves to be least prepared for the administrative procedures, the curriculum should be reconsidered in this respect. The findings derived from the competency survey further underscore the necessity for curriculum modifications about drug administration and collaboration.

Keywords: Clinical pharmacist competency, Experiential learning, Pharmacy education, Clinical pharmacy, Pharmaceutical care.

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Received: 18-12-2023;
Revised: 25-05-2024;
Accepted: 07-10-2024.

INTRODUCTION

Advances in science and technology have broadened the scope of today's pharmacy services and expanded pharmacists' tasks and responsibilities. Today, a pharmacist's responsibilities have shifted from dispensing medications to providing patient-centered pharmacy services, transforming them into health specialists who promote health and disease prevention by optimizing drug therapy and providing patient care.[1]

The American College of Clinical Pharmacy (ACCP) defines clinical pharmacy as a health science discipline in which pharmacists provide patient care that optimizes medication therapy and promotes health, wellness, and disease prevention.[2] This definition places the clinical pharmacist at the center of this patient care service. Indeed, other health professionals regard clinical pharmacists' interventions in a variety of healthcare settings as critical to ensuring rational medication use.[3-5] Increasing clinical responsibilities necessitates that clinical pharmacists acquire enhanced competencies.[1] A clinical pharmacist must have both professional and interpersonal skills in addition to scientific knowledge. The ACCP describes the clinical pharmacist competencies for clinical practices as a combination of (1) comprehensive therapeutic knowledge, experience, problem-solving skills, and judgment; (2) comprehensive

DOI: 10.5530/ijper.20255958

understanding of diseases, medicines' mechanisms of action, interactions, and adverse drug reactions; and (3) the ability to manage and review patients' medicines, assess, and interpret laboratory findings, and openness to teamwork.[6,7] Realizing this vision is critical, and it requires pharmacy schools to intervene with their curricula to reflect the evolving nature of the profession and provide young pharmacists with patient-centered care practices in line with current needs.[8]

The length and scope of pharmacy education vary around the world. In Europe, European legislation foresees a unified degree that includes at least four years of full-time theoretical and practical training and a six-month traineeship in a hospital or community pharmacy.[9] Because Türkiye is an EU candidate country, the basic curricular structure is the same, yet faculties adopt different approaches to patient-centered care. Although the patient-centered education model was first introduced in the 1990s, it did not appear in curricula until about ten years later. The National Accreditation Board for Pharmacy Education places a strong emphasis on the necessity of including both theoretical and practical patient-centered courses in the curriculum Faculties, however, adopt a variety of methods and processes to achieve the intended outcome.

A literature review on the effectiveness of learning outcomes in Pharmaceutical Care (PC) courses indicates that a variety of approaches and methodologies, including experiential learning, case-based activities, role-playing and problem-based learning are adopted.[10] This study aims to explore the impact of an experiential learning approach on the students' level of perceived professional readiness, clinical problem-solving, reasoning, and decision-making skills.

MATERIALS AND METHODS

Participants and setting

This study is a cross-sectional survey study by design. A cross-sectional survey is a type of observational research that examines data from a sample population at a given time. Researchers measure the outcomes and exposures of study participants simultaneously by using surveys.[11] Participants were recruited using the non-probability sampling (purposive sampling) technique. Data were collected from a total of 278 students (68 males and 210 females) who are enrolled to one of the PC courses. 103 of the 278 participants were in their seventh semester, 106 were in their eighth, and 69 were in their ninth semester. Pharmaceutical Care courses (Pharmaceutical Care 1, 2, 3) are offered in three consecutive semesters in the curriculum: the seventh, eighth, and ninth semesters. Pharmaceutical Care 1 (2 hr per week) is taught in the faculty, with students examining cases. Pharmaceutical Care 2 and 3 courses, on the other hand, are structured as a 3 hr theoretical session followed by a half-day hospital practice that aim to provide students with onsite experience in patient monitoring and drug administration in a hospital setting. Students monitor patients, evaluate patient-specific medical problems, drug treatment and comprehensive drug administration, and cooperate with patients, patient care providers, and other health professionals in bedside practices as they rotate through emergency, pediatric, surgery, cardiology, and internal medicine clinics.

Data collection

Two questionnaires were used to collect data. Data on students' perceived readiness for patient-centered care was collected using the Perceptions of Preparedness to Provide Pharmaceutical Care (PREP) scale, which was first designed by Ried *et al.*[12] This scale assesses students' perceived readiness to perform pharmacy practice competencies in five sub-domains: technical, psychosocial, communication, administrative aspects, and understanding research.[12] The study utilized the Turkish-translated version by Okuyan *et al.*[13] It includes of 33 items asking students to rate their perceived preparation on a 5-point Likert-type scale, ranging from 1 (poor preparation) to 5 (excellent preparation).

The influence of PC courses on students' clinical problem-solving, reasoning, and decision-making competencies was assessed using the Clinical Pharmacist Competencies Self-Evaluation Questionnaire (CPCSE). The scale was created by the researchers based on the competencies outlined in the "Clinical Pharmacist Competencies" document published by the ACCP in 2008.[2] The scale comprises 28 items and utilizes a 5-point Likert scale. Students assess the impact of PC courses on their competence in patient monitoring (6 items), patient-specific problem assessment (7 items), patient-specific drug therapy evaluation (7 items), patient-specific drug therapy design (5 items), and collaboration with stakeholders (3 items).

Upon completion of each PC course, students were administered the PREP scale. Additionally, at the conclusion of the ninth semester, students were given the CPCSE scale.

Prior to data collection, ethical approval was received from the corresponding author's Institutional Research Ethics Committee. There were no incentives for students to participate in the study, and all data was anonymized. The participants were provided with information on the study objectives and asked to sign a waiver of informed consent on the first page of the questionnaires.

Statistical analysis

An ANOVA test was used for cross-sectional differences. The Spearman Correlation test was used to analyze the relationship between students' patient-centered pharmacy practice preparedness level and their self-perceived problem-solving, reasoning, and decision-making competencies.

RESULTS

The reliability coefficient of the Perceptions of Preparedness to Provide Pharmaceutical Care (PREP) questionnaire was calculated as 0.95 and the reliability coefficient of the Clinical Pharmacist Competencies Self-Evaluation Questionnaire (CPCSE) questionnaire as 0.98. The skewness and kurtosis coefficients of the data were in the acceptable range (+1.5/-1.5), indicating that the data were normally distributed.[14]

Means and standard deviations of the PREP scale and sub-scales were calculated to assess students' perceived preparedness. The overall mean scores revealed that seventh-semester students exhibited the lowest level of perceived preparedness, with a mean score of 2.32 out of 5. Conversely, eighth-semester students reported a mean score of 3.33, indicating a perception of adequate preparedness. Furthermore, ninth-semester students had the highest average score of 4.33, indicating a strong sense of preparation. Figure 1 displays a consistent upward trend in students' perceived preparedness from the seventh to the ninth semester. A similar progression was also evident in the subscales. A one-way between-subjects Analysis of Variance (ANOVA) was performed to determine if there were significant differences in the mean scores of perceived preparedness. As shown in Table 1, the analysis revealed a statistically significant effect of PC courses on students' overall perceived preparedness ($F(2,275)=264.33$, $p<0.001$). The eta squared effect size ($\eta^2 = 0.658$) indicated a large effect. The same pattern was also observed in the technical care ($F(2,275)=253.63$, $p<0.001$), psychosocial ($F(2,275)=229.58$, $p<0.001$), communication ($F(2,275)=230.74$, $p<0.001$), administrative aspects ($F(2,275)=96.95$, $p<0.001$), and understanding research domain ($F(2,275)=115.42$, $p<0.001$). Tukey's HSD post-hoc test indicated a significant difference in perceived level of preparedness between the ninth-semester students and those of both the eighth ($p<0.001$) and seventh-semester ($p<0.001$) students. A significant difference in perceived preparedness was also found between the students in their seventh and eighth semesters ($p<0.001$).

The means and standard deviations of the CPCSE scale were computed to examine the self-assessed level of competence of the ninth-semester students. As shown in Table 2, the mean scores for the whole scale and subdomains varied from 4.35 to 4.08, with a narrow standard deviation range (SD=0.66 to SD=0.80). The overall mean score of 4.18 indicated that students felt they had gained a high level of competence by the end of the Pharmaceutical Care 3 course. As Figure 2 displays, therapy evaluation, problem assessment, and patient monitoring had the highest level of competence, with mean scores of 4.35, 4.17, and 4.12, respectively. The collaboration and drug delivery subdomains exhibited the lowest means, with values of 4.10 and 4.08, respectively.

A Pearson correlation coefficient was computed to assess the relationship between students' preparedness and perceived competence. A statistically significant positive correlation was found between the variables (r (67) = 0.534 $p<0.001$) (see Table 3). The students' preparedness was moderately related to their pharmaceutical care problem-solving and decision-making competencies.

DISCUSSION

Pharmacy schools have the responsibility to ensure future pharmacists are equipped with the knowledge and competencies needed to prepare them for future professional responsibilities. This requires a careful alignment between theory and clinical practice.[15] Pharmacy schools responded this requirement by adopting pharmaceutical care as a philosophy of practice. This

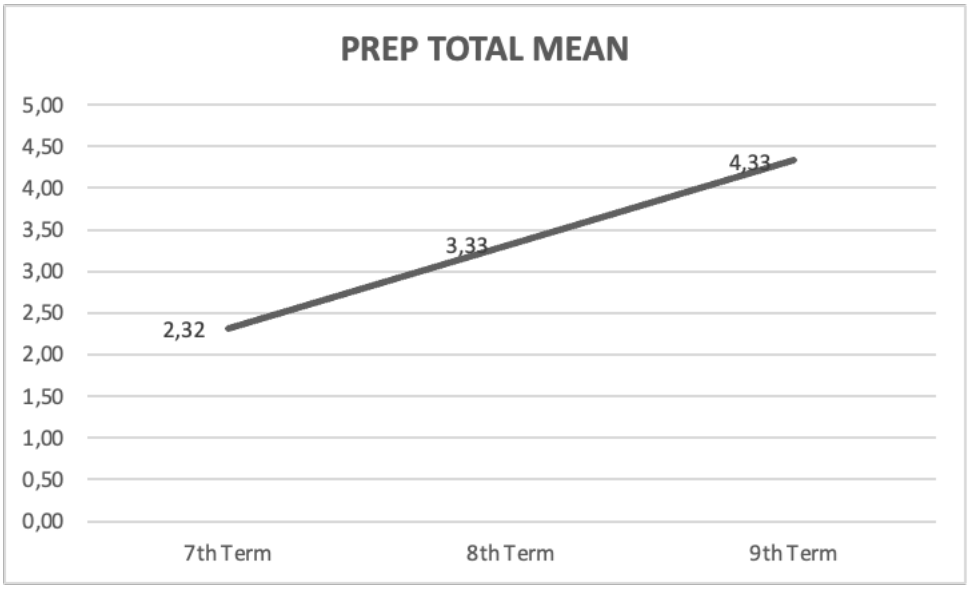

Figure 1: Change in PREP from the seventh to the ninth-semester.

Table 1: Means, Standard Deviations, and One-Way Analyses of Variance in PREP.

Domain	7th Term		8th Term		9th Term		*F* (2. 275)	η^2
	M	*SD*	*M*	*SD*	*M*	*SD*		
Technical Care	2.23	0.56	3.26	0.62	4.34	0.65	253.63**	.648
Administrative	2.22	0.62	3.07	0.84	3.98	1.01	96.95**	.454
Research	2.15	0.70	3.14	0.81	4.12	1.04	115.42**	.456
Psychosocial	2.47	0.45	3.50	0.67	4.39	0.63	229.58**	.625
Communication	2.47	0.54	3.49	0.71	4.51	0.57	230.74**	.627
PREP Total	2.32	0.48	3.33	0.59	4.33	0.63	264.33**	.658

** Correlation is significant at the 0.01 level (2-tailed).

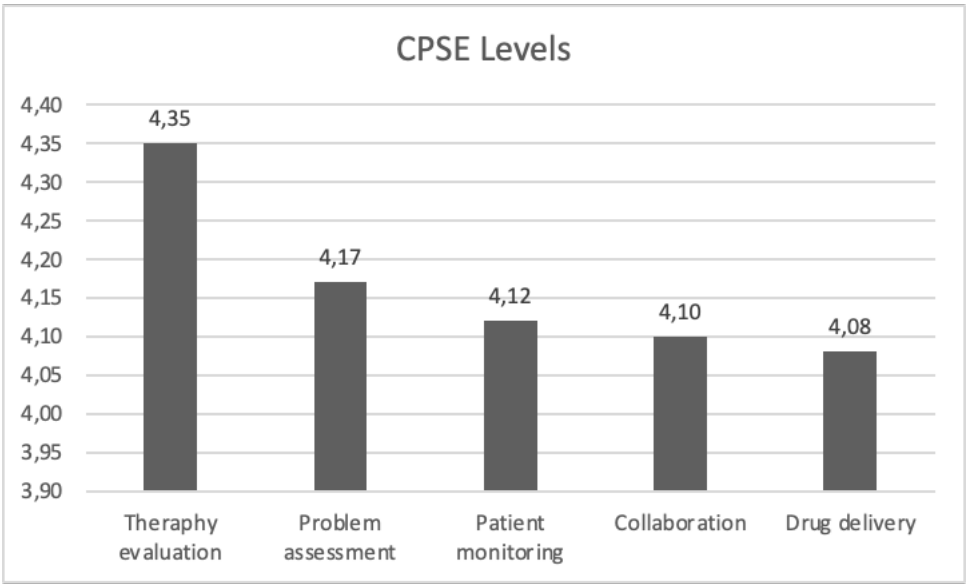

Figure 2: Perceived Clinical Pharmacist Competencies of the ninth-semester students.

Table 2: Descriptive statistics of CPCSE scale.

Domain	Mean	SD
Patient monitoring	4.12	0.68
Problem assessment	4.17	0.69
Therapy evaluation	4.35	0.66
Drug delivery	4.08	0.69
Collaboration	4.10	0.80
CPCSE Total	4.18	0.61

philosophy can be defined as the monitoring of pharmacotherapy by pharmacists to ensure that patients receive maximum benefit from medical treatment.[16] A global study of undergraduate pharmacy education curricula reveals that the pharmacy practice cluster has the most variation, preventing standardized competency-based practice.[17] Moreover, practical teaching corresponded to 30.0% and, 30 of 37 countries have undergraduate education in Clinical Pharmacy (CP) accredited by a regulatory body.[1] According to this survey, Türkiye ranked 10th out of 37 countries, with 39% of contact hours devoted to practical teaching in CP (the number of CP semesters and contact hours/semester were 3.7 and 297, respectively).[1] Thus, it is critical to investigate the effect of clinical practice provided through PC courses from the students' perspectives.

The objective of this research was to investigate the impact of on-site experiential learning on the students' level of perceived professional readiness, clinical problem-solving, reasoning, and decision-making skills. The findings of this study confirm that students' perceived level of preparedness exhibited a consistent and gradual increase from the seventh to the ninth semester. The significant differences observed between the cohorts suggest that onsite experiential learning contributes to the pharmacy students' perceptions of readiness to execute clinical pharmacy skills. This finding is comparable to the findings of studies conducted in the United States,[12,18] Malaysia,[19,20] Qatar and Kuwait.[21,22]

Our findings demonstrated that the clinical placements strengthened students' perceptions of readiness to carry out their communication, psychosocial and technical care aspects as well as their administrative tasks and research skills. These

Table 3: Correlations between PREP and CPCSE.

Variable		1	2	3	4	5	6	7	8	9	10
PREP	Technical Care	--	--	--	--	--	--	--	--	--	--
	Administrative	0.83**	--	--	--	--	--	--	--	--	--
	Research	0.82**	0.74**	--	--	--	--	--	--	--	--
	Psychosocial	0.75**	0.77**	0.69**	--	--	--	--	--	--	--
	Communication	0.81**	0.64**	0.68**	0.80**	--	--	--	--	--	--
CPCSE	Patient monitoring	0.50**	0.42**	0.46**	0.49**	0.46**	--	--	--	--	--
	Problem Assessment	0.52**	0.42**	0.51**	0.37**	0.43**	0.76**	--	--	--	--
	Therapy Evaluation	0.36**	0.44**	0.32**	0.40**	0.30**	0.70**	0.75**	--	--	--
	Drug Delivery	0.48**	0.44**	0.46**	0.31**	0.34**	0.64**	0.81**	0.78**	--	--
	Collaboration	0.49**	0.36**	0.53**	0.33**	0.39**	0.56**	0.71**	0.65**	0.71**	--

** Correlation is significant at the 0.01 level (2-tailed).

findings are in line with the findings of Reid *et al.* who found that students exhibited higher levels of preparedness to engage in patient-centered-care activities, communicate and interact with patients, and handle administrative tasks at graduation.[12] Similarly, Hasan *et al.* reported increase in therapeutic, psychosocial and communication skills.[19] In our study, the lowest change was observed in the administrative aspect. This finding echoes findings from previous studies in which administrative competencies were rated the lowest among the four competencies.[18,20,22] The result might be attributed to the fact that students are placed in hospitals that demand distinct administrative skills and that their primary emphasis during their clinical practice is on patient monitoring and drug administration rather than managerial procedures. The consistent observation across many research indicates that, instead of reassessing the course content, it is more effective to employ an alternative instructional approach for teaching the administrative aspect.

Regarding the perceived competence, ninth-semester students believed that they had attained a high level of competence by the time they completed the Pharmaceutical Care 3 course. The competency areas of therapy evaluation, problem assessment, and patient monitoring exhibited a greater degree of competence compared to collaboration and drug delivery. Therapy evaluation, problem assessment, and patient monitoring are the clinical competencies that are essential for pharmacists in practice. The results suggest that experiential learning provided through PC courses had an invaluable contribution to the development of these competencies. The presence of correlations between preparedness and perceived competencies provides further evidence of this contributing impact.

CONCLUSION

This study examined the influence of experiential learning provided in PC courses on students' clinical pharmacy readiness and clinical pharmacist competencies. We observed a consistent and statistically significant increase in students' perceived preparedness from the seventh to the ninth semester. This finding suggested that PC courses improved pharmacy students' perceptions of readiness to the profession. The mean score from the CPCSE questionnaire suggested that students believed they had acquired a high level of competence by the end of PC 3 course, particularly in therapy evaluation, problem solving, and patient monitoring competencies. Taken together, these findings indicated that clinical practices positively influence the development of students' patient-centered care competencies. Experiential learning not only provides them with a platform to interact with other healthcare professionals but also an opportunity to understand their roles and responsibilities regarding patient care.

The results of the study highlight possible areas for curricular improvement. Given that the students deemed themselves to be least prepared for the administrative procedures, the curriculum should be reconsidered in this respect. The findings derived from the competency survey further underscore the necessity for curriculum modifications about drug administration and collaboration.

There are certain limitations to this research that need to be addressed. First, this research is a cross-sectional examination of the perspectives of a heterogeneous student population enrolled at a single public university. Also, students' competencies were not initially assessed as enrollment in the PC course is contingent upon their successful completion of theoretical courses. Further investigation is warranted to ascertain the temporal evolution of pharmacy students' competencies.

ACKNOWLEDGEMENT

Part of the study was represented in the 2023 ACCP Virtual Poster Symposium.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

ABBREVIATIONS

ACCP: American College of Clinical Pharmacy; **CP:** Clinical pharmacy; **CPCSE:** Clinical Pharmacist Competencies Self-Evaluation; **PC:** Pharmaceutical Care; **PREP:** Perceptions of Preparedness to Provide Pharmaceutical Care.

ETHICS APPROVAL

The study protocol was accepted by the University of Health Sciences Hamidiye Scientific Research Ethics Committee (approval no:13/50, approval date:12.05.2020). A written informed consent was obtained from each student participating in the study after the purpose of the study was explained to them. Participation in the study was voluntary and the identity of each student was anonymous.

SUMMARY

Pharmacy schools have the responsibility to ensure future pharmacists are equipped with the knowledge and competencies needed to prepare them for future professional responsibilities. This requires a careful alignment between theory and clinical practice. Clinical practices positively influence the development of students' patient-centered care competencies. Experiential learning not only provides them with a platform to interact with other healthcare professionals but also an opportunity to understand their roles and responsibilities regarding patient care. The results of the study highlight possible areas for curricular improvement. Students deem themselves to be least prepared for the administrative procedures. The findings derived from the competency survey further underscore the necessity for curriculum modifications about drug administration and collaboration.

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Cite this article: Yürük FU, Mercanoğlu G, Yüksel G, Ay ZY, Uçar N, Tezcan S. The Effect of Pharmaceutical Care Practices on Clinical Problem-Solving Decision-Making Competencies and Students' Preparedness: A Cross Sectional Study. Indian J of Pharmaceutical Education and Research. 2025;59(1s):s341-s346.