



Experience of and Attitudes toward Research among Pharmaceutical Sciences and PharmD Students in Saudi Arabia

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Abstract

Purpose: The aim of this study was to investigate attitudes toward, experience of, and perceived barriers to conducting research among Pharmaceutical Sciences and Doctor of Pharmacy (PharmD) students in pharmacy colleges in Saudi Arabia.

Methods: We conducted a cross-sectional study using a validated questionnaire distributed electronically between July and August 2016 to a convenient sample of Pharmaceutical Sciences and PharmD students in Riyadh, Saudi Arabia. The questionnaire consisted of four sections: demographic information, and perceptions, experience, and knowledge of conducting research.

Results: Of the 245 respondents, most (73.5%) agreed that research is important. Sixty percent agreed that conducting research should be mandatory for PharmD students. However, the majority disagreed that research experience should be a criterion for acceptance on a residency program. Of the PharmD students, 73.8% believed that research projects would improve their ability to work and think independently, whereas only 58% of Pharmaceutical Sciences students agreed ($p = 0.03$). More PharmD students than Pharmaceutical Sciences students believed that they would learn from research experience (65.2% vs. 40.7% [$p = 0.00$]) and publishing or presenting research work (61.6% vs. 39.5% [$p = 0.26$]). The students' major motivations to perform research were that it is a mandatory requirement of the curriculum (43.7%), is a positive addition to one's résumé (22.4%), and facilitates acceptance to a residency program (18.8%). Lack of time and training courses were the most commonly cited barriers to conducting research. Regarding knowledge about performing research, PharmD students had a slightly better average score than Pharmaceutical Sciences students (38.6 vs. 37.28 [$p = 0.49$]) in an objective assessment of knowledge.

Conclusion: Overall, PharmD and Pharmaceutical Sciences students share a positive perception of the importance of research. However, their general knowledge about conducting research is low; thus, more training on time management and research processes is recommended.

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Keywords: Attitude; Pharmaceutical Sciences; Doctor of Pharmacy; Research

Abbreviations: PharmD, Doctor of Pharmacy; IRB, institutional review board; SD, standard deviation.

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1. Introduction

Research is defined as a study performed to establish facts or reach conclusions.¹ Nowadays, research is considered an important component of health-care training because of its emphasis on proving the validity of information, which helps health-care providers to make good decisions. Moreover, research helps students to improve their knowledge, self-directed learning abilities, critical thinking faculties, and problem-solving skills.²

In pharmacy education, the Accreditation Council for Pharmacy Education released a document that recommended the integration of research into Doctor of Pharmacy (PharmD) curricula. However, multiple studies conducted in the United States have found that further investigations are needed to determine the most effective way to integrate research into PharmD curricula.^{1–3}

In 2005, Healey et al.⁴ developed a framework to illustrate the research–teaching connection and describe four ways in which undergraduate students can experience research in the curriculum. According to this framework, students can be treated as an audience or as active participants, and the emphasis can be on the research process or on research content. It has been argued that treating students as participants, combined with an emphasis on research content, is a form of active learning.⁴ Active learning is considered the optimal way to engage students in this kind of activity.^{5–7} This can be implemented, for instance, by offering students the opportunity to conduct or participate in an authentic research project during their internship. In this respect, the hands-on experience of publishing a research paper can be seen as an excellent example of active learning, and would therefore be a great means to encourage scientific minds.

Developing scientific research skills is an essential part of pharmacy programs, and a good understanding of the importance of research may help to increase the amount and quality of research being conducted. For example, the College of Pharmacy of the King Saud bin Abdulaziz University for Health Sciences, Riyadh, Saudi Arabia, has multiple mandatory research courses for PharmD students in the fourth and fifth professional years that involve hands-on assignments. Students are engaged in each step of conducting authentic research, including literature review, writing a research proposal, collecting data after receiving institutional review board (IRB) approval, and critically appraising the study. The purpose of these courses is to create pharmacists skilled in research, which is the first step toward meeting

international standards of research. Similarly, research is a mandatory training requirement for first-year postgraduate residencies in American Society of Health-System Pharmacists-accredited programs.⁸

Factors that can aid the development of research skills include optional and mandatory research courses, attending conferences, and modification of pharmacy courses to help foster these skills.⁹ Understanding the attitudes and opinions of health-care students regarding research is also important for promoting their involvement in research and the development of research skills. Multiple studies have been performed to assess students' knowledge and experience of research.^{10–16} In 2007, Murphy et al.² found that only 25% of pharmacy schools required PharmD students to have research experience. The barriers cited by pharmacy students that prevented them from conducting research included lack of time and limited awareness of research. A study on engaging pharmacy students in elective research courses reported positive feedback from the students regarding their understanding of and confidence in performing research.¹¹ Another study conducted in Malaysia showed that students believed that research would be an important part of their future careers, which shows good attitudes toward medical research. However, the study also identified barriers facing students that limited their involvement in research.¹² A study of dental students showed that students in their sixth year and interns were more aware of the importance of research than first-year students. It also showed that, generally, dental students had good attitudes toward research, but that the number of students involved in research was low.¹³ Alghamdi et al.¹⁴ showed that 97.1% of senior medical students understood the importance of medical research. Furthermore, a study performed in Canada showed that the attitudes and experiences of students and barriers they faced while conducting research varied depending on the year of study.¹⁵

In Saudi Arabia, the PharmD degree is a 5-year program with a clerkship year. This program is oriented toward clinical pharmacy and patient care. The Bachelor in Pharmaceutical Sciences degree is a 5-year program without a clerkship year that focuses on pharmaceutical sciences and features fewer clinical courses. During our literature review, we did not find any published work comparing the experience of and attitudes toward research among Pharmaceutical Sciences and PharmD students. This topic is worth investigating because programs and curricula differ between pharmacy schools. Thus, the aims of this study were to evaluate attitudes toward, experiences of, and

views on research among Pharmaceutical Sciences and PharmD students, identify any barriers to students' involvement in research, and explore what encourages students to participate in scientific research.

2. Methods

2.1. Study design

The study was cross-sectional in design. A questionnaire was administered online between July and August 2016 to a convenience sample of Saudi-Arabian Pharmaceutical Sciences and PharmD students. The students involved were in their second, third, and fourth professional years or were new graduates from a college of pharmacy. Students in their first professional year, non-pharmacy students, and postgraduate students were excluded. We combined a previously validated questionnaire and an objective assessment tool to test the students' general knowledge about conducting research.¹⁶ The survey consisted of 40 closed-ended questions, and was subdivided into the following categories:

- (1) perceptions of the importance of research and its impact on their career;

- (2) obstacles to and motivations for conducting research;
- (3) previous experience of performing research;
- (4) objective assessment of knowledge about research; and
- (5) sociodemographic information.

Participation was voluntary, and confidentiality was maintained because no identifying information was recorded in the survey results.

2.2. Statistical analysis

Descriptive statistics were produced for all survey items, comprising numbers and percentages for categorical variables and means and standard deviation (SD) for continuous variables. Each participant's knowledge assessment score was determined by computing their percentage of correct answers. The independent-samples *t*-test was used to compare knowledge assessment scores between different groups of participants. The chi-squared test was used to compare categorical variables, with the level of significance set at $p < 0.05$. Data management and analyses were performed using the Statistical Package for the Social Sciences (version 22; IBM Corp., Armonk, NY, USA).

Table 1
Baseline characteristic of PharmD and Pharmaceutical sciences students.

		Program		Total (n = 245)	Percent
		PharmD (n = 164)	Pharmaceutical sciences (n = 81)		
Gender	Male	58	24	82	33.5%
	Female	106	57	163	66.5%
Nationality	Saudi	159	63	222	90.6%
	Non Saudi	5	18	23	9.4%
University	King Saud	34	52	86	35.1%
	Princess Norah bin Abdulrahman	45	1	46	18.8%
	King Saud bin Abdulaziz for Health sciences	54	0	54	22%
	Riyadh colleges of Dentistry and Pharmacy	1	3	4	1.6%
	Almaaref Colleges for sciences and technology	0	6	6	2.4%
	Prince Sattam bin Abdulaziz	7	0	7	2.9%
	Um Alqura	2	4	6	2.4%
	AlQassim	2	0	2	0.8%
	King Khaled	1	2	3	1.2%
	Tibah	2	5	7	2.9%
	Jazan	6	0	6	2.4%
	Other	10	8	18	7.3%
Level	2nd professional year	71	24	95	38.8%
	3rd professional year	35	21	56	22.9%
	4th Professional year	26	7	33	13.5%
	Fresh graduate	32	29	61	24.9%

3. Results

In total, 245 students completed the questionnaire. Table 1 shows the demographic data of the respondents. The majority (90.6%) were Saudi-Arabian, with a mean \pm SD age of 22.2 ± 1.6 years. Sixty-six percent were women; 66.9% were PharmD students, and 33.1% were Pharmaceutical Sciences students. Most respondents were from the King Saud University, Riyadh, Saudi Arabia (35.1%), King Saud bin Abdulaziz University for Health Sciences (22%), and Princess Norah bin Abdulrahman University, Riyadh, Saudi Arabia (18.8%). The level of study of the participants was: the second professional year in 38.8%; the third professional year in 22.9%; the fourth professional year in 13.5%; and recently graduated in 24.9%. The distribution of the students according to their program of study (PharmD vs. Pharmaceutical sciences) is illustrated in Table 1.

3.1. Knowledge of Pharmaceutical Sciences and PharmD students about conducting research

The results of an objective assessment of students' knowledge about conducting research showed that there were no statistically significant differences in average knowledge scores between PharmD and Pharmaceutical Sciences students, although the PharmD students' scores were slightly higher (38.6 vs. 37.28; $p = 0.49$).

3.2. Perceptions of Pharmaceutical Sciences and PharmD students about research

Most (73.5%) PharmD and Pharmaceutical Sciences students agreed that research is essential, that conducting research during their education is important (69%), and that research is a central part of pharmaceutical professions (68.2%; Table 2). Furthermore, 60.4%

Table 2

Agreement with statements regarding perception of research by Pharmaceutical Sciences and PharmD Students.

Statement	Program		Total	P-value
	PharmD	Pharmacy		
Research is important	124 75.6%	56 69.1%	180 73.5%	0.38
Conducting research during PharmD school is important	118 72.0%	51 63.0%	169 69.0%	0.14
Conducting research should be mandatory for all PharmD students	102 62.2%	46 56.8%	148 60.4%	0.57
Research methodology should be a part of all PharmD school curricula	116 70.7%	48 59.3%	164 66.9%	0.07
Research experience should be a criterion for acceptance in a residency program	75 45.7%	36 44.4%	111 45.3%	0.89
Doing a research project has helped or will help improve my ability to work and think independently	121 73.8%	47 58.0%	168 68.6%	0.033
My research experience has helped or will help my ability to read and understand journal articles and scientific literature	121 73.8%	51 63.0%	172 70.2%	0.19
I learned or will learn about the research process from my pathway project experience	107 65.2%	33 40.7%	140 57.1%	0.00
My research experience has made or will likely make me more interested in doing research in the future	109 66.5%	44 54.3%	153 62.4%	0.11
My research experience distinguishes me from PharmD students at other schools	90 54.9%	31 38.3%	121 49.4%	0.11
My pathway project has allowed or will allow me to present my findings at a PharmD meeting and/or publish in a journal	101 61.6%	32 39.5%	133 54.3%	0.00
I feel research is an important part of the profession of Pharmacy	115 70.1%	52 64.2%	167 68.2%	0.63

agreed that conducting research should be mandatory for all pharmacy students, and 66.9% thought that research methodology should be part of the curriculum. However, more than half of the participants (54.7%) disagreed that research experience should be a criterion for acceptance on a residency program. Almost 74% of PharmD students believed that a research project would improve their ability to work and think independently, whereas only 58% of Pharmaceutical Sciences students agreed ($p = 0.03$ between the groups). More PharmD than Pharmaceutical Sciences students believed that they were more likely to learn about the research process from experiencing research (65.2% vs. 40.7%; $p = 0.00$). PharmD students spent slightly less time than Pharmaceutical Sciences students on their research projects (8.13 ± 10.81 h vs. 9.64 ± 12.94 h; $p = 0.49$), and were marginally more likely to have published research or presented at a meeting than Pharmaceutical Sciences students (60.6% vs. 39.4%, $p = 0.26$; Tables 2 and 3).

3.3. Research experience of Pharmaceutical Sciences and PharmD students

There was no significant difference between Pharmaceutical Sciences and PharmD students in the design of research projects that students had participated in, except in basic laboratory sciences research: PharmD students had participated significantly more in this kind of research than Pharmaceutical Sciences students (21 vs. seven students; $p = 0.05$). Most Pharmaceutical Sciences and PharmD students were involved in cross-sectional studies (26%), retrospective studies (13.4%), and preparing review articles (11.8%; Table 4). Most students who had experience in conducting research had completed a literature review (38.4%), data entry (31.8%), and manuscript writing (24.1%). The least students had conducted data analysis (20%).

3.4. Motivations for and barriers to conducting research

The major motivations for conducting research cited by PharmD and Pharmaceutical Sciences students were

Table 3
Average hours spent in research projects.

How many hours per week do you spend on your research project?	Program	Mean	Std. Deviation	P-value
	Pharmacy	9.64	12.940	

Table 4

Distribution of Pharmaceutical Sciences and PharmD Students' research involvement according to research design.

Design of research	Program		Total	P value
	PharmD	Pharmacy		
Cross-sectional study	42	23	65 (26.5%)	0.64
Retrospective observational study	23	10	33 (13.4%)	0.71
Review article	22	9	31 (12.6%)	0.27
Basic sciences (Lab)	21	7	28 (11.4%)	0.06
Clinical trail	16	7	23 (9.3%)	0.74
Case Report	13	5	18 (7.3%)	0.62
Prospective observational study	11	4	15 (6.1%)	0.58
Total	148	65		

that it is a mandatory requirement of the curriculum (43.7%), is considered a positive addition to one's résumé (22.4%), and facilitates acceptance to a residency program (18.8%). Lack of time and training courses (15.3%), unavailability of data (15%), lack of experts (12%), and difficulty obtaining IRB approval (10%) were the most commonly reported barriers to performing research (Figs. 1 and 2).

4. Discussion

The PharmD and Pharmaceutical Sciences students surveyed believed in the importance of research during their education and as part of their chosen profession; both groups also agreed that research would enhance their ability to read and understand medical journals. These results are consistent with those of a previous study by Alghamdi et al.¹⁴ Lack of time, training courses, and unavailability of data were the most commonly cited barriers to conducting research projects, and were also mentioned in a previous report by Murphy et al.² Efforts should be made to provide pharmacy students with adequate time for and training courses on participation in research to encourage their involvement. However, many students disagreed that research experience should be mandatory for acceptance on a residency program, and were uncertain as to whether research experience is a true reflection of students' skills and abilities. This viewpoint may have several underlying explanations. First, some undergraduate students may feel too stressed and overwhelmed to conduct research during their academic years, especially those with busy schedules. Second, given that most pharmaceutical research requires experimental work, some universities lack the necessary facilities and appropriate supervision for conducting research. This may explain the low number of research

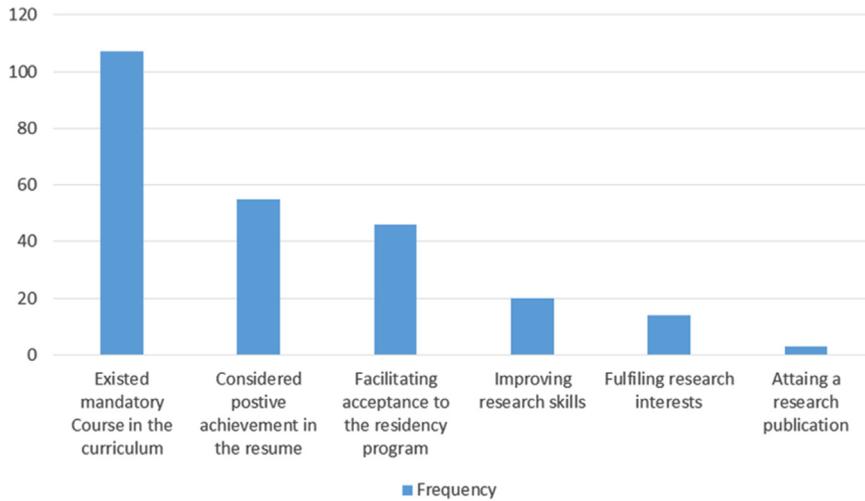


Fig. 1. Motivations for conducting research.

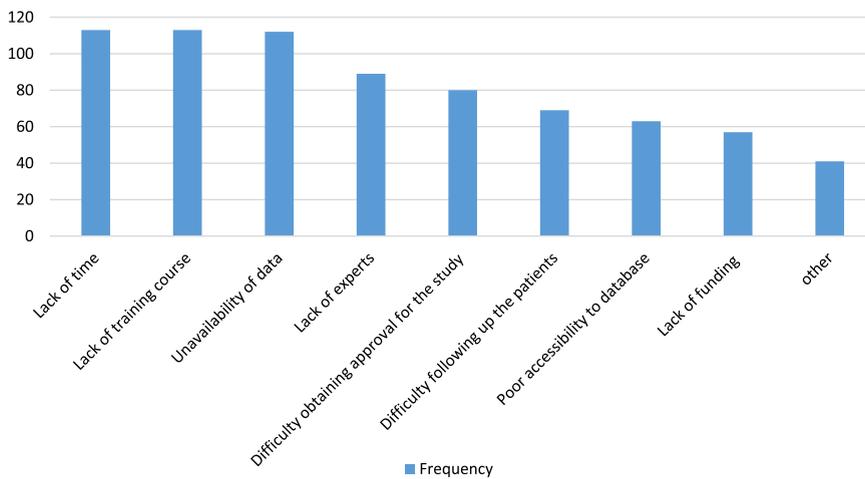


Fig. 2. Barriers to conducting research.

projects conducted by Pharmaceutical Sciences students. In comparison, PharmD students, who are more specialized in research and have access to clinical practice, have more opportunities to conduct varied types of research. Although PharmD students were more involved in laboratory research, this may be because they are keen to explore nonclinical research before joining clinical practice. Finally, publication may be a challenging task for undergraduates because it requires the cooperation of skilled and capable authors to prepare a manuscript of sufficient quality in the necessary style.

Strategies should be implemented to reduce the barriers that students face to conducting research and enhance their experience of and attitudes toward research. Our survey showed that few students have internal motivations to conduct research such as fulfilling research interests and improving their research

skills. On the other hand, most students were encouraged to participate in research by external motivations such as research experience being mandatory in their programs of study, appearing beneficial on their résumé, facilitating acceptance on a residency program, and enabling attainment of a research publication. Our results were consistent with those of Esfahani et al.,¹⁷ who found that students were mainly encouraged to participate in research projects by external motivations such as improving their curriculum vitae. Another study by Solaja et al.¹⁸ reported that most students were encouraged to participate in research by external factors: they believed that involvement in research would increase their employability after their residency. The only internal motivation cited by these students was a personal obligation to advance the practice through research.

To enhance the experience of and attitudes toward research of students, various strategies should be implemented. A study in Syria found that encouragement, support, and good mentorship by professors can make students more interested in writing and publishing research.¹⁹ Furthermore, a study conducted by Ommering and Dekker²⁰ emphasized the importance of intrinsic over extrinsic motivating factors for performing scientific studies. Consistent with these studies, we recommend focusing on enhancing the intrinsic motivations of students for conducting research. First, the curricula at some universities should be modified to include more research courses, and students should be encouraged to conduct research; our survey showed that the requirement to conduct research as part of a course is a powerful motivation. In addition, performing research makes acceptance into residency programs easier, enhances one's résumé, and helps improve students' research skills. At the King Saud bin Abdulaziz University for Health Sciences, research is a mandatory requirement for graduation. During the first semester of the second professional year, students are taught the basic skills for conducting a research project. In the second semester, students are encouraged to generate ideas for their research, and begin a literature review and a research proposal. In the third professional year, students continue to take courses about research. By the end of the year, the research itself should be completed and ready for presentation. Students should be given sufficient time to engage in research, supported by the fact that the biggest barrier to undertaking research cited in our survey was "lack of time". Moreover, it is important that students have access to appropriate data: some colleges do not have access to hospital data.

This study has some limitations. One is its small sample size, which we attribute to the use of an electronic survey. This may have limited the generalizability of our results; however, an electronic survey was considered the only suitable method to communicate with students at the wide range of institutions involved in this study. In addition, the questionnaire was too long and contained closed-ended and leading questions, which may have affected the reliability of the data. The "knowledge" section comprised only 10 questions and was taken from a previously validated survey, but the questions may have been insufficient to assess the knowledge of the students. Further qualitative studies should be conducted to obtain more complete information on students' attitudes, which will help in understanding and exploiting the results.

5. Conclusion

PharmD and Pharmaceutical Sciences students share a positive perception of the importance of research. Most participants, but predominantly PharmD students, perceive participation in research activities to be a learning opportunity with the potential to improve their capacity to work and think independently. However, the level of knowledge of PharmD and Pharmaceutical Sciences students about conducting research was low; therefore, more training on time management and research processes is recommended.

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