Pharmacy students' perception of their preparedness to counsel patients about medical devices: An exploratory study from Saudi Arabia

Ahmed I Fathelrahman; MSc, PhD

Department of Clinical Pharmacy, College of Pharmacy, Taif University, P.O. Box Taif 888, Zipcode: 21974, Saudi Arabia.

Abstract

Context: Evidence have shown high rates of errors among patients in the use of very common medical devices. Educational interventions to improve device use among patients are effective. This necessitates the preparedness of healthcare providers including pharmacists. **Aims:** The aim of the present study was to assess pharmacy students' knowledge of and perceived preparedness to counsel patients about medical devices. **Settings and Design:** This was an exploratory survey-based cross-sectional study that was conducted among 4th-, 5th-, and 6th-year PharmD pharmacy students from a college in Saudi Arabia. **Material and Methods:** An online-version survey was used to collect data using Google forms. Each student was provided with pictures of 10 medical devices followed by questions about the name, ability to use, and ability to counsel patients about its use. **Statistical analysis:** Data were analyzed and presented descriptively and comparatively. Student's t-test, one-way ANOVA, and Pearson correlation were used for inferential analyses. A p-value of <0.05 was considered statistically significant. Results: Seventy-three pharmacy students responded to the online survey. They showed moderate knowledge of medical devices. Participants perceived their preparedness to counsel patients about medical devices to be high to moderate. Students' overall scores on knowledge of and preparedness were not different by age, gender, or year of study. **Conclusions:** Pharmacy students showed moderate knowledge and reported high to moderate perceived preparedness to counsel patients about medical devices. Students' perceived ability to use medical devices and perceived ability to counsel were highly correlated.

Keywords: Medical devices; Pharmacy students; Saudi Arabia; Preparedness; Counselling; Knowledge

INTRODUCTION

High rates of errors in medical devices use have been reported worldwide among patients [1-5]. Counseling from healthcare providers offers effective solutions [6-9].

Pharmacists are exposed to a large array of medical devices during practice [10]. Due to the advancement in technology, the number and types of medical devices involved in the diagnosis, treatment, prevention, and monitoring of diseases and patients' outcomes are increasing dramatically. The number of medical devices sold in community pharmacies is increasing also, and because of the wide spread of self-care and responding to symptoms concepts, pharmacists need to counsel patients about medical devices. However, shortages among healthcare providers including pharmacists regarding the correct use of medical devices have also been reported [11].

To our knowledge, medical devices are not covered widely during the study in pharmacy colleges as individual courses but they may be covered as part of broader taught subjects like therapeutics, over-the-counter (OTC) medications, pharmaceutical care skills, and clinical skill lab or experiential training [12, 13]. Even clinical guidelines literature resources available in this area are limited [14, 15].

Study objective:

The aim of the present study was to assess the knowledge of and the perceived preparedness to counsel patients about medical devices among PharmD pharmacy students.

SUBJECTS AND METHODS:
Study design and participants:

This was an exploratory cross-sectional survey-based study that was conducted among 4th-, 5th-, and 6th-year PharmD students from the College of Pharmacy Taif University, Saudi Arabia to assess their knowledge of and perception of their preparedness to counsel patients about medical devices.

Address for correspondence: Ahmed I Fathelrahman, Department of Clinical Pharmacy, College of Pharmacy, Taif University, P.O. Box Taif 888, Zipcode: 21974, Saudi Arabia. Email: afathelrahman @ yahoo.com

Pharmacy students at Taif University receive first introductory pharmacy practice experiential (IPPE-1) training course (conducted in community pharmacies) before starting their 4th year, second introductory pharmacy practice experiential (IPPE-2) training course (conducted in health clinics) before starting their 5th year, and advanced pharmacy practice experiential (APPE) training (conducted in hospitals) during their 6th year of study. All students from the 4th, 5th, and 6th years of study were eligible to participate voluntarily in the current study. Ten medical devices commonly available in practice were included namely, blood glucose monitor, Accuhaler, Turbuhaler, Metered Dose Inhaler (MDI), spacer, insulin pen, heart rate monitor, blood pressure monitor, nebulizer, and respirometer.

Research questions:
The study aimed to answer five questions using a five-point Likert scale; will students be able to correctly identify ten medical devices commonly used in practice? How did they perceive their ability to operate every medical device? How did they perceive their ability to counsel patients about such medical devices? What are their sources of information to learn about medical devices? What are their views about the need for certain measures intended for improving medical device-related knowledge and skills among pharmacy students and pharmacists?

Sample size:
During the time of data collection, there were 392 students in the final three years of study in the college as follows; 54 males and 77 females in 4th year, 61 males and 78 females in 5th year, and 57 males and 65 females in 6th year (i.e. 131, 139, and 122 in the 4th, 5th and 6th years, respectively). The plan was to get a sample size that represents at least 10% of the total students (i.e. at least 40 students overall) and 10% in each category if possible.

Data collection:
Following the lockdown due to Coronavirus (COVID-19) pandemic in Saudi Arabia (i.e. starting from March 2020) and up to date (i.e. October 2020), students from all Saudi universities including Taif University were studying virtually according to a decision from the Ministry of Higher Education. The present study was conducted in March and April 2020 during the lockdown. An online-version survey was used to collect data for the study using Google forms. The survey link was sent to the students via students' leaders from each batch in the college (i.e. year of study and there is a male and a female leader for each batch). The students were told that participation is voluntary, and the respondents completed answering the survey at a convenient time.

Ethical considerations:
The study got approval from the Taif university research ethics committee (reference number 41-34-00149). Participating students were informed about the study goals and significance, and they were told that participation is voluntary and that data will be analyzed anonymously, and they agreed to participate in the survey.

The survey:
Students were provided with pictures of the 10 medical devices each followed by three questions; what is the above medical device (device name options were provided as a pull-down menu and later on each student's answer was coded as 1: correct or 0: wrong)? to what extent do you know how to use the previous medical device (using a 5-point Likert scale starting from "not at all" =1, "not well" = 2, "average" = 3, "well" = 4, and "very well" = 5)? to what extent you will be able to provide counseling to the patients about the previous medical device (using 5-point Likert scale starting from "not at all" =1, "not well" = 2, "average" = 3, "well" = 4, and "very well" = 5)? Then, students were asked to identify their sources of information to learn about medical devices (question: from where have you become aware of the previous medical devices?) and they were asked to rate four measures aimed at increasing students' and pharmacists' medical device-related knowledge and skills (question: to what extent do you agree or disagree about the need for the following?, answers on 5-point Likert scale, starting from strongly disagree =1, disagree = 2, neutral = 3, agree = 4, and strongly agree = 5).

The validation of the questionnaire:
The questionnaire has been validated for the face and content by colleagues from the Department of Clinical Pharmacy, College of Pharmacy, Taif University who have good experience with teaching and research in the areas of pharmacy practice and healthcare services.

The importance of the devices' pictures:
Devices' pictures were used to replace actual devices due to the impossibility of gathering students and showing them real devices. The responses provided for the first three questions; "what is the above medical device?", "to what extent do you know how to use the previous medical device?", and "to what extent you will be able to provide counseling to the patients about the previous medical device?"; are not affected whether a student is able or unable to correctly identify the name of a device as the students' reference for answering the three questions was the device picture and not the name of the device. A student might be exposed to the medical devices during didactic courses or pharmacy practice experiential training and knows how to operate a device but forgot its name if the name has not been emphasized very well or he/she remembers the name but does not know how to operate it. So, a response provided to one question was not affected by the response provided to the other question. In other words, the three questions independently assess students' knowledge of the devices, their perceived ability to operate them, and their perceived ability to counsel patients about them. However, it was expected that knowledge of a device would predict ability to operate and ability to counsel.

Scores on knowledge, perceived ability to use, and perceived ability to counsel:

Scores on knowledge of medical devices were computed with a maximum possible value of 10 (ability to identify all ten devices) and a minimum possible value of zero (inability to identify any device). Scores on students' perceived ability to use and perceived ability to counsel patients about medical devices were also computed with a maximum possible value of 50 (i.e. a maximum score of 5 for each question multiplied by 10 devices) and a minimum possible value of zero.

Statistical analysis:

Data were analyzed and presented descriptively and comparatively. Comparison by gender was conducted using student's t-test and that for age group and year of study were done using one-way ANOVA. Pearson correlation was used to test the correlation between the mean total scores on knowledge, perceived ability to use, and perceived ability to counsel patients. A p-value of <0.05 was considered statistically significant.

RESULTS:

Demographic characteristics:

Seventy-three pharmacy students responded to the online survey. Forty-six (63%), 15 (20.5%), and 12 (16.4%) were from the 4th, 5th, and 6th years, respectively. Thirty-nine (53.4%) were males and 34 (46.6%) were females. Seven (9.6%) students aged less than 22 years, 25 (34.2%) aged 22, 19 (26%) aged 23, and 22 (30.1%) aged more than 23 years.

Participants ability to correctly identify each of the 10 devices:

Table 1 presents the students' answers to the question "what is the medical device below?". Almost all students were able to correctly identify three devices: the blood glucose monitor (93.2%), the insulin pen (91.8%), and the blood pressure monitor (90.4%). Most of the students correctly identified two devices: the heart rate monitor (80.8%), and the MDI (79.5%). Substantial proportions (i.e. >50%) of the students correctly identified three devices: the respirometer (56.2%), the spacer (54.8%), and the nebulizer (52.1%). Lower proportions of students correctly identified the turbuhaler (45.2%) and accuhaler (26%).

Participants' perceived ability to use/operate medical devices on the five-point Likert-scale:

Table 2 shows the participants' response to the question "To what extent do you know how to use/operate the previous medical device?" using the five-point Likert-Scale. The participants perceived their ability to operate a blood glucose monitor, insulin pen, and blood pressure monitor to be very high (score ≥4). They perceived their ability to operate MDI, and heart rate monitor to be high (score between 3 and 4). They perceived their ability to operate nebulizer, spacer, accuhaler, and turbuhaler to be moderate (score between 2.5 and 3). Participants perceived their ability to operate respirometer the lowest (less than 2.5).

Participants' perceived ability to counsel patients about medical devices on a five-point Likert-scale:

Table 3 shows the participants' responses to the question "to what extent you will be able to provide counselling to the patients about the previous medical device?" using five-point Likert-scale. Participants perceived their ability to counsel patients about blood glucose monitor to be very high (score ≥4). They perceived their ability to counsel patients about blood pressure monitor, MDI, insulin pen, and heart rate monitor to be high (score between 3 and 4). They perceived their ability to counsel patients about spacer, nebulizer and accuhaler to be moderate (score between 2.5 and 3). They perceived their ability to counsel patients about turbohaler and respirometer the lowest (less than 2.5).

Participants' sources of information to learn about medical devices:

Table 4 shows the participants' response to the question "from where you became aware of previous medical devices?". Overall, didactic courses were the most important source of information reported by all students. In general, other sources seem to play less role as sources of information about medical devices.

The participants' views about the need for certain measures related to medical devices:

Table 5 shows the participants' response to the question "to what extent you agree or disagree about the need for the following?". Overall, most of the students (60% to 70%) agreed about the need for the mentioned measures.

Overall scores on knowledge and perceived preparedness:

The students' total score on knowledge (i.e. identifying devices correctly) was on average 6.7 (St D = 2.6) out of a maximum score of 10 (i.e. 67%). The students' total scores on their perceived ability to use/operate and to counsel patients about all devices were on average 32.3 (St D = 8.4) and 31.4 (St D = 8.9), respectively (maximum possible scores = 50).

There were no significant differences between students by gender, age, or year of study in the mean total scores on knowledge or the mean total scores on the perceived ability to use/operate and to counsel patients about the devices (Table 6).

Correlation between knowledge, perceived ability to use devices, and perceived ability to counsel patients about devices

Table 7 shows the correlation between knowledge and perceived ability to use devices and to counsel patients about devices. There was a highly significant correlation between perceived ability to use devices and perceived ability to counsel patients about devices.

Table 1: Proportion of participants able to correctly identify each of the 10 devices

What is the medical device below?	Correct responses (%) N=73
Shown Devices	
A blood glucose monitor	68 (93.2)
An accuhaler	19 (26.0)
A turbuhaler	33 (45.2)
Metered Dose Inhaler	58 (79.5)
Spacer	40 (54.8)
An insulin pen	67 (91.8)
A heart rate monitor	59 (80.8)
A blood pressure monitor	66 (90.4)
A nebulizer	38 (52.1)
Respirometer	41 (56.2)

Table 2: Participants' perceived ability to use/operate each of the 10 devices on five-point Likert scale

Question on five-point Likert scale (maximum 5) *	Mean score (Std. D)
To what extent do you know how to use/ operate the medical device?	
A blood glucose monitor	4.2 (1.0)
An accuhaler	2.7 (1.3)
A turbuhaler	2.4 (1.5)
Metered Dose Inhaler	3.9 (1.2)
Spacer	2.8 (1.4)
An insulin pen	4.0 (1.3)
A heart rate monitor	3.3 (1.5)
A blood pressure monitor	4.0 (1.2)
A nebulizer	2.8 (1.5)
Respirometer	2.0 (1.3)

* 5-point Likert scale, starting from not at all =1, not well = 2, average = 3, well = 4, and very well = 5

Table 3: Participants' perceived ability to counsel patients about each of the 10 devices on a five-point Likert scale

Question on five-point Likert-scale (maximum 5) *	Mean score (Std. D)
To what extent you will be able to provide counseling to the patients about the medical device?	
A blood glucose monitor	4.0 (1.0)
An accuhaler	2.6 (1.3)
A turbuhaler	2.3 (1.4)
Metered Dose Inhaler	3.8 (1.3)
Spacer	2.7 (1.5)
An insulin pen	3.9 (1.3)
A heart rate monitor	3.3 (1.4)
A blood pressure monitor	3.9 (1.3)
A nebulizer	2.7 (1.5)
Respirometer	2.0 (1.4)

* 5-point Likert scale, starting from not at all =1, not well = 2, average = 3, well = 4, and very well = 5

Table 4: Participants sources of information to learn about medical devices (N=73)

From where have you become aware of the previous medical devices?	Yes responses (%)
From didactic courses in the college	42 (57.5)
During Introductory Pharmacy Practice Experience 1 (community pharmacy)	21 (28.8)
During Introductory Pharmacy Practice Experience 2 (hospital pharmacy)	23 (31.5)
During Advanced Pharmacy Practice Experience (internship year)	29 (39.7)
From international conferences and workshop attendance	26 (35.6)
From conferences and workshops organized in Saudi Arabia	11 (15.1)

Table 5: The participants' views about the need for certain measures related to medical devices (N=73)

Question	Responses				
To what extent you agree or disagree about the need for the following?	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
Pharmacy colleges should offer pharmacy students a didactic course on medical devices	5 (6.8)	5 (6.8)	18 (24.7)	12 (16.4)	33 (45.2)
Pharmacy colleges should offer pharmacy students special practical training on medical devices	4 (5.5)	0	16 (21.9)	19 (26.0)	34 (46.6)
There should be special training on medical devices provided to practicing pharmacists as a continuing professional development activity	5 (6.8)	2 (2.7)	14 (19.2)	20 (27.4)	32 (43.8)
There is a need for a reference book on medical devices for pharmacists	5 (6.8)	3 (4.1)	20 (27.4)	16 (21.9)	29 (39.7)

Table 6: Overall scores on knowledge, perceived ability to use devices, and perceived ability to counsel patients by age, gender, and year of study

	knowledge	Perceived ability to use	Perceived ability to counsel
Age group			
<22 years	7.6 (2.7)	26.6 (8.9)	25.1 (10.9)
22 years	6.2 (2.9)	32.6 (8.3)	31.9 (9.2)
23 years	6.9 (2.6)	34.4 (9.4)	34.0 (9.2)
>23 years	6.7 (2.0)	31.9 (7.0)	30.7 (7.0)
P-value	0.634 (ANOVA)	0.211 (ANOVA)	0.151 (ANOVA)
Gender			
Male	6.4 (2.2)	31.5 (8.6)	30.7 (9.0)
Female	7.0 (2.9)	33.2 (8.2)	32.3 (8.8)
P-value	0.367 (t-test)	0.394 (t-test)	0.423 (t-test)

Year of study

4th year	6.4 (2.4)	30.5 (8.5)	29.8 (9.2)
5th year	6.8 (3.3)	35.2 (8.6)	34.5 (8.9)
6th year	7.6 (2.1)	35.5 (6.2)	34.0 (6.2)
P-value	0.392 (ANOVA)	0.056 (ANOVA)	0.110 (ANOVA)

Table 7: Correlation between knowledge, perceived ability to use devices, and perceived ability to counsel patients about devices

	knowledge	Perceived ability to use	Perceived ability to counsel
knowledge		0.071 P-value =0.548	0.020 P-value = 0.864
Perceived ability to use	0.071 P-value =0.548		0.967 P-value <0.001
Perceived ability to counsel	0.020 P-value = 0.864	0.967 P-value <0.001	

DISCUSSION:

Most of the pharmacy students in this study were able to correctly identify five commonly-used medical devices reflecting a moderate knowledge of the ten medical devices. The overall average score on the knowledge of medical devices was acceptable (6.7 out of 10, equivalent to 67%). The students' perceived abilities to operate and to counsel patients about the medical devices were high to moderate and the two variables were highly correlated. Despite clear differences in responses concerning various devices, students' overall scores on knowledge and their perceived abilities to operate and to counsel patients about the medical devices were not different by age, gender, or year of study.

Before conducting this study, it was expected to see variability in the students' ability to correctly identify medical devices and in their perceived preparedness to provide counseling to patients by year of study with students from the highest level showing better responses. However, findings showed very comparable responses among students regardless of gender, age, or year of study. Although the students' overall knowledge of and perceived preparedness to provide counseling can be considered acceptable, the absence of important differences by year of study requires paying attention. This is because it indicates that students' knowledge and awareness about devices are not improving across years of study inside the college. This is supported by the finding that the students' important source of information on devices was mainly didactic courses with a limited role played by other teaching techniques. At the time of study, fifth-year students already had been exposed to the second introductory pharmacy practice experience (IPPE 2) and the students in the sixth year were on the advanced pharmacy practice experience (APPE) training (i.e. internship year) and they should have exhibited significantly higher medical device-related knowledge and skills compared to their

colleagues in the fourth year. This requires placing higher emphasis during experiential training on education and training on medical devices to fill-in gaps in this area reaching the maximum level of preparedness among graduates. There is a need that students receive special training on the proper use of medical devices from various therapeutic categories and to receive enough information and practical sessions about how they are operated and the advantage and disadvantages of each and on how to interpret their readings.

In Taif University there is a clinical skill lab under establishment with plans to introduce simulations and OSCE assessment techniques as components of pharmaceutical care skill courses [16]. The practical application of theoretical knowledge on medical devices is essential to improve students' skills and competencies. The research suggested that the provision of active technique education to patients via one-on-one technique coaching, observation, verbal instruction, and physical demonstration is more effective in improving devices technique than merely providing theoretical information [17].

Ndukwe et al. evaluated the proportion of near-graduation students demonstrating correct inhaler technique approximately one year after initial training [13]. Only about one-fifth of students demonstrated the correct technique of pressurized metered-dose inhaler and none demonstrated proper use of a dry powder inhaler. In our study, the students perceived their ability to use and their ability to counsel about turbuhaler and accuhaler (i.e. dry powder inhaler devices) the lowest. The study by Basheti et al. which was conducted in Australia and Jordan revealed difficulty in the use of Diskus (i.e. accuhaler) and Turbohaler steps among both pharmacists and patients [18]. Ndukwe et al. concluded that "students did not retain the ability to correctly demonstrate inhaler technique one year after initial instruction" [13]. The authors suggested that demonstrable tasks may need to be repeatedly assessed to ensure the task is mastered and becomes a routine part of a student's practice. Other solutions suggested for improving the correct use of medical devices include the implementation of inter-professional education to allow for frequent delivery of educational instruction in primary health care settings involving pharmacists and general medical practitioners [19, 20].

The present study did not assess the pharmacy students' actual abilities to operate or to counsel patients about medical devices but evaluated students' perception of their ability to operate and to counsel patients about the medical devices. It was an exploratory study that should be followed in the near future by an evaluation of students' actual preparedness to counsel patients about medical devices including an assessment of the correctness of their use of medical devices.

CONCLUSION:

In general, pharmacy students showed moderate knowledge of medical devices. They reported high to moderate perceived preparedness to counsel patients about medical devices.

There was a highly significant correlation between the perceived ability to use devices and the perceived ability to counsel patients. Students' overall average scores on knowledge and readiness to counsel were not different by age, gender, or year of study.

KEY MESSAGES:

- Pharmacy students' experiences with medical devices are limited since they are not covered widely in pharmacy colleges.
- Practical training on medical devices is required for pharmacy students with a special focus on simulation.
- Pharmacy students perceived ability to use medical devices correlates with their perceived ability to counsel patients about devices

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