

Pharmacy students' knowledge and attitude of prescribing errors

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ABSTRACT

Medication errors, particularly prescribing errors (PEs), are a major concern in the healthcare field. The growing incidence of PEs poses a risk to patients and a challenge for healthcare management. Pharmacists can play a major role in observing, intervening, and correcting PEs. The study was conducted to measure pharmacy students' knowledge of and attitude towards PEs. The study was a cross-sectional survey based on the Likert scale to assess pharmacy students' attitudes towards PEs. Due to the accessibility of the sample, purposive sampling was used as the sampling method, and a structured questionnaire as the data collection method. The study targeted all students enrolled in the fifth year Bachelor of Pharmacy programme at the University of Petra in Jordan. The number of students who completed the questionnaire was 125. Most of the participants (81, 64.8%) thought PEs are not common in Jordan. The majority of students (122/125, 97.6 %) believed that PEs could lead to death. Around a quarter of students, 26.4% (33/125) believed that PEs were secondary to other medical issues such as hospital infections. Most students (120/125, 96.0 %) believed that only the person who committed PEs was responsible. The majority of respondents (90/125, 72.0 %) do not believe that intervening on and correcting PEs was a major responsibility of pharmacists only. Students had good knowledge about general terms and features of medication errors, particularly PEs. However, students had many misconceptions about detecting specific scenarios of PE events. In addition, students had a lack of knowledge about PEs incidence in Jordan as most of them thought PEs are not common in Jordan. The odds of students' agreement about the extent of PEs in Jordan were 3.56 times more likely in students who experienced a PE in their life than students who did not (OR 3.56; 95%CI 1.09%-11.62%; p=0.036). Senior pharmacy students at the University of Petra had an overall positive attitude toward statements related to the importance of PEs and the role of pharmacists in the intervention on and correction of PEs. The undergraduate curriculum should contain modules about patient safety and medication errors. Teaching students appropriate skills to detect and intervene.

Keywords: Prescribing errors, Pharmacy students, Jordan, Medication errors, Patient safety

Introduction

The medication usage process has four stages: prescribing, transcribing, dispensing and administration. Errors can occur in

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any of these stages, however, prescribing errors (PEs) were shown to be the most predominant element of medication errors that could lead to serious adverse drug event (ADEs) [1-3]. PEs are common, affecting 7% of medication orders, 2% of illness days and 50% of hospital admissions [4]. In Saudi Arabia, PEs incidence ranged from 7.1% to 94% [5]. A UK study conducted in a hospital with an electronic prescribing system (EPS) showed that PEs incidence at hospital discharge was 8.4% [6]. Although pharmacists have a major role in observing, intervening on and correcting PEs, no studies were conducted to assess pharmacists' or pharmacy students' knowledge of and attitude towards PEs. Most studies were carried out either to assess pharmacists' attitude toward medication error reporting

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or to assess pharmacy students' attitude of patient safety in general [7]. In Ethiopia, pharmacy students had an overall good attitude to patient safety. However, they claimed the culture and attitude within the pharmacy workplace lacked for patient safety. Moreover, standardised patient safety courses should be considered in the curriculum for junior pharmacy students to improve their attitude toward patient safety [8]. In Malaysia, pharmacists in outpatient and ambulatory units and those in health clinics had better perceptions of safety culture [9]. Therefore, improving pharmacists' knowledge, culture, perceptions, and attitudes toward PEs is vital to prevent PEs. This improvement can be generated by educational approaches [8]. Educational interventions, alterations in medical student's curriculum, and interactive clerkships for health care professionals can improve knowledge, attitudes, and practice (KAP) towards ADE reporting and help diminish preventable medication errors [10]. In the USA, a study conducted to explore attitudes of pharmacy students toward an elective, inter-professional patient safety course showed that students found great value in patient safety education [11]. The literature has shown that there is a general lack of patient safety education in Doctor of Pharmacy degree training [11]. In this regard, many countries, such as Australia implemented the WHO's patient safety curriculum [12], which increased students' perceptions and knowledge toward medication safety [13]. Despite the importance of pharmacists' and pharmacy students' attitudes of PEs assessment, it has been rarely studied.

Aim of the study

We aimed to study senior pharmacy students' attitude and knowledge toward PEs, and assess predictors of senior pharmacy students' positive attitude and knowledge toward PEs.

Ethics approval

The study was approved by the Institutional Review Board (IRB) at the University of Petra.

Materials and Methods

Study design

The study was a cross-sectional survey based on the Likert scale to assess pharmacy students' attitude of PEs. Pharmacy students' knowledge about PEs was assessed by 3-point responses (1= Yes, 2= No, 3= I don't know). A structured questionnaire was used as the data collection method. The questionnaire was delivered to senior pharmacy students at the University of Petra during their lectures in A4 paper form to ensure covering the maximum response rate.

Study population

The study population included the fifth-year pharmacy students at the University of Petra.

Pharmacy curriculum at the University of Petra

The pharmacy curriculum at the University of Petra seeks to integrate both basic and applied pharmaceutical and medical sciences into its academic programmes in order to provide students with the information necessary to be competent and successful in the increasingly challenging field of pharmacy. Departmental courses cover a broad range of disciplines, including anatomy, physiology, pathophysiology, immunology, microbiology, biochemistry, phytochemistry, pharmacology, toxicology, clinical pharmacy and pharmaceutical care practice. In addition, the pharmacy curriculum teaches many core and elective courses such as physical pharmacy, dispensing, biopharmacy, pharmacokinetics, pharmaceutical microbiology and industrial pharmacy.

Definitions

Definitions of attitude and knowledge were adopted from different references, as listed in **Table 1**. These operational definitions were used to construct the attitude and knowledge statements in the questionnaire.

Table 1. Definitions of attitude, knowledge and intention.

Attitude	"The sum total of man's inclination and feelings, prejudice or bias, preconceived notions, ideas, fears, threats and convictions about any specific topic [12]
Knowledge	A belief that is true and justified. "Nonaka and Takeuchi, 1995; p.87

Sample size determination

Yamane's formula was adopted to calculate the sample size required for the study. Yamane (1967) suggested a simple formula, according to him, for a 95% confidence level and $p = 0.5$, size of the sample should be (" *Bulletin of the Gauhati University Mathematics Association* Vol. 12, 2012)

$$n = \frac{N}{1 + N(e^2)} \quad (1)$$

Where N is the population size, e is the level of precision and n is the required sample number. For our study ($N = 130$, 95% CI, $p = 0.05$, with $\pm 5\%$ precision). Therefore, the required sample number was 98 students.

Questionnaire's structure

Our survey consisted of three sections with 28 questions in total. It was adapted from previous studies [14-17], and adjusted to suit the aims of the study:

Section I contains 10 demographic and experience-based questions to collect information about students' gender, age, grade, study year, recently transferable student or not, the

experience of medication errors, attendance at patients' safety courses, patients' safety meeting or conferences, and experience of reading prescribing error papers.

Section II includes 9 questions to assess pharmacy students' attitudes towards PEs, including their intentions toward intervening on and correcting PEs. A 5-point Likert type scale was used to measure responses (1= strongly disagree, 2= disagree, 3= I don't know, 4= agree, 5= strongly agree).

Section III consists of 8 questions to assess pharmacy students' knowledge about PEs. A 3-point response was used (1= Yes, 2= No, 3= I don't know).

Piloting

A pilot study was conducted by hand-administering the survey to 20 pharmacy students at the University of Petra. The optimum time and clarity of questions were discussed with students. Based on the results obtained, adjustments to the items and the rating scale were made.

Instrument administration and data collection

A cover letter was attached to each survey, which explained the nature and aims of the study. It emphasised the importance of the study and its voluntary nature. It also stated that all the

responses would be kept confidential. The cover letter and the questions were given in English and Arabic to ensure correct understanding of questions and ideas.

Data analysis

IBM SPSS, version 20.0 for Windows 7 was used for statistical analysis of the survey. The internal reliability of the survey was assessed by measuring the Cronbach's alpha for the survey. Multivariate logistic regression was used to study predictors. Descriptive statistics were conducted for students' knowledge and attitudes of PEs.

Results and Discussion

Demographic characteristics of students

One hundred and twenty-five students completed the questionnaire. All students were in the fifth year of study. The majority of the students were females (88/125, 70.4 %). The age of 44% (55/125) of participants was 23-24 years. The academic grade of 50.4% (63/125) of students was good, while the grade of 29.6% (37/125) of students was very good and only the grade of 1.6% (2/125) of students was weak. **Table 2** shows the socio-demographic features of students.

Table 2. Socio-demographic features of students (n= 125)

Variables	Category	Percentage
Gender	Female(2)	88, 70.4 %
	Male(1)	37, 29.6 %
Age	23-24 Years (1)	55, 44 %
	21-22 Years (2)	51, 40.8 %
	>25 Years (3)	18, 14.4 %
	<20 (4)	1, 0.8 %
Academic Grade	Good (1)	63, 50.4 %
	Very good (2)	37, 29.6 %
	Excellent (3)	20, 16 %
	Fair (4)	3, 2.4 %
	Weak (5)	2, 1.6 %

Previous experience and future plans of students

Although all respondents were interested in patient safety, only 42.4% (53) of students attended patient safety courses at the university. As **Figure 1** shows, most students (77/125, 61.6%) were not currently training in a community pharmacy. Almost

half of the students (66/125, 52.8 %) read an article about PEs. One-third (32.8%, 41) of students had a clinical pharmacist in their families. About two-thirds (81/125, 64.8%) of students experienced a PE in their lives. Students' plans for the future as shown in **Figure 2** were diverse. Most students planned to continue graduate studies (42/125, 33.6%) or work in a hospital (41/125, 32.8%).

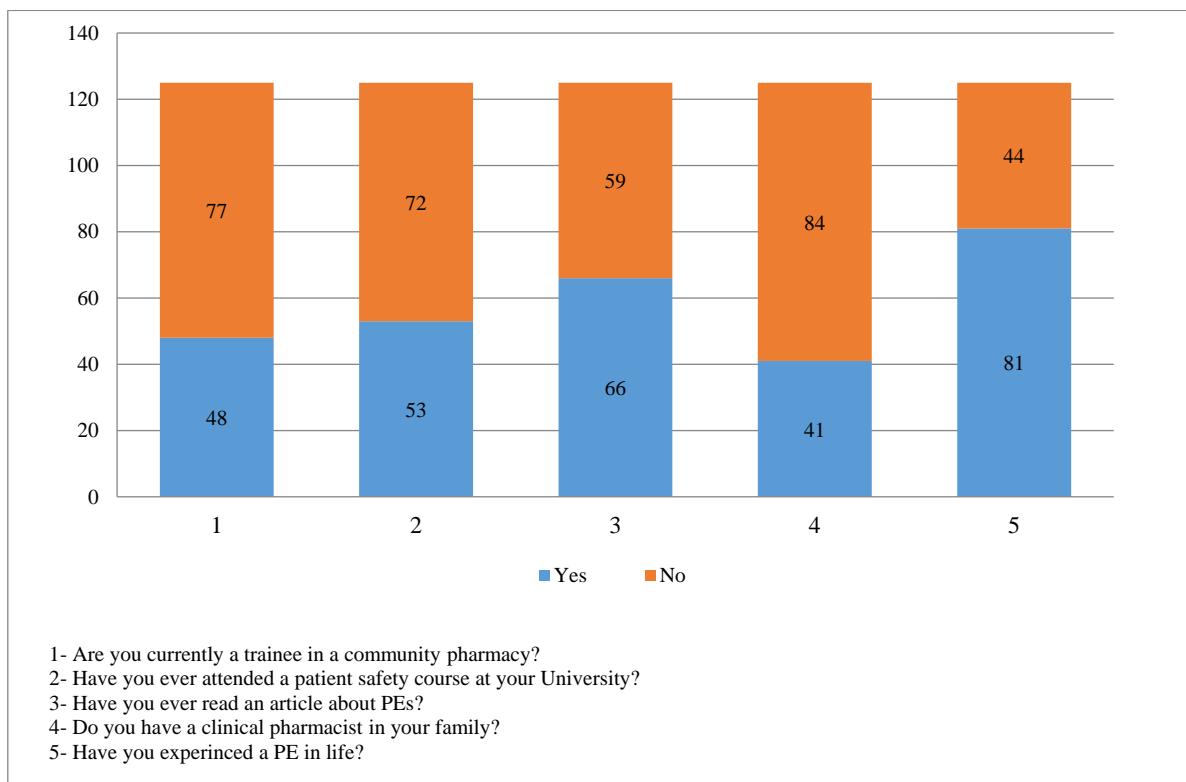


Figure 1. General information of students (n=125)

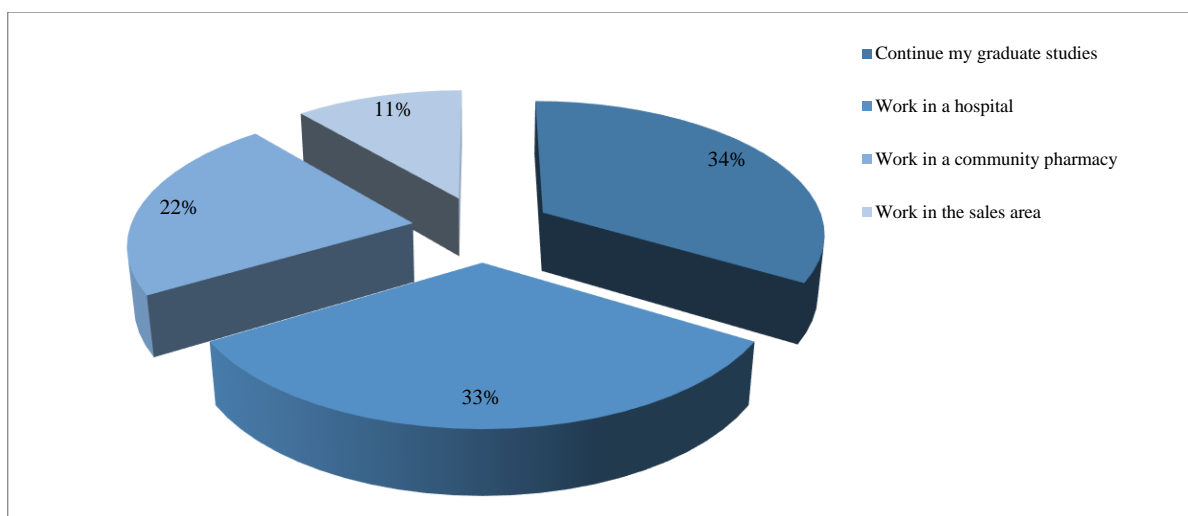


Figure 2. Plans of students for the future

Pharmacy students' attitudes towards PEs

As shown in **Table 3**, the majority of students (122/125, 97.6%) believed that PEs could lead to death. Around a quarter (33/125, 26.4%) of students believed that PEs were a secondary issue compared to other medical issues such as hospital infections. Almost all students (120/125, 96%) thought that only the person who commits PEs should be held responsible. The majority of respondents (90/125, 72.0%) did not believe that intervening on and correcting PEs were a major responsibility of pharmacists only. Just over half of students

(65/125, 52.0%) disagreed and strongly disagreed (35, 28.0%) with the statement "If I saw a prescribing error not causing harm, I would not report it". Most students (120/125, 96.0%) would intervene on and report PEs if they worked in a hospital setting. Most students (102/125, 81.6%) stated that they would refuse to dispense a prescription if it contained errors even if the doctor insisted to. Also, most students (119/125, 95.2%) clearly intended to attend patient safety conferences in the future. The majority of students (121/125, 96.8%) stated that they would discuss PEs more with their fellow friends.

Table 3. The level of pharmacy students' attitudes toward PEs (n=125)

Statements	Strongly disagree (1) (No, %)	Disagree (2) (No, %)	I don't know (3) (No, %)	Agree (4) (No, %)	Strongly agree (5) (No, %)
Prescribing errors could lead to death.	(0, 0.0 %)	(2, 1.6 %)	(1, 0.8 %)	(34, 27.2 %)	(88, 70.4 %)
Prescribing errors issue is a secondary issue compared to other medical issues such as hospital infections.	(14, 11.2 %)	(69, 55.2 %)	(9, 7.2 %)	(28, 22.4 %)	(5, 4.0 %)
Only the person who commits prescribing errors should be held responsible.	(1, 0.8 %)	(2, 1.6 %)	(2, 1.6 %)	(83, 66.4 %)	(37, 29.6 %)
Intervening and correcting prescribing errors are a major responsibility for pharmacists only.	(15, 12.0 %)	(75, 60.0 %)	(1, 0.8 %)	(25, 20.0 %)	(9, 7.2 %)
If I saw a prescribing error not causing harm, I would not report it.	(35, 28.0 %)	(65, 52.0 %)	(6, 4.8 %)	(17, 13.6 %)	(2, 1.6 %)
I would like to intervene and report prescribing errors if I worked in a hospital setting.	(0, 0.0 %)	(1, 0.8 %)	(4, 3.2 %)	(63, 50.4 %)	(57, 45.6 %)
I would refuse to dispense a prescription if it contained errors even if the doctor insists to.	(2, 1.6 %)	(13, 10.4 %)	(8, 6.4 %)	(54, 43.2 %)	(48, 38.4 %)
I would like to attend courses or conferences about patient safety in the future.	(0, 0.0 %)	(3, 2.4 %)	(3, 2.4 %)	(48, 38.4 %)	(71, 56.8 %)
I would like to discuss more about prescribing errors with my classmates.	(0, 0.0 %)	(1, 0.8 %)	(3, 2.4 %)	(83, 66.4 %)	(38, 30.4 %)

Pharmacy students' knowledge of PEs

Direct statements assessed pharmacy students' knowledge of PEs and patient safety. As shown in **Table 4**, most students (81/125, 64.8%) wrongly thought that PEs are not common in Jordan. Also, most students (101/125, 80.8%) thought that PEs could be prevented. Most students (98/125, 78.4%) did not believe that medication errors involved only errors in prescribing and administrating processes. The majority of students (85/125, 68.0%) thought that omission of diagnosis from a prescription was considered a PE. Almost half of the respondents (60/125, 48.0%) correctly answered the statement (*the following case contains three prescribing errors "a One-year-old female patient is diagnosed with acute non-infectious*

gastroenteritis. The prescription contains only diclofenac sodium suppository 12.5mg BID"). Only 23.2% (29/125) of students correctly answered the statement (*the following case contains two prescribing errors "a 49-year-old female patient is diagnosed with iron deficiency anaemia. The prescription contains diclofenac sodium tablet 150mg BID"*). More than half of participants (69/125, 55.2%) failed to answer this statement correctly (*the following case contains one prescribing error "a 46-year-old patient is diagnosed with liver cancer and he suffered from severe headache, the prescription is ibuprofen tablet 400mg p.r.n"*). Overall, the vast majority of students answered correctly to 5 of 7 statements.

Table 4. Pharmacy students' knowledge about PEs (n=125)

Statement	Answers	(n, %)
Prescribing errors are not common in Jordan.	Yes	(81, 64.8%)
	No	(19, 15.2%)
	I don't know	(25, 20%)
Medication errors involve only errors in prescribing and administrating process	Yes	(23, 18.4 %)
	No(1)	(98, 78.4 %)
	I don't know	(4, 3.2 %)
The omission of diagnosis from a prescription is considered to be a prescribing error.	Yes (1)	(85, 68.0 %)
	No	(20, 16.0 %)
	I don't know	(20, 16.0 %)
The omission of medications from a prescription is considered to be a prescribing error.	Yes (1)	(77, 61.6 %)

	No	(25, 20.0 %)
	I don't know	(23, 18.4 %)
Prescribing errors are considered to be preventable.	Yes (1)	(101, 80.8 %)
	No	(16, 12.8 %)
	I don't know	(8, 6.4 %)
The following case contains three prescribing errors "1-year-old female patient is diagnosed with acute non-infectious gastroenteritis. The prescription contains only diclofenac sodium suppository 12.5mg BID".	Yes (1)	(60, 48.0 %)
	No	(23, 18.4 %)
	I don't know	(42, 33.6 %)
The following case contains two prescribing errors "49-year-old female patient is diagnosed with iron deficiency anaemia. The prescription contains diclofenac sodium tablet 150mg BID".	Yes	(66, 52.8 %)
	No (1)	(29, 23.2 %)
	I don't know	(30, 24.0 %)
The following case contains one prescribing error "46-year-old patient is diagnosed with liver cancer and he suffered from severe headache, the prescription is ibuprofen tablet 400mg p.r.n".	Yes	(69, 55.2 %)
	No (1)	(33, 26.4 %)
	I don't know	(23, 18.4 %)

Reliability test (Cronbach's alpha)

Cronbach's alpha value was 0.653, the internal consistency between items of the questionnaire, which was considered acceptable according to Taber [18].

Predictors of good knowledge toward identifying and intervening on PEs

Students who had good knowledge about PEs were expected to answer correctly statements that measured students' knowledge about PEs prevalence in Jordan. Choices of the dependent variable statement were combined as follows (Strongly agree + Agree = more), (Strongly disagree + disagree = less) and

students who answered (I don't know) were excluded. Multivariate logistic regression was conducted to find which predictors were significant. Independent variables were all statements in the demographic and personal information section. Predictors were tested against the dependent variable (prescribing errors are common in Jordan). Only significant predictors were listed in **Table 5**. Odds ratio and p-values for each model at 95% confidence interval were calculated using SPSS software (20 Version). The odds of students agreement about the prevalence of PEs in Jordan were 3.5 times more likely in students who experienced a PE in their life (OR 3.56; 95%CI 1.09-11.62; $p=0.036$).

Table 5. Significant predictors for good knowledge about PEs

Statements	Predictors	Odds ratio	p-value	95 % CI for odds	
				lower	Upper
Prescribing errors are common in Jordan	Students who experienced a PE in life	3.560	0.036	1.090	11.629

Even though pharmacists' attitudes and behaviours are vital toward preventing and correcting medication errors, particularly PEs, pharmacists' and pharmacy students' attitudes of PEs have been rarely studied. In fact, this study was the first

study to assess pharmacy students' attitude of PEs in the Middle East.

Our study had a few limitations. Firstly, as the sample was drawn exclusively from a single institution, the findings may not

be representative of students enrolled in other pharmacy programmes. However; it is hoped that this study will prompt further interest in the importance of patient safety in pharmacy students' education. Moreover, our study provided clear insight toward pharmacy students' attitudes towards PEs in Jordan. Secondly, our study was a cross-sectional study; it represented one point in time, and therefore, it did not reflect any change in students' attitudes over time.

The study adopted a practical methodology for assessing the professional attitude of the 5th-year pharmacy students on PEs and patient safety. Yamane's formula [19] was adopted to calculate the sample size. The required sample number was 98 students and a total of 125 students completed the questionnaire. The survey targeted students in the fifth year of study to ensure that they finished more than 75% of their curriculum courses.

Getachewand Nathaniel M also targeted pharmacy students in their fifth year of the study [8, 16]. Aghakouchakzadeh *et al.*, targeted medical students in their fourth year to assess their knowledge and attitude toward medication errors [10]; whereas, Walpola targeted pharmacy students in their first and second years to assess their attitude and knowledge about patient's safety [11, 20]. However, asking students who had completed only 20% of their curricula on pharmacy and medical practice could lead to misleading outcomes.

Our results showed that senior pharmacy students at the University of Petra had a lack of knowledge about PEs incidence in Jordan and a positive attitude toward the role of pharmacists in intervening on PEs. Similar to us, Getachew stated that the majority of pharmacy students (84.33%) had an overall positive attitude of patient safety [8]. As for prevention, most students (80.7%) believed that after an error occurred, an effective strategy was to work hard to be more careful [8]. This was also the belief of the majority of students (88%) according to the report done in China [21]. However, according to 'To Err Is Human' being more careful in work is an ineffective strategy to minimise or prevent PEs, where adopting the systems approach among all workers is the most reliable solution [22].

Our results showed that most of the pharmacy students at the University of Petra believed that PEs were preventable and that healthcare professionals were responsible for preventing these errors. Consistent with our results, Leung and Patil showed that most of the students (97%) believed that healthcare professionals could prevent medication errors [21]. However, one-third of pharmacy students (30.1%) believed that most errors were due to things that healthcare professionals could not prevent [8]. This is in close agreement with the results of a study conducted on students of Urmia University (Iran), which reported that 32.3% of students thought that most errors were due to things that doctors could not do anything about [23]. The variation in students' attitude toward this topic could not be explained easily; however, we believe that students from different countries, cultures, and level of knowledge would have different awareness level toward the fact that PEs are preventable.

In our study, some students had a misconception that only pharmacists were responsible for decreasing PEs rate. In addition, many students believed that only the person who commits prescribing errors should be held responsible. However, humans are just one part of a complex system and other factors within these complex systems also contribute to errors within the workplace [24]. We believe that in addition to the people involved, all professionals, managers and patients should participate in the discussion about error prevention in the patient care practice. This is an opportunity to share experiences between different professionals to clarify how the error happened and how it could be prevented because they often are not the result of an isolated act of a professional [4]. The reporting of medical errors is an important step in improving the quality and safety of healthcare [25]. It was encouraging to notice that the majority of our students supported the reporting of PEs, indicated by more than 90% of the students agreeing or strongly agreeing that they would like to intervene on and report PEs. Encouragingly, most of the students in our study also reported that they would report errors not causing harm. In comparison to the literature, some students (37.3%) expressed that they would keep it to themselves if the error did not cause harm [8]. Our study showed several important misconceptions in pharmacy students' knowledge on PEs and patient safety. More than two-thirds of the students in our study believed that omission of diagnosis from the prescription was a PE. Furthermore, a quarter of the students believed that medication errors involved only errors in the prescribing and administrating processes.

Our results demonstrated that the odds of students' agreement about the prevalence of PEs in Jordan were 3.5 times more likely in students who had experienced a PE in their life than students who had not (OR 3.56; 95%CI 1.09-11.62; $p=0.036$). Mozafari *et al.* and Getachew reported that factors, such as age, gender, and years of work experience did not contribute toward the overall attitude toward patient safety among emergency medicine residents and pharmacy students [8, 26]. Another study done in Iran reported the presence of a significant relationship between students' attitudes to patient safety with years of study and sex [23]. A study conducted in Saudi Arabia also reported female doctors had a more positive attitude toward patient safety than male doctors [25].

In conclusion, senior pharmacy students at the University of Petra had an overall good knowledge on and attitude towards PEs in Jordan. However, students had many misconceptions about detecting and correcting PEs. The strength of our study was the use of a validated survey instrument and a large sample of senior pharmacy students. As attitude is highly influenced by culture, the result of our study may not be generalised to pharmacy students who are outside Jordan. Educational intervention and interactive workshops for pharmacy students to detect and intervene on PEs are required to improve pharmacy practice and to provide a stronger barrier to the emergence of PEs.

Conclusion

Our findings suggest that pharmacy students in the fifth year of study at the University of Petra had an overall positive attitude toward PEs in Jordan, as well as the role of pharmacists in intervening on and correcting PEs. Students were aware of the general terms related to PEs. However, students had many misconceptions about specific PEs' definitions and clinical scenarios. The pharmacy undergraduate curriculum should contain modules about patient safety and medication errors. Teaching students appropriate skills to detect and intervene upon PEs is important to advance their future clinical careers.

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