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Original article

Adverse-drug reaction reporting by Pharm D students during hospital training

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ABSTRACT

Background: Hospital pharmacists can play an important role in the detection, prevention, and reporting of adverse drug reaction (ADR) since they interact with patients in hospital settings. The ADR reporting practice by Pharm D students, who represent the future hospital pharmacists, has not been adequately investigated in the literature.

Objective: To evaluate Pharm D students' knowledge, attitude, and practice regarding ADR reporting, and the associated barriers and motivators to ADR reporting during clinical training at different hospital sites in Jordan.

Methods: The present cross-sectional study was conducted on sixth year pharm D students during clinical training at different hospital departments in different hospital sites Jordan. In addition to socio-demographic variables, a structured self-reported questionnaire was used to assess students' knowledge, attitude, practice, barriers, and motivators towards ADR reporting. Binary logistic regression was used to explore the variables associated with the study outcomes.

Results: A total of 497 students participated in the study. The participants showed inadequate knowledge regarding ADR reporting, with a mean knowledge score of 3.20 (±1.78). On the other hand, the study participants showed positive attitude towards ADR reporting with a total mean score of 13.6 (±1.96). However, the ADR reporting practice was low with a mean score of 5.78 (±1.88). Not knowing how to report (60.2%) and not knowing where to report (55.9%) were the most common barriers to ADR reporting, while the most reported motivators for ADR reporting were seriousness of reaction (84.1%) and involvement of new drug (51.1%). Logistic regression analysis showed that time from the start of training (OR = 0.510; 95%CI = 0.305–0.852; P = 0.010), female gender (OR = 1.759; 95%CI = 1.083–2.857; P = 0.022), and attending a course/workshop about pharmacovigilance (OR = 0.213; 95%CI = 0.137–0.332; P = 0.00) were significant predictors of knowledge about ADR reporting. Increased age (OR = 0.93; 95%CI = 0.880–0.997; P = 0.041) and low knowledge (OR = 0.564; 95%CI = 0.380–0.837; P = 0.004) were significantly associated with negative attitude toward ADR reporting. Female gender (OR = 0.481; 95%CI = 0.302–0.766; P = 0.002) and attitude level (OR = 1.837; 95%CI = 1.205–2.802; P = 0.005) were significant predictors of ADR reporting practice.

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Conclusions: Pharm D students showed positive attitude towards ADR reporting, however, the knowledge and practice of ADR reporting were inadequate and the participants reported several barriers. Therefore, the topic of ADR reporting and pharmacovigilance, as well as, educational training programs need to be included in future pharmacy curriculum in order to improve students' awareness and practice of ADR reporting.

1. Introduction

Adverse drug reaction (ADR) is defined by the World Health Organization (WHO) as a response to a drug that is noxious and unintended that occurs at doses normally used in man for the prophylaxis, diagnosis, or therapy of disease, or for the modifications of physiological function (Adverse Drug Reaction Definition By World Health Organization, 2020). ADR burden on patients' health is high, accounting for considerable increase in morbidity and mortality, responsible for 6.5% of hospital admissions, and costing the National Health Service (NHS) around 574 million dollars annually (Pirmohamed et al., 2004).

Pharmacovigilance is the science and activities relating to the detection, assessment, understanding and prevention of adverse effects or any other medicine/vaccine related problem (World Health Organization, 2022). Having an effective pharmacovigilance system is essential for ensuring patients' safety and thus, improving their health outcomes (Hansberry, 2017). In Jordan, the Jordanian Pharmacovigilance Center (JPC) was established in 2001 in cooperation with the Sweden International Development Agency (SIDA) and the Higher Council for Science and Technology (Yadav, 2008). However, under-reporting of ADRs represents a widespread and significant challenge to the goals and objectives of pharmacovigilance system (Hazell & Shakir, 2006), highlighting the need for detecting the factors that are associated with poor ADR reporting practice.

Both community and hospital pharmacists play an important role in ADR reporting as they are the medication experts (Taybeh et al., 2020). Hospital pharmacists in particular, can play a significant role in ADR reporting because the most serious ADRs usually occur in hospitals, and ADRs are responsible for a substantial proportion of hospital admissions (van Grootheest & de Jong-van den Berg, 2005). Pharm D students are the future clinical pharmacists, and they are trained in their last academic year in multiple clinical rotations through different hospital departments including internal medicine, cardiology, oncology, intensive care unit, surgery, pediatric medicine, psychology, outpatient clinics, hospital pharmacies and drug information center (DIC) over a period of ten months (Al-Wazaify et al., 2006). Training in different hospital departments for nearly a year increases Pharm D students' exposure to a large number of ADR cases that require an effective approach for dealing with it including ADR reporting.

Effective ADR reporting requires good students' knowledge and awareness about pharmacovigilance concept and ADR reporting, which was found inadequate in several earlier studies (Farha et al., 2015; Tekel et al., 2021; Upadhyaya et al., 2015). Furthermore, it is necessary to ensure a positive attitude, bypass the barriers, and enhance the facilitators required for improving ADR reporting practice. Therefore, the aim of this study was to assess the knowledge, attitude, practice and the associated barriers and motivators for ADR reporting among final year pharm D students during their clinical training. Findings of the present study provide insight to consider pharmacovigilance and ADR reporting in the curriculum and hospital training of final year Pharm D students.

2. Material and methods

2.1. Study design and subjects

The present cross-sectional study was conducted on the sixth year Pharm D students during training at different hospital departments including internal medicine, cardiology, oncology, ICU, surgery, pediatric medicine, psychology, outpatient clinics, hospital pharmacies and drug information center (DIC) at different hospitals across Jordan. Students who were enrolled in Pharmacy program, and Pharm D students who were not registered in the Final year Pharm D Program or were not receiving clinical training course in the time of completing the study questionnaire were excluded from the study.

2.2. Sampling technique and sample size calculation

Convenient sampling technique was utilized to recruit the study participants. According to Krejcie and Morgan equation with 95% confidence interval and 5 % margin of error (Krejcie & Morgan, 1970), the estimated sample size for the present study was 385.

2.3. Study instruments

The study survey was developed after extensive review of the relevant literature (Nisa et al., 2018; Suyagh et al., 2015; Tew et al., 2016). The questionnaire included socio-demographic variables such as age, gender, time from the start of training and the current training department. The questionnaire also evaluated students' knowledge, attitude, practice, barriers, and motivators towards ADR reporting. The validated knowledge part consisted of 7 multiple choice and yes/no questions adapted from Suyagh et al (Suyagh et al., 2015). A score of 1 was given for each correct answer with a maximum possible score of 6. Participants' attitude was assessed using a questionnaire adapted from Nisa et al (Nisa et al., 2018). This 4-item questionnaire included a 4-ponit Likert scale ranging from strongly agree (score = 4) to strongly disagree (score = 1) for attitude assessment, with a maximum possible score of 16. Reverse scoring was made for the negatively worded question and a mean attitude score was calculated for each respondent to be categorized as having positive or negative attitude. The practice part was adapted from Tew et al (Tew et al., 2016) and Suyagh at al (Suyagh et al., 2015) and included 8 items with multiple choice and yes/no responses. A score of 1 was given for each favorable response and a total score was calculated, with a maximum possible score of 13. Finally, a list of barriers and facilitators in which the participants were asked to select the barrier(s) and motivator(s) they face to report the ADR from their point of view was adapted from Nisa et al (Nisa et al., 2018). The students were provided with a description of the study and its objectives, and those who agreed to participate in the study were asked to sign a consent form. The researcher emphasized that the collected data will only be used for the research purposes and will be saved in the office of the Principal Investigator to ensure confidentiality.

Ethical approval was obtained from the Institutional Review Board (IRB) of KAUH at Jordan University of Science and Technology.

2.4. Instrument validity and reliability

The initial draft of the questionnaire was delivered to three hospital pharmacists and three academic professors of clinical pharmacy and modifications were applied when appropriate. The clarity of the survey was assessed during a pilot study of ten students. Results of the pilot study were not included in the final analysis. Given that the teaching language in the Jordanian pharmacy schools is English, the study survey was administered in English language. In order to evaluate the reliability, the responses for the knowledge items were collapsed into correct vs. incorrect. Cronbach's alpha value was 0.71 for the knowledge scale and 0.80 for the attitude scale indicating the reliability of the developed study questionnaire.

2.5. Data analysis

Data was analyzed using statistical package for the social sciences (SPSS version 27). Descriptive statistics were used to describe students' demographic data, knowledge, attitudes, practice, barriers, and motivators towards ADR reporting, whereas continuous variables were presented as means and standard deviations. Binary logistic regression was used to explore the variables that were associated with knowledge, attitude, and practice towards ADR reporting. A P-value of less than 0.05 was considered statistically significant.

3. Results

3.1. Demographic characteristics of the study participants

Out of 600 invited students, 497 agreed to participate, with a response rate of (82.8%). The majority of the participants (79.7%) were females, 42.5% started their clinical training 1 to 3 months ago, and 20.1% were currently training at the outpatient clinic department. The mean age of the participants was 24 years (SD = 5). Demographic characteristics of the study participants are presented in Table 1.

Table 1
Demographic characteristics of the study participants (n = 497).

		Frequency (%) or Mean (±SD)
Age		24 (±5)
Gender	Female	396 (79.7%)
	Male	101 (20.3%)
Time from the start of training:	1–3 months	211 (42.5%)
	4–6 months	156 (31.4%)
	7–10 months	130 (26.2%)
Current training department	Drug information center (DIC)	26 (5.2%)
	Intensive care unit (ICU)	64 (12.9%)
	Psychology	5 (1.0%)
	Cardiology	45 (9.1%)
	Hospital pharmacies	80 (16.1%)
	Internal medicine	79 (15.9%)
	Oncology	45 (9.1%)
	Outpatient clinics	100 (20.1%)
	Pediatric	22 (4.4%)
	Surgery	31 (6.2%)

3.2. Description of Pharm D students' knowledge towards ADR reporting

As shown in Table 2, the mean of the total knowledge score was 3.20 (±1.78). The majority of the participants have heard about the concept of pharmacovigilance (72.0%), successfully recognized that we have an official standardized form for reporting adverse drug reactions in Jordan (65.4%), there are legal provisions in the medicines act that provide for pharmacovigilance activities (52.7%), and there is a pharmacovigilance center (51.9%). On the

Table 2
Pharm D students' knowledge about pharmacovigilance and ADR reporting.

Item		Frequency (%) or Mean (±SD)
General Knowledge Score		1.50 (±1.01)
Have you ever heard about the concept of Pharmacovigilance?	No	139 (28.0%)
	Yes *	358 (72.0%)
What is the definition of pharmacovigilance?	The detection, assessment, understanding and prevention of adverse effects*	180 (36.2%)
	The process of improving the safety of drugs	23 (4.6%)
	The science detecting the type and incidence of ADR after the drug is marketed	119 (23.9%)
	The science of monitoring ADR's happening in a hospital	52 (10.5%)
	Do not know	123 (24.7%)
What is the definition of adverse drug reaction?	Noxious and unintended response to drug and occurs at doses normally used in man or animal for prophylaxis, diagnosis or therapy of Disease	126 (25.4%)
	Noxious and unintended response to drug and occurs at doses normally used for prophylaxis, diagnosis and therapy of disease*	206 (41.4%)
	Any untoward medical occurrence that may present during treatment with a medicine but which does not necessarily have a causal relationship with this treatment	60 (12.1%)
	Any adverse reaction identified in regulatory documents such as investigators brochures or product monograph occurring within the expected frequency	45 (9.1%)
	Do not know	60 (12.1%)
Pharmacovigilance in Jordan Score		1.70 (±1.23)
In Jordan, are there legal provisions in the medicines act that provide for pharmacovigilance activities?	No	235 (47.3%)
	Yes*	262 (52.7%)
In Jordan, is there pharmacovigilance center?	No	239 (48.1%)
	Yes*	258 (51.9%)
In Jordan, is there an official standardized form for reporting adverse drug reactions?	No	172 (34.6%)
	Yes*	325 (65.4%)
Total Knowledge Score		3.20 (±1.78)

*Indicating correct answer.

other hand, less than half of the participants were able to identify the correct definition of pharmacovigilance (36.2%) and adverse drug reaction (41.4%).

3.3. Description of Pharm D students' attitude towards ADR reporting

As shown in Table 3, The participants showed positive attitude towards ADR reporting with a total mean score of 13.6 (±1.96). Most of the participants strongly agreed that ADR reporting is necessary (75.9%), ADR reporting should be mandatory (60.6%), and that ADR reporting increases patients' safety (71.2%), while only 9.3% of them thought that ADR reporting is time consuming.

3.4. Description of Pharm D students' practice towards ADR reporting

As shown in Table 4, the mean practice score was 5.78 (±1.88). Most of the participants did not receive training on how to report ADR (75.7%), did not report any ADR (74.2%), reported ADR less than five times per week (83.1%), reported both non-severe and severe or life-threatening ADR (63.4%), reported the ADR on patients' records (60.0%), and failed to recognize the period within which a serious ADR should be reported (70.4%). Using adverse drug reaction reporting form was the most preferred method for ADR reporting among the study participants (42.4%).

3.5. Barriers and motivators towards ADR reporting

When the participants were asked about the barriers they faced to report ADR, the majority reported that they did not know how to report (60.2%), followed by "Not knowing where to report" (55.9%) (Fig. 1), while the most reported motivators towards ADR reporting were "seriousness of reaction" (84.1%), followed by "involvement of new drug" (51.1%) (Fig. 2).

Table 3
Attitudes towards ADR reporting.

		Frequency (%)	Mean (±SD)
ADR reporting is necessary	Strongly Disagree	9 (1.8%)	4 (1)
	Disagree	14 (2.8%)	
	Agree	97 (19.5%)	
	Strongly Agree	377 (75.9%)	
ADR reporting should be mandatory	Strongly Disagree	5 (1.0%)	4 (1)
	Disagree	23 (4.6%)	
	Agree	168 (33.8%)	
	Strongly Agree	301 (60.6%)	
ADR reporting increase patient safety	Strongly Disagree	8 (1.6%)	4 (1)
	Disagree	13 (2.6%)	
	Agree	122 (24.5%)	
	Strongly Agree	354 (71.2%)	
ADR reporting is time consuming*	Strongly Agree	46 (9.3%)	3 (1)
	Agree	154 (31.0%)	
	Disagree	193 (38.8%)	
	Strongly Disagree	104 (20.9%)	
Attitude Score			13.60 (±1.96)

*Indicating reverse scoring.

Table 4
ADR reporting practice.

Item		Frequency (%) or Mean (±SD)
I have been trained on how to report ADR	No	376 (75.7%)
	Yes*	121 (24.3%)
How often do the patients report you ADRs of medications?	Never	192 (38.6%)
	A few times a year	136 (27.4%)
	Once a month	102 (20.5%)
	More than once a week*	67 (13.5%)
Have you ever reported any ADR?	No	369 (74.2%)
	Yes*	128 (25.8%)
How often do you report ADR per week?	0–5	413 (83.1%)
	6–10	52 (10.5%)
	More than 10*	32 (6.4%)
I only report severe or life threatening ADR	Yes	182 (36.6%)
	No*	315 (63.4%)
I mention the ADR on patients' record	No	199 (40.0%)
	Yes*	298 (60.0%)
What is the period within which you should report a serious ADR experienced by a patient?	No	350 (70.4%)
	Yes*	147 (29.6%)
How do you prefer to report the ADRs?	A phone call to drug company	99 (19.9%)
	Verbally inform the representative of the drug company on routine visits	60 (12.1%)
	Mail via internet	58 (11.7%)
	Using adverse drug reaction reporting form*	213 (42.4%)
	Other	67 (13.5%)
Practice Score		5.78 (±1.88)

*Indicating favorable practice.

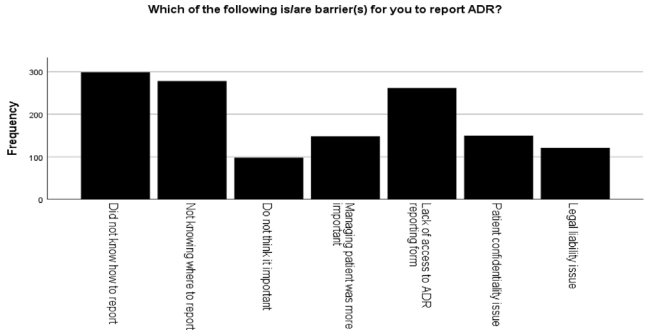

Fig. 1. Barriers for ADR reporting by Pharm D students.

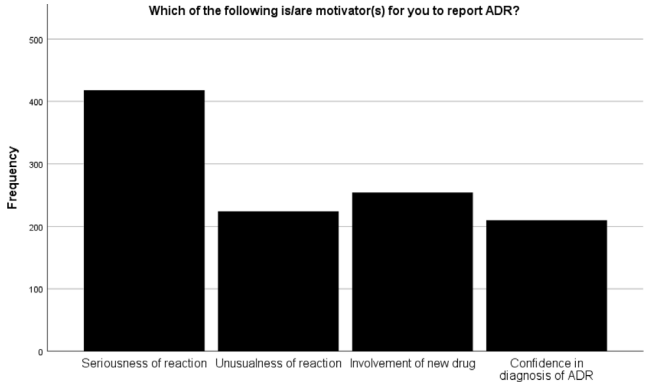

Fig. 2. Motivators of ADR reporting by Pharm D students.

Table 5
Factors associated with knowledge, attitude, and ADR reporting practice.

	Knowledge				Attitude				Practice			
	p-value	OR	CI		*p-value*	OR	CI		*p-value*	OR	CI	
			Lower	Upper			Lower	Upper			Lower	upper
Age	0.797	0.995	0.958	1.033	**0.041**	0.937	0.880	0.997	0.953	1.001	0.963	1.040
Time from the start of training												
1–3 months	0.165	0.714	0.444	1.149	0.095	0.673	0.423	1.071	0.528	1.173	0.714	1.926
4–6 months	**0.010**	0.510	0.305	0.852	0.081	0.641	0.388	1.057	0.867	0.955	0.556	1.639
7–10 months	Reference											
Sex												
Female	**0.022**	1.759	1.083	2.857	0.568	0.873	0.548	1.391	**0.002**	0.481	0.302	0.766
Male	Reference											
Attended course												
No	**0.00**	0.213	0.137	0.332	0.557	1.139	0.738	1.759	0.068	0.658	0.420	1.031
Yes	Reference											
Knowledge Level												
Low					**0.004**	0.564	0.380	0.837	0.192	0.755	0.495	1.152
High					Reference							
Attitude Level												
Low									**0.005**	1.837	1.205	2.802
High									Reference			

3.6. Multivariate regression analysis of the variables associated with knowledge, attitude and practice towards ADR reporting

As shown in Table 5, results of the binary logistic regression showed that the participants who trained for 4–6 months had lower odds to be in high level knowledge group (OR = 0.510; 95% CI = 0.305–0.852; P = 0.010), when compared with those who trained for 7–10 months. Female participants had more odds to be in the high-level knowledge group (OR = 1.759; 95%CI = 1.08 3–2.857; P = 0.022) when compared with male participants. The participants who answered 'no' to the question "have you ever had a course/attended a workshop about pharmacovigilance?" had lower odds to be in the high knowledge group (OR = 0.213; 95%CI = 0.137–0.332; P = 0.00) when compared to the participants who answered 'yes'. The results also indicated that attitude level was significantly associated with participants age, as an increase in age decreased the odds of being in the high attitude level group (OR = 0.937; 95%CI = 0.880–0.997; P = 0.041) and participants who had low knowledge level (OR = 0.564; 95%CI = 0.380–0.837; P = 0.004) had less odds to be in the high attitude group. As for the significant variables associated with practice level, female participants had lower odds to be in the high practice group (OR = 0.481, 95%CI = 0.302–0.766; P = 0.002) when compared with male participants. Surprisingly, participants who had low attitude level had higher odds to be in the high practice group (OR = 1.837; 95%CI = 1.205–2.802; P = 0.005).

4. Discussion

The study participants showed inadequate knowledge about pharmacovigilance and ADR reporting, which was comparable with earlier studies findings (Adisa & Omitogun, 2019; Agarwal et al., 2013; Alemu & Biru, 2019; Gidey et al., 2020; Kaso & Gebissa, 2017; Mulatu & Worku, 2014; Nisa et al., 2018; Peymani et al., 2016; Rathod & Panchal, 2014; Suyagh et al., 2015; Upadhyaya et al., 2015). Despite the insufficient knowledge exhibited by the study participants, the majority were aware about pharmacovigilance concept, which was similar to the findings reported in Nigeria (Adisa & Omitogun, 2019), India (Rajalakshmi et al., 2017), and Ethiopia (Kaso & Gebissa, 2017), and much higher than that reported in studies conducted in Pakistan (Nisa et al., 2018), Jordan (Suyagh et al., 2015), and Ethiopia (Alemu & Biru, 2019). While the majority of the present study participants were familiar with the concept of pharmacovigilance, only 36.2% and 41.4% of them were able to identify the correct definition of pharmacovigilance and ADR respectively. Unlike the results found in this study, most of the participants surveyed in earlier studies knew the definition of pharmacovigilance (Misra et al., 2019; Mulatu & Worku, 2014; Reddy et al., 2014; Srinivasan et al., 2017). A previous Jordanian study found that few of the participating pharmacists correctly defined pharmacovigilance, but the majority of them knew the correct definition of ADR (Suyagh et al., 2015). Another study conducted in Nigeria showed that only 5% of the health workers enrolled in the study understand the comprehensive definition of pharmacovigilance and 39.7% of them correctly recognized ADR definition (Adisa & Omitogun, 2019). This highlights the need to implement educational programs in healthcare facilities and to develop appropriate academic curriculum for students in medical faculties that discuss the importance of pharmacovigilance and its national situation in order to increase the knowledge and awareness about pharmacovigilance and to enhance the benefits associated with ADRs reporting among healthcare workers and students.

Jordan Pharmacovigilance Center was established in 2001 within the Ministry of Health to collect and assess all information on pharmaceutical products commercialized in Jordan, with a special emphasis on adverse reactions (Yadav, 2008). Nevertheless, more than a third of the participants in this study were unaware of the existence of an official standardized form for reporting adverse drug reactions (34.6%), and nearly half of them were unaware that Jordan has legal provisions in the medicines act that provide for pharmacovigilance activities (47.3%), and that we have a pharmacovigilance center in Jordan (48.1%). Higher percentages were also reported in a previous Jordanian survey conducted on community and hospital pharmacists (Suyagh et al., 2015). These findings should shed the light on the necessity of enhancing Jordanian pharmacists' understanding of the pharmacovigilance situation in Jordan, the present laws and regulations governing this subject, as well as the value of the pharmacovigilance center available in Jordan.

The current study findings revealed that longer training period, female gender, and attending a training course/workshop about pharmacovigilance were significant predictors of adequate knowledge about ADR reporting. A study conducted in Ethiopia showed that healthcare professionals who attended training on ADR reporting were found to have a significantly better knowledge than those who didn't attend any training course about ADR reporting

(Alemu & Biru, 2019). Another Chinese study found that pharmacists who did not participate in ADR reporting training significantly had lower knowledge scores than their counterparts (Hu et al., 2022). These findings should provide an insight into the importance of providing continuous educational and training interventions which has proven its effectiveness in enhancing pharmacists' knowledge and awareness about pharmacovigilance and ADR reporting (Reddy et al., 2014), and subsequently, improving pharmacy career and clinical practice of pharmacy students.

Consistent with the findings reported in earlier studies (Aghakouchakzadeh et al., 2015; Alemu & Biru, 2019; Gidey et al., 2020; Haines et al., 2020; Hu et al., 2022; Kaso & Gebissa, 2017; Mulatu & Worku, 2014; Nisa et al., 2018; Rajalakshmi et al., 2017; Rathod & Panchal, 2014; Thomas et al., 2013; Upadhyaya et al., 2015), the current study participants showed positive attitude towards ADR reporting. On the other hand, poor attitude towards ADR reporting has been found in other studies (Agarwal et al., 2013; Misra et al., 2019; Zewde, 2020). Almost 76% of the participants in this study believed that ADR reporting is necessary, while 60.6% of them strongly agreed that ADR reporting should be mandatory. Although the majority of the participants surveyed in an Ethiopian study agreed that ADR reporting is necessary, only 37.8% of them agreed that ADR reporting should be mandatory (Gidey et al., 2020). Additionally, the majority of the participants enrolled in previous studies agreed that ADR reporting is necessary and mandatory (Haines et al., 2020; Nisa et al., 2018; Upadhyaya et al., 2015). Other Indian studies showed that most of the participating healthcare professionals thought that ADR reporting is necessary (Misra et al., 2019; Reddy et al., 2014; Srinivasan et al., 2017). Since pharmacists' roles have shifted substantially over the last few decades from dispensers to guardians of medication safety (Abdul Hadi et al., 2017), it's imperative to understand their perspectives about the influence of ADR reporting on patient safety. While 71.2% of our study participants agreed that ADR reporting increases patients' safety, only half of the participants in an Ethiopian study did (Gidey et al., 2020). Similar findings were reported in a study conducted in Pakistan (Nisa et al., 2018), but higher percentages were found in several other studies (Haines et al., 2020; Mulatu & Worku, 2014; Peymani et al., 2016; Rajalakshmi et al., 2017; Salehi et al., 2021; Upadhyaya et al., 2015). Furthermore, older age was negatively associated with the attitude towards ADR reporting in the current study, which was consistent with the findings reported in a previous Chinese study (Hu et al., 2022). Low knowledge level was also associated with lower attitude scores among our study participants.

The ADR reporting practice in this study was far below the expectations, with the majority of the participants did not receive any training about how to report ADR. Similarly, most of the participants surveyed in previous studies have not been trained on ADR reporting (Adisa & Omitogun, 2019; Alemu & Biru, 2019; Gidey et al., 2020; Hu et al., 2022; Mulatu & Worku, 2014; Nisa et al., 2018; Rathod & Panchal, 2014; Srinivasan et al., 2017). In contrast, around 90% of the participants enrolled in an Indian study have been trained on how to report ADR (Misra et al., 2019). One of the most important hurdles to ADR reporting was identified as the lack of training (Salehi et al., 2021), highlighting the urgent need for implementing training programs in order to increase ADR reporting and optimize the benefits of pharmacovigilance systems, as well as improve pharmacists' practice of ADR reporting. While 91.2% of the pharmacists participated in a previous Jordanian study have encountered at least one ADR in a patient per year (Suyagh et al., 2015), 38.6% of the participants in this study had never encountered one. One possible explanation for this finding is that the undergraduate students in our study were younger and had less work experience than the participants in the other study, which comprised community and hospital pharmacists with varied levels of expertise. Surprisingly, 74.2% of the study participants did not report any ADR, which was higher than the findings reported in studies conducted in Ethiopia (Alemu & Biru, 2019; Gidey et al., 2020; Zewde, 2020) and India (Rajalakshmi et al., 2017; Srinivasan et al., 2017) but lower than that reported in other studies (Haines et al., 2020; Misra et al., 2019; Mulatu & Worku, 2014; Nisa et al., 2018; Suyagh et al., 2015; Upadhyaya et al., 2015). On the other hand, most of the participants surveyed in recent studies have reported ADRs encountered during their professional practice (Hu et al., 2022; Kaso & Gebissa, 2017). The majority of this study participants reported ADRs 5 times or less per week (83.1%) and more than one third of them reported only severe or life-threatening ADRs (36.6%). Higher percentages were revealed in a Malaysian (Agarwal et al., 2013) and a Pakistani study (Nisa et al., 2018), where more than half of the participants indicated that they will report the ADR only if it was serious or severe. Around 40% of the participants in the present study noted the ADR encountered on patients' records, which was double the percentage found in India (Srinivasan et al., 2017) and Ethiopia (Kaso & Gebissa, 2017). Another study showed that only one third of the healthcare professionals noted ADRs encountered in patients' clinical records (Gidey et al., 2020). Two studies conducted in Ethiopia reported that most of the participating healthcare professionals noted the encountered ADRs on clinical records (Alemu & Biru, 2019; Mulatu & Worku, 2014). Although the majority of the current study participants did not know the period within which a serious ADR experienced by a patient should be reported, only 1.5% of the pharmacists surveyed in a Jordanian study knew it (Suyagh et al., 2015). Nevertheless, using ADR reporting form was the most preferred method for ADR reporting identified by both studies' participants (Suyagh et al., 2015). Although female students in the present study had better knowledge about ADR reporting, their practice of ADR reporting was significantly lower than males. On the other hand, lower attitude towards ADR reporting was significantly associated with higher practice in the current study, which was contradictory to the results found in a Chinese study, where higher attitude scores were associated with higher practice of ADR reporting among the participating pharmacists (Hu et al., 2022).

Several barriers to ADR reporting were reported in the present study. The most commonly reported barriers were "not knowing how to report" (60.2%) and "not knowing where to report" (55.9%), which was consistent with the findings of an African study (Haines et al., 2020). Similarly, 66.7% of the participants enrolled in a Jordanian study agreed that not knowing how to report ADR can discourage them to report ADR (Suyagh et al., 2015). Almost 40% of the healthcare professionals enrolled in an earlier study agreed that not knowing how to fill and report ADR is a reason for not reporting ADR and nearly half of them thought that not knowing where to report is another reason (Alemu & Biru, 2019). On the other hand, only 19.4% of the pharmacists participated in a Chinese study reported that not knowing how to report ADR could influence their reporting of ADR. Other studies conducted in India (Misra et al., 2019) and Pakistan (Nisa et al., 2018) reported that less than a quarter of the participants surveyed recognized not knowing how to report and not knowing where to report as factors affecting ADR reporting.

Aside from the barriers that discourage ADR reporting, most of the current study participants believed that the seriousness of the reaction (84.1%) and the involvement of a new drug (51.1%) encourage them to report ADR. Similarly, the majority of the healthcare providers participated in a Pakistani study reported that they are more likely to report ADR if the reaction is serious (63.8%), however, only 8.4% of participants claimed that new drug involvement is a motivator for ADR reporting (Nisa et al., 2018). A Jordanian study found that almost all of the pharmacists agreed that

the serious nature of the reaction is an encouraging factor for ADR reporting (99%), while only 57% of them preferred to report the reaction if it was to a new product (Suyagh et al., 2015). Interestingly, the seriousness of the reaction and the reaction of a new product were encouraging factors to report ADR indicated by over 95% of the participants in an Indian study (Thomas et al., 2013). These findings suggest the need for the development of effective strategies that are capable of overcoming the obstacles to good practice of ADR reporting and.

4.1. Strengths and limitations of the study

The study findings provide spot on improving ADR reporting practice by the final year Pharm D students, which in turn would enhance having optimal ADR reporting practice in different clinical settings by the Pharm D graduates from the starting point. The factors influencing knowledge, attitude and ADR practice in the present study should be fed in future clinical training plans with the aim pf improving ADR reporting among Pharm D students. Furthermore, the study was conducted on a large sample size of sixth-year Pharm D students from different hospitals in Jordan, which increases the generalizability of the findings. On the other hand, the cross-sectional design used in this study limits the ability to establish a cause-effect relationship. Additionally, the study relied on self-reported data, which may be subject to social desirability bias, where participants may respond in a socially acceptable way rather than reporting their true beliefs and behaviors.

Based on the findings of this study, future clinical pharmacy protocols should design and implement interventions to enhance ADR reporting via incorporating ADR reporting education into the curriculum or providing workshops and training sessions to address the identified knowledge, attitude and practice gaps. In terms of future research, conducting a randomized controlled trial to evaluate the effectiveness of different educational interventions in enhancing knowledge, attitude, and practice of ADR reporting among medical students is deemed necessary.

5. Conclusions

Although Pharm D students clearly demonstrated positive attitude towards ADR reporting, knowledge and practice of ADR reporting were inadequate, necessitating the need for further improvement. Future teaching strategies need to consider pharmacovigilance and ADR reporting in Pharm D curriculum, along with implementing continuous training courses and educational workshops in order to raise students' awareness about ADR reporting practice.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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