ISSN:2958-0420 Contents lists available at JJOAS-N

Jordan Journal of Applied Science - Natural Science Series
Applied Science Private University

Research Article *Vol. 20*

Educational Exposure and Awareness of Pharmacovigilance and Adverse Drug Reactions Among Health Professions Students.

Manal A. Ayyash[1]*, Kamel A Jaber[2], Nesrin Seder[3], Aman Hammad[1], Ibraheem Alani[1], Sofiyan Mohd Ramahi[4], Razan I. Nassar[5]

[1]Department of Pharmaceutics and Pharmaceutical Science, Faculty of Pharmacy, Applied Science Private University, Amman, Jordan.

[2]School of Medicine, University of Jordan, Amman, Jordan.

[3]Department of Pharmaceutical Chemistry and Pharmacognosy, Faculty of Pharmacy, Applied Science Private University, Amman, Jordan.

[4]Faculty of Medicine, The Hashemite University, Zarqa, Jordan.

[5]Department of Clinical Pharmacy and Therapeutics, Faculty of Pharmacy, Applied Science Private University, Amman, Jordan.

A R T I C L E I N F O

Article history:

Received 27 Aug 2026

Accepted 14 Oct 2026

Published 01 Nov 2026

DOI: https://doi.org/10.35192/jjoas-n.v20i1.759

***Corresponding author:**

[1]Department of Pharmaceutics and Pharmaceutical Science, Faculty of Pharmacy, Applied Science Private University, Amman-Jordan.

Email: m_ayyash@asu.edu.jo.

A B S T R A C T

Background: Pharmacovigilance (PV) fundamental to medication safety and effective reporting of adverse drug reactions (ADRs). aimed to assess the level of PV knowledge and awareness among healthcare students in Jordan.

Methods: A descriptive cross-sectional survey was conducted among 679 undergraduate students from medicine, pharmacy, PharmD, and nursing programs. A structured questionnaire was developed by researchers based on a review of the relevant literature and researchers' academic and teaching experience in PV and ADRs. The questionnaire was used to collect data on demographics, exposure to PV education, knowledge of ADRs and PV and attitudes. Descriptive statistics and multiple regression were used for data analysis.

Results: While 67.3% reported formal education on ADRs and 41.5% had taken a PV course, only 9.3% correctly defined PV. Pharmacy and PharmD students achieved significantly higher knowledge scores. Age, university type, academic year, and field of study significantly predicted knowledge levels ($p < 0.05$). Most students acknowledged PV's role in reducing morbidity and mortality.

Conclusion: This study identified important gaps in pharmacovigilance knowledge among undergraduate health-professions students, despite their exposure to pharmacovigilance education. Knowledge varied according to students' academic and educational characteristics, highlighting the need for stronger and more structured pharmacovigilance education and practical training. Enhancing these components may better prepare future healthcare providers for effective ADR reporting and contribute to improved patient safety.

Keywords :Pharmacovigilance, Adverse Drug Reactions, Health Professions Students, Education, Pharmacy, Jordan.

Introduction

Adverse drug reaction (ADR) was defined by the World Health Organization (WHO) as "a response to a medicine which is noxious and unintended, and which occurs at doses normally used in man" (1). The ADRs have been recognized as a major global cause of morbidity and mortality (2). Although drugs are subject to rigorous pre-approval testing for efficacy and safety, clinical trials assess only a small number of selected individuals and may not reveal adverse effects of medicines that may occur during extensive and long-term use. Therefore, continuous monitoring of medicines after marketing is essential to identify previously unrecognized safety signals and to ensure that the benefits of medicines continue to outweigh their risks. Pharmacovigilance (PV) is defined by WHO as "The science and activities relating to the detection, assessment, understanding and prevention of adverse effects or any other medicine/vaccine- related problem."(3) . PV helps keep patients and the public safe by spotting problems with medicines, weighing their benefits and risks, and supporting their safe and proper use. . Healthcare professionals play a vital role in pharmacovigilance because their recognition and reporting of suspected ADRs they gather critical post marketing safety data (1, 4).

The WHO Program for International Drug Monitoring WHO PIDM: In 1968, WHO launched WHO PIDM that allowed for collaboration and exchange of information across borders regarding medicine-related safety issues (5). Jordan joined the WHO PIDM in 2002. In Jordan, the National Pharmacovigilance Center was established in 2001 within the Jordan Food and Drug Administration (JFDA), with responsibility for pharmacovigilance activi-

Published by Jordan Journal of Applied Science - Natural Science Series — This is an open access article under the CC BY 4.0 license.

ties and the monitoring of suspected ADRs (6, 7). The JFDA is the national regulatory authority responsible for the regulation and safety monitoring of medicines in Jordan (7).

Initially, ADR reports were always delivered and accepted only from physicians, as it was believed that they had the skills to determine whether a disease or medicine was responsible for a particular symptom during diagnosis, thereby providing more reliable information and avoid questionable reports (8). However, this assumption has been challenged and proven wrong, as it has been proven that multidisciplinary professional collaboration is effective in identifying various medicine-related problems and can provide an end to achieving PV goals (9). Currently, health professionals learn and are trained in ADR reporting and the PV concept during the educational stages. Despite the well-established PV system and the increasing recognition of the importance of ADR reporting, gaps in pharmacovigilance knowledge and reporting practices among healthcare professionals and students have been reported in Jordan and elsewhere(10-13). Evidence from Arab countries has highlighted gaps in pharmacovigilance knowledge and adverse drug reaction (ADR) reporting among healthcare students. In Jordan, Abu Farha et al. reported insufficient knowledge of pharmacovigilance and ADR reporting among pharmacy students from three universities, with a mean knowledge score of 4 out of 10, despite generally positive attitudes toward ADR reporting (10). Another study done among the last year pharmacy students in Yemen was also found to lack adequate knowledge about PV and ADR reporting, highlighting the need for educational programs and the integration of PV into the curricula of health care professionals (14). In Saudi Arabia, Alwhaibi et al. reported that only 39% of healthcare students had received some form of pharmacovigilance education, while pharmacy students demonstrated higher knowledge and more positive perceptions than students from other healthcare disciplines (15). More recently, another study done among PharmD students in Jordan who are under their clinical training found that their knowledge about PV and ADR reporting was inadequate, while their practice toward reporting was also below satisfactory, despite having positive perceptions regarding the reporting of ADRs (16). These data seem to emphasize the importance of taking educational efforts and practical PV training seriously in health care training programs across disciplines.

Method

Study design, settings, and participants

that was done to evaluate undergraduate students of medicine, pharmacy, and nursing in Jordanian universities regarding their knowledge and awareness of the PV concept. . In this study, a convenience sample of undergraduate students in medicine, pharmacy, and nursing was invited to participate by sending the survey link through two social media platforms (Facebook and WhatsApp). All the participants were aware of the objective of the study and that the survey will take 10 minutes to be completed and that participation in the study was voluntary. Survey instrument development and validation

A structured, questionnaire was generated by the authors following the review of relevant literature with regard to pharmacovigilance, ADRs, and ADR reporting and the relevance of the pharmacovigilance-related course content taught to health professions students. . Previous studies investigating pharmacovigilance knowledge, attitudes, and perceptions among healthcare students, including the study by Živanovic´ et al. (11), informed the development and selection of relevant questions. The questionnaire was designed to be specifically used in gauging PV knowledge and awareness among Jordanian medical, pharmacy, and nursing students studying at universities throughout Jordan. The questionnaire was designed to assess the PV knowledge and awareness among medical, pharmacy, and nursing students in Jordanian universities. It was reviewed by faculty experts with relevant expertise in pharmacy practice, pharmacovigilance, and therapeutic and clinical disciplines to assess its face and content validity, clarity, relevance, and comprehensiveness. Their feedback was considered, and necessary modifications to the wording and content of the questionnaire were made before its administration. The questionnaire comprised four sections assessing different items of interest. The questionnaire incorporated multiple-choice, closed-ended questions, as well as a 5 -point scale measuring the perception (from strongly agree to strongly disagree) of participants regarding PV in Jordan.

Statistical analysis

For purposes of statistical analysis, the data were collected and entered into Statistical Package for the Social Sciences (SPSS) Version 28.0 software (IBM Corp., Armonk, New York, USA). The continuous variables were expressed as mean ± standard deviation while the categorical variables were expressed as frequencies and percentages. Multiple linear regression analysis using the Enter method was performed to examine the factors associated with students' overall knowledge scores. Variables with p-values below 0.25 in the univariate analysis were initially considered for inclusion in the regression model. Statistical significance in the final model was determined using a threshold of $p < 0.05$. Multicollinearity was also evaluated to assess the stability of the model.

Results

Demographic characteristics

A total of 679 healthcare students completed the electronic version of the survey. More than two-thirds of the participants were female (68.9%). About 60.0% of the students were aged between 20 and 22, followed by almost one-fifth aged 23 to 25, and 13.1% aged between 17 and 19 years. Most students (90%) resided in central regions (Table 1).

Regarding university type, 37.8% were enrolled in a public university, while 62.2% were enrolled in a private university. The study's sample consisted of 53.0% pharmacy students, 21.9% medical students, 17.4% nursing students, and 7.7% PharmD students. Fourth-year students made up the largest proportion at 31.8%, followed by fifth-year students at 26.4% (Table 1).

Information sources on ADRs and PV

Figure 1 illustrates the sources students relied on for information about ADRs. University courses were the most frequently used sources (77.5%), followed by pharmacists (74.2%) and websites (69.4%). On the other hand, doctors and social media were the least frequently reported sources (59.2% and 54.1%, respectively).

Table 1. Demographic characteristics of the participants (n=679).

Parameter	n (%)
Gender	
Male	211 (31.1)
Female	468 (68.9)
Age	
17–19 years	89 (13.1)
20–22 years	405 (59.6)
23–25 years	154 (22.7)
>25 years	31 (4.6)
Living Place	
North region (Irbid, Ajloun, Jerash, and Mafraq)	58 (8.5)
Central region (Amman, Zarqa, Balqa, and Madaba)	611 (90.0)
South region (Karak, Tafilah, Ma'an, and Aqaba)	10 (1.5)
University Type	
Public university	257 (37.8)
Private university	422 (62.2)
Studying Field	
Medicine	149 (21.9)
Pharmacy	360 (53.0)
PharmD	52 (7.7)
Nursing	118 (17.4)
Studying Year	
1st year	59 (8.7)
2nd year	79 (11.6)
3rd year	119 (17.5)
4th year	216 (31.8)
5th year	179 (26.4)
6th year	27 (4.0)

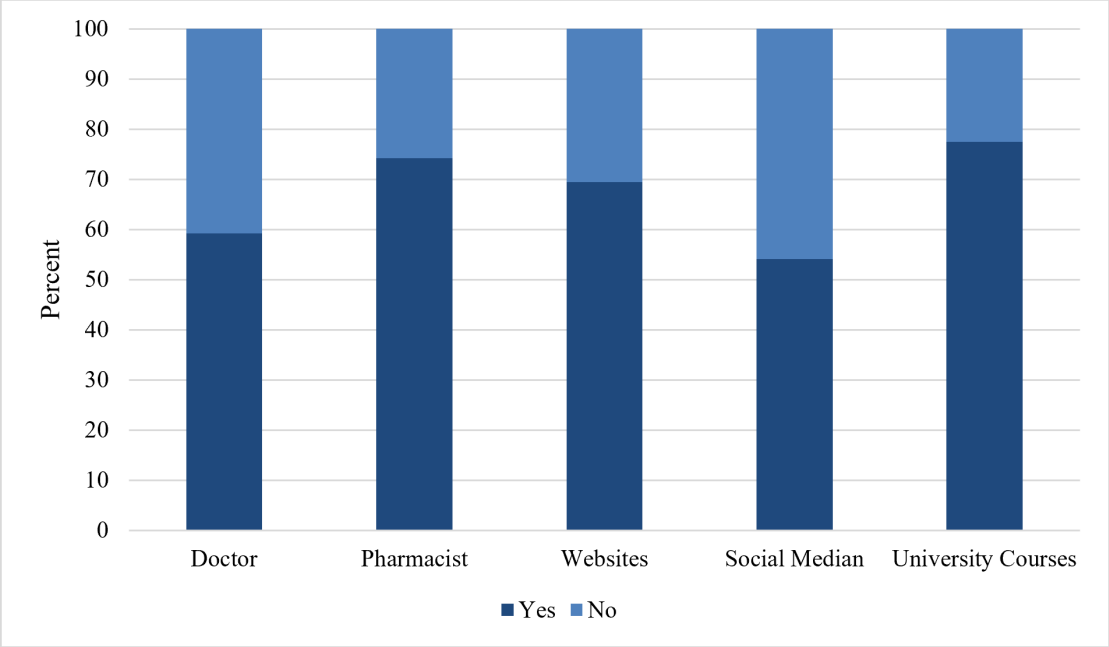


Figure 1. Information sources on ADRs among the study participants (n=679).

Exposure to PV during undergraduate studies

Students were asked about their exposure to PV during their undergraduate studies (Table 2). Among them, 41.5% reported being introduced to PV through a separate PV course, while 67.5% were introduced to it as part of a course or during a semester. However, 32.4% reported that they had never received any information on that topic. Notably, more than two-thirds reported learning about ADRs and how to report them formally (67.3%). In addition, 26.8% mentioned attending a workshop/lecture on PV and ADRs in college.

Table 2. Participants' responses regarding PV during their undergraduate studies.

Parameter	Yesn (%)	No n (%)
I was introduced to PV through a separate course on PV	282 (41.5)	397 (58.5)
I was introduced to PV through a part/semester of a course	458 (67.5)	221 (32.5)
I did not receive any information about PV in any of the courses	220 (32.4)	459 (67.6)
During my studies, I learned about ADRs and how to report them formally	457 (67.3)	222 (32.7)
I attended a workshop/lecture on PV and ADRs in college	182 (26.8)	497(73.2)

Students' knowledge of ADRs and PV

Figure 2 illustrates students' responses to the eight knowledge items regarding ADRs and PV. Students reported being introduced to PV. The most correctly answered item was "*ADRs is an unexpected harmful or unwanted effect that results from taking a certain medication and requires the patient to change the medication or the need for medical intervention or to change the medication completely*", with 76.1% of the students responding "Yes". This was followed by "*The Jordan Food and Drug Administration (JFDA) is the regulatory authority responsible for monitoring and reporting ADRs in Jordan*", with 74.4% responding "Yes", and "*Only life-threatening ADRs should be reported*", with 55.5% responding "No".

Few students (47%) knew the statement "anyone may report ADRs" and responded "No" to "Only healthcare providers (doctors, pharmacists, and nurses) can report ADRs". Similarly, nearly an equal percentage were aware that the public can directly report ADRs and responded with "No" to "*The public cannot directly report any ADRs they experience to the Jordan PV Center themselves and must contact any of their healthcare providers*" (Figure 2). Regarding the classification of adverse drug reactions, 37.4% of students correctly identified Type A reactions, whereas 34.5% correctly identified Type B reactions (Figure 2). Only 9.3% of students correctly recognized that the statement "P.V is the science and activities involved in detecting, evaluating, understanding, and preventing adverse effects or any other drug-related problem before the drug is marketed" was incorrect; 13.5% were uncertain, and 77.2% provided incorrect responses (Figure 2).

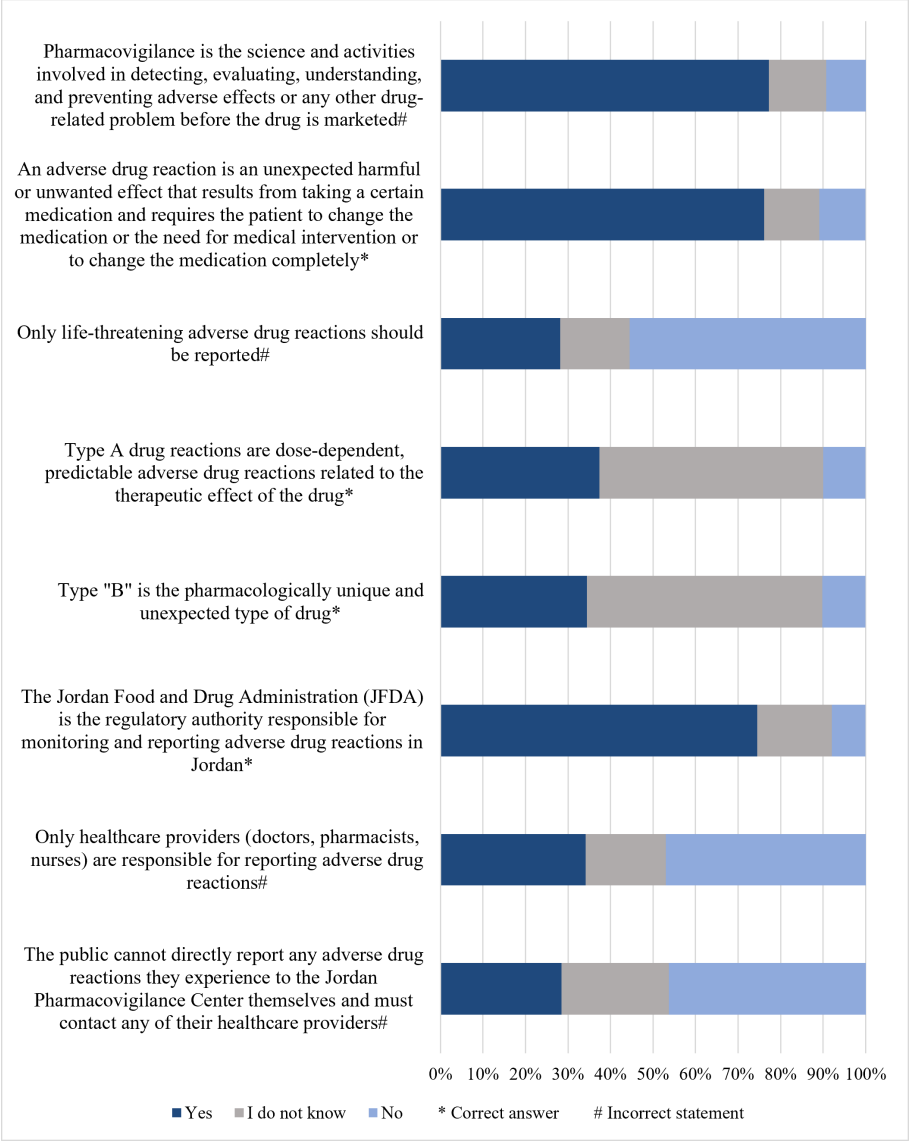


Figure 2. Students' responses to the knowledge items regarding ADRs and PV.

Analysis of the total knowledge scores revealed a mean score of 3.81 (SD=1.74), with scores ranging from 0 to 8 out of 8. Only 0.7% of the students (n=5) answered all the items correctly; on the other hand, 5.3% (n=36) answered all the items incorrectly.

Knowledge of ADRs and PV among different fields.

The scores for each item were calculated according to the field of study (Table 3). Notably, the first item "P.V is the science and activities involved in detecting, evaluating, understanding, and preventing adverse effects or any other drug-related problem before the drug is marketed" had the lowest mean score among the pharmacy, medical, and nursing students (0.13, 0.03, and 0.04, respectively). On the other hand, the second item, "An ADR is an unexpected harmful or unwanted effect that results from taking a certain medication and requires the patient to change the medication or the need for medical intervention or to change the medication completely" had the highest mean score among the pharmacy, medical, and nursing students (0.77, 0.72, and 0.77, respectively).

Pharmacy students (n=412) had an average (SD) score of 3.99 (1.75) (range 0–8); Medical students (n= 149) had an average (SD) score of 3.47 (1.77) (range 0–7); Nursing students (n= 118) had an average (SD) score of 3.60 (1.62) (range 0–8). Bivariate analysis of factors associated with knowledge As for the simple linear regression, only 4 variables were entered into the multiple regression analysis, those were: age, university type, field of study, and year of study (P-value<0.25) (Table 4).

Multivariable analysis of factors associated with knowledge

Significant variation in the total knowledge score was seen using multiple linear regression analysis where age (p-value=0.009), type of university (p-value=0.024), and field of study (p-value=0.005), year of study (p-value<0.001) significantly affected the total knowledge score. Being older, studying at a public university, studying pharmacy or PharmD, and in their fourth year of university studies or more significantly associated with a higher total knowledge score compared to all other students (Table 4). The overall model, F(4, 674)= 14.927, p-value <0.001, accounted for 8.1% of the variation in the total knowledge score (adjusted R-squared=0.076).

Students' perceptions of PV

Table 5 shows the students' perceptions of PV. While more than half of the students (51.4%) agreed/strongly agreed that PV is adequately studied at the university level, 27.8% were neutral. A high percentage (84.6%) agreed/strongly agreed that awareness of PV and the activation of the ADR monitoring system will reduce diseases and deaths. Participation in side-effect monitoring to avoid legal accountability varied among the students; about 30% agreed or strongly agreed, 35.3% were neutral, and 34.6% disagreed or strongly disagreed.

Interestingly, about 84.0% agreed/strongly agreed that it is important to establish a center for reporting adverse effects within each hospital. In addition, 87.4% agreed/strongly agreed that ADRs related to new drugs on the market should be reported (Table 5).

Table 3. Comparison of mean knowledge scores by field of study for each item.

Item	Pharmacy Mean ± SD	Medicine Mean ± SD	Nursing Mean ± SD
Pharmacovigilance is the science and activities involved in detecting, evaluating, understanding, and preventing adverse effects or any other drug-related problem before the drug is marketed.	0.13 ± 0.338	0.03 ± 0.162	0.04 ± 0.202
An ADR is an unexpected harmful or unwanted effect that results from taking a certain medication and requires the patient to change the medication or the need for medical intervention or to change the medication completely.	0.77 ± 0.419	0.72 ± 0.451	0.77 ± 0.422
Only life-threatening ADRs should be reported.	0.57 ± 0.496	0.58 ± 0.495	0.47 ± 0.501
Type A drug reactions are dose-dependent, predictable ADRs related to the therapeutic effect of the drug.	0.40 ± 0.491	0.26 ± 0.441	0.42 ± 0.495
Type "B" is the pharmacologically unique and unexpected type of drug.	0.37 ± 0.484	0.26 ± 0.441	0.36 ± 0.481
JFDA is the regulatory authority responsible for monitoring and reporting ADRs in Jordan.	0.76 ± 0.426	0.69 ± 0.464	0.75 ± 0.432
Only healthcare providers (doctors, pharmacists, nurses) are responsible for reporting ADRs.	0.47 ± 0.500	0.51 ± 0.502	0.42 ± 0.495
The public cannot directly report any ADRs they experience to the Jordan PV center themselves and must contact any of their healthcare providers.	0.50 ± 0.501	0.42 ± 0.495	0.37 ± 0.486

Table 4. Factors affecting the total knowledge score among the students (N=679).

Parameter	Total Score					
	Simple regression β	P-value#	Multiple regression B	Standardized β	95% CI for B	P-value$
Gender • Male • Female	Reference 0.036	0.342	---	---	---	---
Age • ≤ 22 years • > 22 years	Reference 0.184	<0.001	0.413	0.105	0.104 to 0.721	0.009
Living place • Central regions • Others	Reference 0.034	0.371	---	---	---	---
University type • Public University • Private University	Reference -0.059	0.123	−0.329	-0.092	−0.615 to −0.043	0.024
Studying field • Pharmacy or PharmD • Medicine/ Nursing	Reference -0.128	<0.001	−0.411	-0.115	−0.698 to −0.124	0.005
Studying year • ≤ 3 years • > 3 years	Reference 0.241	<0.001	0.624	0.174	0.337 to 0.911	<0.001

Model summary: $R^2 = 0.081$; adjusted $R^2 = 0.076$; $F(4, 674) = 14.927$; $p < 0.001$.

Notes: # Simple linear regression; $ Multiple linear regression; * Statistically significant at the 0.05 significance level.

Table 5. Students' perceptions of PV (N=679).

Item	Strongly Disagree n (%)	Disagree n (%)	Neutral n (%)	Agree n (%)	Strongly Agree n (%)
PV is adequately studied during university studies	18 (2.7)	123 (18.1)	189 (27.8)	188 (27.7)	161 (23.7)
I believe that awareness of PV and activation of the ADRs monitoring system will reduce morbidity and mortality	1 (0.1)	15 (2.2)	89 (13.1)	238 (35.1)	336 (49.5)
I do not prefer to participate in monitoring side effects to avoid legal accountability	69 (10.2)	166 (24.4)	240 (35.3)	103 (15.2)	101 (14.9)
I think it is important to establish a center for reporting ADRs within each hospital	2 (0.3)	17 (2.5)	91 (13.4)	202 (29.7)	367 (54.1)
ADRs related to new drugs on the market should be reported	1 (0.1)	9 (1.3)	76 (11.2)	196 (28.9)	397 (58.5)
I believe that in the future (after graduating from university), I will be prepared and able to monitor and report any adverse effects resulting from the use of the drug	5 (0.7)	23 (3.4)	153 (22.5)	267 (39.3)	231 (34.0)
I believe that healthcare providers are prepared and able to monitor and report potential drug interactions from medications	2 (0.3)	41 (6.0)	167 (24.6)	240 (35.3)	229 (33.7)
Healthcare providers (doctors, pharmacists, nurses) in Jordan provide patients with adequate information and education about ADRs and how to report them	18 (2.7)	93 (13.7)	216 (31.8)	178 (26.2)	174 (25.6)
The Jordanian public is well aware of how to report ADRs	63 (9.3)	180 (26.5)	212 (31.2)	106 (15.6)	118 (17.4)
Educational campaigns should be organized to raise awareness about ADRs and PV by the competent health authorities and bodies in Jordan	4 (0.6)	11 (1.6)	87 (12.8)	198 (29.2)	379 (55.8)
There is a specialized department for PV in every pharmaceutical company (factory, drug store) in Jordan that can be contacted in the event of any ADRs resulting from the use of the drug	8(1.2)	45 (6.6)	285 (42.0)	163 (24.0)	178 (26.2)
Educational campaigns should be held to raise awareness concerning ADRs and PV by health authorities and health professional unions within the framework of education and continuous professional development for health professions	9 (1.3)	54 (8.0)	238 (35.1)	204 (30.0)	174 (25.6)

Regarding preparedness, 73.3% agreed or strongly agreed that they would be able to monitor and report any adverse effects in the future, and 69.0% agreed/strongly agreed that healthcare providers are prepared and able to monitor and report potential drug interactions from medications. While 51.8% agreed or strongly agreed that Jordanian healthcare providers provide patients with adequate information and education about drug interactions and how to report them, 31.8% expressed a neutral stance (Table 5).

There was a variation in student opinions regarding the public's awareness of ADRs reporting in Jordan; 33.3% of students agreed or strongly agreed that the public is aware of reporting procedures, 31.2% were neutral, and 35.8% disagreed or strongly disagreed. A majority of the students (85.0%) agreed or strongly agreed that educational campaigns should be organized to raise awareness about PV. Over half of the students supported the role of health authorities and health professional unions in conducting workshops on continuing professional development (Table 5).

Discussion

Enhancement of public health and ensuring safe practice of HCPs in handling medication ADRs, requisite equipping the future practitioners with necessary knowledge and skills is a way forward. ADRs reported to the authority is part of a worldwide safety database that will aid decisions and ensure safer use of medication which is the endpoint of PV. It is for this reason the study determined the knowledge of health professional students on PV and ADRs and reporting. The results were promising regarding participants' knowledge of the ADR definition, as more than three-quarters of the participants correctly identified its meaning. This finding aligns with a previous study conducted in Jordan in 2021, where 73.1% of the participants were familiar with the definition (17). However, this percentage was higher than those reported in studies conducted in other countries, such as Saudi Arabia and China (15, 18), where 40% and 19.71% of the participants, respectively, reported being familiar with the concept.

Pharmacovigilance is good means of testing the efficacy and the safeness of medicines during their life cycle. It involves detection, assessment, understanding, and prevention of ADRs or any other drug-related problems. This process continues after a drug is approved, launched on the market, and used by patients (4). Concerning the results of this present study, interestingly just 9.3% of the studied sample explained the definition of pharmacovigilance appropriately, which was less than the percentages seen in other comparable studies in Saudi Arabia, China and Jordan (15, 18, 19).

While participants learned PV through a course, class, or programme (67.5%) and also through a separate PV course (41.5%), they did not have enough knowledge of the correct definition of PV. This suggests that PV needs to be included if it is not already in the curriculum, extended where applicable, taught in the classroom, and practical training need to be included to ensure the concept is understood.. On a more optimistic note, it is possible that participants were aware of PV elements but misunderstood their timing.

Many participants incorrectly believed that PV takes place before a drug is authorized and launched on the market, rather than after, as it is meant to monitor drug safety once it becomes available to patients. This misconception, as reflected in the survey, further emphasizes the need for improved PV education. Moreover, 69.0% of the participants agreed or strongly agreed that healthcare providers are prepared and able to monitor and report potential drug interactions. In contrast, a study conducted in Jordan in 2017, reported that most healthcare professionals were unaware of the concept of pharmacovigilance (20).

Furthermore, few students (26.8%) had previous experience in PV courses; this proportion is comparable to that reported in a previous study carried out in India (21). This inadequate percentage should be increased, since over half (55.6%) of the students supported the role of health authorities such as the Ministry of Health, JFDA, and health professional unions such as the Jordanian Pharmacy Syndicate, Medical Syndicate, and Nursing Syndicate in conducting workshops and educational campaigns to raise awareness concerning ADRs and PV as part of the continuous professional development for health professions.

Majority of the students believed that increasing awareness about PV and ADR reporting had a strong positive impact on improving patients' health and reducing the mortality rate, which is supported by the literature (18, 22).

Despite the increasing awareness and interest in PV, the reported percentages regarding ADR reporting varied. According to the findings of the current study, only 47% of students believe that ADR reporting is a right for everyone and that the public can report them on their own.

Pharmacy and PharmD students had the highest proportion of correct definitions of PV and ADR, a finding consistent with the literature (18). This may be explained by their greater exposure to ADRs during their training courses. Previous evidence has also highlighted the contribution of pharmacy-related interventions to improving patient outcomes, including reductions in hospital and intensive care unit stays, readmissions, and mortality (23).

The findings indicate that exposure to pharmacovigilance education alone may not be sufficient to ensure adequate knowledge among health-professions students. The differences in knowledge according to age, university type, field of study, and academic year suggest that pharmacovigilance education may benefit from greater consistency and integration across health-professions curricula. The results of the multivariable analysis highlight the importance of considering students' demographic and academic characteristics when developing and implementing pharmacovigilance education. Curricular content should include practical components addressing ADR identification, assessment, and reporting, with opportunities for students to apply their knowledge through case-based learning or reporting exercises.

Clinical Implications

The findings underscore the importance of improving education about pharmacovigilance and ADR reporting skills among future healthcare professionals. Embedding more experiential ADR identification and reporting education within health professions curricula could enable students to acquire the skills necessary to promote medication safety in practice.

Strengths and Limitations

The sample of 679 undergraduate students from four health -profession disciplines (medicine, pharmacy, PharmD and nursing) from public and private universities across different years of study allowed us to compare levels of pharmacovigilance knowledge across disciplines, university settings, and years of study. This diversity enabled comparisons of pharmacovigilance knowledge across fields, university types, and academic progression. The study also comprehensively assessed educational exposure, information sources, knowledge, and perceptions related to pharmacovigilance and ADRs. In addition, the questionnaire underwent expert review for face and content validity, and multivariable analysis was performed to identify factors associated with knowledge scores.

A few limitations should be noted. Participants were recruited voluntarily via Facebook and WhatsApp which may lead to selection and self-selection bias. The uneven distribution of the sample may lead to bias in the generalizability of the data regarding all health-professions students in Jordan. Educational exposure and information sources were self-reported and may therefore be subject to recall or reporting bias. Finally, perception items were analyzed individually rather than as a composite score, precluding multivariable analysis. Future studies should consider using a validated composite perception scale to facilitate more comprehensive multivariable analysis.

Conclusion and Future Recommendations

This study identified important gaps in pharmacovigilance knowledge among undergraduate health-professions students despite their exposure to pharmacovigilance education. Strengthening and integrating structured pharmacovigilance education and practical ADR-reporting training into health-professions curricula may better prepare future healthcare professionals for effective ADR reporting and contribute to improved patient safety. Future multicenter and interventional studies are recommended to evaluate the effectiveness of such educational approaches.

Conflict of interest

The authors declare that there are no conflicts of interest relevant to this research.

Data Availability Statement

The data supporting the findings of this study are available from the corresponding author upon reasonable request.

Authors' Contributions

Manal Ayyash: Conceptualization, Visualization, Writing, review & editing, Supervision, Methodology. Kamel Jaber: Formal analysis, Writing - review & editing Nesrin Seder: Writing - original draft. Aman Hammad: Writing - original draft, Data Collection. Ibraheem Alani: Writing - original draft, Data Collection. Sofiyan Mohd Ramahi: Data Collection. Razan Nassar: Formal analysis

Funding

The authors declare that no financial, personal, or institutional relationships have influenced the content or findings of this manuscript.

Acknowledgment

Not applicable

Ethical consideration

The current study was given the approval by the Ethics Committee at the institution (Approval number: 2024-PHA-10). Participants were advised that their participation in this study was completely voluntary and that their responses and data would be anonymous and kept confidential.

Running head

Pharmacovigilance among Health Profession Students

References

1. World Health Organization. Safety of medicines: a guide to detecting and reporting adverse drug reactions: why health professionals need to take action. 2002. Report No.: WHO/EDM/QSM/2002.2.

2. Patton K, Borshoff D. Adverse drug reactions. Anaesthesia. 2018;73:76–84. doi: 10.1111/anae.14143.

3. World Health Organization. Regulation and prequalification [Internet]. Geneva: World Health Organization. Available from: https://www.who.int/teams/regulation-prequalification

4. World Health Organization. Pharmacovigilance [Internet]. Geneva: World Health Organization. Available from: https://www.who.int/teams/regulation-prequalification/regulation-and-safety/pharmacovigilance

5. Lindquist M, Edwards IR. The WHO Programme for International Drug Monitoring, its database, and the technical support of the Uppsala Monitoring Center. J Rheumatol. 2001; 28(5):1180–1187. PMID: 11361210.

6. Shroukh WA, Shakhatreh FM, Yasein NA, Sharkas GF. A survey on the knowledge, attitudes and practices of physicians towards pharmacovigilance in Jordanian health centres. International Health. 2018;10(5):363–70. doi: 10.1093/inthealth/ihy029.

7. Jordan Food and Drug Administration. Guidelines for detecting and reporting adverse drug reactions in Jordan: individual case safety reports for healthcare professionals [Internet]. Amman: Jordan Food and Drug Administration; 2014. Available from: https://www.jfda.jo/ebv4.0/root_storage/ar/eb_list_page/تعليمات_تعبئة_تقارير_رصد_الآثار_الجانبية.pdf

8. Seid MA, Kasahun AE, Mante BM, Gebremariam SN. Healthcare professionals' knowledge, attitude and practice towards adverse drug reaction (ADR) reporting at the health center level in Ethiopia. International Journal of Clinical Pharmacy. 2018;40:895–902. doi: 10.1007/s11096-018-0682-0.

9. Khan Z, Karatas Y, Hamid SM. Evaluation of health care professionals' knowledge, attitudes, practices and barriers to pharmacovigilance and adverse drug reaction reporting: a cross-sectional multicentral study. PLoS One. 2023;18(5):e0285811. doi: 10.1371/journal.pone.0285811.

10. Farha RA, Alsous M, Elayeh E, Hattab D. A cross-sectional study on knowledge and perceptions of pharmacovigilance among

pharmacy students of selected tertiary institutions in Jordan. Tropical Journal of Pharmaceutical Research. 2015;14(10):1899–1905. doi: 10.4314/tjpr.v14i10.23.

11. Živanovic´ D, Jovin VM, Javorac J, Kvrgic´ S, Raškovic´ A, Stojkov S, et al. Measuring pharmacovigilance knowledge and attitudes among healthcare sciences students: development and validation of a universal questionnaire. European Review for Medical & Pharmacological Sciences. 2022;26(4). doi: 10.26355/eurrev_202202_28112.

12. Rao TN, Kummara MK, Kumar DRP. Knowledge, attitude, and practice of medical, pharmacy, and nursing students towards pharmacovigilance and adverse drug reaction reporting at a rural medical setting: a cross-sectional study. NeuroQuantology. 2022;20 (17):1239–1242. doi: 10.48047/NQ.2022.20.17.NQ880158.

13. Era N, Mukherjee S, Bordoloi SK. Assessment of knowledge, attitude, and practice of pharmacovigilance among undergraduate medical students in a tertiary care teaching hospital of Eastern India: a questionnaire-based study. National Journal of Physiology, Pharmacy and Pharmacology. 2020;10(6):460. doi: 10.5455/njppp.2020.10.03062202025032020.

14. Othman GQ, Ibrahim MIM, Alshakka M, Ansari M, Al-Qadasi F, Halboup AM. Knowledge and perception about pharmacovigilance among pharmacy students of Universities in Sana'a Yemen. Journal of Clinical and Diagnostic Research: JCDR. 2017;11 (6):FC09. doi: 10.7860/JCDR/2017/24228.10028.

15. Alwhaibi M, Alhindi G, Alshamrani M, Essa MB, A. Al Aloola N, Alhawassi TM. Pharmacovigilance in healthcare education: students' knowledge, attitude and perception: a cross-sectional study in Saudi Arabia. BMC Med Educ. 2020;20:210. doi: 10.1186/s12909-020-02116-2.

16. Madae'en S, Dmour I, Alrosan AZ, Alwidyan T, Alrosan K, Alqhewii T, et al. Pharmacovigilance in pharmacy education: students' knowledge, attitude and perception: a cross-sectional study in Jordan. Currents in Pharmacy Teaching and Learning. 2025;17 (11):102442. doi: 10.1016/j.cptl.2025.102442.

17. Alnawaiseh NA, AL-Oroud RY. Knowledge, attitude and practices of pharmacovigilance and adverse drug reaction reporting among pharmacists working at Alkarak Governorate, Jordan. Biomedical and Pharmacology Journal. 2022;15(2):967–978. doi: 10.13005/bpj/2432.

18. Zhao Y, Yang L, Tan R, Yuan J. Evaluation of the knowledge of and attitudes towards pharmacovigilance among healthcare students in China: a cross-sectional study. BMC Med Educ. 2024;24 (1):570. doi: 10.1186/s12909-024-05561-5.

19. Ayyash MA, Nassar RI, Al-Muhtaseb R, Jaber KA. Drug regulatory affairs under focus: knowledge and perceptions among pharmacists and pharmacy students. PLoS One. 2025;20(3):e0320599. doi: 10.1371/journal.pone.0320599.

20. Abu Hammour K, El-Dahiyat F, Abu Farha R. Health care professionals knowledge and perception of pharmacovigilance in a tertiary care teaching hospital in Amman, Jordan. Journal of Evaluation in Clinical Practice. 2017;23(3):608–613. doi: 10.1111/jep.12683.

21. Tiwari A, Mishra PS, More S, Sharma A, Hetawal P, Patel S. Assessment of knowledge, attitude, and practices toward pharmacovigilance among undergraduate medical students of a tertiary care teaching hospital of central India. National Journal of Physiology, Pharmacy and Pharmacology. 2023;13(9):1806–1810. doi: 10.5455/njppp.2023.13.01052202304022023.

22. Kulmi M, Chittora G, Mahashabde P, Sharma PK. Assessment of knowledge, attitude and practices regarding pharmacovigilance among medical students of a tertiary care teaching hospital in central India. J Cardiovasc Dis Res. 2022;13(5):2673–2679. Available from: https://www.jcdronline.org/index.php/JCDR/article/view/13494

23. Saadah LM, Khan AH, Syed Sulaiman SA, Bashiti IA. Maximizing acceptance of clinical pharmacy recommendations to reduce length of hospital stay in a private hospital from Amman, Jordan. BMC Health Serv Res. 2021;21:937. doi: 10.1186/s12913-021-06966-4.