Research Article

Assessment of pharmacy students' awareness and knowledge of the COVID-19 pandemic and vaccines in Jordan: A cross-sectional study at private universities

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Abstract

Introduction: The COVID-19 pandemic prompted a global effort in developing vaccines to combat the virus. While several COVID-19 vaccines have been authorized and distributed internationally, there is a lack of research on the knowledge and perceptions of pharmacy students regarding these vaccines in Jordan.

Methods: A cross-sectional study was conducted among pharmacy students at a private university in Jordan from July 28 to August 5, 2022. A Google survey consisting of 12 questions was administered to 200 respondents.

Results: The survey aimed to assess pharmacy students' understanding of COVID-19 clinical characteristics, transmission routes, precautionary measures, hazard control, and knowledge of the different types of COVID-19 vaccines available in Jordan. Literature review indicated that students primarily obtained information from social media (80%), written articles (20%), and television (10%). The overall score for students' awareness of COVID-19 and its vaccines was 85%. The majority of students (82%) demonstrated a high level of knowledge and awareness of the pandemic. However, their understanding of hypercoagulation as an adverse event of COVID-19 vaccination and mask-wearing practices in various settings was limited. Most students believed that effective immunization strategies could eradicate the virus.

Conclusion: Our findings indicate that pharmacy students possess a good understanding of COVID-19 and its vaccines. To enhance infection prevention among future pharmacists, measures and public awareness campaigns should be implemented to promote knowledge about the benefits of immunization in combating the COVID-19 pandemic.

Introduction

In March 2020, the declaration by the World Health Organization confirmed the global outbreak of the COVID-19 pandemic caused by the emergence of a novel coronavirus strain called severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) (COVID CDC 2021). While many COVID-19 patients exhibit mild to severe respiratory symptoms, a significant portion can experience severe respiratory distress, pneumonia, and even mortality

(Babiker et al. 2014). By September 2021, over 6 million individuals had been infected worldwide, resulting in more than 2 million recorded deaths due to the pandemic. At the time of this study, over 3 million Jordanians had been vaccinated against COVID-19, highlighting the crucial role of pharmacists in patient care and their involvement in the interdisciplinary healthcare team's decision-making process, medication administration, and patient care evaluation (Lopez Bernal et al. 2021). Therefore, the expertise, motivations, and actions of pharmacists, along with their inclusion in pandemic management and COVID-19 vaccinations, are essential for pandemic control (McIntosh et al. 2020). Pharmacists have the responsibility of disseminating information, providing quality healthcare services, and safeguarding individuals from infection during any pandemic outbreak (Mahase 2020). In response to these considerations, this study aims to assess pharmacy students' understanding of the COVID-19 pandemic and vaccinations, evaluating their level of awareness and implications for public health (Almaaytah and Salama 2022). Furthermore, this research seeks to contribute to the development of an effective educational program that promotes awareness among future healthcare providers. To the best of the authors' knowledge, this study is the first of its kind to specifically examine the knowledge, attitudes, and practices of pharmacy students in Jordan regarding COVID-19 and its vaccines (Raouf et al. 2020).

Materials and methods

Study design and sample size

From July 28 to August 28, 2022, Jordan's private universities' faculties of Pharmacy conducted cross-sectional administrative research. RaoSoft, an online sample size calculator, was used to compute the sample size. With a level of certainty of 95% and an error margin of 5%, the minimal desired sample size was 200 individuals based on an estimated total of 450 students and a 50% response rate.

Instrument for survey

Questionnaire Development and Data Analysis A pre-validated questionnaire was created based on an extensive review of the literature, incorporating up-to-date information from reputable sources such as the World Health Organization (Zhong et al. 2020), the Centers for Disease Control and Prevention (CDC, USA), and the Jordanian Ministry of Health. The initial version of the questionnaire underwent review by a panel of experts selected for their expertise and knowledge in relevant fields. They assessed the research questions for relevance, clarity, and significance. The final version of the questionnaire was administered through a Google form, which was distributed to participants via email. The questionnaire consisted of two main parts: demographic information and questions related to students' knowledge, attitudes, and practices

(KAP). The demographic section included variables like age, gender, and current residence. The knowledge assessment component comprised 12 questions covering various aspects of COVID-19. The first four questions (Q1–Q4) focused on clinical signs of COVID-19, questions 5–7 (Q5–Q7) addressed transmission routes, and questions 8–12 (Q8–Q12) assessed preventive measures and vaccination information. Participants were required to respond with "true," "false," or "I don't know." Each correct response received one point, while incorrect or uncertain answers received zero points. The overall knowledge score ranged from 0 to 12, with higher scores indicating a better understanding of COVID-19. The survey also included two questions (A1–A2) to measure participants' level of agreement with COVID-19 control measures and their confidence in the effectiveness of vaccines. Participants' behaviors were evaluated through four questions (P1–P4) assessing their attitudes toward crowded places, mask-wearing practices, adherence to social distancing guidelines, and vaccine uptake. Additionally, a question was included to determine the sources from which participants obtained COVID-19 information. The study assured respondents that their personal information and responses would remain confidential and anonymous. Participation in the study was voluntary and required informed consent.

Data analysis

The collected data was analyzed using the Statistical Package for the Social Sciences (SPSS) version 21.0 (SPSS 20.0, Chicago, IL). The significance level for all analyses was set at $p < 0.05$. The data from the questionnaire was initially categorized into variables, and the internal consistency of the pilot study was assessed using Cronbach's alpha coefficient. The normality of the data was checked using the Kolmogorov-Smirnov test. Descriptive and inferential statistical analyses, including chi-square tests, Mann-Whitney U tests, correlations, and logistic regression, were utilized. To assess the participants' knowledge levels regarding the COVID-19 pandemic, a scoring system was employed. Each question was assigned a score of one for correct answers and zero for incorrect answers. The mean knowledge scores (KSs) of the participants were calculated by summing their responses to all knowledge questions. The knowledge score was then scaled from 0 to 12, with higher scores indicating a better understanding of COVID-19, vaccines, and the pandemic. Participants were categorized into different knowledge level groups using a cutoff point of 80%, considering scores above 80% as good and scores below 80% as poor (Xiao et al. 2011).

Results

Subject Characteristics: The study included a total of 200 pharmacy students who completed an online survey. The average age of the participants was 21±1 years, with

90 (45%) male students. The majority of students, 180 (90%), resided in Amman, while 20 (10%) lived in other regions of Jordan (refer to Table 1). The findings indicated that social media (80%) was the most common source of COVID-19 information for students, followed by written articles (20%), and television (10%). COVID-19 Related Knowledge Characteristics: The primary objective of this study was to assess the understanding of pharmacy students regarding COVID-19. The overall COVID-19 knowledge score was 85% (refer to Table 1). Based on the 80% cutoff criterion, 82% of students demonstrated a good level of knowledge and awareness about the epidemic, while 18% had insufficient knowledge. Among the four questions measuring comprehension of COVID-19 clinical manifestations (Q1–Q4), the highest correct answer rate (95%) was observed for the statements "Fever,

tiredness, and a dry cough are the predominant clinical symptoms of COVID-19 illness (True)" and "Elderly individuals and individuals with pre-existing health issues are more likely to develop serious illness with COVID-19" (refer to Table 1). The statement "Coagulation dysfunction is a significant leading cause of mortality in patients suffering from severe COVID-19 (True)" had the lowest correct answer rate (45% in total). For the question "COVID-19 may cause aches and pains, nasal congestion, runny nose, sore throat, or diarrhea in some persons," 15% of students responded with "I don't know." The following three questions (Q5–Q7) evaluated students' understanding of transmission routes, with Q5 (90% correct), Q6 (98% correct), and Q7 (96% correct) achieving good ratings. The results for the next five questions (Q8–Q12), which assessed knowledge of COVID-19 prevention and vaccination, were similar. The study found a significant association between knowledge scores and the use of published articles as a source of information (p < 0.05). COVID-19 Related Attitude and Practice Characteristics: A set of questions was used to investigate students' attitudes and practices related to COVID-19. The COVID-19-related attitude item with the highest positive response rate was "Are you certain that health-care workers and specialists can succeed in the fight against the COVID-19 virus using vaccines?" (95% of respondents agreed). The question with the lowest favorable response rate was "Do you believe that COVID-19 vaccination is the only way to eradicate COVID-19?" (85% of respondents agreed) (refer to Table 2). The COVID-19-related practice item with the highest performance rate was "Have you recently visited

Table 1. Demographic and source of knowledge.

socio-demographic characteristics	No	(%)
Age (years)(mean±SD, range)	21±1	
Gender		
Male	90	45%
Female	110	55%
Place of current residence		
Amman	180	90%
Other government	20	10%
Sources of information		
social media	160	80%
written articles	40	20%
television	20	10%
Physicians	50	25%

Table 2. Knowledge of students towards COVID-19.

Questions	Agree (%)	Disagree (%)	I don't know (%)	Bivariate RR (95% CI)
Fever, fatigue, and a dry cough are the most common COVID-19 symptoms.	190 (95%)	5 (2.5%)	5 (2.5%)	0.959 (0.819–1.123)
Some COVID-19 virus sufferers may experience aches and pains, nasal congestion, runny nose, sore throat, or diarrhea.	150 (75%)	20 (10%)	30 (15%)	0.727 (0.619–0.853)
In individuals with severe COVID-19, coagulation dysfunction is one of the leading reasons of death.	90 (45%)	100 (50%)	10 (5%)	1.562 (1.015–2.403)
COVID-19 appears to cause significant sickness more frequently among the elderly and those with pre-existing medical disorders (such as high blood pressure, heart disease, lung disease, cancer, or diabetes).	188 (94%)	1 (0.5%)	11 (5.5%)	0.72 (0.40–0.86)
When a person has COVID-19, they will not transfer the virus to others unless they have a fever.	180 (90%)	20 (10%)	0	0.84 (0.74–1.01)
When a person with COVID-19 coughs or exhales, tiny droplets from the nose or mouth move from person to person.	196 (98%)	4 (2%)	0	0.54 (0.34–0.87)
Wear a mask only if you have COVID-19 symptoms or are caring for someone who may have COVID-19.	192 (96%)	8 (4%)	0	0.64 (0.469–0.873)
Children and young adults do not need to take any precautions to avoid becoming infected with the COVID-19 virus.	190 (95%)	6 (3%)	4 (2%)	0.896 (0.709–1.133)
Individuals should avoid crowded settings, such as public transportation, to avoid becoming infected with COVID-19.	188 (94%)	10 (5%)	2 (1%)	0.959 (0.819–1.123)
Antibiotics are ineffective against COVID19 since it is caused by a virus. Antibiotics should not be used to prevent or treat COVID-19 infection. And the immunizations are the only alternative.	193 (96.5%)	7 (3.5%)	0	0.84 (0.74–1.01)
You are vaccinated and believe that the vaccination is the only method to defeat COVID 19.	198 (99%)	0	2 (1%)	0.72 (0.40–0.86)
Will you advise people to be vaccinated?	196 (98%)	0	4 (2%)	0.967 (0.851–1.098)
Knowledge score (mean±SD, range)		Number		%
Knowledgeable		164		82%
Insufficient knowledge		36		18%

Table 3. Attitudes & practice of students towards COVID-19.

Questions	Agree (%)	Disagree (%)	I don't know (%)	Bivariate RR (95% CI)
Do you believe COVID-19 can be effectively controlled using vaccines?	190 (95%)	10 (5%)	0	
'Do you believe that taking COVID-19 vaccines is the only way to get rid of COVID 19?	170 (85%)	30 (15%)	0	
Have you been to a crowded place in the last few days?	188 (94%)	12 (6%)	0	
Have you worn a mask before leaving your residence in the last few days?	121 (60.5%)	79 (39.5%)	0	
Did you maintain a social distance of at least 2 meters from other people in the last few days?	150 (75%)	50 (25%)	0	
Do you believe that everyone should get the vaccine?	180 (90%)	20 (10%)	0	

any crowded places?" (94% of respondents answered no). Conversely, the item with the lowest performance rate was "Have you used a mask when outside your apartment recently?" (60.5% of respondents answered no). Gender differences were observed in habits related to going out in crowded places, with females showing a lower inclination compared to males. Additionally, males were found to maintain better social distance than females. Significant associations were identified between knowledge sources and certain practices. For example, wearing a mask when leaving the house was associated with obtaining information from television, while relying on doctors' advice as a source of information was linked to maintaining a social distance of at least 2 meters from others ($p < 0.05$) (Table 4). The study also examined the correlation between knowledge, attitude, and practice measures. A significantly low positive correlation was found between attitude and practice ($r = 0.2$; $p < 0.01$). Knowledge and attitudes, as well as knowledge and behaviors, appeared to be unrelated (refer to Table 3). Students with a good understanding of COVID-19 were three times more likely to believe that COVID-19 can be effectively managed with vaccines (98% agreement) (1.03–4.72, confidence interval). Students residing in Amman were 2.5 times more likely to follow social distancing practices compared to students in other districts and governorates.

Table 4. The relationship between Knowledge , attitude and practice.

Variables	rank correlation coefficient	P-value
Attitude and knowledge	−0.046	0.34
Knowledge and practice	0.054	0.9
Attitude and practice	0.24	0.009

Discussion

The present study aimed to assess the awareness and knowledge of pharmacy students in Jordan regarding the COVID-19 pandemic and vaccines. The findings revealed that pharmacy students generally demonstrated good awareness and knowledge of the pandemic. However, there were certain areas of knowledge gaps identified, particularly regarding coagulation dysfunction as a leading cause of mortality in severe cases of COVID-19 (World Health Organization 2020) . The study highlighted the influential role of social media as the primary source of COVID-19 information for pharmacy students. While social media provides a wide reach, it is important to ac-

knowledge the challenges associated with ensuring the accuracy and reliability of information obtained from these platforms (Fraser et al. 2009). Pharmacy students exhibited a high level of understanding regarding COVID-19 transmission routes and preventive measures. This indicates that pharmacy education programs in Jordan adequately cover these topics (Scott et al. 2010). However, continuous education and training initiatives should be implemented to address any emerging knowledge gaps and provide updated information on COVID-19 (Jordan et al. 2020) . In terms of COVID-19 vaccines, pharmacy students demonstrated a good understanding of their efficacy, safety profile, and availability (Taber 2018). This knowledge is vital as pharmacy students will play a crucial role in promoting vaccination and addressing vaccine hesitancy. Ongoing education and updates on vaccine-related information are necessary to ensure that students remain well-informed about the latest developments and research. The study also explored pharmacy students' attitudes and practices related to COVID-19. While the majority expressed confidence in healthcare workers and vaccines in combating the virus, there were varying levels of agreement regarding the belief that COVID-19 vaccination is the sole solution for eradicating the disease. This emphasizes the need for accurate information dissemination and addressing misconceptions to promote informed decision-making. There were variations in COVID-19-related practices among pharmacy students, with some not consistently adhering to recommended behaviors such as mask usage and social distancing. These findings indicate the importance of continuous reinforcement of preventive practices and the implementation of interventions to improve adherence among pharmacy students (Souan et al. 2022) Associations were found between knowledge sources and certain practices, highlighting the influence of information received on behavior (Talafha et al. 2022) Effective communication strategies and reliable sources of information are essential in shaping behavior and promoting public health practices among pharmacy students. The correlation analysis revealed a low positive correlation between attitude and practice, suggesting that attitudes alone may not always translate into corresponding behaviors (Tang et al. 2020) . Additionally, no significant correlations were observed between knowledge and attitudes, as well as knowledge and behaviors. This highlights the need to address attitudinal and behavioral factors separately when designing interventions to promote desired health outcomes. It is important to acknowledge the limitations of this study. First, the cross-sectional design

limited the ability to establish causality or assess changes in knowledge and practices over time. Second, the sample size was relatively small, comprising pharmacy students from private universities in specific regions of Jordan, which may limit the generalizability of the findings to the entire pharmacy student population in the country. Future research with larger, diverse samples and longitudinal designs would provide a more comprehensive understanding of pharmacy students' awareness, knowledge, attitudes, and practices related to COVID-19. Also, does not contain questions about the need for the frequency of vaccination, students' awareness of different types of vaccines against COVID-19. In conclusion, this study provides valuable insights into the awareness, knowledge, attitudes, and practices of pharmacy students in Jordan regarding the COVID-19 pandemic and vaccines. The findings highlight areas of strength as well as opportunities for improvement in pharmacy education and public health campaigns. Targeted interventions, continuous education, and collaborative efforts among healthcare professionals, educators, and policymakers are necessary to enhance knowledge, promote positive attitudes, and ensure the adoption of appropriate preventive practices among pharmacy students and future pharmacy practitioners.

Conclusion

COVID-19 is most likely well-known among pharmacy students. Some clinical indications of severe COVID19 infection, such as hypercoagulation, are unknown to them. The latest research is the first conducted in Jordan to investigate future pharmacists' knowledge and attitudes concerning pandemic illnesses. Lastly, pharmacy students' awareness of COVID-19, as well as the factors that impact their attitudes and behaviors regarding the illness, might be used to drive prevention efforts. To lower the likelihood of infection among future pharmacists, measures and education programs should be established. Pharmacy students should study more about the severity and repercussions of a COVID-19 infection, as well as the significance of COVID 19 vaccines.

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