



RESEARCH ARTICLE

ASSESSMENT OF THE STUDENTS IN PHARMACY EDUCATIONAL INSTITUTES
OF LAHORE, PAKISTAN, REGARDING COVID-19 AND ITS IMPACT ON THEIR
EDUCATION: AN ONLINE CROSS-SECTIONAL SURVEY

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ABSTRACT

Background: Globally, COVID-19 pandemic has drastically trembled day to day activities, including education. **Objective:** This study aims to assess students studying at pharmacy institutes that are located in Lahore, Pakistan. **Methodology:** An online cross-sectional survey was performed from 25th August to 25th December, 2020 in order to collect the data from students. The Statistical Package for Social Sciences (SPSS Version: 25) was used to commute descriptive statistics and independent t-test. **Results:** Total 471 responses were received out of which 261 (55.4%) females and 210 (44.6%) males participated in this study. The majority of population 429 (91.1%) belonged to Doctor of Pharmacy (Pharm-D) in comparison to 33 (6%) M.Phil./MS and 9 (1.9%) PhD scholars. The summary of the results with maximum response against each question is: 201 (42.7%) participants were not satisfied by e-lectures, 435 (92.4%) had internet availability, 354 (75.2%) replied they were guided before switching to online teaching, 201 (42.7%) claimed they understood e-lectures thoroughly, 420 (89.2%) faced internet and voice interruptions, 420 (89.2%) said their lab and research work got disturbed during pandemic, 261 (55.4%) were satisfied with their assessment, 273 (58%) said that pandemic had affected their mental health and 366 (77.7%) students were optimistic and wished they could study physically in their institutes. **Conclusion:** COVID-19 pandemic affects the education system in a worst possible way. Once this pandemic is over, proper policies should be developed by the government and pharmacy institutes to facilitate students regarding clinical rounds, industrial internships and retail rotations so they can perform well in their professional field.

Keywords: COVID-19, Education, Pharmacy, Pandemic, Teaching.

INTRODUCTION

January 2020, marked in history as a beginning of COVID-19 pandemic and no one could anticipate that it could change the face of globe in an unexpected way. It has created a massive panic among scientist and general population as it is a novel virus and still no treatment is available to cure this infection. COVID-19 affects the human societies in a worst possible way and almost all the sectors of life were forced to rearrange and reshape (1). In this alarming situation, all sorts of daily activities have been suspended as social distancing considered imperative to prevent the spread of infection. Soon after the lockdown announcement, all organizations included educational institutes were closed and policy 'work from home' was followed throughout the globe (2). This health catastrophe was a big threat to all the teaching institutes, to prevent the loss of students they had to reallocate from the physical classroom to virtual teaching. During the period of confinement, faculty members were directed to teach via digital learning platforms. Subsequently, this shift leads to the technology revolution globally and soon students and teachers started to interact virtually (3). Before switching to e-learning, teachers and students were properly guided through online platforms about the use of different technologies and available electronic teaching tools. Without any further delay, online lectures and examinations were started. Moreover, many organizations succeeded in arranging virtual scholastic events, including conferences, workshops, seminars and webinars (4).

This research is mainly paying attention to the impact of coronavirus pandemic on the

studies of pharmacy students. Pharmacy is a professional degree which comprised of a diverse syllabus and pharmacy aspirants have to complete required theoretical content of the course alongside the recommended experiments, clinical rotations, industrial internships and retail pharmacy clerkships (5, 6). Hence, after cancellation of on-campus classes and exams, the first problem was to tackle the adjustments of pharmacy core curriculum according to the current crisis demands and needs. Selection of an appropriate online learning platform was also a big concern for the educational authorities and institutes. Different modes of electronic media were introduced, including Zoom, Google Meet and Learning Management System (LMS) etc. (7). Besides all the possible efforts that were made to deal with calamity; complex teaching atmosphere at home, distribution of the workload among teachers, information gap while delivering online lectures, synchronized simulation, internet availability, voice distortions and interruption of the internet signals remained as the point of debate (8-10).

Pharmacy students and researchers are much worried about their practical training and future employment. Government and pharmacy teaching organizations should make some strategies to facilitate pharmacy scholars in terms of internships and practical skills. Later, they must be evaluated on strict criteria so that they have requisite competencies to perform their duties in a better way (11).

This article is aimed to investigate the impact of COVID-19 on Pharmacy education by taking the students' responses of different pharmacy institutes located in Lahore, Pakistan region as previously no such study has been

documented. We hoped that this study may serve as a reference and would be helpful in future to implement policies regarding crisis and education.

MATERIALS & METHODS

Study Design and Duration

An online cross-sectional survey was done from 25th August, 2020 to 25th December, 2020 in order to obtain the data because physical interaction for questionnaire distribution and filling was not possible during pandemic.

Subjects

This is online survey-based research of the 471 undergraduate and postgraduate students studying in various pharmacy educational institutes of Lahore, Pakistan.

Inclusion Criteria

All undergraduate (Doctor of Pharmacy) and postgraduate (MS/M.Phil/PhD) students enrolled in government, semi government and private sector pharmacy institutes of Lahore, Pakistan were included in the present study.

Exclusion Criteria

All those undergraduate and postgraduate students who were not enrolled in pharmacy discipline were excluded. Those participants who were studying in pharmacy institutes that are located outside the Lahore, Pakistan were also disqualified for this study.

Data Collection Instrument & Procedure

A structured questionnaire was constructed in the Google forms by consulting recent published articles (2, 12-14). The credibility of the questionnaire was tested by Cronbach's Alpha which is found to be 0.70 revealing that the data collection form is reliable. A Google form link was shared with students via WhatsApp and emails.

This link is also shared on social media websites, i.e., Twitter, Facebook, LinkedIn etc. The authors have also sought help from their reliable connections to spread this sample collection form in order to get maximum response from the volunteers. Data collection form was divided into the two sections first dealt with participant consent. Participants were provided full consent before participation in the online survey and then navigated to main form. Second Section is the main form which is further divided to obtain demographic information, responses to close ended questions regarding knowledge, attitude and practices of pharmacy students and open-ended questions section in order to gain more valuable feedback and comments from the students.

Data Analysis

All the analysis were performed by using the Statistical Package for Social Science (SPSS Version: 25). For data entry in SPSS, the options No, Yes and May be codes were assigned as 0, 1, and 2 respectively. Descriptive statistics and independent t-test were calculated to evaluate the received data. The value of *p* (statistical significance level) was kept less than 0.05 which was considered significant for this study.

RESULTS

Out of 500 responses, 471 were considered for computation of the results while 29 were rejected as they were not following the research inclusion criteria. Information regarding the socio-demographic is presented in Table 1. Results showed that majority of the population belonged to an age group of 21-25 (51%) and was unmarried 459 (97.5%). The female respondents were highest in numbers 261

(55.4%) in comparison to male respondents which were 210 (44.6%). Population demographic statistics revealed that the mainstream of the students was living in Lahore City 342 (72.6%) while remaining students were hostilities, came from villages 81(17.2%) and towns 48 (10.2%) to study in Lahore, Pakistan. Most of the students 429 (91.1%) were currently

enrolled in Doctor of Pharmacy (Pharm-D) program, however 33 (6%) and 9 (1.9%) students were doing M.Phil./MS and PhD respectively in pharmacy disciplines. A large amount of the students 444 (94.3%) were studying in private sector institutions juxtaposed to government 18 (3.8%) and semi government 9 (1.9%) institutions.

Table 1. Socio-demographic information of the students studying at pharmacy institutes of Lahore, Pakistan

Parameter	N	%	±SD
Age			
16-20	219	46.5	0.535
21-25	243	51.6	
26-30	9	1.9	
Gender			0.498
Male	210	44.6	
Female	261	55.4	
Marital Status			0.158
Unmarried	459	97.5	
Married	12	2.5	
Living Area			0.519
Village	81	17.2	
City	342	72.6	
Town	48	10.2	
Educational level currently enrolled			0.559
Doctor of Pharmacy (Pharm-D)	429	91.1	
M.Phil./MS	33	6	
PhD	9	1.9	
Institute			0.33
Government	18	3.8	
Semi Government	9	1.9	
Private	444	94.3	

Information regarding knowledge and practices was taken from the participants and results are exhibited in Table 2 and Figure 1. Concerning about satisfaction towards online teaching, the majority of the students 201 (42.7%) replied in negative whereas 150 (31.8%) gave positive feedback and 120 (25.5%) were unconfident. 354 (75.2%) of the respondents acknowledged that their institutions gave them a demonstration about using online platforms before switching to digital learning as compared to 51 (10.8%) who didn't receive any guidance in this regard and 66 (14%) were uncertain. 426 (90.4%) participants asserted that study material/references/videos/books etc in soft copy was shared by their instructors whilst 36 (7.6%) were undetermined and 9 (1.9%) said that they weren't provided with any kind of study material. 201 (42.7%) of the research population had admitted that they thoroughly understood the online lectures while 93 (19.7%) replied in negative and 177 (37.6%) were indecisive. Most of the scholars 420 (89.2%) claimed that they faced interruptions during online teaching such as network, voice modulation issues and other technical glitches, etc. as compared to 18 (3.8%) who believed that it is a comfortable mode of teaching and 33(7%) were unsure. Nearly all of the participants 420 (89.2%) avowed that their laboratory or research work got recklessly affected due to COVID-19 pandemic, though 30 (6.3%) stated that they didn't face any sort of issue and 21 (4.5%) were not fixed regarding this matter. 357 (75.8%) of the current study population confessed that their family members cooperated during their online lectures when weighed against 54 (11.5%) who nullified this statement

and 60 (12.7%) were irresolute about it. Regarding the online examination assessment, 261 (55.4%) students answered in affirmation and thought to be satisfied whilst 126 (26.8%) were not pleased and 84 (17.8%) didn't replied on it. 285 (60.5%) of the study candidates accepted that their instructors acquainted them with practical knowledge along with theoretical information, however 93 (19.7%) of the respondents negated it and a similar number of the contributors were found to be dubious on the same topic. 273 (58%) participants indicated that virtual teaching and learning badly affected their physiological and mental well-being and on the other hand 111 (23.6%) of the participants didn't experienced this health issue and 87 (18.5%) were puzzled and didn't answered. 198 (42%) respondents said that they strived to improve their skills and learning via online courses, webinars, workshops etc. while 90 (19.1%) didn't paid any attention and 183 (38.9%) were ambiguous. A large number of the students 294 (62.4%) verified that pandemic depressingly affected their education while 87 (18.5%) stated the otherwise and 90 (19.1%) were undermined. Students were also asked about the overall performance of their educational organization for continuing education during lockdown. 276 (58.6%) were contented by the overall performance of their educational organization, however 114 (24.2%) were not happy and 81 (17.2%) were hesitant to give response. The bulk of the scholars 366 (77.7%) were optimistic and would like to go back to their institutions in contrast to 54 (11.5%) who didn't want to attend physical classes and 51 (10.8%) of the participants preferred silence.

Table 2. Closed ended questions and answers related to the knowledge and practices of pharmacy students

Title	Yes		No		May be		±SD	P value
	N	%	N	%	n	%		
Are you satisfied with online learning?	150	31.8	201	42.7	120	25.5	0.808	0.524
Your institute gave a demonstration about using online platforms before switching to online teaching?	354	75.2	51	10.8	66	14	0.498	0.843
Your teachers are supportive and cooperative Study material/references/videos/books in soft etc. regarding topic shared with you by your instructor	375	79.6	18	3.8	78	16.6	0.434	0.167
You understand e-lectures thoroughly	201	42.7	93	19.7	177	37.6	0.737	0.133
During online teaching, you faced interruptions like network down/voice issue etc.	420	89.2	18	3.8	33	7	0.328	0.019
Your lab work or research work disturbed due to pandemic	420	89.2	30	6.3	21	4.5	0.311	0.423
Your family members cooperate with you while you are taking lectures online?	357	75.8	54	11.5	60	12.7	0.492	0.99
Are you satisfied with your assessment? With theoretical knowledge, practical information regarding to your subject also provided by instructor?	261	55.4	126	26.8	84	17.8	0.662	0.815
Online learning psychologically/mentally disturbed you	273	58	111	23.6	87	18.5	0.647	0.15
During lockdown period, you tried to improve your skills via online courses, webinars, workshops etc.	198	42	90	19.1	183	38.9	0.736	0.705
This pandemic overall negatively affects your education	294	62.4	87	18.5	90	19.1	0.614	0.136
You are satisfied with your educational organization for the efforts to continue education during lockdown	276	58.6	114	24.2	81	17.2	0.64	0.843
You want to go back your institution and prefer classroom teaching?	366	77.7	54	11.5	51	10.8	0.473	0.342



Figure 1. Illustration of closed ended questions and answers related to the knowledge and practices of pharmacy students

Answers regarding open ended questions are displayed in Table 3. The comments of the students concerning the online evaluation methods which were adopted by instructors, are summarized as; 412 (87.4%) quizzes, 392 (83.2%) feedback, 278 (59%) questions and answers, 407 (86.41%) assignments, 60 (12.7%) used additional mode for the assessment (for example, Google Forms, Moodle, LMS etc). Respondents also adopted healthy activities during lockdown i.e. 120 (25.5%) exercise, 432 (91.7%) balance

diet, 321 (68.2%) selection of healthy games, 50 (10.6%) painting and 112 (23.8%) cooking. Furthermore, a question was designed on the improvement of online teaching in response to which participants replied with few suggestions such as 213 (45.2%) by provision of full internet access, 302 (64.2%) by accessibility of recorded lectures, 174 (36.9%) were least hopeful about any improvement and 153 (32.5%) gave no suggestion.

Table 3. Open-ended questions and answers related to the knowledge and practices of pharmacy students

Title	N	%
How you assessed by your teachers?		
Quizzes	412	87.47
Feed Back	392	83.23
Answer Questions	278	59.02
Assignments	407	86.41
Others	60	12.74
Healthy activities you adopted during lockdown		
Exercise	120	25.48
Balance Diet	432	91.72
Select Healthy Games	321	68.15
Painting	50	10.62
Cooking	112	23.78
Nothing new	42	8.92
How online teaching can be improved?		
By full internet access	213	45.22
By providing recoded lectures	302	64.12
Can't be improved	174	36.94
No suggestion	153	32.48

DISCUSSION

In early 2020, the coronavirus 2019 (COVID-19) disease outbreak transformed into the pandemic and human life drastically collapsed all around the earth. To avoid the spread of disease, social distancing was suggested as a solution and lockdown was observed around the globe (1). This confinement destroyed almost every sector of human existence, including the education system. Worldwide, face-to-face learning and examinations were temporarily cancelled. Similar practices were also adopted in Pakistan and the Ministry of Education published a notice to provisionally cease all activities in educational organizations, including universities, public and private schools,

technical and vocational training establishments etc. Subsequently, instructions were followed by educational institutes around the state and vigorous efforts were made to equip academicians for virtual teaching (15). Despite the fact, these efforts were quite helpful to reduce the transmission of infection but at the same time this radical change has created a panic among students and teachers (16).

Pharmacy is an empirical noble occupation. In 1948, Pharmacy education was started in Pakistan by a Public sector university called University of the Punjab. Till the late 1990s, only public sector universities were offering degree in pharmacy. With the passage of time, this profession gained recognition in the country and afterwards private institutes

were also allowed to offer pharmacy education to cater the need of pharmacy graduates in Pakistan. Now these private educational organizations have outnumbered the public sector institutes with requisite skills and competencies to produce pharmacists that can dish up in multiple areas of the pharmacy profession (17). The education of pharmacy is based on an amalgamation of conjectural and technical knowledge with real time practical experience. Due to pandemic, virtual learning was a great challenge for pharmacy scholars as to gain practical skills and required competencies in their subject area they have to work in laboratories, clinics and industries. Many developed countries have succeeded to build e-model of the laboratory settings to convey practical content of the syllabus to students (18, 19).

In prevailing scenario, which online teaching platform should be used was a major point of debate. Faculty members of various pharmacy establishments were instantly engaged in this regard and multiple virtual discussions were held to identify optimum modern technologies with best format to continue smooth teaching and to avoid educational loss of the students. Besides, evaluation of the online teaching methods and to cope up to the required demands of virtual learning in a timely fashion were also a big challenge for educational institutes in the current period of health crisis (20, 21). In Pakistan, students' community belonged to both city and rural areas. Pharmacy students inhabiting in rural areas faced many difficulties like the accessibility of the internet and availability of digital devices (computer, android mobile etc.). Moreover, students have to purchase internet data due to limited resources that

put extra financial burden on them. Government and concerned authorities should take necessary steps in order to financially assist less privileged pharmacy students (22). As all types of examinations were cancelled, ministry of education directed educational organizations to modify assessment policies. Pharmacy academicians were provided with a wide range of evaluation methodologies (assignments, quizzes, presentations, projects, viva examination etc.) and were directed to select any one or combination of provided options that would represent objective of their Class Learning Outcomes (CLO) in a best possible way. A fear was prevalent among the pharmacy students regarding online exams and their performance. Before conducting online exams, clear instructions were delivered to students, i.e., code and conduct of online exams, distribution of the marks, time allowed etc. Almost all organizations successfully conducted online exams of academic year 2019-2020 (second semester) (23, 24). Many studies have indicated the impact of pandemic crisis on the psychological health of the students. During COVID-19 students experienced various psychological issues such as worry, fear and anxiety that may be due to their concern about studies and future hiring. In such circumstances, family support cannot be ignored. Motivation and encouragement, particularly provided by family members can play an important role to maintain mental well-being of the students (25, 26). In time of health crisis, pharmacy students should actively participate in virtual conferences, workshops, seminars and webinars to keep themselves engaged and updated regarding recent practices that will not only boost their knowledge but also polish their skills

(27, 28). There is a dire need that all stakeholders (students, administrators and teachers) cooperate with each other so that this situation routed successfully. Further, teaching organizations should give confidence to students and their faculty members to stay connected and enthusiastically move forward to achieve their goals during current COVID-19 emergency (24, 29-31).

Study Limitations

This study has a few limitations as mentioned below:

1. The current study is confined to the pharmacy teaching institutes located in region of Lahore, Pakistan.
2. Data collection was limited to those students who were approachable via online.

CONCLUSION & FUTURE RECCOMENDATIONS

To conclude, the current pandemic has an overall devastating influence on the education system. Proper course instructions, study material and resources should be provided to students in order to continue the learning process without any hindrance. It is recommended that once this health crisis will get over, government and respective pharmacy teaching institutes should take mandatory steps and make strategies to facilitate students regarding their internships, clinical residencies and their exposure to industries. Such initiatives would be helpful to build confidence among students and unlock better job opportunities for them in future.

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DECLARATIONS

Authors' Contributions

KA contributed to study concept. AY and MA contributed to study design and data collection. KA, RP, AA contributed in data analysis and interpretation. HAS, RP and MA did the literature review and critically reviewed the manuscript. All the authors read and approved the final manuscript.

Ethical Approval

Ethical approval was obtained from The Research & Ethics Committee of The Superior College, Lahore (IRB # 21-08-REC2020).

Conflict of Interest

The authors declare no conflict of interest among them.

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REFERENCES

1. Wijesooriya NR, Mishra V, Brand PL, Rubin BK. COVID-19 and telehealth, education, and research adaptations. *Paediatric Respiratory Reviews*. 2020;35:38-42. <https://doi.org/10.1016/j.prrv.2020.06.009>
2. Bajwa MA, Ashiq K. The COVID-19 crisis and supportive role of pharmacists in cancer patients. *Journal of the Dow University of Health Sciences*. 2020;14(2):95-6. <http://doi.org/10.36570/jduhs.2020.2.966>
3. Crawford J, Cifuentes-Faura J. Sustainability in higher education during the COVID-19 pandemic: A systematic

- review. *Sustainability*. 2022;14(3):1879. <https://doi.org/10.3390/su14031879>
4. Bao W. COVID-19 and online teaching in higher education: A case study of Peking University. *Human behavior and emerging technologies*. 2020;2(2):113-5. <https://doi.org/10.1002/hbe2.191>
 5. Ashiq K. Importance of Project-based learning (PBL) for Pharmacy Education. *Turkish Journal of Pharmaceutical Sciences*. 2023; inpress. <https://doi.org/10.4274/tjps.galenos.2022.69023>
 6. Fuller KA, Heldenbrand SD, Smith MD, Malcom DR. A paradigm shift in US experiential pharmacy education accelerated by the COVID-19 pandemic. *American Journal of Pharmaceutical Education*. 2020;84(6). <https://doi.org/10.5688/ajpe8149>
 7. Sandars J, Correia R, Dankbaar M, de Jong P, Goh PS, Hege I, Masters K, Oh SY, Patel R, Premkumar K, Webb A. Twelve tips for rapidly migrating to online learning during the COVID-19 pandemic. *MedEdPublish*. 2020;9:1-19. <https://doi.org/10.15694/mep.2020.000082.1>
 8. Zhang W, Wang Y, Yang L, Wang C. Suspending classes without stopping learning: China's education emergency management policy in the COVID-19 outbreak. *Journal of Risk and financial management*. 2020;13(3):55. <https://doi.org/10.3390/jrfm13030055>
 9. Porpiglia F, Checucci E, Autorino R, Amparore D, Cooperberg MR, Ficarra V, Novara G. Traditional and virtual congress meetings during the COVID-19 pandemic and the post-COVID-19 era: is it time to change the paradigm?. *European urology*. 2020 Sep;78(3):301. <https://doi.org/10.1016/j.eururo.2020.04.018>
 10. Jacob ON, Abigeal I, Lydia AE. Impact of COVID-19 on the higher institutions development in Nigeria. *Electronic Research Journal of Social Sciences and Humanities*. 2020;2(2):126-35.
 11. Brazeau GA. Lessons Learned and Brighter Opportunities for Pharmacy Education Amid COVID-19. *American Journal of Pharmaceutical Education*. 2020;84(6):641-3. <https://doi.org/10.5688/ajpe8230>
 12. Chen X, Ran L, Liu Q, Hu Q, Du X, Tan X. Hand hygiene, mask-wearing behaviors and its associated factors during the COVID-19 epidemic: A cross-sectional study among primary school students in Wuhan, China. *International journal of environmental research and public health*. 2020;17(8):2893. <https://doi.org/10.3390/ijerph17082893>
 13. Sabry NA, Kamel A, Farid SA. Designing and using an online survey as a tool for teaching pharmacy students about COVID-19: Innovation in experiential learning or assessment. *Pharmacy Education*. 2020;20(2):19-20. <https://doi.org/10.46542/pe.2020.202.1920>
 14. Aucejo EM, French J, Araya MP, Zafar B. The impact of COVID-19 on student experiences and expectations: Evidence from a survey. *Journal of public economics*. 2020;191:104271. <https://doi.org/10.1016/j.jpubeco.2020.104271>
 15. Esposito S, Principi N. School closure during the coronavirus disease 2019 (COVID-19) pandemic: an effective intervention at the global level? *JAMA pediatrics*. 2020;174(10):921-2. <https://doi.org/10.1001/jamapediatrics.2020.1892>
 16. Elmer T, Mephram K, Stadtfeld C. Students under lockdown: Comparisons of

- students' social networks and mental health before and during the COVID-19 crisis in Switzerland. *Plos one*. 2020;15(7):e0236337. <https://doi.org/10.1371/journal.pone.0236337>
17. Bashir S, Khan AU, Mahmood M, Abbas M, Akhtar S, Khan AW, Aqeel MT, Akhlaq M, Ahmad H. Students' perception of the learning environment in private-sector pharmacy institutes of Pakistan. *Pharmacy Education*. 2020;20:191-7. <https://doi.org/10.46542/pe.2020.201.191197>
18. Sadjadi EN. Challenges and Opportunities for Education Systems with the Current Movement toward Digitalization at the Time of COVID-19. *Mathematics*. 2023;11(2):259. <https://doi.org/10.3390/math11020259>
19. Bajwa MA, Ashiq S, Qayyum M, Khokhar R, Tanveer S. An Updated Review: The Year 2020 and COVID-19 Pandemic. *Thai Journal of Pharmaceutical Sciences*. 2021;45(5).
20. Hussain FN, Al-Mannai R, Agouni A. An emergency switch to distance learning in response to the COVID-19 pandemic: experience from an internationally accredited undergraduate pharmacy program at Qatar University. *Medical Science Educator*. 2020 Dec;30:1393-7. <https://doi.org/10.1007/s40670-020-01079-9>
21. Al-Fraihat D, Joy M, Sinclair J. Evaluating E-learning systems success: An empirical study. *Computers in Human Behavior*. 2020;102:67-86. <https://doi.org/10.1016/j.chb.2019.08.004>
22. Adebisi YA, Agboola P, Okereke M. COVID-19 pandemic: medical and pharmacy education in Nigeria. *International Journal of Medical Students*. 2020;8(2):162-4. <https://doi.org/10.5195/ijms.2020.559>
23. Alqurshi A. Investigating the impact of COVID-19 lockdown on pharmaceutical education in Saudi Arabia—A call for a remote teaching contingency strategy. *Saudi Pharmaceutical Journal*. 2020;28(9):1075-83. <https://doi.org/10.1016/j.jsps.2020.07.008>
24. Sahu P. Closure of universities due to coronavirus disease 2019 (COVID-19): impact on education and mental health of students and academic staff. *Cureus*. 2020;12(4). <https://doi.org/10.7759/cureus.7541>
25. Cao W, Fang Z, Hou G, Han M, Xu X, Dong J, Zheng J. The psychological impact of the COVID-19 epidemic on college students in China. *Psychiatry research*. 2020;287:112934. <https://doi.org/10.1016/j.psychres.2020.112934>
26. Ashiq K, Ashiq S, Bajwa MA, Tanveer S, Qayyum M. Knowledge, attitude and practices among the inhabitants of Lahore, Pakistan towards the COVID-19 pandemic: an immediate online based cross-sectional survey while people are under the lockdown. *Bangladesh Journal of Medical Science*. 2020;20:69-S. <https://doi.org/10.3329/bjms.v19i0.48169>
27. Durand E, Kerr A, Kavanagh O, Crowley E, Buchanan B, Bermingham M. Pharmacy students' experience of technology-enhanced learning during the COVID-19 pandemic. *Exploratory research in clinical and social pharmacy*. 2023;9:100206. <https://doi.org/10.1016/j.rcsop.2022.100206>
28. Ashiq K, Bajwa MA, Ashiq S. COVID-19 pandemic and its impact on pharmacy education. *Turkish Journal of*

Pharmaceutical Sciences. 2021;18(2):122.
<https://doi.org/10.4274/tjps.galenos.2020.39024>

29. Rashid AA, Rashid MR, Yaman MN, Mohamad I. Teaching medicine online during the COVID-19 pandemic: a Malaysian perspective. Bangladesh Journal of Medical Science. 2020.
<https://doi.org/10.3329/bjms.v19i0.48170>

30. Bajwa MA, Ashiq K, Hafeez H, Qayyum M, Tanveer S, Arslan W. Health Emergency with COVID-19 and Supporting Role of Community

Pharmacists in Pakistan. RADS Journal of Pharmacy and Pharmaceutical Sciences. 2020;8(4).

<https://doi.org/10.37962/jpps.v8i4.421>

31. Crawford J, Butler-Henderson K, Rudolph J, Malkawi B, Glowatz M, Burton R, Magni P, Lam S. COVID-19: 20 countries' higher education intra-period digital pedagogy responses. Journal of Applied Learning & Teaching. 2020;3(1):1-20.

<https://doi.org/10.37074/jalt.2020.3.1.7>



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