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COVID-19 SPECIAL COLLECTION

RESEARCH ARTICLE

Impact of the COVID-19 national lockdown on pharmacy students' productivity and their coping strategies in a developing country: An online survey in Nigerian universities

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Abstract

Background: The COVID-19 pandemic in Nigeria led to a national lockdown that resulted in the suspension of academic activities. **Objective:** To evaluate the impact of the COVID-19 national lockdown on pharmacy students' productivity and their coping strategies. **Methods:** This study involved the cross-sectional collection of responses from undergraduate students of six Nigerian schools of pharmacy. Data was collected using a structured, validated questionnaire in the form of Google form. The data was entered into a statistical product and service solutions software (SPSS, version-25) for analysis. **Results:** A total of 808 students responded to the questionnaire. The majority of the students' responses (757, 93.7%) showed that their reading duration had decreased during the lockdown. The most missed variable during the closure by students was 'school life' (303, 37.5%). The use of social media (133, 16.5%) was the most common coping strategy. The majority of the students, 544 (67.3%), agreed to participate in the virtual mode of learning. The cost of data was the main challenge to online learning by the students (288, 36.0%). **Conclusion:** This study shows that the productivity of pharmacy students decreased during the COVID-19 lockdown. Social media and business activities were the most common coping mechanisms of pharmacy students. Pharmacy students were willing to accept virtual learning despite possible challenges.

Introduction

The COVID-19 pandemic is a global shock, especially because it was unprecedented and has spared no sector or aspect of human life (Gondwe, 2020). In Wuhan, the capital of the Hubei province of China, the first recorded cases of COVID-19 were witnessed as an epidemic in late 2019 and by March 2020, the World Health Organisation (WHO) declared COVID-19 a pandemic and on the 27th of February 2020, Nigeria recorded its first case (Daniel & Bamidele, 2020; WHO 2020). Since the ripple progression of this pandemic, many nations have faced, and are still facing, national lockdowns, with academia being among the first sectors that faced a rapid shutdown of all its activities (Rajhans *et al.*, 2020). In March 2020, Nigeria

started imposing lockdowns in some states of the country to forestall the spread of COVID-19 (Kalu, 2020). The COVID-19 national lockdown in Nigeria was implemented in phases and varying proportions, depending on the number of cases reported in different states of the country (Kalu, 2020).

The pandemic had its toll on various aspects of human life and education was not spared, as across the nation all institutes for primary, secondary, and tertiary education had all physical activities halted (Federal Ministry of Education, 2020). This has forced students in Nigerian universities to sit back at home with uncertainties on when academic activities will resume. As of April 8th 2020, UNESCO reported that schools have been suspended nationwide in 188 countries and over 90% of enrolled learners (1.5 billion students) worldwide are now without education (Lee, 2020). As many institutions of learning suspended classroom teaching and switched to online teaching, the lives of students changed drastically. This was due to an increase in the social isolation of students and a simultaneous decrease in the focus and interest of these students on academic-related activities, causing lower productivity levels (Elmer, Mepha, & Stadtfeld, 2020). Although some schools can endeavour to provide online classes, these are unavailable to the majority of students in resource-limited settings like Nigeria where many students lack computers or high-speed Internet services, thus making a considerable number of families unable to afford or sustain the educational needs of their wards (Briggs & Numbere, 2020).

School routines are important coping mechanisms for young people with mental, health, family, and personality issues, however, when schools are closed these students lose an anchor in life which affects their productivity (Lee, 2020). The lack of productivity can be attributed to an increased likelihood of physical and sexual abuse, teenage pregnancies, bullying, and outright hooliganism stemming from the prolonged lockdowns, lack of food, inflation in prices, and widespread poverty in developing countries like Nigeria (Briggs & Numbere, 2020).

Schools' closure during the lockdown period in Nigeria could have a significant impact on students' productivity in terms of reading hours and other learning activities. This effect is likely to be more pronounced on pharmacy students due to the peculiarities of pharmacy education, as it involves clinical rotation exposure, laboratory experiences, internships, in-person didactic lectures and tutorials, presentations, and clinical clerkship amongst many others (Ayogu, Isah, & Adibe, 2018; Adebisi, Agboola, & Okereke, 2020). Also, since a good number of pharmacy students are in the process of preparing for, or undertaking, assessments that require clinical exposure, the impact of the COVID-19 pandemic on Nigerian pharmacy students is likely to be highly significant, due to the probable disastrous post-pandemic effects on immediate academic performance and competency of these future healthcare professionals (Adebisi, Agboola, & Okereke, 2020). The COVID-19 lockdown thus creates a complex mixture of threats and opportunities for pharmacy education in Nigeria and highlights the need for critical evaluation. The objective of this study was to evaluate the impact of the COVID-19 national lockdown on pharmacy students' productivity and to ascertain their coping strategies to provide an evidence-based foundation for the promulgation of recommendations to prevent enormous adverse disruption of future pandemics on pharmacy students' productivity.

Methods

Study design

This study, a questionnaire-based online survey, involved the cross-sectional collection of responses from undergraduate students of a limited selection of Nigerian schools of pharmacy.

Study setting

Nigeria is geographically divided into six zones: north-east (NE), north-central (NC), north-west (NW), south-west (SW), south-south (SS), and southeast (SE). Purposely, one university in each of the zones was chosen for this study, considering two criteria: availability of a pharmacy school and access to the students' WhatsApp-enabled numbers. The institutions selected were the University of Nigeria, Nsukka (UNN) – SE, the University of Lagos, Lagos (UNILAG) – SW, the University of Maiduguri (UNIMAID) – NE, the University of Jos, Jos (UNIJOS) – NC, the Ahmadu Bello University, Zaria (ABU) – NW, and the University of Uyo (UNIUYO) – SS.

Study sample

Pharmacy students in their professional years of study were recruited for this study. The professional years of study in Nigerian pharmacy schools are from the second year to the fifth year, based on the five-year Bachelor of Pharmacy degree. A six-year Doctor of Pharmacy degree has recently been approved at some institutions, but none of them offer the degree yet. Using the total population of pharmacy students in the six schools, the sample size was calculated using the Raosoft online sample size calculator,

fixing the confidence interval at 95%. The calculation showed that a minimum of about 450 responses would be enough for the study to cover the six institutions. However, the sample size was considered to be too small when it was divided proportionately among the participating schools and stratified to cover all study levels in the institutions. Thus, the obtained sample size was doubled to give a required sample size of 900 for the study.

Data collection tool

A questionnaire was developed for this study. It involved the use of print and electronic literature to determine possible questions that fit the research objectives of the study. The compiled questions were then validated (both face and content) to confirm that they would fit the intended research questions. Thereafter, a Cronbach's alpha analysis was run to establish the instrument's reliability. The final draft was then transformed into a Google form whose link was used to collect responses.

Study procedure

The shortened link of the Google form was sent to the students of the various institutions after obtaining the permission of the appropriate authorities, as well as the students' consent. The questionnaire link was sent to each student's number to avoid multiple completions by a respondent. The data collection was stopped after three months.

Data management and analysis

At the completion of data collection, the responses were downloaded into Microsoft Excel (2016) and checked for completeness. The cleaned data was exported into a statistical product and service solutions software (SPSS, version-25) for statistical analysis. The students' responses were summarised using descriptive statistical analysis. This included the use of frequency and percentages. The relationship between the dependent and independent categorical data in the study variables was determined using chi-square. In all cases, a two-tailed *p*-value of less than 0.05 was considered statistically significant.

Results

Sociodemographic characteristics of the pharmacy students

The response rate in this study was 89.8%. UNN, which had the largest student population of the selected schools, had the highest response of 468 (58.4%), while UNIJOS had the least response (35, 4.4%). Out of the 808 students who responded to the questionnaire, 779 (96.4%) were neither married nor engaged. There was an almost equal distribution of the students based on gender, as there were 408 (50.5%) females among them. In Table I, the students' sociodemographic characteristics are shown, including their current place of residence, age category, and pre-closure year of study, among others.

Table I: Sociodemographic characteristics of the pharmacy students

Characteristics	Frequency	%
Age (years)		
18 - 20	274	33.9
21 - 25	463	57.3
26 - 30	64	7.9
Greater than 30	7	.9
Total	**808**	**100.0**
Marital Status		
Single	779	96.4
Engaged	14	1.7
Married	15	1.9
Total	**808**	**100.0**
Accommodation		
School hostel	420	52.0
Off-campus accommodation	313	38.7
Family home accommodation	75	9.3
Total	**808**	**100.0**
Current residence		
Rural	158	19.6
Urban	650	80.4
Total	**808**	**100.0**
Gender		
Male	400	49.5
Female	408	50.5
Total	**808**	**100.0**
Current qualification		
Senior school certificate examination	709	87.7
National diploma/National certificate in education	21	2.6
Bachelor's degree	78	9.7
Total	**808**	**100.0**
Year of study		
Second year	238	29.5
Third year	193	23.9
Fourth year	153	18.9
Fifth year	224	27.7
Total	**808**	**100.0**
Institution		
University of Nigeria Nsukka	468	58.4
University of Uyo	43	5.4
University of Jos	35	4.4
University of Lagos	114	14.2
Ahmadu Bello University Zaria	68	8.5
University of Maiduguri	73	9.1
Total	**801**	**100.0**

Table II: Impact of the national lockdown/school closure on the pharmacy students

Variable of the impact of lockdown	Frequency	%
Duration of lockdown (months)		
0	1	0.1
1	55	6.8
2	85	10.5
3	290	36.0
4	253	31.4
5	122	15.1
Total	**806**	**100.0**
What is most missed		
Learning	287	35.5
Friends	103	12.7
School life	303	37.5
Freedom away from parents	90	11.1
Nothing	5	.6
All of the options	14	1.7
Financial support from parents	2	.2
Others	4	.5
Total	**808**	**100.0**
Greatest implication of the lockdown		
Delay of year of graduation	303	37.5
Prolonged period away from studies	111	13.8
Reduction in upkeep allowance	20	2.5
Others	3	.4
Nothing	9	1.1
Delay of year of graduation and prolonged period away from studies	191	23.7
Delay of year of graduation, prolonged period away from studies, and reduction of upkeep allowance	111	13.8
Prolong period away from studies and reduction of upkeep allowance	15	1.9
Delay of year of graduation and reduction of upkeep allowance	44	5.5
Total	**807**	**100.0**
Ever read any school materials since lockdown?		
No	210	26.0
Yes	598	74.0
Total	**808**	**100.0**
Reading duration		
Decrease	757	93.7
Increase	51	6.3
Total	**808**	**100.0**
Most read quarter	557	68.9
First quarter	557	68.9
Second quarter	133	16.5
Third quarter	118	14.6
Total	**808**	**100.0**

Impact of the national lockdown/school closure on the pharmacy students

Although all schools in the country were shut down during the national lockdown, different locations had a varying degree of lockdown for other mundane activities. Just over a third of the students reported a lockdown duration of three months, as stated by 290 (36.0%) of 806 students. The least reported duration of lockdown was a month, which was reported by one student. The most missed variable from the closure by the students was 'school life' (303, 37.5%), while 303 (37.5%) students mentioned that the greatest implication of the lockdown was a delay of their year of graduation. The impact of the lockdown on students is illustrated in table II, while table III shows the variation in the students' reading habits as the lockdown persisted in their various points of residence.

Coping strategies of pharmacy students in the lockdown

To cope with the lockdown, students engaged in different activities. An almost equal number reported that they were engaged on social media (133, 16.5%) and in business activities (131, 16.2%). However, the majority of the students, 544 (67.3%), agreed to participate in a virtual mode of learning while the lockdown lasted. Zoom was the most preferred mode of learning for the students (344, 43.1%), while the cost of out-of-pocket payment for data was the main challenge to online learning for the students, as stated by 288 (36.0%) (Table IV).

Relationship between sociodemographic characteristics and acceptability of online learning

The only statistically significant relationship between the sociodemographic characteristics and the willingness to participate in online learning was gender. More female students (290) expressed willingness to participate in online learning compared to their male counterparts (254), p=0.022.

Relationship between sociodemographic characteristics and perceived challenges to online learning

Out of the four sociodemographic characteristics that were examined in relation to the possible challenges to online learning for the students, only marital status presented a statistically significant relationship of $p \leq 0.0001$. However, fewer than 4% of the respondents were married. The students whose marital status was 'single' returned the highest proportion for most of the challenges to online learning that were presented to them in the study. The full relationship variations are shown in Table V.

Table III: Pharmacy students' reading habit of various courses during the lockdown (N=808)

Course	Quarter of lockdown	Never	Once in a month	Twice in a month	More than twice in a month
		Frequency (Percentage)			
Clinical pharmacy	First	348 (43.1)	143 (17.7)	116 (14.4)	201(24.9)
	Second	416 (51.5)	163 (20.2)	117 (14.5)	112 (13.9)
	Third	523 (64.7)	119 (14.7)	70 (8.7)	96 (11.9)
Pharmacology	First	312 (38.6)	164 (20.3)	130 (16.1)	202 (25.0)
	Second	378 (46.8)	183 (22.6)	132 (16.3)	115 (14.2)
	Third	484 (59.9)	140 (17.3)	84 (10.4)	100 (12.4)
Pharmaceutics	First	396 (49.0)	145 (17.9)	103 (12.7)	164 (20.3)
	Second	471 (58.3)	156 (19.3)	109 (13.5)	72 (8.9)
	Third	562 (69.6)	131 (16.2)	59 (16.2)	56 (6.9)
Pharmacognosy	First	393 (48.6)	153 (18.9)	109 (13.5)	153 (18.9)
	Second	482 (59.7)	154 (19.1)	102 (12.6)	70 (8.7)
	Third	573 (70.9)	120 (14.9)	68 (8.4)	47 (5.8)
Pharm. Chem.	First	345 (42.7)	154 (19.1)	133 (16.5)	176 (21.8)
	Second	432 (53.5)	155 (19.2)	129 (16.0)	92 (11.4)
	Third	543 (67.2)	115 (14.2)	76 (9.4)	74 (9.2)
Pharm. Micro.	First	428 (53.0)	134 (16.6)	102 (12.6)	144 (17.8)
	Second	497 (61.5)	136 (16.8)	104 (12.9)	71 (8.8)
	Third	573 (70.9)	109 (13.5)	67 (8.3)	59 (7.3)
Pharm. Tech.	First	492 (60.9)	121 (15.0)	91 (11.3)	104 (12.9)
	Second	540 (66.8)	138 (17.1)	83 (10.3)	47 (5.8)
	Third	600 (74.3)	112 (13.9)	62 (7.7)	34 (4.2)

Table IV: Coping strategies of pharmacy students in the lockdown

Coping strategies	Frequency	%
What do you do with most of your times?		
Reading class work	13	1.6
Engagement on social media	133	16.5
Playing games	11	1.4
Locum job as a pharmacy assistant	32	4.0
Business activity	131	16.2
Online academic programmes	12	1.5
All of the options	43	5.3
Engagement on social media and playing games	60	7.4
Reading class work, engagement on social media, and business activity	23	2.8
Engagement on social media, playing games, and business activity	73	9.0
Engagement on social media, playing games, and private practice in a pharmacy as an assistant	17	2.1
Engagement on social media and online academic programmes	116	14.4
Engagement on social media and online academic programmes	7	.9
Others	121	15.0
Engagement on social media and locum job as a pharmacy assistant	16	2.0
Would you accept a virtual learning mode for now until the lockdown is lifted?		
No	264	32.7
Yes	544	67.3
Total	**808**	**100.0**

Coping strategies	Frequency	%
Which lecture delivery mode would you prefer?		
Live video	328	40.6
Live audio	52	6.4
Recorded video	307	38.0
Recorded audio	121	15.0
Preferred online learning mode		
WhatsApp	284	35.6
Zoom	344	43.1
Google classroom	130	16.3
Google meeting	24	3.0
Telegram	11	1.4
Others	5	.6
What would be your challenge(s) in an online class at the moment?		
Laptop/mobile devices	36	4.5
Access to internet	21	2.6
Cost of data	288	36.0
Power source to charge device	20	2.5
All of the options	83	10.4
Access to internet, cost of data, and power to charge device	107	13.4
Access to Internet and cost of data	82	10.3
Cost of data and power source to charge device	104	13.0
Laptop/mobile devices and cost of data	50	6.3
Laptop/mobile devices and access to Internet	8	1.0

Table V: Relationship between sociodemographic characteristics and perceived challenges to online learning

Sociodemographic characteristics (N = 799)			Challenge(s) to online learning										Total
			Laptop/ mobile devices	Internet access	Cost of data	Electricity	All of the options	Internet access, cost of data, and electricity	Internet access and cost of data	Cost of data and electricity	Laptop/ mobile devices and cost of data	Laptop/ mobile devices and Internet access	
Age (years) *p = 0.255*	18 - 20	Frequency	8	7	109	7	25	31	32	34	16	0	269
		Percentage	22.2	33.3	37.8	35.0	30.1	29.0	39.0	32.7	32.0	0.0	33.7
	21 - 25	Frequency	25	11	159	10	51	64	42	64	29	5	460
		Percentage	69.4	52.4	55.2	50.0	61.4	59.8	51.2	61.5	58.0	62.5	57.6
	26 - 30	Frequency	3	3	19	2	6	11	7	4	5	3	63
		Percentage	8.3	14.3	6.6	10.0	7.2	10.3	8.5	3.8	10.0	37.5	7.9
	Greater than 30	Frequency	0	0	1	1	1	1	1	2	0	0	7
		Percentage	0.0	0.0	.3	5.0	1.2	.9	1.2	1.9	0.0	0.0	.9
Marital status *P ≤ 0.0001*	Single	Frequency	32	19	285	18	79	104	80	100	46	8	771
		Percentage	88.9	90.5	99.0	90.0	95.2	97.2	97.6	96.2	92.0	100.0	96.5
	Engaged	Frequency	3	2	1	0	1	1	0	2	4	0	14
		Percentage	8.3	9.5	.3	0.0	1.2	.9	0.0	1.9	8.0	0.0	1.8
	Married	Frequency	1	0	2	2	3	2	2	2	0	0	14
		Percentage	2.8	0.0	.7	10.0	3.6	1.9	2.4	1.9	0.0	0.0	1.8
Gender *p* = 0.101	Male	Frequency	21	15	138	12	41	44	38	54	26	7	396
		Percentage	58.3	71.4	47.9	60.0	49.4	41.1	46.3	51.9	52.0	87.5	49.6
	Female	Frequency	15	6	150	8	42	63	44	50	24	1	403
		Percentage	41.7	28.6	52.1	40.0	50.6	58.9	53.7	48.1	48.0	12.5	50.4
Level before the lockdown *p = 0.094*	Second year	Frequency	9	5	99	6	18	31	20	31	14	1	234
		Percentage	25.0	23.8	34.4	30.0	21.7	29.0	24.4	29.8	28.0	12.5	29.3
	Third year	Frequency	16	5	64	4	16	22	25	26	9	2	189
		Percentage	44.4	23.8	22.2	20.0	19.3	20.6	30.5	25.0	18.0	25.0	23.7
	Fourth year	Frequency	4	5	64	2	18	21	14	12	12	1	153
		Percentage	11.1	23.8	22.2	10.0	21.7	19.6	17.1	11.5	24.0	12.5	19.1
	Fifth year	Frequency	7	6	61	8	31	33	23	35	15	4	223
		Percentage	19.4	28.6	21.2	40.0	37.3	30.8	28.0	33.7	30.0	50.0	27.9

Discussion

The COVID-19 pandemic has resulted in an unprecedented impact on global health (Sandhu & de Wolf, 2020). Many countries have adopted total or partial lockdowns to curtail the transmission of COVID-19 (UNECA, 2020). This has resulted in a visible impact on different spheres of human life, part of which include educational institutions (Sahu, 2020). The lockdown has exposed university students, including pharmacy students, to varying degrees of anxiety and distress which could have a far-reaching impact on their self-esteem, confidence, productivity, and overall wellbeing (Schlesselman *et al*., Divall, 2020; Stephen & Omonyemen, 2020).

This study sought to explore the effect of a COVID-19 national lockdown in a developing country on pharmacy students' productivity, their coping mechanisms, and their willingness to participate in virtual learning. Respondents in this study were evenly spread across gender. This has been the finding of another study conducted among pharmacy students in Nigeria (Aluh, Abba, & Afosi, 2020). The majority of the respondents in this study were within the 18-25 age category. This is consistent with the age category of undergraduate students in Nigerian institutions, which could be attributed to the six-three-three-four educational model. Under this system, undergraduate students in Nigeria will be at least 16 before they get into their first academic year at university (Aluh, Okonta, & Odili, 2019).

About one-third of the pharmacy students in this study named school life as what they missed the most during lockdown. School life is a broad term that incorporates both the academic and social life of students in their respective institutions. Despite the rigorous nature of the pharmacy curriculum, students still engage in different extracurricular activities that are important to their professional and personal growth (Sabourin, Prater, &

Mason, 2018; Kalu, 2020). The need for social distancing that came with COVID-19 and the eventual closure of schools has denied students the opportunity to physically interact and socialise with their peers which has caused serious concern among pharmacy students (Elmer et al., 2020). Such disruptions could have a serious consequence on students' mental health (Aafka, 2020; Fuller *et al.*, 2020). A similar finding was observed among pharmacy students from Monash University in Australia and in Malaysia where students were found to grieve the loss of social interaction with their peers and engagement in co-curricular activities (Lyons, Christopoulos, & Brock, 2020). Learning new skills and knowledge, among other reasons, is one of the students' main purposes of attending universities (Reed, Kennett, & Emond, 2015; Bhardwa, 2017). It is therefore not surprising that after missing school life, learning activities were the most missed events by students. Learning activities were missed by about 35% of the respondents. Learning activities determine students' progress through their studies and also determine when a student can graduate from pharmacy school.

About one-tenth of the respondents in this study indicated that they missed their freedom away from parents, something which they enjoy when they are in school. Going to university has usually been associated with some level of freedom and independence (Lewis *et al*., 2015). Such autonomy and ability to independently make decisions are usually missed when students are in the midst of their parents and siblings.

Teaching and learning activities were abruptly halted because of the lockdown when most universities were actively conducting their academic activities (Jacob et al., 2020). Students have left back home with courses that were taught already, and several pending academic activities (Jacob *et al*., 2020). Unlike in developed countries, where remote learning and teaching methods were able to be adopted, in Nigeria the lockdown means that learning is completely suspended in most tertiary institutions until it is safe to return to classrooms (Anifowoshe *et al.*, 2020; Choi *et al.,* 2020; Sandhu & de Wolf, 2020). Despite these challenges, the authors of this study found that pharmacy students continued reading their courses during lockdown. Most of the respondents (76%) in this study showed that they have read their courses during lockdown. However, a significant majority (93.7%) indicated that their reading time had decreased. This decrease in productivity could be related to a lack of motivation and increased stress and pressure caused by the COVID-19 pandemic (INGSA, 2020).

There was also a progressive decline in the number of students that read their courses during lockdown. The number of students who read their courses was highest during the first quarter (68%) and fell to 14% in the last quarter of the lockdown, indicating an increase in distress and pressure on students, coupled with decreased motivation toward studies as the number of cases increased and the lockdown continued (Grubic, Badovinac, & Johri, 2020). There were variations in the rate at which pharmacy students read their courses from different departments. Pharmacology and clinical pharmacy courses were the most read by students in all quarters of the lockdown. This could be attributed to students' preference among the courses they are offered while in school. Most pharmacy students choose clinical pharmacy as a future career plan and will therefore focus more on the subjects with the most clinical application, even during the lockdown (Alhaddad, 2018). The number of students who read their courses progressively declined regardless of the department, except for those that read their courses twice in a month, where the second quarter had a higher proportion than the first.

The COVID-19 lockdown has affected the pharmacy students who participated in this study in many ways. The lockdown and social distancing policy has greatly impacted aspects of pharmacy training such as clinical rotations and clerkship in hospitals (Adebisi *et al*., 2020). This will eventually result in postponing the year of graduation for pharmacy students. Some pharmacy students in this study were worried that the lockdown will result in a prolonged period away from their studies. The majority of pharmacy students in this study also identified the postponement of the year of graduation as the greatest implication of the lockdown. Even after graduation, students are likely to be affected by the challenges of a global recession caused by COVID-19 (Sahu, 2020). Fourth- and fifth-year students made up more than 40% of the respondents in this study. This could explain why a significant proportion of the students were worried about the effect of the lockdown on their graduation time.

The lockdown imposed on daily activities as a result of COVID-19 could have a profound impact on the wellbeing of students staying away from schools (Schlesselman *et al*., 2020). To minimise the effect of the lockdown, different coping mechanisms were adopted by pharmacy students in this study. Social media is becoming increasingly popular (Akram & Kumar, 2017; Ngonso, 2019). The use of social media was the most common coping mechanism exhibited by pharmacy students. It is used as an avenue to interact with friends on different

social platforms and share information on trending issues within their social space (Akram & Kumar, 2017). Social media could therefore serve as a suitable alternative to the physical interaction pharmacy students missed having with their friends while in school (Elmer *et al.*, 2020). In a similar study among students, more than half reported using social media as a coping mechanism (Baloran, 2020). The use of both social media and online academic programmes as a coping mechanism was also adopted by up to 14% of pharmacy students. These practices could be related to the current residence of students during the lockdown. More than 80% of respondents in this study live in urban areas. The use of social media and online academic programmes requires good broadband Internet access, which is usually limited to the urban areas (Hoffman & De Wet, 2011; Townsend *et al*., 2013)

There is an unprecedented strain in the health workforce due to the COVID-19 pandemic (Mainoo & Ogurchak, 2020). Pharmacists are among the frontline health workers who continue to provide essential services during the COVID-19 pandemic (Bukhari *et al*., 2020; Elbeddini *et al*., 2020). This creates an opportunity for students, especially those in their final year, to support the overburdened pharmacy workforce. However, according to the findings of this study, only 4.0% of pharmacy students engage themselves in any form of pharmacy practice, either as locum or pharmacy assistants. This is contrary to the findings of a study in the UK where medical students agreed that assisting in hospitals during the COVID-19 pandemic will enhance their learning ability (Choi *et al*., 2020). Working in the pharmacy as a coping mechanism could serve as an avenue for students to learn new skills and integrate themselves into the health services provision team. Despite its potential benefits to students, working in the pharmacy during this period comes with an increased risk of contracting COVID-19 (Dzingirai *et al.*, 2020). Strict adherence to the recommended self-protection protocols by students will help in mitigating this risk.

Universities and colleges in developed countries were able to develop novel means of learning to ensure that students continue to receive teaching, thereby reducing the impact of COVID-19 on their academic activities (Choi *et al*., 2020; Sandhu & de Wolf, 2020). Most of these schools have transitioned teaching and learning activities from physical classrooms to the virtual space, which has proven to be effective (Romanelli *et al.*, 2020). The use of a virtual learning system was adopted by only a few private institutions in Nigeria. None of the public institutions from which the respondents in this study came implemented any form of virtual learning during the lockdown. When asked about whether they would accept virtual learning, most of the respondents (67.3%) in this study agreed. This demonstrates the willingness of pharmacy students to continue their learning process during the lockdown. The acceptability of an online learning mode was not affected by students' socio-demographic characteristics, other than gender. Females had a significantly higher acceptability of online learning than males. Contrary to the authors' findings, the majority of students in a study conducted in the Philippines disagreed with online learning, the primary reason being a poor Internet connection (Baloran, 2020).

Not only were pharmacy students willing to engage in virtual learning, but the majority preferred a live audiovisual delivery mode that allows for real-time interaction between them and their preceptors. Because of the popularity and ease of usage, most pharmacy students in this study chose Zoom as the preferred online learning mode. Zoom was identified as the most commonly used virtual learning platform among university students in India (Kapasia *et al*., 2020). This type of virtual learning model was adopted by the Monash University Faculty of Pharmacy in Australia and has proven to be successful in ensuring the continuity of pharmacy education (Lyons *et al.*, 2020).

Despite the readiness of pharmacy students to engage in virtual learning, some challenges were outlined as possible barriers to its successful implementation. Access to the Internet, cost of data, and power to charge devices was a challenge for 13.4% of the respondents. The use of virtual learning platforms requires the use of a power source to charge a laptop or mobile device. Electricity supply is still not stable in Nigeria, and poor power supply could hinder virtual learning among students (Stephen & Omonyemen, 2020). A lack of access to the Internet, especially among rural residents, can make virtual learning impossible. Several studies have pointed out poor access to the Internet as a major challenge to virtual learning (Baloran, 2020; Kapasia *et al*., 2020). Even in developed countries like the United States, access to reliable high-speed Internet connections is a possible challenge to the proper implementation of virtual learning (Fuller *et al.*, 2020; Sahu, 2020). The majority of the respondents cited the cost of data as a major challenge to online learning. This is because even with adequate power supply and access to the Internet, the high cost of data could hinder the optimal use of online learning. The high cost of data means that students will have to spend a huge sum of money to access lectures online, which raises many questions regarding the feasibility of online learning in Nigeria (Adebisi *et al*., 2020).

The findings of this study have provided the authors with an insight into how the COVID-19 lockdown affects the productivity of pharmacy students in Nigeria. It has also provided the authors with information on the willingness of pharmacy students to participate in virtual learning and the perceived barriers to its implementation. These findings are important to policymakers in pharmacy education. The findings of this study will serve as a guide in developing policies that will address pharmacy education needs in times of global public health pandemics such as COVID-19. Pharmacy schools will also find this study useful for designing academic programmes that will take into consideration the effects of the lockdown and the COVID-19 epidemic on the productivity and overall wellbeing of students when universities eventually resume.

Limitations

The cross-sectional design of this study posed the limitation of not having objective results of the changes in the students' academic productivity at different times of the lockdown period. A longitudinal study would, most likely, have presented findings from follow-up interventions as appropriate. But the findings of the study in its current design have provided invaluable insights into the students' self-reported perceived challenges from the closure of all schools, although the possible ways of overcoming the challenges were not documented. The online method of data collection in this study exempted some eligible students whose residence did not have Internet access or who could not afford the cost of mobile data. However, the lockdown protocols which involved social distancing made the online method of data collection the only choice. Moreover, the multi-centre approach of data collection ensured that different regions of the country were captured.

Conclusion

This study showed that the productivity of pharmacy students decreased during the COVID-19 lockdown. Most of the pharmacy students have reduced their reading time, and the number of those that read their courses has progressively decreased as the lockdown progressed. Social media and business activities were the most common coping mechanisms for pharmacy students. Pharmacy students were willing to accept virtual learning but have expressed worries over challenges such as the cost of data that could hinder its implementation.

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