



# Literature Review: “COVID-19 Pandemic: Where to Pharmacy Education?”

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## Abstract

The COVID-19 pandemic has greatly altered the way humanity lives in every scope of our lives. The socio-economic impact of lockdown measures is yet to be fully understood and measured. Educational systems have been disrupted thus affecting the approach and quality assessment of learning methodologies. The training of pharmacists is necessary for the discharge of an efficient and effective pharmaceutical service in light of heightened demand due to increased morbidity due to COVID-19 has been compromised. The literature review focuses on the corpus of work on online learning methodologies in general and their application and impact with respect to pharmacy education. A key attempt is made to trace the genesis, application, and challenges faced by academic institutions as they migrate onto an online pharmacy education platform to continue producing quality pharmacists effectively trained to meet today’s pharmaceutical service challenges in light of the COVID-19 pandemic and the future. The literature review article further evaluates the impact of such strategy on curriculum development and how enduring strategies can be formulated to enhance quality assessment and education. The paper engages with the various qualitative and quantitative approaches employed in the research process and their relevance in unearthing lasting views and solutions to the problem. The study concluded that migration to online pharmacy education had unique challenges for both students and academic staff hence the need for developing policies and systems that address these issues. Furthermore, it is necessary to develop support programs for ongoing initiatives. There is a compelling need for further research study into alternative content delivery systems.

## Subject Areas

Business Management

## Keywords

COVID-19, Pharmacy Education, Online Teaching, Quality Assessment, Online e-Learning

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## 1. Introduction

The global and regional impact of COVID-19 across all economies, industries and business sectors is still unfolding and its effects yet to be fully assessed. However, what has been apparent is that COVID-19 has altered the way humanity relates, lives, and interacts thus permanently altering the human ecosystems in the process. As such, most educational institutions are struggling to find appropriate measures to acclimatize to the new normal brought by the COVID-19 pandemic. The training of pharmacist and pharmacy support staff is critical to the running of an efficient and effective pharmaceutical service, moreso, in the COVID-19 era where demand for the service has been increasing to meet needs. In the discharge of pharmaceutical service training, both globally and regionally, one notes the varied response measures and efforts by academic institutions to contain further academic quality decline in pharmacy education in these difficult times. Training programs were bunked completely or altered to suit the unfolding situations. For those institutions that altered their training program approaches, the struggle has been to find the most suitable online learning strategies that uphold effective student learning experience, quality assessment and still produce a quality cadre who is able to provide uncompromised service.

This literature review traces the unfolding story of the strategies implemented by various academic institutions in diverse communities to respond to the challenge of COVID-19's impact on training of pharmacists and pharmacy support staff globally. The contextual settings and differences are noted and highlighted to provide a basis for future response strategies to mitigate the challenges associated with pandemics of such grave magnitude. The learnings from the varied interventions and their successes and demerits provide a basis for proactive interactions in the future. In their introduction, Kibuule *et al.* (2020) [1] clearly stated the issues identified with their research, the challenges faced and the impact of the research phenomena on outcomes related to it. The points included the inadequacies pertaining to modifications in training methods; the need to innovate beyond traditional content delivery methodologies; the compelling need for ICT integration; and the strengthening of pharmaceutical systems through continual in-built quality assurance assessments. Kibuule *et al.* (2020) [1] also posited a succinct current situational analysis of the subject by drawing the strengths and weaknesses of the Moodle platform under the current threats. The applicability of such response strategies is highly situational and would need localization to enhance implementation. Several global experiences and approaches are highlighted with a view to delineate and propose generic response

strategies in emergency situations. The impact of COVID-19 on pharmacy education is further elucidated and hopefully should in future pandemics of a similar magnitude arise, educators are better equipped to deal with the situations.

## 2. Literature Review

Since it erupted in Wuhan, the advent of COVID-19 brought radical approach dimensions to the management of diseases, impact on global public health and the socio-economic posture. Whilst the medical challenge was initially centred in China, its virulent spread across the globe left behind a disaster trail of significant magnitude and scope. Furthermore, the social landscape was completely altered by ushering in a new era with a dynamic way of engaging relationships and interactions. The disease burden placed huge demands on medical facilities, pharmaceutical training, service provision, choice of treatment regimens by medical practitioners and search for effective therapies.

Kibuule *et al.* (2020) [1] explicitly reflected on the genesis, impact, spread and enormity of COVID-19 and its impact on academic institutions against background of diverse global socio-economic backgrounds. Whilst there was increased demand for pharmacist training to improve medical care in hospital settings and pharmaceutical service provision, the authors bemoaned the effect of COVID-19 mitigation strategies during lockdown periods whereby lessons were suspended leaving the students with little hope for training completion. Furthermore, the authors noted the extent to which modification of learning methodologies have been utilized across Africa with varied success stories.

Meanwhile, Devlin & Samarawickrema (2010) [2] reviews the Australian Learning and Teaching Council's award system. The authors review the award system as an example of what effective teaching methodology should be and compare it with the Student Evaluation of Educational Quality (SEEQ) in a context of evolving educational environment. Their views set the tone for the need for educational review in Australia and argue that for teaching to be effective and relevant, it needed to proactively respond to the dynamics in the learning environment and incorporate the transformations occurring within into the educational ecosystem.

Shawaqfeh *et al.* (2020) [3] bemoaned the impact of COVID-19 on medical and pharmacy training. The authors highlight how institutions have been forced to close schools due to the pandemic thereby altering the general approach to traditional teaching methodology. Commenting further, Shawaqfeh *et al.* (2020) [3] reported closure of pharmacy schools in order to implement mandatory social distancing as a strategy to contain in-class further spread of COVID-19. In doing so, the strategy affected continued implementation of didactic teaching methodology and conducting of practical sessions in pharmacy schools. As such, the practical laboratory-based learning methodology which relies on social, physical and face to face interaction to impart and gauge knowledge transfer was grossly compromised. The challenges imposed by such shifts in learning me-

thodology may not be essentially appreciated for now. However, whilst didactic teaching methods may not be greatly impacted by such strategies in terms of learning assessments and outcomes. Thus, practical knowledge for pharmacy students may be affected in the long run.

Furthermore, Shawaqfeh *et al.* (2020) [3] argued that the migration to online teaching brought several challenges to lecturers and faculty members due to the need to maintain social distancing in delivering lecture notes, examinations and assessments. The students and teaching staff's exposure to health risk had to be curtailed. Challenges included impact of COVID-19 on student's mental health, lack of motivation by learners, difficulty in adapting to distance online learning methods, technical and bandwidth problems, and content creation of distance online learning materials for didactic and, especially, practical and laboratory-based courses. Other challenges include the economic impact on families and the immediate and high demand for training and IT support.

Bouali *et al.* (2020) [4] also argued about the level of uncertainty that prevailed in Morocco during the early phase of the COVID-19 pandemic. Pharmacy students were worried about when class resumption and examinations would occur for them to continue with their studies. Such anxiety climaxed more amongst the academic staff and faculties regarding potential possible intervention strategies to enable pharmacy students to enjoy their academic lifestyle. The case was further complicated by the abrupt stoppage of interns from conducting their internships in academic and teaching hospitals leading to serious drop in morale and psychological effects on the students, particularly those who had predisposing factors.

In the wake of the novel coronavirus (COVID-19) pandemic, Ferrel & Ryan (2020) [5] argued that the challenge was greater than just understanding the pathology and health impact of the disease but rather the impact of COVID-19 on medical education. Here, one notes the over-arching effect of disease progression on health workforce growth and development efforts. Meanwhile, Murphy (2020) [6] also argued that the COVID-19 pandemic which quickly led to the closure of universities and colleges around the world, would be curtailed by public health officials' advice of social distancing thereby flattening the infection curve, reduce total fatalities, and help the students to continue with their studies. Whilst such impact was unknown, faculty and medical students had to come up with proactive strategies to manage the crisis within the education system whilst maintaining quality education for the students. Being a new experience, any working strategy would be adopted to save development of the profession.

Meanwhile, in Nigeria Isah *et al.* (2020) [7] witnessed pharmacy schools' closure during the lock-down period with serious repercussions on students' productivity thus affecting their study time and other learning activities. Furthermore, such drastic measures impacted students' ability to attend clinical rotation exposure, perform and acquaint themselves with laboratory experiences, undertake clinical internships, have in-person didactic lectures and tutorials, presenta-

tions, and clinical clerkship amongst many others. Meanwhile, in Nigeria, Okeke *et al.* (2020) [8] further highlighted strategies implemented by the local in-country relevant stakeholders to improve the quality of pharmacy education on the backdrop of increasing COVID-19 transmission. Whilst total/partial lockdowns, banning of public gatherings and other unprecedented measures were enforced, delivery of pharmacy school academic activities were grossly affected.

In Saudi Arabia, Al Qumaizi (2020) [9] also reported the adverse effects of COVID-19 on medical student teaching and learning opportunities including the pharmacy school. Social distancing was applied as a critical control measure with unclear benefits and long-term effects in their learning experience. The view is corroborated by Karaoui & Chaine (2020) [10] who argued that the associated social distancing measures imposed by the current COVID-19 pandemic placed unprecedented global challenges on medical educational institutions. In the Asia-Pacific region, Lyons *et al.* (2020) [11] bemoaned the unprecedented global challenges faced by pharmacy schools and colleges with regard to delivering emergency remote teaching, placement of purposeful experiential experience for the students, providing support to the displaced or isolated students, maintaining clear communication channels with faculty members, staff members, and students. As such, students were not allowed to have in-class lessons even in large study rooms or halls, clinical settings and auditoriums. Of serious note was the loss of educational time and its down the line effect on the students who needed to acquire clinical experience and exposure in order to develop their practical expertise in medical and pharmacy practice resulting in a gap in learning and education.

In the UK, Sandhu, P., & de Wolf, M. (2020) [12] shared a similar view regarding the global impact of the coronavirus pandemic medical education. However, innovative educational delivery measures were embraced to avert the further spread of the virus whilst maintaining the closure of schools and universities to ensure continued learning and teaching using different methods of modality. The strategy enabled adoption of new methods of modalities, the continuation of education for the future NHS workforce and development of novel ways of online teaching and practical skills delivery in new medical curricula development for the medical students thus ensuring the release of an additional 5500 medical graduates to support the NHS during the pandemic. In similar vein, Mirzaian, E., & Franson, K. L. (2021) [13] also conceded that the global COVID-19 pandemic not only posed a challenge to education but created an opportunity to spearhead a digital transformation and the novel delivery of a Pharm.D. curriculum. Paradoxically, the pandemic fostered and accelerated adoption of global opportunities for new models of pharmacy education.

In Zimbabwe, whilst the national lockdown presented many challenges for both pharmacy education and pharmacy practice, pharmacy educators and policymakers have risen to the occasion, and their response has advanced the pro-

fession (Siyawamwaya *et al.*, 2020) [14]. Classes were affected by school closure, but students were enabled to receive content regularly through various media platforms which enabled engagement with facilitators and tutors.

## 2.1. Adaptive Learning Methodologies

The response strategies engaged by academic institutions were situational, varied, and diverse. However, the success or shortcomings of such strategies are still either unknown or unquantified. What is common though is that most institutions adopted e-learning methodologies as an alternative learning system to avert potential challenges associated with school closures with varied levels of success in implementation. The effects of such measures on student performance and outcomes are yet to be appreciated. As such, a novel learning methodology was instituted with varying levels of success. Earlier, a meta-analysis conducted by Means *et al.* (2013) [15] had concluded that from an outcome's perspective, the impact of various distance learning forms did not differ significantly from regular classroom instruction in terms of student performance and content assimilation. Arguably, it had been concluded that online education contributed to better learning outcomes as well as higher adoption and user satisfaction rates by students compared to traditional learning approaches due to increased web-based application capabilities and applications, the rise of blended learning models and easy content access which improve student interaction with content material in robust settings. The findings provided the necessary confidence for the adaptation and adoption of e-learning as an alternative instructional methodology in learning institutions with relative haste and efficacy.

## 2.2. Application of Online e-Learning Methodology

Jeffries *et al.* (2013) [16] had earlier argued that emerging technological developments and live streaming had made e-learning a common learning methodology which successfully facilitated learning materials access by both students and professionals online. The methodology had been successfully used by the Purdue University College of Pharmacy's Centre for Medication Safety Advancement in developing training needs for its three e-resources to enhance medication safety online.

Alkoudmani & Elkalimi (2015) [17] quoted elearning, also called "web-based learning," based on the Joint Information Systems Committee (2003) definition which states that e-learning is "facilitated and supported learning through the use of information and communications technology." Such learning could be either electronic or blended whilst proactively facilitated by academic educators. The advantage of online learning is that it facilitates learning via the web at any time and from anywhere using different online educational technologies which support students' learning, help educators to use modern methods for more interactive teaching and facilitate the learning process among their students.

In a study enrolling University students in Jordan, Almaiah *et al.* (2020) [18]

found out that whilst e-learning using Blackboard was not a new approach to learning in universities, the provision and usage of online and e-learning system itself, was becoming the main challenge for many universities during COVID-19 pandemic. Several adoption factors were faced by the institutions including technological factors, e-learning system quality factors, cultural aspects, self-efficacy factors and trust factors. From a user perspective, e-learning technical issues, change management issues and financial support were the critical challenges impeding usage of e-learning methodologies.

To facilitate continuous learning by pharmacy students during schools' closure during the COVID-19 pandemic, several countries adopted the online e-learning strategy as an alternative. In Namibia, Kibuule *et al.* (2020) [1] reflected on the impact of COVID-19, a new pandemic of which little information was yet fully known about it, and the Namibian academic institution's strategic move to migrate onto the online learning platforms for its Bachelor of Pharmacy students across all levels of training.

Indrayana & Sathikin (2020) [19] highlight the extent of COVID-19 impact on 215 countries forcing educators to re-strategize learning models by migrating onto e-based learning. However, such migrations were undertaken as part of emergency management, and being unplanned their implementations posed several challenges to the academics. The varied levels of technological innovation meant that migration to e-learning methodology had to be dealt with situational. African academic institutions were hit hardest due to limited or lack of ICT technology and infrastructure. Furthermore, most faculty staff lacked the professional systems design experience to develop, facilitate and deliver content material online. As such, Okereke *et al.* (2020) [8] raised a clarion call for improved educational standards which proactively respond to external influences seamlessly to avoid putting pressure and stress on students and academics in the future.

Karaoui *et al.* (2020) [10] noted that schools and colleges of pharmacy across the United States responded by offering distance learning options and designing contingency plans to maintain operations. The pandemic impacted all aspects of pharmacy education including didactic instruction, experiential education, inter-professional education, co-curricular activities, community service, scholarship, professional service, well-being, resilience, recruitment, admissions, and celebrating student success. Pharmacy faculty, staff, and students were subsequently trying to navigate a rapidly changing environment by taking advantage of opportunities as they arise while mitigating many threats that were affecting their professional and personal lives. Such approaches called for the Pharmacy faculty to be and to remain flexible, embrace change, and create innovative solutions to help students progress through the curriculum while maintaining their contributions to society. Students were also called upon to find creative ways to remain engaged with their courses and co-curricular activities; increase contact with academic staff through various media platforms and form study groups to

offer each other support and share scholarly experience in areas requiring remedial assistance.

### 2.3. The Migration of e-Learning Pharmacy Education Experience

Whilst the unexpected migration from traditional learning methods to e-learning methodology was implemented globally, the transition brought with it varied experiences and challenges. The main outcome from such migration has been the continuation of learning experiences by the students whilst the education facilitators also gained immense benefits from its application. Therefore, it is prudent to reflect on the students' psychological experiences and attitudes as such learnings will define the progressive, futuristic strategic methodologies and their implementation to bring out positive academic outcomes. Historically, the general perspective on e-learning backed by findings of Khadmlu *et al.* (2013) [20] with regard to student attitudes towards e-learning in general indicated students' positive attitude regarding access to technology, constant student-facilitator communication and engagement, student motivation, learning through the media, internet chat and e-learning success. The study concluded a positive outlook of e-learning application to Medicine and Pharmacy students thus making its use acceptable to the academic institutions.

Another study by Alkoudmani & Elkalmi (2015) [17] appreciated the promising benefits associated with e-learning to push pharmacy and medical education forward but cited major barriers regarding adaptation of e learning in Arab nations mainly due to higher connectivity costs, information communication technology (ICT) problems, language barriers, wars and political conflicts, poor education, financial problems, and lack of qualified ICT savvy educators. Such barriers appear to be still hampering adoption of e-learning methodology within poorly resourced settings globally. A similar study conducted in Kenya corroborated similar challenges in African higher academic institutions mainly as inadequate ICT infrastructure, lack of technical skills and financial constraints (TarTarus, J. K., Gichoya, D., & Muumbo, A. 2015) [21]. Later on, Mulhanga, M. M., & Lima, S. R. (2017) [22] further concluded that poor interface design; inadequate technical support and lack of IT skills were primary barriers to the successful implementation of e-learning methodology in Africa whilst Kenan, T., Pislaru, C., Othman, A., & Elzawi, A. (2013) [23] contented that cultural, political, and economical constraints were the critical challenges for e-learning initiatives in Libya.

Recently, the potential usefulness of virtual reality (VR) in pharmacy education was observed by Coyne *et al.* (2019) [24], who noted that virtual reality provided an immersive educational experience that reflect real world situations, particularly with head-mounted displays which are just beginning to be adopted in pharmacy education. Shawaqfeh *et al.* (2020) [3], in a study on e-learning, highlighted the challenges faced in educational institutions brought on by the strictive COVID-19 regulations—mental health, lack of motivation, internet



connectivity, adjusting to online delivery of lectures, adapting classroom content for online learning—this in addition to the demand for IT support and training.

These are some examples of the challenges preceding the migration to e-learning as a result of the COVID-19 pandemic. In Morocco, Bouali *et al.* (2020) [4] observed the disruption to pharmacy education and cautioned that if not effectively addressed, the long-term impact would be felt for years to come. In a study of six Nigerian schools of pharmacy, Isah *et al.* (2020) [7] found that the productivity of students had decreased with students focusing rather on social media and carrying out business activities to fend for themselves, though they expressed a willingness to engage in e-learning.

Almaiah *et al.* (2020) [18] stated that there were factors that influenced the adoption of e-learning in institutions of higher learning, in both developed and developing countries, though in the latter it was not as pronounced as efforts to move to e-learning were more advanced. In the context of developing countries, Eltahir, M. E. (2019) [25] argued that the effects of the digital divide were an obstacle to adopting e-learning.

Though the migration to e-learning is necessary, Ferrel & Ryan (2020) [5] noted the loss of opportunities for collaboration which could be a shortcoming to the educational experience. They stated that medical clerkships, which facilitate transfer of practical skills and network building, have been cancelled therefore posing a risk to the education of medical students. In addition, there were no conference presentations which enabled personal development of medical students and offer opportunities to gain residency for their careers. Ferrel & Ryan (2020) [5] further stated that implementing technology to address some of these challenges was necessary for medical students as well as adopting the necessary digital skills.

There are also lessons learned because of the pandemic. Kawaguchi-Suzuki *et al.* (2020) [26] noted the recognition of pharmacists as frontline workers and their importance, especially in resource limited countries in Africa. They highlighted the necessity to expand opportunities for volunteering to pharmacy students to equip them for future public health emergencies. Kawaguchi-Suzuki *et al.* (2020) [26] also noted the recognition among educators for standardized national policy or framework from the Ministries of Education and accreditation bodies, to offer guidance in instances where in-person delivery of lecturers is not possible in future.

Despite the pandemic, online classes have enabled the continuation of training of pharmacy students, though Lyons *et al.* (2020) [11] stated that on-campus learning encourages connections among students and discussions around the content of their curriculum. They noted that even at the beginning of online delivery of lectures, students expressed their views on losing the in-person interactions with one another, participating in co-curricular activities, and found it difficult to self-motivate to engage in curriculum content without interactions with fellow students. The strengthened areas by this pandemic likely include online

teaching and learning, research/practice collaborations for remote activities, and expansion of pharmacists' and students' clinical services, such as telehealth. The potential outcomes of measures taken during the pandemic, e.g., changes to the training curriculum, students' future performance in licensure examinations, and their practice performance at their place of employment, are also of interest.

In a study to understand the perceptions of pharmacy students and faculty on online learning at the Faculty of Pharmacy Universitas Andalas, Syofytan *et al.* (2020) [27] found that generally, online learning as considered not very effective to achieve learning objectives. However, with the COVID-19 pandemic not yet over, online learning was considered the reasonable option, though with a careful selection of learning activities. Meanwhile, Mirzaian & Franson (2021) [13] argued that there were five crucial aspects needed to transform the School of Pharmacy curriculum in view of the happenings around COVID-19. These are mainly communication, maintaining faculty engagement, allowing outside the box thinking, providing resources and tools and creating accountability and timelines. They argued that at their institution digital transformation was accelerated by the COVID-19 pandemic, and that implementation could be undertaken with effective planning, aligning organizational interests, communication, deploying resources and engaging faculty. They stated that after the pandemic, the changes adopted are envisaged to transform future educational systems.

The above discourse raises pertinent issues regarding technological challenges, student/facilitator individual challenges, political and cultural challenges, and course challenges. It is important that consideration be given to dealing with such challenges in emergency situations like what has been experienced during the COVID-9 pandemic outbreak. Furthermore, it quite difficult to be prescriptive in the approaches as local situation dictates strategy choices due to different culture, context, and readiness. For example, lack of ICT knowledge, poor network infrastructure and weakness of content development were the main challenges of e-learning system adoption in third world countries. System characteristics, internet experience and computer self-efficacy were the main issues that were found to impede the successful adoption of e-learning systems.

### 3. Findings from Migration to Online Learning

Drawing learnings from previous global ICT adoption strategies in e-learning environments would have also enabled development of cohesive research constructs to allow comparative learning analysis necessary for policy formulation and development in academic institutions to shape future response strategies in emergency pandemic situations. Earlier works by Eltahir (2019) [25]; Almaiah, M. A. and Man, M. (2016) [28], 2020 [18]) revealed the challenges of adopting e-learning systems within the third world countries due to limited connectivity, financial viability and lack of resources (both human and financial) to drive adoption and effective utilization of technology. Furthermore, the challenge of resistance to change was highlighted as the major barrier to embracing newer

technologies leading to incongruent digital divide amongst nations. Almaiah, M. A. and Man, M. (2016) [28], 2020 [18]) noted technological, individual, organizational, cultural and course challenges are composite issues delimiting a fuller adoption of new technology in Asian countries. Transposed to the Africa setting, the experience highlighted by Kibuule *et al.* (2020) [1] is inimical to similar challenges. The authors argued on the benefits of adopting the Moodle learning platform as an advanced technology for use by the learners whilst noting the weaknesses of Moodle in purposing its functionality to Pharmacy training particularly in scenarios that require practical application and cognition. A great attempt was made to link the challenges experienced due to the migration experience to previous literature within the online learning methodology scope, e.g., limitations to quality assurance of learning, inability to monitor assessments and technological weaknesses of the Moodle platform to experiential learning in practical settings. Issues pertaining to isolation of students from their lecturers resulting in limited interactions were similarly highlighted in Khadmlu (2013)'s research study [20] hence developing a common thread of challenges within the Namibian learning environment. Financial limitations coupled with limited connectivity on internet platforms presented significant barriers to effective and efficient running of the online e-learning platforms.

#### 4. Discussion

Research on the impact of online learning methodology has a huge corpus of information buttressed by studies in various settings across the globe (Alkoudmani, *et al.*, 2015 [17]; Almaiah, *et al.*, 2020 [18]; Coyne, *et al.*, 2019 [24]; Elletson, H. and MacKinnon, A. (2014) [29]). Various learnings have been accentuated by progressive efforts within the African context (Mashiyane, Bangani, & Van Deventer, 2020) [30]. However, the application of online learning methods within the field of Pharmacy training have been limited due to the argument that practical teaching and assessment were impossible hence affecting the quality of cadre produced. With the advent of COVID-19 pandemic, the Faculties of Pharmacy training across the globe have been forced to revise and relook at their teaching methodologies by incorporating online platforms integrated with videoconferencing and chat facilities to enhance the delivery process. Kawaguchi-Suzuki, *et al.* (2020) [26] explored the currents trends in Africa, Japan, USA, and the UK and scoped on strategic changes to curriculum development and content delivery and its impact on future training. Further efforts by Alrasheedy, (2021) [31]; Bouali, *et al.* (2020) [4]; Karaoui & Chahine (2020) [10]; Mirzaian & Franson (2021) [13]; Lucca *et al.* (2020) [32] sought to explore how online pharmacy training and digital innovations can be fully leveraged for the benefit of developing a responsive curriculum for pharmacy training.

The major hurdle is still premised on simulation techniques that aid practical assessment and clinical practice. Whilst various efforts have been made to create simulating environments that mimic laboratory settings, the interface has failed

to create ideal circumstances for seamless student practical engagements that create the requisite climate for practical knowledge transfer. In view of the practical nature of pharmacy training, the simulative effects still require further development before the concept can be deemed appropriate for online assessment and grading. Furthermore, the adoption of such initiatives in poorly resourced economies like Africa might be jeopardized by the high cost of simulation technology thus derailing the initiatives. Supportive technology transfer exchange programs between first world economies and poor nations may be the appropriate strategy to enhance adoption. Another challenge relates to in-hospital ward bedside practical training. The use of online methodologies may not be appropriate in such settings. In any case, students require interface with collaborative clinical staff to engage in the vital exercise as it imparts the much-needed practical clinical experience. As such, the alternative methodology will fall short. Ideally remote sharing of patient clinical notes might be regarded as a suitable option although it lacks direct human interface, a critical aspect in patient management endeavors. Furthermore, the complexities brought about instituting administrative process that uphold dissemination of patient clinical information and ethical practice may be too huge to manage. As such, the efforts for seamless remote patient management are still a far-fetched concept which still requires innovative endeavors.

## 5. Conclusions

The paper reviewed the corpus of research work on the extensive global impact of COVID-19 on pharmacy education. In doing so, the major strategic responses most academic institutions defaulted to school closure based on the national lock down regulations. Secondly, some of the institutions engaged online learning methodologies as alternative learning. The response strategies varied from one country to another due to differences on the level of IT technology, IT infrastructure, internet connectivity and cost. In some countries, the political and economic climate coupled with cultural inclination towards IT adaptability affected migration. Furthermore, the paper reviewed the genesis, implementation, successes and weaknesses of online learning methodology and its acceptance in medical training institutions as well as student and facilitator perceptions and reactions. Whilst in IT savvy countries migration was flawless, there was apprehension and insecurity to embrace it in developing countries. Most facilitators felt inadequately trained to handle the migration due to limited IT skills. This is an area requiring upgrade to close the gap and enhance IT use, content design and access by the facilitators.

A common thread was the applicability and benefits derived from the use of online education. However, the studies did not provide emphatic proof of its superiority over traditional teaching pedagogies. Whilst online teaching was generally found to be as effective as face-to-face learning, blended teaching is still the most preferred due to effective student—facilitator interaction and con-

venience in practical subjects requiring laboratory access and experience. Impact and effectiveness of online learning on a global scale, particularly in clinical learning settings would need to be further undertaken to validate the concept. Meanwhile, as an emergency response strategy, online has saved the day.

### Conflicts of Interest

The authors declare no conflicts of interest.

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