Editorial

COVID-19 and the impact on the education of healthcare professionals across countries with a particular focus on developing countries

Kona Chowdhury[1], Ayukafangha Etando[2], Moyad Shahwan[3a,b] Ranko Škrbić[4], Ammar Abdulrahman Jairoun[5], Mainul Haque[6], Brian Godman[7a,b,c]

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COVID-19 has had an appreciable impact on morbidity, mortality and costs across countries[1,2], which is continuing. Before the advent of vaccines, the only effective measures to limit the spread of the virus and its impact were itiatives to limit contact between people through lockdown and other measures[3-6]. Public health measures included the closure of borders and hospital clinics, introduction of social distancing and improved prevention including the wearing of personal protective equipment (PPE) such as masks and regular hand washing, routine testing and subsequent tracing and quarantining of infected personnel as well as the closure of schools and universities[1,4,7-10]. However, there was considerable variation in the rate of their implementation across countries, which appreciably impacted on prevalence and mortality rates[9-12].

Despite the closure of universities, it is important to ensure healthcare professionals, including medical and pharmacy personnel, are fully equipped on graduation to tackle the ongoing challenges across countries given the concerns with managing patients posed by the pandemic[13].

We have seen considerable misinformation regarding possible treatments for patients with COVID-19[14]. In the case of hydroxychloroquine, this has resulted in increased morbidity, mortality and costs without improving patient care[15-18]. Community pharmacists and others can play a key role addressing misinformation as well as assisting with preventative approaches including supplies of PPE, symptomatic relief and vaccinations[19-23]. Consequently, it is important that they have the necessary skills on graduation to help out at this important time. This also means ensuring patients have adequate supplies of prescribed medicines, and know how to take them, given concerns with the pandemic on rising cases of non-communicable diseases and their associated morbidity and mortality[9,13,21].

1. Department of Paediatrics, Gonoshasthaya Samaj Vittik Medical College and Hospital, Dhaka, Bangladesh. ORCID ID: https://orcid.org/0000-0002-3836-1691
2. Department of Medical Laboratory Sciences, Faculty of Health Sciences, Eswatini Medical Christian University, P.O Box A624, Swazi Plaza, Mbabane, Kingdom of Eswatini. ORCID ID: https://orcid.org/0000-0001-5678-4121
3. [a]College of Pharmacy and Health Science, Ajman University, Ajman, United Arab Emirates; [b]Centre of Medical and Bio-allied Health Sciences Research, Ajman University, Ajman, United Arab Emirates. ORCID ID: https://orcid.org/0000-0001-8367-4841
4. Department of Pharmacology, Toxicology and Clinical Pharmacology, Faculty of Medicine, University of Banja, Banja Luka, The Republic of Srpska, Bosnia and Herzegovina.
5. Health and Safety Department, Dubai Municipality, Dubai, United Arab Emirates. ORCID ID: https://orcid.org/0000-0002-4471-0878
6. Unit of Pharmacology, Faculty of Medicine and Defence Health, Universiti Pertahanan Nasional Malaysia (National Defence University of Malaysia), Kem Sungai, Besi, 57000 Kuala Lumpur, Malaysia. ORCID ID: https://orcid.org/0000-0002-6124-7993
7. [a]Department of Pharmacoepidemiology, Strathclyde Institute of Pharmacy and Biomedical Sciences, University of Strathclyde, Glasgow, UK; [b]Centre of Medical and Bio-Allied Health Sciences Research, Ajman University, Ajman, United Arab Emirates; [c]Division of Public Health Pharmacy and Management, School of Pharmacy, Sefako Makgatho Health Sciences University South Afica. ORCID Number: https://orcid.org/0000-0001-6539-6972

Correspondence: Strathclyde Institute of Pharmacy and Biomedical Sciences, University of Strathclyde, Glasgow G4 0RE, United Kingdom. Email: brian.godman@strath.ac.uk.

Alongside this, we have seen considerable over-prescribing of antibiotics for patients with COVID-19 across countries during the pandemic despite only a limited number of patients with COVID-19 having concomitant bacterial or fungal infections[24-28]. This is a concern as the inappropriate use of antibiotics in patients with COVID-19 increases antimicrobial resistance rates (AMR), with an associated increase in morbidity, mortality and costs[29-33]. Hospital pharmacists can play a key role, alongside infectious disease specialists, with introducing antimicrobial stewardship programmes (ASPs) to reduce inappropriate prescribing[32,34-36]. However, there have been concerns with the level of activity and knowledge regarding ASPs among hospital clinicians in low- and middle-income countries (LMICs), which needs to be addressed with appropriate educational initiatives going forward[37,38]. This also applies to addressing the considerable prescribing of antibiotics for viral upper respiratory tracts apart from COVID-19, which currently accounts for an appreciable proportion of the prescribing of antibiotics in ambulatory care[32,39].

Community pharmacists can also play a role with improving antibiotic utilisation in ambulatory care. This includes dissuading patients against unnecessarily purchasing antibiotics without a prescription when this occurs especially in those with suspected COVID-19[23,40]. This builds on their major role as often the first contact point patients have with healthcare professionals, especially in countries with high patient co-payments, are community pharmacists[41,42]. Alongside this, appropriately trained pharmacists can assist with the instigation of ASPs, as well as educational initiatives generally, in ambulatory care to improve future antimicrobial prescribing[43,44]. Healthcare professionals, including community pharmacists, can also help address issues of vaccine hesitancy and other key issues going forward starting with appropriately trained medical and pharmacy students[45,46].

There also continues to be a rise in the prevalence rates of non-communicable diseases across countries, especially among LMICs including African and Asian countries[47-49], with an increase in patients with multi-morbidities especially in African countries[50-52]. Consequently, physicians and pharmacists need to be appropriately trained to deal with these increasing challenges. Without this, there will continue to be increasing rates of morbidity and mortality from both infectious and non-infectious diseases.

However, we are aware there has been considerable variation across countries in terms of the readiness and ability of university faculty staff and students to instigate e-learning approaches, and away from didactic approaches, in response to restrictions and closure of Universities at the start of the pandemic[50,53-58]. We are also aware that the transition to online learning has not been easy for a number of faculty members and students[58]. Identified issues included appreciable variations in the necessary skills among both faculty staff members and students to conduct teaching and interactions on-line at the start of the pandemic, exacerbated by poor computer skills among some faculty members and students[59-63]. Alongside this, the necessary ICT equipment including laptops alongside available, reliable and affordable internet facilities, as well as quiet rooms, to fully undertake e-learning[50,57,62,64-66].

We are aware there has been considerable investment among high income countries such as Saudi Arabia prior to the pandemic to improve the e-learning infrastructure and familiarity among staff and students, helped by available resources. This resulted in a relatively smooth transition to e-learning approaches, including using Zoom® and BlackBoard™ platforms, alongside shifting problem-based learning (PBL) online using small groups, at the start of the pandemic[56,67,68]. Backboard™ as well as Backboard Collaborate® were also used for teaching and examinations early on, with Zoom® used for discussion and interactive sessions[69].

At the start of the pandemic, the majority of Universities in the United Arab Emirates (UAE) were also pre-equipped with learning-management systems supported by service providers[70], with a number of students already using e-learning platforms and sharing experiences before the pandemic[71]. However, there were concerns with the level of preparedness among some faculty staff and students at the start of the pandemic as well as the challenges involved with conducting practicals and assessments on line[63,72,73], which needed to be addressed going forward. Encouragingly, the Telecommunications Regulatory Authority (TRA) in UAE worked with local telecommunication companies at the start of the pandemic to help provide free access to numerous on-line learning platforms among staff and students as well as sought to expand the internet bandwidth[70]. These initiatives were welcomed since the rapid implementation of distance learning at the start of the pandemic caused surges in internet traffic volume exceeding network capabilities. This was particularly

the case with video conferencing platforms.

Ajman University like other universities in UAE also rapidly assembled systems for e-learning, which combined open-sources such as BigBlueButton™ with a subscription-based Blackboard Collaborate™ web conferencing tool to enhance e-learning at the start of the pandemic[74,75]. These systems have now been replaced with a more flexible combination of tools, with Zoom® and Microsoft Teams™ being the principal platforms and instant messaging services such as WhatsApp® being used when appropriate. There were concerns initially including that some educators and students were outside the UAE when travel restrictions were introduced at the start of the pandemic; consequently, timetables had to refined to meet the needs of students in multiple time zones. In addition, the video conferencing platforms required for e-learning placed heavy demands on limited bandwidths. However, these challenges have now been addressed. This is reflected by the levels of comfort and trust between educators and students, and confidence among students has increased as the e-learning experience has progressed, with e-learning here to stay with new developments continually evolving[63,76,77]. Alongside this, there is ongoing research and evaluation among Arab countries to identify best practices to improve future online learning processes including assessments[68,69,78].

We have also seen encouraging developments among other Universities in UAE. The IT department at Zayed University rapidly provided network support to both staff and students at the start of the pandemic as well as instigated a call centre to help solve problems to enhance e-learning approaches. The library could also be accessed remotely if wished[70]. At Khalifa University of Science and Technology, there were also rapid learning experiences. Learning management system platforms including Blackboard™ and Moodle™ were also provided to students and faculty members to support e-learning to quickly address identified concerns. Meeting tools including BigBlueButtons™, Microsoft Meetings™ and Zoom® were also used for self-demonstrations and those conducted on standardized patients among small groups replacing previous conventional patient examinations as part of new e-learning approaches[63,70]. These developments are likely to persist post the pandemic to increase flexibility.

This contrast though with the situation among a number of LMICs. A considerable number of African countries faced difficulties at the start of the pandemic. Both faculty members and students were appreciably under-equipped to deal with e-learning at the start of the pandemic across Africa alongside concerns with access to, and affordability, of the internet[50,79-82]. Similar issues were also seen in Egypt, Jordan and Libya at the start of the pandemic, with technological support a key barrier to address[55,57,64,83]. Chowdhury *et al*. (2022) and others also documented similar concerns in Bangladesh at the start of the pandemic, with a number of challenges still persisting especially among medical and dental students[84,85]. These issues need to be addressed with increasingly complex cases among patients in LMICs including those with both infectious and non-infectious diseases to ensure fully trained healthcare professionals on graduation[50,84].

We have also seen similar issues and concerns regarding e-learning at the start of the pandemic among Central and Eastern European (CEE) countries. However, this was not universal. In Bulgaria, Getova *et al.* (2020) found that available platforms for e-learning worked slowly and frequently crashed, which negatively impacted on the experiences of both faculty members and students[86]. There were also concerns that faculty members and students were poorly prepared for e-learning approaches in the Czech Republic at the start of the pandemic alongside concerns with excessive messaging and chatting during on-line lessons[87]. Whilst there was excellent access to the Internet among over 40% of university students recently surveyed in Poland, this was less than seen in North Macedonia (60.0%) and Bosnia and Herzegovina (56.5%)[58]. In addition, faculty members and students appeared poorly prepared for e-learning approaches in Poland at the start of the pandemic[58,88]. Bączek *et al.* (2021) also ascertained there were technical problems with IT equipment among 844 medical students in Poland surveyed in the early of the pandemic. In addition, medical students were less active during on-line classes further impacting on their e-learning[89]. However, this is now changing with generally good support from teachers and course instructors and greater flexibility[58,89]. There were also concerns with limited e-learning experiences among some Universities in Romania at the start of the pandemic although transitioning to e-learning was rapid among the top universities[90,91]. Despite this, the online theoretical learning ability was considered low among some dental students in Romania despite allocated times to e-learning[92]. However, others have ascertained that dental students in Romania considered online

activities a good alternative to face-to-face learning during the pandemic[93].

Encouragingly in Lithuania, universities and business establishments provided all university teachers free access to digital resources combined with opportunities to take part in training courses to improve their e-learning experiences[94]. However, this was compromised by concerns with e-learning among students in Lithuania[95]. This was different in Slovenia where students were typically positive towards e-learning and this is likely to continue[96]. Faculty members and students in Latvia also believed remote on-line learning could help provide good quality education in the longer term after this current pandemic[97].

The situation in the Republic of Srpska (Bosnia and Herzegovina) has also been better than a number of other CEE countries since the state universities are typically well equipped with IT and affordable internet facilities and students were ready to accept e-learning as a new model. Soon after the Government declared the pandemic and introduced lock-down measures, the Ministry of Scientific and Technological Development, Higher Education and Information Society of the Republic of Srpska issued a decision that universities should rapidly organize remote learning. Based on this, the authorities at the University of Banja Luka in the Republic made the necessary preparations to switch from classical teaching methods to the Google Classroom e-learning platform[98]. In addition, Google Meet™ and Zoom® platforms were also made readily available for distance/online learning, with staff members trained in how to use new techniques properly. Concurrent with this, all students received relevant information relating to the updated teaching methods through their personal e-mails, and all additional information was made available on the faculty's web pages. This comprehensive approached appeared to work well based on recent self-evaluation data. The findings showed the medical students at the University of Banja Luka were very satisfied with the new teaching opportunities emphasizing that new teaching methods are equal to the ordinary "ex cathedra' lectures and likely to stay.

Similarly, a recent study from the University of Kragujevac in Serbia showed that e-learning technologies were well accepted by dental students where 'augmented reality' technology was used in training delivered through mobile devices[99]. Encouragingly as well, a recent study in Croatia ascertained that a switch to e-learning platforms did not affect burnout levels among medical students or their perception regarding their study programmes[100].

There have though been concerns across countries with conducting examinations with integrity at the start of the pandemic to ensure graduates had the necessary knowledge and skills to perform their tasks on graduation[50,101-103]. Tied in with this, certainly among healthcare professionals including medical and pharmacy students, there were challenges and concerns with how to conduct practicals, clinical teaching sessions as well as clinical examinations within the necessary social distancing and hygiene standards[50,101,104,105]. This resulted in new approaches being introduced including the use of simulations in small peer groups, telehealth techniques and other approaches[50,104-106]. However, there are continued concerns regarding the lack of interaction with lecturers and time pressures affecting students' understanding of the topics being discussed and leaning experiences[105,107]. These need to be addressed going forward with blended learning likely to remain.

Potential ways forward to improve e-learning where there are still issues can build on examples across countries regarding activities instigated among medical and pharmacy colleges to address identified concerns. Examples include help from Governments, Universities and Internet providers[50]. In addition to the examples Lithuania and UAE, which have already been mentioned, other examples include instigating trials of virtual platforms for teaching and practicing physical examination skills in Egypt to improve the learning experience[108]. Alongside this, faculty members altering assignments and examinations in countries to better reflect being taught remotely[107], the Ivorian Ministry of Education, Technical and Professional Training and the Senegalese Ministry of Education establishing online platforms and resources for students[109], and key elements being identified in Namibia for the successful implementation of robust and resilient pharmacy education approaches during the pandemic including compounding skills[110,111]. In addition, universities in South Africa sourcing ICT devices where necessary for staff and students as well as purchasing these at preferential rates, with some universities obtaining external sponsorships to help cover these costs[109,112-114].

We are also aware there is increased anxiety among health science students at university, especially those leaving home for the first time without parental support[115]. This situation has typically been

exacerbated as a result of the COVID-19 pandemic and associated activities[93,116-120]. For instance, the forced exclusion from the social aspects of campus life has affected the mental health of students and their learning in Universities in UAE and other Universities[120], with students among Arab Universities encountering sociocultural challenges with e-learning approaches including privacy concerns among female students with webcams[63,121,122]. Chandratre (2020) showed that medical students have experienced increasing anxiety as a result of the disruption caused by the COVID-19 pandemic[123]. Saddik *et al.* (2020) also reported increased anxiety levels among medical students especially those on rotation in hospitals in UAE if they had been in contact with patients with COVID-19[124]. Saraswathi *et al*. (2020) also demonstrated increased anxiety and stress levels among medical students in India as a result of COVID-19 and its implications[125], with Iosif *et al.* (2021) showing similar findings among dental students in Romania[92]. However, others have suggested that the impact of lockdown measures associated with COVID-19 on perceived stress and quality-of-life of students in UAE, in this case pharmacy students, may be minimal[126]. In addition, as mentioned, Žuljević *et al.* (2021) ascertained that burn-out levels among medical students was no higher after the introduction of e-learning approaches[100]. These differences may reflect differences in circumstances between studied countries. Further research though is need before any concrete conclusions can be drawn.

In conclusion, a number of strategies have been introduced across both high-income countries as well as LMICs to improve the education of healthcare professionals, including both physicians and pharmacists, during the current pandemic. These include universities and governments entering into agreements with internet providers, increased flexibility and support for students, partnerships with companies to raise funds for PPE for face-to-face teaching and practicals, provision of equipment to disadvantaged students, provision of electronic books free-of-charge, and continuing research to assess different approaches to address current challenges[50,70,105]. In addition, counselling and other services to reduce the impact of COVID-19 and its consequences on the mental health of both students and staff[50].

We believe these multiple initiatives will continue with blended learning here to stay in view of its increased flexibility. Alongside this, there will be ongoing research into ways to continue to improve e-learning experiences, including addressing the challenges associated with practicals and clinical rotations, among all key stakeholder groups. Alongside this, continued research into addressing the mental health consequences of COVID-19 and associated lockdown measures among both faculty members and healthcare students to provide future guidance. These combined activities are seen as critical given the important role of physicians and pharmacists in managing increasingly complex patients in the future. We will continue to monitor the situation.

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