



# Challenges and opportunities of clinical pharmacists during COVID-19: A review of the literature

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## ARTICLE INFO

Received on: 15/03/2022  
Accepted on: 26/05/2022  
Available Online: 05/07/2022

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### Key words:

Clinical pharmacy, clinical pharmacist, COVID-19, coronavirus disease, SARS-CoV2.

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## ABSTRACT

The success and sustainability of any profession can be evident during times of crises. Clinical pharmacists adapted and adopted multiple roles, which were an extension of their routine activities including a few new activities depending on the situation demands. Numerous studies in the literature discussed the various roles played and the activities offered by clinical pharmacists during the coronavirus disease of 2019 (COVID-19) pandemic. The challenges and opportunities faced by the clinical pharmacists during this time are worth contemplating. We aimed to summarize the challenges faced by clinical pharmacists during the pandemic and the opportunities that arose. Providing direct patient care, change in scheduling, and burnout were among the top challenges. Telehealth services and participation in guideline development and education were among the prominent opportunities. A discouraging finding was the lack of adequate recognition along with other front-line workers. The pandemic was a clear indicator of the significant role a clinical pharmacist plays in the healthcare team. Measures need to be taken by clinical pharmacists to ensure authorities are well-informed of their activities. It is also recommended to incorporate these experiences in pharmacy degree programs to ensure that pharmacists are better prepared for any future health or natural crises.

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## INTRODUCTION

It is observed and clearly evident that the pharmacy profession has an important role in the frontline healthcare response to the coronavirus disease of 2019 (COVID-19) pandemic across all settings (Paudyal *et al.*, 2020). As clinical pharmacists are involved in “direct patient care,” they are at a similar high risk during this pandemic as physicians, nurses, and other healthcare providers (Bauman, 2020). It is great to notice that physicians and nurses received many appropriate and well-deserved tributes in the media for their heroic efforts in caring for patients with COVID-19 (Erstad, 2021). A number of clinical pharmacists were involved as caring and competent practitioners in the daily care of these patients; however, they were often overlooked by the other

heroes on the front line and have received less attention (Barlow *et al.*, 2020; Bauman, 2020; Erstad, 2021).

Clinical pharmacists were proactive and fulfilled an essential service during the COVID-19 pandemic by working in the frontline along with other healthcare providers to ensure the best possible outcomes for the patients they served (Bauman, 2020; Ferguson *et al.*, 2020; Visacri *et al.*, 2021). While they have taken a range of service adaptations and adoption of novel roles, they were invisible heroes (Bauman, 2020; Paudyal *et al.*, 2020). One study, however, showed a positive perception of the general population about pharmacists in different sectors and the services they provided during the pandemic (Alhamad *et al.*, 2021). A wide range of skills and knowledge were taken up for effective crisis, which included clinical expertise, education, data analysis, health informatics infrastructure, and inventory management in times of surging medication use and manufacturer shortages (Ferguson *et al.*, 2020).

The aim of this review is to summarize the literature related to the challenges faced by clinical pharmacists and the opportunities that evolved while providing general and specialized services during COVID-19 pandemic.

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## LITERATURE SEARCH

A literature search in PubMed was conducted to evaluate relevant studies published in English language. Only articles that discussed the roles performed, challenges, and opportunities experienced specifically by clinical pharmacists during COVID-19 pandemic were reviewed. If a paper discussed pharmacists from different sectors, only the part that stated the roles of clinical pharmacists was reviewed.

### Challenges and opportunities for clinical pharmacists

#### General clinical pharmacists

As pharmacists in other sectors were impacted by COVID-19 pandemic, clinical pharmacists had their share of the burden (Table 1). One of the challenges encountered by clinical pharmacists included shifting roles and reassignment. For example, general clinical pharmacists were mobilized to critical care units or to the main hospital pharmacy to cover the shortage and assist with general hospital pharmacy operations (Cheong, 2020; Damuzzo *et al.*, 2021; Johnston *et al.*, 2020). Another major challenge was the interruptions of routine clinical services by withdrawing the clinical pharmacists from inpatient wards to reduce the risk of infection, as well as suspending ambulatory care services in outpatient clinics (Cheong, 2020; Paudyal *et al.*, 2020).

As the literature on COVID-19 pharmacotherapy was rapidly changing with the controversy on using hydroxychloroquine, lopinavir/ritonavir, tocilizumab, and other agents, clinical pharmacists were faced with an increased demand on consultations regarding safety and efficacy of COVID-19 therapy both during and after hours or during teleconferences with other healthcare providers. As such, having to remain alert to every update on the management based on the hurriedly emerging literature and keeping up with its pace while carefully appraising and interpreting the evidence was a necessity (Al-Quteimat Om Msc *et al.*, 2021; Cheong, 2020; Paudyal *et al.*, 2020; Ying *et al.*, 2021). Contributing to this literature was also part of the increased workload as clinical pharmacists participated in some of the published and ongoing clinical trials on COVID-19 (Danelich *et al.*, 2021; Meng *et al.*, 2020; Paudyal *et al.*, 2020). What may have made the burnout more challenging in many cases is that it came on top of an already present high burnout prior to the pandemic (Johnston *et al.*, 2020; Manohar *et al.*, 2021).

Despite these challenges, numerous opportunities have elicited the critical role of clinical pharmacists in pandemics and public healthcare emergencies (Table 2). Some major examples in the inpatient setting included the utilization of advanced

technology to provide remote counseling to healthcare providers (telehealth services), remote therapeutic drug monitoring (TDM) (telemonitoring) of hospitalized patients, and virtual rounding (Aburas *et al.*, 2020; Allison *et al.*, 2021; Arain *et al.*, 2021; Aruru *et al.*, 2021; Bhat and Kehasse, 2020; Danelich *et al.*, 2021; Herzik *et al.*, 2021; Li *et al.*, 2021; Marchese *et al.*, 2021; Meng *et al.*, 2020; Muflih *et al.*, 2021; Song *et al.*, 2021; Surapat *et al.*, 2021; Thomas *et al.*, 2021; Wieruszewski *et al.*, 2021; Zheng *et al.*, 2021; Zhou *et al.*, 2021). One hospital described a technology named Connect Care Pro, which was utilized during the pandemic (Kjerengtroen *et al.*, 2020). The technology comprises a high-definition television, camera, and a two-way audio speaker. These devices were installed in hospitalized patients' rooms, where it allowed healthcare providers, including clinical pharmacists, to access the rooms remotely to communicate with patients and access drug infusion rates on intravenous (IV) infusion pumps. This technology was also connected to the electronic medication record, which helped the pharmacists providing direct care via evaluating the list of drugs the patients are receiving.

Clinical pharmacists were also involved in institutional emergency preparedness planning and training (Merks *et al.*, 2021; Waldron *et al.*, 2021). During the tough time of the pandemic, a provision of 24/7 service was necessary to ensure an uninterrupted service. Changes in work schedules of clinical pharmacists in order to provide 24/7 consultation services while decreasing work burnout and limit exposure to sick patients was also one of the strategies developed by clinical pharmacists, where a pharmacist would alternate between 2 weeks of on-site services and 2 weeks of off-site services (Moye *et al.*, 2021). Other institutions also developed other pharmacy staffing plans to cope with the hospital's needs during the pandemic to ensure continuous provisions of services (Arain *et al.*, 2021; de Val *et al.*, 2021; Yerram *et al.*, 2021). To minimize duplication of efforts and avoid coverage gaps, clinical pharmacists were also assigned clear roles and responsibilities. Regardless of their specialty, clinical pharmacy specialists were repurposed to assist with clinical pharmacy coverage of COVID-19 admitted patients in addition to their standard job responsibilities. Such uninterrupted service was also achieved by involving clinical pharmacy residents, general or specialized, to be on-call or to alternate with clinical pharmacy staff in covering evening or night shifts (Faine *et al.*, 2020).

In addition, patients with acute respiratory distress syndrome who were placed on extracorporeal membrane oxygenation (ECMO) had issues with drug distribution for drugs that are highly lipophilic or have high protein binding tendency due to the possibility of adsorption to the ECMO circuit leading

**Table 1.** Summary of challenges encountered by clinical pharmacists during COVID-19 pandemic.

• Shifting roles and assisting with hospital pharmacy operations
• Change in work schedules to ensure provision of 24/7 services
• Withdrawal from inpatient wards to reduce infection risk
• Suspension of ambulatory care services
• Increased consultations regarding COVID-19 management
• Having to remain alert to fast-paced emerging updates on COVID-19 management with critical appraisal of the literature
• Participation in clinical trials

**Table 2.** Opportunities arose for clinical pharmacists of various specialties during COVID-19 pandemic.

Specialty	Opportunities
General clinical pharmacists	<ul style="list-style-type: none"> <li>Utilization of technology via telehealth services and virtual rounding with the medical team</li> <li>Involvement in emergency preparedness planning and training</li> <li>Repurposing of specialized clinical pharmacists to care for COVID-19 inpatients</li> <li>Monitoring patients receiving drugs for COVID-19 for potential adverse effects</li> <li>Development of innovative strategies to administer inhaled medications</li> <li>Involvement in COVID-19 testing</li> <li>Involvement in COVID-19 vaccination campaigns and training of other pharmacists and pharmacy students</li> </ul>
Infectious diseases pharmacists	<ul style="list-style-type: none"> <li>Participation in the development of hospital-specific COVID-19 guidelines</li> <li>Guiding appropriate use of antimicrobial therapy in COVID-19 patients and patients with other infections</li> <li>Involvement in public education and awareness on COVID-19 through different media platforms</li> <li>Participation in preparing global guidelines for COVID-19 management</li> </ul>
Critical care pharmacists	<ul style="list-style-type: none"> <li>Recommending medications and selecting appropriate doses to control pain and agitation in intubated patients</li> <li>Participation in preparing global guidelines for COVID-19 management in critically ill patients</li> </ul>
Emergency medicine pharmacists	<ul style="list-style-type: none"> <li>Participation in specialized multidisciplinary COVID-19 teams</li> <li>Development of strategies to preserve personal protective equipment</li> <li>Provision of uninterrupted code blue response</li> </ul>
Ambulatory care pharmacists	<ul style="list-style-type: none"> <li>Provision of remote patient education and consultation for chronic diseases</li> <li>Assistance in acquisition of self-monitoring devices</li> <li>Initiation of medications that require less laboratory monitoring</li> <li>Help coordinate with external laboratories to minimize patients travel and exposure to the hospital</li> <li>Development of drive-thru and virtual clinics</li> </ul>

to subtherapeutic plasma concentration (Cheng *et al.*, 2018). Therefore, clinical pharmacists had an essential role in monitoring patients receiving such drugs for response and possibility of dose adjustment (Surapat *et al.*, 2021). Same applied to drugs removed by hemadsorption, which is an adjunctive therapeutic procedure used in COVID-19 patients experiencing cytokine storm (Surapat *et al.*, 2021). For some difficult to acquire medications that showed some benefit in the management of severe COVID-19 cases like tocilizumab, anakinra, and baricitinib, clinical pharmacists reviewed patients' laboratories, such as ferritin and C-reactive protein in persistently febrile patients to determine eligibility for therapy and then referral to the respective service (critical care, immunology, or rheumatology) (Ferguson *et al.*, 2020; Gross *et al.*, 2020). In order to limit the unnecessary exposure of nursing staff to COVID-19 inpatients, clinical pharmacists innovated a strategy to administer inhaled medications using IV extension sets; hence, pumps could be placed outside the patients' room, where medications can be timed (Gross *et al.*, 2020).

As COVID-19 was associated with coagulopathy and increased risk for venous thromboembolism, clinical pharmacists were on board to provide counseling on the use of anticoagulants, as well as dose adjustment and TDM (such as INR in patients prescribed warfarin and anti-Xa activity in obese and renally impaired patients) (Surapat *et al.*, 2021). Furthermore, clinical pharmacists continuously monitored adverse drug reactions and drug–drug interactions and assessed eligible patients to receive anticoagulants, especially with drugs being trialed for COVID-19

(Araïn *et al.*, 2021; Gourieux *et al.*, 2021; Perez *et al.*, 2021; Skalafouris *et al.*, 2021; Surapat *et al.*, 2021; Ying *et al.*, 2021). For example, checking QTc interval at baseline and later in patients treated with hydroxychloroquine, as well as checking for drug–drug interactions with the protease inhibitors (lopinavir/ritonavir) although these drugs are no longer recommended for COVID-19 management.

Pharmacists were also involved in testing for COVID-19 early in the pandemic where licensed pharmacists in several countries were authorized to order and conduct tests for SARS-CoV-2 (Jordan *et al.*, 2021; U.S. Department of Health & Human Services, 2020). Furthermore, with the involvement of COVID-19 vaccines, pharmacists played a vital role in the vaccination campaigns. Those who were certified immunizers trained their fellow pharmacists and pharmacy trainees on the proper administration techniques, post-vaccination counseling, monitoring, and reporting of adverse reactions, as well as management of severe allergic reactions (Andrade *et al.*, 2021; Jordan *et al.*, 2021; Merks *et al.*, 2021; Patel *et al.*, 2021; Srirangan *et al.*, 2021).

All these examples and others resulted in the recognition of the paramount role a clinical pharmacist plays as a member of the multidisciplinary team during the pandemic.

### **Specialized clinical pharmacists**

Several important roles were also revealed during this crisis for specialized clinical pharmacists, such as infectious

diseases and critical care pharmacists (Table 2). Many hospitals created COVID-19 multidisciplinary teams that included infectious diseases pharmacists as essential team members to provide guidance on therapy based on the updated literature (Bhat *et al.*, 2020; Chahine, 2020; Danelich *et al.*, 2021; Hussain *et al.*, 2020; Song *et al.*, 2021). Infectious diseases pharmacists were also a part of committees that developed hospital-specific COVID-19 guidelines, which were communicated to the chairs of different departments (such as medicine and critical care) to be included in their daily briefings and educational sessions (Arain *et al.*, 2021; Aruru *et al.*, 2021; Ferguson *et al.*, 2020). Such pharmacists also had a huge impact in directing the appropriate use of antibiotics and antivirals in COVID-19 patients and patients with other infections (Al-Quteimat Om Msc *et al.*, 2021; Ashiru-Oredope *et al.*, 2021; Goff *et al.*, 2020). They also continued to provide antimicrobial stewardship services via virtual rounds and encouraging testing for procalcitonin to help distinguish between viral and bacterial infections; hence, selecting the appropriate antimicrobial therapy accordingly (Ashiru-Oredope *et al.*, 2021; Thong *et al.*, 2021). Additionally, many infectious diseases pharmacists were involved in public education and awareness on COVID-19 through different media platforms, such as TVs, radio, and social media (Aruru *et al.*, 2021; Ying *et al.*, 2021).

Likewise, critical care pharmacists remained invaluable team members caring for critically ill COVID-19 patients and coordinated between the intensive care unit (ICU) and the hospital pharmacy (Ferguson *et al.*, 2020; Lemtiri *et al.*, 2020; Wang *et al.*, 2021). In the ICU, critical care pharmacists worked with physicians and nurses in recommending medications and selecting the right doses to control intubated patients' pain and agitation (Traynor, 2020). They also helped with dose adjustment depending on patients' responses, laboratory results, body weight, renal or hepatic impairment, as well as the need for renal replacement therapy, such as hemodialysis or continuous renal replacement therapy (Gurnani *et al.*, 2021; Surapat *et al.*, 2021; Traynor, 2020). One retrospective study identified 470 interventions done by pharmacists to critically ill patients within less than 3 months during the pandemic (Alwhaibi *et al.*, 2021). Most of these interventions pertained to suggesting alternatives to drugs on shortage. Other interventions involved correction of dosing regimens, drug class duplicates, and provision of drug information services.

An evolving role for emergency medicine pharmacists became prominent during the pandemic, where in one institution (University of Iowa Hospitals and Clinics, Iowa City, IA) they served on a team named "COVID-19 airway team" (Faine *et al.*, 2020). This team encompassed other healthcare members, including an anesthesiologist or emergency medicine physician, a senior medical resident, a registered nurse, and a respiratory therapist. In this team, emergency medicine pharmacists provided the following services: Development of intubation medication kit (neuromuscular blocking agents, sedatives, analgesics, and vasopressors), facilitation of rapid delivery of intubation medications, evaluation of patient's medical history and vital signs to ensure appropriate dosing, preparation of these medications, and documentation of interventions and recommendations made during the intubation process. In another institution (Mayo Clinic,

Rochester, MN), emergency medicine pharmacists developed strategies to preserve personal protective equipment and limit exposure to COVID-19 in patients placed in isolation. They anticipated the needs of patients as much as possible, delivering medications in the most finalized dosage forms, priming the IV lines, and programming the pump infusion prior to medication delivery to the room (Wieruszewski *et al.*, 2021). Uninterrupted code blue response was provided by two clinical pharmacists in one institution, where the responding pharmacists participated by preparing the medications and providing counseling to the providers who were inside the patient room via mobile phone (Danelich *et al.*, 2021).

In the outpatient setting, clinical pharmacists, particularly pharmacists specialized in ambulatory care, pharmacotherapy, and cardiology, provided remote patient education and consultation for chronic diseases (Badr *et al.*, 2021; Bhat *et al.*, 2020; Bhat and Kehasse, 2020; Chahine, 2020; Do *et al.*, 2021; Elnaem *et al.*, 2021; Marchese *et al.*, 2021; Moreau, 2021; Surapat *et al.*, 2021; Thorakkattil *et al.*, 2021). They also assisted in acquiring self-monitoring devices, and initiated medications that require less laboratory monitoring to keep the patients at home or if monitoring was needed, they helped coordinating with external laboratories to minimize patients travel and exposure to the hospital (Bhat and Kehasse, 2020; Surapat *et al.*, 2021). One key service that was modified during the pandemic was anticoagulation monitoring and adjustment of warfarin therapy. Some institutions developed a drive-thru curbside clinics for counseling and monitoring of patients on warfarin (Moreau, 2021; Truong *et al.*, 2021). Another institution developed virtual clinic that was shown to be effective as face-to-face consultation (Al Ammari *et al.*, 2021). Other institutions evaluated patients for transitioning from warfarin therapy to direct oral anticoagulants that do not require frequent monitoring, thus limiting patients' visits. The results of a study that implemented this strategy showed that this short-term switch did not impact the efficacy or safety of chronic management of warfarin therapy (Cope *et al.*, 2021). In patients with diabetes, 11 studies showed positive clinical outcomes following telepharmacy services provided by ambulatory care pharmacists, where telephone calls were the mostly used technology followed by electronic messages (Iftinan *et al.*, 2021). Most of the services included providing patient counseling and monitoring medication adherence. A study from a transplant clinic evaluated the services provided by ambulatory transplant pharmacists during the pandemic (Park *et al.*, 2021). Within a seven-month period, 385 virtual clinic visits were conducted with lung transplant recipients with more than 890 interventions made, most of which were related to medications errors and involved patient education. Notably, more than 55% of these interventions demonstrated value of clinical pharmacy services.

Moreover, several national and international pharmacy societies and organizations invited clinical pharmacists, especially those specialized in infectious diseases, to participate in the development of guidelines or protocols on COVID-19 management and monitoring for their fellow pharmacists and other pharmacy employees (Goff *et al.*, 2020; Li *et al.*, 2021). On a more global basis, clinical pharmacists were also included in taskforces of national and international COVID-19 guidelines,



namely, the Infectious Diseases Society of America Guidelines on the treatment and management of patients with COVID-19, the Surviving Sepsis Campaign: guidelines on the management of critically ill adults with COVID-19, and the US National Institute of Health COVID-19 treatment guidelines (Alhazzani *et al.*, 2020; Bhimraj *et al.*, 2020; National Institute of Health, 2020).

### FUTURE DIRECTIONS AND RECOMMENDATIONS

As demonstrated from the vast majority of the discussed studies, pharmacists had invaluable roles as members of the healthcare team. As many lessons have been learned from this pandemic, many of the changes in practice made and developed could be utilized at times of crises, whether they are health or natural, such as the development of work schedules to provide uninterrupted 24/7 service and the provision of telehealth services to inpatients and outpatients. Such big roles played by clinical pharmacists should be emphasized, especially in areas where clinical pharmacists might be underutilized (Assiri *et al.*, 2021). We also suggest that clinical pharmacy training and education during the undergraduate pharmacy programs should include a part on emergency preparedness and planning in times of disasters. As there is a plethora of papers that discussed the contribution of pharmacists from all sectors (clinical, hospital, community, etc) during COVID-19 pandemic, this training and education could include a summary of this literature.

As life returns to normal, face-to-face clinic visits are returning, as well. One study reported significant decrease in no shows and cancellations (Thomas *et al.*, 2021). While many patients benefited from telepharmacy services provided by ambulatory care pharmacists, one study found that medication-related problems were significantly more identified during face-to-face encounter with patients than during virtual clinic visits when the number of medication-related problems was compared between the pre-pandemic time and during the pandemic (McNamara *et al.*, 2021). However, this was less significant only with patients who were not diabetic. The major reason behind this difference was the lack of access to technology or training by many of the patients making virtual clinic visits a difficult task. As such, it is suggested that one or more of the follow up visits be made virtually to train the patient or their caregiver on the use of technology and provide a detailed manual as such technology may be needed in the case of any crisis that may hinder access to direct healthcare. This is also helpful to make patients who may not feel comfortable about telehealth visits get used to it as one study showed that such uncomfortable feeling was one of the limitations of virtual clinic visits during the pandemic (Segal *et al.*, 2020).

### CONCLUSION

It is pretty evident from the published literature that clinical pharmacists responded to the needs of the society during this unprecedented time to their best limits. Equally interesting are the new roles or activities they adopted in response to the situation, many of which may need to be continued after the end of the pandemic. The pandemic has brought to light the need for clinical pharmacists to be more prepared for such emergency situations and unprecedented times like other healthcare professionals. Along with all the positive findings observed with clinical pharmacy services

during this time, there seems to be a lack of deserved recognition and importance from the media, administrations, and other sources. This calls for the need of clinical pharmacists to be even more proactive and press on the concerned parties to ensure that they receive the accolades that they deserve. However, this will not deter clinical pharmacists from carrying on with their relentless and substantial services with the ultimate aim of patient care for optimal outcomes.

### AUTHOR CONTRIBUTIONS

JJ and AKT conducted the literature search and evaluation of articles for inclusion, whereas AKT extracted the information and summarized the findings.

The manuscript has been read and approved by both authors. Both authors are eligible to be an author as per the International Committee of Medical Journal Editors (ICMJE) guidelines.

### FUNDING

There is no funding to report.

### ETHICAL APPROVAL

This study does not involve experiments on animals or human subjects.

### DATA AVAILABILITY

All data generated and analyzed are included within this research article.

### PUBLISHER'S NOTE

This journal remains neutral with regard to jurisdictional claims in published institutional affiliation.

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**How to cite this article:**

Thabit AK, Jose J. Challenges and opportunities of clinical pharmacists during COVID-19: A review of the literature. *J Appl Pharm Sci*, 2022; 12(07):053–060.