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Critical care tele-pharmacy services during COVID-19 pandemic: A qualitative exploration of healthcare practitioners' perceptions

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Abstract

What is Known and Objective: The scope of clinical pharmacy services has changed during COVID-19 pandemic with the view to mitigating both exposure and spread of the virus. The performance of novel pandemic-driven services such as tele-pharmacy has remained unexplored, until now. The aim of this study is to investigate the perceptions of healthcare providers of the impact of tele-pharmacy services provided in critical care units during COVID-19.

Methods: A qualitative study of semi-structured interviews conducted with healthcare practitioners who worked in COVID-19 intensive care units and remotely interacted with clinical pharmacists at the Weill Cornell-affiliated Hamad Medical Corporation, Doha, Qatar. Random sampling technique was employed to recruit participants, with the resultant interview guide piloted before commencement of data collection process.

Results and Discussion: From a total 129 and 200 physicians and nurses, respectively, 20 interviews were conducted with physicians ($n = 15$), and nurses ($n = 5$). From these interactions, a number of major themes emerged including: satisfactory understanding across clinical environment and personnel (physician and nurses) about remote clinical pharmacists' roles; additional robust feedback on the perception of the remote clinical pharmacy service; an understanding by 'frontline' health personnel on the discernible differences between remote and in-person coverage of clinical pharmacists; a reflection by both physicians and nurses on the novel challenges involved in the implementation of such pandemic-driven service; and solutions to overcome these challenges.

What is New and Conclusion: In this novel qualitative study of pandemic-driven tele-pharmacy service, we found a positive perception amongst healthcare practitioners towards this service; with residual challenges that will need further evaluation by large sampled sized surveys or mixed methods research.

KEYWORDS
clinical pharmacy, COVID-19, intensive care unit, qualitative, tele-pharmacy

1 | WHAT IS KNOWN AND OBJECTIVE

Coronavirus disease 2019 (COVID-19) clinical syndrome is caused by the Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2), and it has been declared as global pandemic by the World Health Organization (WHO) in March 2020.[1] Worldwide current morbidity and mortality statistics stands at 490 million cases and 6 million deaths.[2] In spite of the most successful vaccination rollout perhaps in the whole of human history, morbidity and sometimes mortality challenges continue to emerge largely driven by emergence of different COVID-19 variants, such as the recent concerns around the Omicron variant so declared as a 'variant of concern' by WHO.[3] In Qatar, to date, confirmed positive COVID-19 cases have exceeded 360 thousand with more than 670 deaths.[4] Moreover, it has been observed that there is 110% inflation in the intensive care unit (ICU) admissions which started on February 2021.[5] The dominant paradigm pre COVID-19 pandemic setting around the world and across different clinical environment has been direct physical interaction between healthcare practitioners (HCP) (e.g., physician, pharmacist, nurse, physiotherapist, etc.) when challenged with any clinical problem. Since the emergence of COVID-19 infection, healthcare systems were challenged by the necessity to sustain both the quantity and quality of services provided to patients without undue exposure and facilitation of the spread of the virus both in communities and amongst HCP. This is extremely important, particularly with the exponentially high transmission rates of SARS-CoV-2 which imposed a heavy burden on health professionals and healthcare systems.[6] Therefore, there was a need to initiate and utilize approaches to maintain the continuity of care such as telehealth strategies including telemedicine and tele-pharmacy.[4] Several studies conducted in different countries have described the role of tele-pharmacy in ambulatory settings, however, data on its use in critical care settings is sparse; and where available would not be representative of the peculiar pandemic settings.[7–9] Previous studies solely explored the clinical pharmacists' (CPs) general roles during the COVID-19 pandemic from the pharmacy standpoint.[10] To our knowledge, no published studies investigated the role of CPs in ICUs from the viewpoint of other healthcare providers in multidisciplinary teams, particularly with the remote provision of the clinical pharmacy services.

During the pandemic, the pharmacy department at Weill Cornell-affiliated Hamad Medical Corporation (HMC) in Qatar launched a tele-pharmacy service to allow CPs to remotely communicate with physicians, nurses, and patients. The department identified strategies to allow CPs to attend to their usual responsibilities without physically attending medical ward rounds which may involve conducting medication reconciliation, providing recommendations related to initiating/terminating/adjusting medications amongst others. Other clinical activities that would hitherto require contribution to therapeutic decision and plans of care, responding to consultations and drug information questions, application of antimicrobial stewardship principles, verification of medication orders, as well as delivery of medication education.

This qualitative explorative study aims to investigate the perception of other HCP (physician and nurses) regarding the role of critical care CPs in optimizing therapeutic plans remotely, and to identify the perceived challenges of integrating CPs into the multidisciplinary management of patient care during the COVID-19 pandemic. Additionally, it aims to identify strategies that can help to improve tele-pharmacy clinical services involvement in patients' care during pandemics and possibly ICU tele-pharmacy services in general.

2 | METHODS

2.1 | Aim

Investigate the perceptions of HCP towards the role and the impact of the remote CPs in optimizing patients' therapeutic plans. Discuss the perceived challenges of integrating CPs into the multidisciplinary management of patient care during the pandemic and explore suggested strategies to advance the CPs' involvements in patient care from the perspective of other HCP.

2.2 | Study design, setting and participants

This qualitative study employed semi-structured interviews between October 2020 to January 2021 at Weill Cornell-affiliated Hamad Medical Corporation (HMC), which is considered the main tertiary governmental provider of healthcare in the State of Qatar. The participants were HCP (physicians and nurses) who worked in isolated ICU facilities earmarked for COVID-19 patients and who were in remote non-physical contact with CPs in the process of optimizing patients therapeutic care plans. Eligible participants were selected using random sampling technique and subsequently an invitation was sent through a unified electronic mail system for participation. We electronically shared the informed consent form with HCP who agreed to participate in the research before the interview, with a statement that

the agreement to participate in the interview would be considered as implied provision of consent. Consequently, participants were interviewed through voice calls using Microsoft Teams 2.0.

2.3 | Data collection

To guide interviewers, a tool was developed based on questions from previously published studies investigating similar outcome of our interest. To ensure the face and content validity of the instrument, experts in qualitative research have reviewed the tool for language, wording, relevance and how well it measures our objectives. Then, two pilot interviews were conducted with volunteer participants to ensure the clarity and readability of the interview questions. The final version of the guide (see Supporting information) incorporated questions to elicit information on the following broad topics:

- Current knowledge and perceptions regarding the role of tele-pharmacy in critical care units.
- Perceived challenges that impede HCPs from acquiring the full benefit of clinical pharmacy services when these services are provided remotely.
- Perceived strategies to address these barriers.

Thirty minutes interviews through Microsoft Teams 2.0 were scheduled at mutually convenient times. Each interview was conducted by one investigator (AA, SA or NI) and was audio-recorded. Study investigators had 'debriefing' sessions after each interview. The audio recordings were transcribed verbatim and inserted into a Microsoft Excel spreadsheet. Data collection continued until saturation of themes was reached, and no new points emerged.

2.4 | Data analysis

Thematic analysis was employed for data analysis via Microsoft Excel software. Using thematic content analysis, recommended by Braun and Clarke for qualitative research, texts that are considered relevant to the research questions were coded independently by two investigators (NI, SS).[11] Codes were generated manually by reading each interview alone and a continuous process of reflection and refinement was done to ensure the constant meaning of the codes. Agreements made through consensus and discussions continued until a stable coding structure was created. Once all data coding was completed, codes were compared and sorted into relevant categories based on the key concepts of the study then themes were identified.

3 | RESULTS

From a sample pool of $n = 129$ and $n = 200$ physician and nurses, respectively, a total of 20 interviews were conducted with HCP which comprised 15 physicians and 5 nurses from October 2020 until January 2021. All participants worked directly with critically ill COVID-19 patients during the pandemic (Table 1). Theoretical saturation was reached by the 13th interview with the physicians and the 3rd interview with the nurses, but we enrolled two additional participants to confirm that no new data would emerge from subsequent interviews.

From these interviews, 40 codes were identified and consequently categorized into five major themes. These, together with the subthemes, are described in Table 2.

TABLE 1 Characteristics of study participants

	Physicians ($N = 15$)	Nurses ($N = 5$)
Age	30–40: 5 (33.3%) 40–50: 5 (33.3%) 50–60: 5 (33.4%)	30–40: 3 (60%) 40–50: 2 (40%)
Gender	Female: 3 (20%) Male: 12 (80%)	Female: 0 (0%) Male: 5 (100%)
Grade	Specialist: 5 (33.3%) Consultant: 4 (26.7%) Associate consultant: 2 (13.3%) Senior consultant: 4 (26.7%)	Nurse: 3 (60%) Chief nurse: 2 (40%)
Specialty	General ICU: 8 (53.3%) Trauma ICU: 2 (13.2%) Surgical ICU: 1 (6.7%) Internal medicine: 1 (6.7%) Cardiology: 1 (6.7%) Endocrinology: 1 (6.7%) Pulmonology: 1 (6.7%)	ICU: 5 (100%)
Year of graduation	Before 2000: 7 (46.7%) After 2000: 8 (53.3%)	Before 2000: 1 (20%) After 2000: 4 (80%)
Year of joining HMC	Less than 5 years: 3 (20%) Mora than 5 years: 12 (80%)	Less than 5 years: 0 (0%) Mora than 5 years: 5 (100%)
Worked with clinical pharmacist before COVID-19	Yes: 15 (100%) No: 0 (0%)	Yes: 5 (100%) No: 0 (0%)
Frequency of consulting a clinical pharmacist in COVID-19 facility	Daily: 10 (66.7%) More than 1x/wk. but less than 1x/day: 4 (26.6%) Less than once weekly: 1 (6.7%) Never: 0 (0%)	Daily: 0 (0%) More than 1x/wk. but less than 1x/day: 0 (0%) Less than once weekly: 0 (0%) Never: 5 (100%)

Abbreviations: HMC, Hamad Medical Corporation; ICU, intensive care unit.

TABLE 2 Themes derived from the interviews

Major themes	Subthemes	Summary of findings
1. Healthcare professionals' current knowledge about the remote clinical pharmacists' role	I. Knowledge about the CP role in all settings II. Knowledge about the role of the remote clinical pharmacists in COVID-19 ICUs	Overall, healthcare professionals are aware of the role of the CPs in their original settings. They are also aware to a high level of the remote CP role during the pandemic
2. Perception of the healthcare professionals towards the remote clinical pharmacists	I. Satisfaction of healthcare professionals with the remote CP responses II. Healthcare professionals' willingness to cooperate with the remote CP	Healthcare professionals perceived that the remote CP responses to the drug-related inquiries were satisfactory. They also showed great willingness to cooperate with the remote CP to optimize patients' care
3. Differences between remote and in-person coverage of clinical pharmacists during the pandemic	I. The impact of the remote CP coverage versus in-person attendance of CP II. Areas of consultations	Healthcare professionals mentioned that the overall impact of the remote CP was enormous on both sides: direct patient care and quality improvement projects. They also reported that they usually ask for the remote CP consultations to confirm the patients' medications histories, to inquire about the use of newly approved medications, and to get updates about the protocols of antimicrobial and anticoagulation therapy for COVID-19 patients
4. Challenges to patients' care	I. High patients' number II. Delayed access to patients' clinical status III. Difficult communication IV. Limited patients' clinical assessments	Healthcare professionals highlighted that the high patient load, the unavoidable delay in electronic documentation and the complicated communication process due to the COVID-19 precautions were the main challenges in the remote CP coverage
5. Solutions to overcome the challenges	I. Increasing remote CP number II. Expanding remote CP privileges III. Dedicating time for remote CP communication	Due to the high number of patients and the increased load on the remote CP, healthcare professionals suggested increasing the remote CP number in critical areas. They also highlighted the need for expanding the remote CP privileges to include ordering lab tests required for medication safety and efficacy monitoring. Lastly, due to the shortage of time during the pandemic, a daily dedicated time to communicate with the remote CP would help the team to generate a multidisciplinary care plan

Abbreviations: CP, clinical pharmacists; ICU, intensive care unit.

3.1 | Theme 1: Healthcare professionals' current knowledge about the traditional and remote CPs

3.1.1 | Participants' knowledge about the traditional CPs' role in all settings

Although study participants were from different specialties, most of them showed an understanding of the general role and responsibilities of CPs in contributing to optimal patients care in their respective initial settings (COVID-19 facilities were covered by HCP from different specialties due to shortage in HCP experienced in infectious diseases).

'Clinical pharmacists are very important. I mean very important. I think their main role is to advise clinicians about different aspects of medications that we prescribe for the patients. For example, usually, patients admitted to the hospitals are receiving many medications (polypharmacy). So, the clinical pharmacist helps us to know the right drugs depending on patient's factors and drug pharmacokinetics and pharmacodynamics characteristics. In addition to checking the drug-drug interactions. So, I find pharmacists are extremely helpful in guiding us through the process of designing therapeutic plans'. (Physician 9)

'Clinical pharmacists are very helpful in our original department. We used to call them to verify the patients' medications and to confirm

if there are any drug-drug interactions between the medications that we want to administer together. Additionally, we used to contact them if we want to confirm the timing of drawing blood for drug level measurement'. (Nurse 2)

3.1.2 | Participants' knowledge about the role of the remote CPs in COVID-19 ICUs

Participants were aware of the role of the remote CPs during the pandemic. They highlighted that CPs had a major impact by primarily ensuring that patients are receiving treatment according to the most updated international guidelines and aligning with the local protocols. Participants reported that it was challenging to provide up-to-date management as multiple national and international clinical guidelines were hurriedly developed with several updates and changes incorporated to them with the increased understanding of the COVID-19 clinical syndrome. It also meant that patients were taking multiple medications in varying combinations and permutations which exposed them to polypharmacy and its consequences (e.g., adverse drug reactions, drug–drug interactions, drug-disease interactions, etc.). Additionally, they stated that as CPs are the medication experts, they were more capable of managing COVID-19 complications as well as other concomitant comorbidities as compared to physicians. This is because physicians came from various background specializations (e.g., cardiology and endocrinology) that may hinder them from providing a holistic care to patients, which is of extreme importance particularly in ICU settings.

'I am a cardiologist, I covered COVID-19 ICU for more than 6 weeks during the pandemic. I used to contact the clinical pharmacist daily. You know in the heart hospital; we are covering cardiac patients and post-surgical patients. So, our knowledge regarding other medications is limited. You know, COVID-19 is a different experience since we face many patients with uncontrolled comorbidities and blood sugar. So, daily, we were contacting a clinical pharmacist, to help us follow the most updated guidelines in managing these comorbidities'. (Physician 3)

'Clinical pharmacists are helpful in answering questions related to the medication, for example identifying drug-drug interactions or the proper administration of any medication'. (Nurse 2)

3.2 | Theme 2: Perception of the healthcare professionals towards remote CPs

3.2.1 | Satisfaction of healthcare professionals with the remote CPs' responses

Overall, the most apparent emergent codes were that most of the participants mentioned remote CPs' level of readiness to deal with the pandemic, which they adjudicated as satisfactory. The pharmacists were periodically updated with the latest COIVD19 management guidelines and the most recent hospital protocols as they become live; consistent with prevailing 'best practice' during the pandemic.

'In my experience, it was definitely satisfactory responses. You know sometimes we have different opinions, but we were always able to talk and come to the best decisions together'. (Physician 6)

3.2.2 | Healthcare professionals' willingness to cooperate with the remote CPs

Participants were willing to cooperate with the CPs in decisions related to the patients' therapeutic plans.

'Yes, I used to cooperate with the clinical pharmacists, and I am open to any suggestion from their side. Again, decisions related to the medications are always optimized when we took them along with clinical pharmacists. The dosage, as I mentioned before, and the drug-drug interactions. For example, a very common phenomenon in COVID-19 patients was cytokine storm syndrome. So, to decide to start the patients on tocilizumab, clinical pharmacist should be involved in the discussion. This medication was not well studied at that time, so the clinical pharmacist opinion was very crucial'. (Physician 1)

3.3 | Theme 3: The main differences between the remote and in-person coverage of CPs during the pandemic

3.3.1 | The impact of the remote CPs' coverage versus in-person attendance of the CPs

There was an agreement between participants regarding the high impact of remote CPs during the pandemic in the care provided to patients, especially that most physicians were from specialties other than infectious diseases and critical care which substantiated the role of the CPs in checking the appropriateness of medications.

'The clinical pharmacists used to call the team after the round, their role basically is reviewing all the patient's medication appropriateness, doses, frequencies, and drug-drug interactions. Many new medications were added newly to the COVID-19 protocol during the pandemic. The efficacy and the safety of these medications were still not clear and there were new studies coming out daily. Clinical pharmacists used to provide us with the updated information'. (Physician 5)

Although most participants strongly agreed with the remote coverage of the CPs during the pandemic, others preferred in-person coverage.

'Of course there were noticeable differences between the physical coverage and the remote coverage. Actually, Cerner (online patient information management system utilized at HMC) helped a lot in keeping the health care team members on the same page but still the physical attendance of the round used to give a higher impact on the patients' care. Indeed, the clinical pharmacists are not doing physical examination to the patients. But they have a great clinical sense'. (Physician 6)

'The remote coverage of the clinical pharmacists did not affect the patients' care at all. This is because there was a robust

communication through mobile or landlines between the physicians and the clinical pharmacists. You know, the Cerner has the ability to allow more than two people to review the same patients' files at the same time. So, we were contacting them (clinical pharmacists) when we have any inquiries or any problem regarding the medications. The senior consultant and I used to conduct a daily session with the clinical pharmacists to review all patients' medications'. (Physician 1)

3.3.2 | Areas of consultations

There are many areas where participants needed the CPs' clinical judgement and recommendations, these areas were either related to COVID-19, ICU settings, or management of other comorbidities. The aspects that were mentioned during the interviews were: initiation of interlukin-6 receptor inhibitor and COVID-19 antiviral treatments, drug interactions, dose adjustments, side effects, polypharmacy, alternative medications and conditions/situations prevalent in ICU settings that may not be as common elsewhere (e.g., electrolyte disturbances, rapid deterioration in patient cases, etc.).

'The most common question during pandemic was related to the anti-COVID-19 therapies and the best anti-coagulations choice and dose'. (Physician 9)

'Of course the questions directed towards the medications and intravenous infusions. You know especially in the critical area; the patients' conditions can change dramatically from moment to moment; whether laboratory or clinically wise. These rapid changes in the patients' conditions need clinical pharmacist who is aware of the patients' medications and who can maintain frequent updates in the medications. For examples: the best management for the high blood sugar level, the electrolytes disturbances, the new cultures, the antibiotics choices and so forth. So, we ask the clinical pharmacists about their recommendations, and they ask us as well, it is a two-way discussion. They suggest to us and we suggest to them certain changes in the medications or intravenous infusions according to the patients' needs'. (Physician 5)

3.4 | Theme 4: Healthcare professionals' perceived challenges to collaborate with the remote CPs during the pandemic

3.4.1 | High patients' number

During the pandemic, the admission rate to the ICU was high which increased the load on the remote CPs covering ICUs. This may have reduced the efficiency of CPs in identifying and preventing some of the medication errors.

'Due to the high number of patients in the ICU, I think the number of the clinical pharmacists who were covering the critical care area was not enough. I mean imagine that we expect the clinical pharmacists to check a huge number of patients' profiles and their medications including doses, indications, and drug-drug interactions. This makes us expect a higher rate of medication errors'. (Physician 4)

3.4.2 | Delayed access to latest patient's clinical condition

The remote coverage allowed CPs to electronically review the patients' cases through Cerner. Documentation of some critical lab values and physical examination could be delayed until after the rounds and on many occasions physicians and nurses will be engaged in the bed-side duties which will postpone the documentation further and since the CP relays mainly on Cerner to receive updates, there could have caused a delay in the workflow.

'Lab results timing used to be different actually. For example, we used to order investigation for monitoring drug levels. Sometimes we know the level from the lab specialist (especially if it is critical) while it is still not appearing in the electronic patients' profile. So, when I contact the clinical pharmacists, I need to inform them about the level and wait for them to respond to me with the correct action. So, like these practical difficulties were there'. (Physician 1)

3.4.3 | Difficult communication

There were different modalities of communication between physicians and remote CPs during rounds, depending on the consultant's preference. While some consultants used to contact the CP after finishing the round and discuss patients' cases one by one, others used to contact the CPs to ask them if they have any intervention and discuss specific questions related to medications.

One of the perceived challenges mentioned during the interviews was the telephone communication with the CP post-round.

'Because, in my original department, I used to go for the round with a clinical pharmacist beside me. To call a clinical pharmacist on the telephone was time challenging. If I was having a clinical pharmacist in the round with me, I would have been asking more questions than we could ask through the telephone'. (Physician 5)

'Because of the COVID-19 risk, we were not allowed to use our telephones (mobile phones). So, we used to go out of the unit with a list of questions prepared in our minds to speak to the clinical pharmacist over the phone then to go in again. This was time-consuming. Also, because I could only have one or two conversations due to my limited time. I had to ask the most important questions while I skip the other questions that I would ask if a clinical pharmacist presented physically with me'. (Physician 2)

None of the nurses included in this study contacted the remote CP during their coverage of COVID-19 ICU units. They mentioned that it was very challenging considering the limited time, thus they had to prioritize other issues such as maintaining constant medication supply which is usually resolved with pharmacy store.

'They were very busy days; we were fully occupied with severe patients' cases. It was a real challenge to have time for calls. So, if I had any question, I used to ask the physician who maybe ask the clinical pharmacists instead of me'. (Nurse 2)

3.4.4 | Limited patients' clinical assessment

CPs have their own clinical judgement, thus their availability during the morning visits to patients' rooms have an impact on their interventions and recommendations.

'Indeed, the clinical pharmacists are not doing physical examinations to the patients. But, they have a great clinical sense. Seeing the patient in the round could highly change their decisions regarding the medications'. (Physician 6)

'The electronic medical profile is not enough to send a full clinical image about the patients' cases. So, sometimes the clinical pharmacists would have recommendations which are not suitable due to their limited clinical information about the patient status.' (Physician 6)

3.5 | Theme 5: Possible solutions expressed by healthcare professionals towards addressing the challenges related to the provision of full collaboration with the remote CPs during the pandemic

3.5.1 | Increasing remote CPs' number

Due to the drastic increase in the patient load during the pandemic, the ratio of CP to patients was very high. Participants suggested increasing the number of remote CPs covering ICUs.

'The number of the clinical pharmacists who were covering the critical care area is low because the bulk of patients was very high. For improving the management of patient cases I highly recommend increasing the number of clinical pharmacists. I mean looking at drugs for many patients and their interactions and all other details is not an easy job. So, we expect a miss or a higher medication error rate'. (Physician 12)

3.5.2 | Expanding remote CPs' privileges

Participants mentioned that the high qualifications of CPs qualify them to expanded privileges such as allowing them to request lab orders.

'One suggestion is to allow clinical pharmacists to put lab orders. This would help us and them to provide better care. For example, the trough level of vancomycin, and anti-Xa levels for patients on enoxaparin. The clinical pharmacists are the best ones to determine the correct timing of these lab tests'. (Physician 2)

3.5.3 | Dedicating time for remote CPs' communication

During the pandemic, an enormous amount of patients were admitted to the ICU, and the time was limited. To conquer this issue, some participants suggested dedicating time for communication with CPs.

'So, what we were doing, we used to finish the round which would take maybe 3 h. Then we decide changes in medications from the physicians' point of view. Then, we used to set with the clinical pharmacists through the mobile phone or landline phone. That specific clinical pharmacists that we were contacting used to review all patients' profiles before our call. This was a great effort from him actually. After that, we start discussing the patients one by one and discuss the clinical pharmacist's recommendations. This session used to take 30 min to 1-h maximum, but it was really helpful and organize our work'. (Physician 7)

4 | DISCUSSION

This study highlighted the perception of other healthcare professionals towards tele-pharmacy service in ICU settings during COVID-19 pandemic. Additionally, it focused on the challenges and their solutions from the perspective of the healthcare professionals who were in direct contact with the remote CPs.

Five major themes emerged from this study: (1) healthcare professionals' current knowledge about remote CPs' roles; (2) perceptions of the healthcare professionals towards remote CPs; (3) differences between remote and in-person coverage of CPs during the pandemic; (4) challenges to patients' care; and (5) solutions to overcome these challenges.

Interestingly, the COVID-19 pandemic was an emergency in which, like multiple other countries, many physicians from different specialties (e.g., internal medicine and endocrinology) were reallocated to help critical care physicians in managing COVID-19 patients.[10] These non-ICU physicians had limited experience in managing the drug therapy of critically ill patients. In theme one, participants highlighted the significant role of remote CPs in assisting physicians from other specialties in managing critically ill patients. Additionally, our findings showed that CPs guaranteed the adoption of an up-to-date therapeutic approaches, which was challenging to do without their presence due to the multiple consecutive versions of national and international guidelines. These guidelines encompassed multiple medication combinations which exposed the patients to the deleterious implications of polypharmacy. Hence, CPs played a major role in ensuring both efficacy and safety and managing adverse events when they occurred.

The perceptions of other healthcare professionals towards tele-pharmacy service in our study is similar to the pharmacists' perceptions reported from previous literature.[12] In our study, participants described the role of remote CPs as vital, particularly in conducting medication reconciliation, identifying drug interactions, and monitoring adverse effects. A recent cross-sectional study examined pharmacists' attitudes towards clinical benefits associated with tele-pharmacy services during COVID-19 pandemic in Jordan. The majority of participants expressed favourable attitude towards tele-pharmacy to accurately capture and report COVID-19 signs and symptoms and they agreed that patients were able to receive immediate medical feedback while utilizing this service. In addition, they emphasized the remote pharmacists' role in monitoring physiological parameters when entered by patients using tele-pharmacy technology.[12]

Our study expanded the knowledge about areas of tele-pharmacy interventions in ICU settings beyond what was shown from previous reports. For example, Our results demonstrated new areas of consultations such as initiation of interleukin-6 receptor inhibitor, COVID-19 antiviral treatments, drug interactions, glycemic control, adverse effects, and alternative medications. Although some of these domains were specific to COVID-19 era, others may be generalized to ICU settings in general such as drug interactions and diabetes management. This finding is similar to the results of a retrospective cohort study of adult ICU patients which showed that most interventions done by tele critical care pharmacists aimed at providing proper glycemic control (36%).[13]

Although Qatar reported the maximum number of people per million affected by COVID-19 amongst Gulf Cooperation Council (GCC) countries, the most updated analysis showed that it also had the highest recovery rate (96.99%) and the lowest death rate (0.15%).[14] Remote CPs service was part of the changes implemented in the national healthcare system to cope with the pandemic, hence they may have contributed to this favourable mortality statistics by ensuring that patients are receiving evidence-based and up-to-date treatments.

In this study, nurses' interviews have reached the saturation point very early, which is primarily due to the lack of contact between CPs and nurses during the pandemic. This might be one of the main tele-pharmacy service limitations as it affected the direct daily contact between nurses and CPs usually seen in in-person coverage.[15] This study also highlighted other barriers for remote staffing, in which most of them were related to communication (e.g., poor communication, lack of communicating the results of bed-side assessment and delayed documentation). Therefore, future larger sample sized studies should further investigate this issue to guide the development of tailored interventions to create new channels to facilitate communication and offer educational programs to improve communications skills.

The principal strengths of our study lie in its novelty at exploring ICU personnel perceptions regarding both the role and the delivery of the CPs' responsibilities by tele-pharmacy during COVID-19 pandemic. Limitations of this study are mostly related to its qualitative design since the findings may be confounded by each individual's interpretation of experiences and perceptions. This could have been influenced by the investigators' personal biases.[16,17] Additionally, it was difficult to invite the participants to check the generated themes. This notwithstanding, the adequacy of our sample size in addition to full thematic saturation meant that these limitations are unlikely to significantly impact the outcome of our report.

Further studies are needed to determine the impact of the tele-pharmacy service in ICU settings on hospital length of stay, morbidity, and mortality. Additionally, a quantitative perspective is perhaps long overdue to compare the interventions and drug-related problems reported by the remote CPs' vis-a-vis in-person CPs' coverage.

5 | WHAT IS NEW AND CONCLUSION

In this novel qualitative study of pandemic-driven tele-pharmacy service, we found a positive perception amongst HCPs towards this service; with residual challenges that will need further evaluation by large sampled sized surveys or mixed methods research.

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CONFLICT OF INTEREST

The study authors have no conflicts of interest to declare.

DATA AVAILABILITY STATEMENT

Additional supplementary material is available from corresponding author on reasonable request.

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SUPPORTING INFORMATION

Additional supporting information may be found in the online version of the article at the publisher's website.

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