Barriers and Facilitators of Pharmacists' Roles During the Pandemic in Malaysia

Thanushiri Palani Velu
Centre for Quality Management of Medicines, Faculty of Pharmacy, Universiti Kebangsaan Malaysia, Kuala Lumpur 50300, Malaysia, thanu1005@yahoo.com

Farida Islahudin
Centre for Quality Management of Medicines, Faculty of Pharmacy, Universiti Kebangsaan Malaysia, Kuala Lumpur 50300, Malaysia, faridaislahudin@yahoo.com

Wei Wen Chong
Centre for Quality Management of Medicines, Faculty of Pharmacy, Universiti Kebangsaan Malaysia, Kuala Lumpur 50300, Malaysia, weiwen@ukm.edu.my

MAKARA Journal of
Health Research

Barriers and Facilitators of Pharmacists' Roles During the Pandemic in Malaysia

Thanushiri Palani Velu[1,2] , Farida Islahudin[1*] , Wei Wen Chong[1]

[1]Centre for Quality Management of Medicines, Faculty of Pharmacy, Universiti Kebangsaan Malaysia, Kuala Lumpur 50300, Malaysia

[2]Pharmacy Department, Hospital Sultanah Aminah, Johor 80100, Malaysia

Abstract

Background: The coronavirus disease 2019 (COVID-19) left a devastating impact on healthcare systems worldwide. The crisis initially emerged as a supply disruption issue but eventually evolved into a myriad of additional challenges, which were attributed mainly to the extensive scale of the pandemic. This study aimed to explore the barriers to the role of hospital pharmacists and related facilitators encountered during the COVID-19 pandemic.
Methods: Pharmacists in Malaysia participated in a cross-sectional online questionnaire-based survey. The participants were recruited using convenient sampling. Cronbach alpha of the questionnaire was analyzed.
Results: The study successfully enrolled 367 pharmacists. The major barrier in terms of knowledge and skills was the difficulty in investigating the trend and usage pattern of COVID-19 medicines (N = 183; 49.9%). A global shortage of medicines (N = 314; 85.6%) occupied the highest barrier in the supply chain. The clinical barriers cited by most of the respondents comprised conducting clinical trials in the search for effective treatments (N = 282; 76.8%), and the largest departmental barrier was the difficulty of predicting usage based on previous data (N = 262; 71.4%). Almost all respondents agreed that a course or module on COVID-19 treatments (N = 354; 96.5%) served as a facilitator, enhancing their awareness and preparedness to respond to the pandemic.
Conclusions: The empowerment of pharmacists with the crucial resources, skills, and support that will enable them to effectively fulfill their roles and responsibilities can be instrumental in the transformation of our approach to addressing future pandemics.

Keywords: barriers, facilitators, Malaysia, medicine supply, pandemic

INTRODUCTION

The coronavirus disease 2019 (COVID-19) pandemic underscored the importance of accessibility, availability, and timely medical interventions in combating coronavirus and its devastating consequences. This highly contagious viral disease exposed the fragilities involving the emergency preparedness and responses of healthcare systems around the world. During the early days of the pandemic, various challenges emerged, and they included the lack of proper COVID-19 treatment protocols as a result of limited information, inadequate supplies, inability to handle COVID-19 cases due to its novelty and spread of misinformation in the media, and the well-being of healthcare workers.[1] The lockdown, which was implemented in several countries, prevented the procurement of medical supplies, especially COVID-19 medication. The disruption in procurement resulted from the heavy reliance on countries such as China and India for their active pharmaceutical ingredients and complete dosage formulations.[2] Extended lead times occurred due to the restricted cross-country

transportation of goods and services and constraints in local manufacturing capacity and capabilities;[3] as a result, eventually a reduced ability to ensure the availability of appropriate medications during emergencies, such as the COVID-19 pandemic, was observed. As such, appropriate processes should be implemented to minimize disruption to the supply of medications in institutions.

The barriers during the pandemic were not only due to the limited importation of medicines but also included increased workload, staff shortages, and rapidly evolving guidelines, as had been observed in Malaysia.[4] Pharmacists faced various hurdles in catering to the urgent demand for COVID-19 medical supplies. Knowledge and skill barriers manifested in unfamiliar territories of COVID-19 management and treatment landscape and limited the ability of pharmacists to provide the best care to patients. Pharmacists demonstrated a strong comprehension of subjects, such as transmission routes, disinfectant utilization, interferon, and quarantine and discharge protocols, although they lacked in areas related to the disease's clinical characteristics.[5] Various drugs were explored for COVID-19 treatment, although a few demonstrated a widespread efficacy and with most being investigational,[6] which led to clinical barriers in navigating the complexities of COVID-19 treatment protocols and monitoring of the safety and efficacy of medications used. Patients undergoing treatment for COVID-19 received 20 types of

*Corresponding author:
Farida Islahudin
Centre for Quality Management of Medicines, Faculty of Pharmacy,
Universiti Kebangsaan Malaysia, Kuala Lumpur, Malaysia
E-mail: faridaislahudin@yahoo.com

medications on average, with each patient undergoing an average of eight interventions.[7] Community pharmacists also expressed concerns regarding the communication strategies employed by regulatory bodies and professional associations and cited ambiguity and the lack of focused guidance.[8] In addition, the application of traditional approaches to purchase essential drugs that had become severely scarce resulted in the inadequate management of drug shortages,[9] and, as a result, a centralized mode of purchasing in Malaysia. These barriers collectively highlight the need for coordinated and adaptable responses that will support pharmacists in overcoming challenges and guaranteeing the efficient distribution of supplies.

A previous work outlined facilitators that can improve the services rendered during the pandemic.[10,11] A multifaceted approach implemented to avert medicine shortages in Taiwan encompassed inventory checking, identification of alternative sources of raw material, expedited review of raw material applications, introduction to financial stimulus and reimbursement plans, and reinforcement of supply-demand balance ruling to ensure that medications are rationally distributed, allocated, and stockpiled.[10] In China, a pharmacy emergency task force oversaw pharmacy administration activities in a module hospital.[11] These activities entailed the implementation of coordinated plans for resource allocation and the formulation and review of treatment medication plans and the drug formulary, and an assessment of emergency drugs.[11]

Despite the extensive exploration of the challenges encountered by pharmacists, most of these investigations were conducted during the initial phases of the pandemic and predominantly centered on their gaining insights into the disease and issues related to drug shortages. Notably, the literature still suffers from the gap regarding the main barriers encountered by pharmacists when fulfilling their expanded roles in clinical practice and medicine supply during a global pandemic. These specific challenges are not yet fully documented. Therefore, this study aimed to explore the barriers and facilitators encountered by hospital pharmacists during the pandemic.

METHODS

This cross-sectional, online survey was conducted in Malaysia during the second wave of the COVID-19 pandemic. Cochran's sample size formula was used to determine this study's sample size formula ($1.96^2pq/e^2$), where e indicates the margin of error, p refers to the (estimated) proportion of the population, and $q = 1 - p$.[12] With the formula as basis, a population size of 18,578 practicing pharmacists was used,[13] and for the attainment of a margin of error of 5%, a confidence level of 95%, and a 50% response distribution rate, a minimum sample size of 376 was required. The participants were recruited via convenience sampling technique. Invitations to research participation were disseminated through social media platforms and collaboration with government Pharmacy Services Department within each state via email. This study included fully registered pharmacists employed in any private or government hospitals in Malaysia and with at least two years of active working experience during the pandemic.

The questionnaire was designed in English and comprised the following sections adapted based on factors related to barriers and facilitators to COVID-19 medicine supply in previous work and tailored by the study investigators to fit the local pharmacy setting: [2,3,8,14–16] pharmacists' demographic, barriers, and facilitators to COVID-19 medicine supply. The pharmacists' demographic characteristics included age, gender, working sector, responsibilities, work location, service duration, and education. To measure the extent of barriers related to medicine supply during COVID-19 experienced by pharmacists in the country, we divided the questionnaire into four knowledge and skills barrier questions (KS1–KS4),[14] four supply chain barriers questions (SC1–SC9),[2,3] four clinical barriers questions (C1–C4),[15] and six departmental barriers questions (D1–D6).[8] Barrier responses were categorized into "Agree," "Disagree," and "I do not know options." Practical facilitators, which consisted of eight questions (F1–F8), accounted for the final part of the questionnaire.[16] The facilitators' response was categorized into "Agree," "Disagree," and "I do not know options."

The face validity of the questionnaire was determined by six hospital pharmacists with at least two years of practice.[17] The questions included in face validation were as follows: "Are the items in the questionnaire clearly presented without grammatical error?"; "Are the items easy to understand?"; "Is the questionnaire relevant?"; "Are the items sufficient to appropriately describe its purpose?" The panel of experts provided feedback responses of either "Agree" or "Disagree." An "Agree" response meant that the item was organized empirically and in accordance with the classification of thematic categories, whereas responding with "Disagree" meant otherwise.[18] The panel was also requested to share their comments and suggestions regarding strategies for improving the instrument. During validation, all respondents noted the grammatical correctness of all the questions, which were also easy to comprehend, relevant, and sufficiently described the purpose of the study appropriately. A total of 25 pharmacists participated in the pretesting of the questionnaire to evaluate its internal consistency. The participants in this pilot study were excluded from subsequent data collection. Cronbach's alpha reliability analysis, which yields a score in the range 0–1, was utilized in this regard.[19] A score close to 1 indicates a high reliability, and a score close to 0 suggests a low reliability.[19] For the questionnaire, Cronbach's alpha

coefficient ≥0.70 was considered the threshold for acceptable reliability.[19]

The data were entered and analyzed using SPSS version 27 (IBM Corp, Armonk, NY, USA). The demographic characteristics were subjected to descriptive analyses. Categorical variables, such as gender, working sector, responsibilities, and education level, were reported as frequencies and percentages. Continuous variables, such as age and service duration, were expressed as mean and standard deviation. The questionnaire for the measurement of the barriers and facilitators to COVID-19 medicine supply was reported as frequencies and percentages and subjected to descriptive analysis.

All study procedures received ethical approval from the Medical Research and Ethics Committee, Ministry of Health (MOH) Malaysia (NMRR-21-1877-61341 (IIR)) and the Universiti Kebangsaan Malaysia Research Ethics Committee (Ref: JEP–2022-766). All participants gave informed consent before participating in this study.

RESULTS

A total of 402 pharmacists, of which 35 were excluded (4 failed to provide consent, and 31 pharmacists reported less than 2 years of experience or were provisionally registered pharmacists), answered the questionnaire. A total of 367 pharmacists were finally included in the study. The respondents had an average age of 33.3 (±4.5) years old, with the majority being female (N = 300; 81.7%). Most of them worked in government hospitals (N = 359; 97.8%) and located in the urban/city area (N = 275; 74.9%). Ward pharmacists (N = 82; 22.3%) accounted for the highest number of respondents, followed by logistics and outpatient pharmacists. More than two-thirds of the participants had an undergraduate pharmacy degree (N = 305; 83.1%), with a few continuing their studies to obtain a master's degree (N = 58; 15.8%) or are PhD (N = 4; 1.1%) holders, with an average of 8.7 (±4.4) years of experience. Cronbach's alpha coefficients for various sections of the questionnaire were also determined: knowledge and skills barriers, 0.816; supply chain barriers, 0.873; clinical barriers, 0.722; departmental barriers, 0.863; and facilitators, 0.792. Given these results, the questionnaire was considered apt for use in the survey.

Table 1 presents the participants' responses to the various barriers and facilitators encountered by them during the pandemic. Their responses concerning the knowledge and skills barriers encountered during that period reflects a diverse range of perspectives among pharmacists.. A substantial proportion of the respondents reported that keeping up with the latest treatment (N = 173; 47.1%) and studying the trends and patterns of drug usage related to

COVID-19 drug treatment (N = 141; 38.4%) were not arduous tasks. Notably, a balanced number of participants agreed and disagreed about the difficulty of coping with an extremely high number of supplementary and urgent indents in the medication supply (N = 161; 43.9% and N = 159; 43.3%, respectively).

According to most of the participants, supply chain barriers hindered their ability to procure medicine during the pandemic. The global drug supply shortage (N = 314; 85.6%) attained the highest agreement among the participants, followed by logistical and transport challenges (N = 296; 80.7%), the lack of locally manufactured drugs (N = 285; 77.7%), and the inability of contract drug suppliers to meet market demand (N = 269; 73.3%). These responses suggest the vulnerability of local supply chains in the pharmaceutical industry, which warrants mitigation.

Table 1 also provides the information reported by the study participants regarding clinical barriers during the COVID-19 pandemic. Most of the respondents concurred with all four statements, expressing the lack of support for pharmacists in this area. The respondents showed the highest agreement for the investigational status of effective COVID-19 treatment via clinical trials (N = 282; 76.8%) and the lack of treatment protocols for recommended off-label use medicines (N = 260; 70.8%).

Moreover, Table 1 presents information implying the departmental barriers encountered during the COVID-19 pandemic. The majority of respondents agreed with the insufficiency of previous procurement data in the estimation of the increase in drug use (N = 262; 71.4%). As responded by more than half of the participants, their department was suffering from the lack of timely reporting of available supply and medicine shortages (N = 210; 57.2%) and lack of early communication with drug suppliers regarding projected demands (N = 203; 55.3%), which implies the presence of underlying issues with communication and information relay.

Several facilitators that may aid pharmacists in overcoming the multitude of barriers present during the COVID-19 pandemic were also identified. Highly positive responses were observed for interventions that focused on the empowerment of pharmacists. These interventions included the implementation of evidence-based patient care through assessment of available therapies and development of drug therapy guides (N = 333; 90.7%), establishment of educational tools and resources that will educate pharmacists on novel therapies and policy updates (N = 349; 95.1%), and organization of educational modules or courses on COVID-19 pharmacological treatment to increase their awareness and preparedness (N = 354; 96.5%).

TABLE 1. Barriers and facilitators during the pandemic (N = 367)

Questions	Agree N (%)	Disagree N (%)	I do not know N (%)
Knowledge and skills barriers			
I find it hard to keep abreast with the latest COVID-19 drug treatment.	155 (42.2)	173 (47.1)	39 (10.6)
I find it hard to study the trends and drug usage patterns of COVID-19 drug treatment.	183 (49.9)	141(38.4)	43 (11.7)
I find it hard to cope with the excessive number of supplementary and urgent indents in medication supply.	161 (43.9)	159 (43.3)	47 (12.8)
I lack knowledge/awareness of my role in COVID-19 drug treatment.	143 (39.0)	171 (46.6)	53 (14.4)
Supply chain barrier			
Logistical and transport challenges caused by national lockdown in drug-manufacturing countries disrupted the medication supply.	296 (80.7)	42 (11.4)	29 (7.9)
The manufacturing capacity of medication decreased due to social distancing measures.	251 (68.4)	45 (12.3)	71 (19.3)
The purchasing costs of active pharmaceutical ingredients/raw materials or finished dosage forms surged.	267 (72.8)	20 (5.4)	80 (21.8)
The drug-purchasing method became restricted.	187 (51.0)	51 (13.9)	129 (35.1)
The budget allocation/funding for purchasing medication was inadequate.	258 (70.3)	44 (12.0)	65 (17.7)
A global shortage of drug supply occurred.	314 (85.6)	13 (3.5)	40 (10.9)
Contract drug suppliers were incapable of meeting market demands.	269 (73.3)	19 (5.2)	79 (21.5)
Heavy reliance on source for raw material/active pharmaceutical ingredients from countries, such as India and China, was observed.	261 (71.1)	7 (1.9)	99 (27.0)
Locally manufactured drugs were inadequate to cope with the market demands.	285 (77.7)	11 (3.0)	71(19.3)
Clinical barriers			
Absence of specific treatments for COVID-19	201 (54.8)	100 (27.2)	66 (18.0)
Emergence of antimicrobial resistance due to the routine use of antibiotics	232 (63.2)	45 (12.3)	90 (24.5)
Lack of treatment protocols for recommended off-label use medicines, such as antiviral drugs, requiring monitoring of their efficacy, safety, interactions, and adverse effects	260 (70.8)	54 (14.7)	53 (14.4)
Ongoing clinical trials in search for effective investigational agents against COVID-19	282 (76.8)	18 (4.9)	67 (18.3)
Departmental barriers			
Unreliable past purchase data for the prediction of the increase in drug usage.	262 (71.4)	23 (6.3)	82 (22.3)
Lack of timely reporting of the available supply and medicine shortages.	210 (57.2)	65 (17.7)	92 (25.1)
Lack of early communication with drug suppliers regarding the projected demand.	203 (55.3)	50 (13.6)	114 (31.1)
Inadequate/irregular review of new evidence and distribution of updated COVID-19 treatment recommendations.	184 (50.1)	87 (23.7)	96 (26.2)
Lack of continuous monitoring of medication use patterns.	187 (51.0)	93 (25.3)	87 (23.7)
Lack of communication with regard to COVID-19 drug needs between clinical and purchasing pharmacists.	133 (36.2)	131 (35.7)	103 (28.1)
Facilitators to COVID-19 treatment			
Leverage on relationships with suppliers for the procurement of essential medicines.	213 (58.0)	28 (7.6)	126 (34.3)
Promotion of the use of drugs with long half-lives, which reduces frequency of administration and is cost effective.	263 (71.7)	43 (11.7)	61 (16.6)
Practice of evidence-based patient care through assessment of available therapies and development of drug therapy guides.	333 (90.7)	2 (0.5)	32 (8.7)
Creation of a pharmacist network or platform for sharing experiences and building of resiliency against burnout.	328 (89.4)	12 (3.3)	27 (7.4)
Provision of educational tools and resources to offer education on novel therapies and policy updates.	349 (95.1)	3 (0.8)	15 (4.1)
Organization of an education module or course for the COVID-19 drug treatment to increase pharmacists' awareness and preparedness.	354 (96.5)	6 (1.6)	7 (1.9)
Creation of a COVID-19 drug–drug interaction database.	345 (94.0)	8 (2.2)	14 (3.8)
Provision of support to local drug manufacturers to meet local needs of essential drugs.	325 (88.6)	9 (2.5)	33 (9.0)

DISCUSSION

COVID-19 caused pharmacists to assume new and expanded roles to provide essential healthcare services while navigating unknown conditions of the pandemic. Despite being their central roles in a multidisciplinary healthcare team during various disasters, disease outbreaks, and pandemics, such as severe acute respiratory syndrome, Ebola, and influenza in the past,[20,21] the novelty of multifaceted challenges that arrived with this pandemic caused hardships of various levels and revealed the gaps present in medicine supply management. In addition, for optimum management, comprehension of the barriers and facilitators of pharmacists determined in the current work can be used to improve the management of future pandemics.

Hospital pharmacists' barriers in knowledge and skills were determined in the present study. In the early days of this global threat, pharmacists were encouraged to acquire knowledge on the novel coronavirus, including its transmission, symptoms, and prevention measures,[22] within a short period. They were forced to grasp quickly the rapidly evolving information and the transitions that must be adopted within their healthcare setting[23,24] to survive the various pandemic waves. In this study, almost half of the participants demonstrated remarkable resilience and adaptability in one of the nation's most difficult periods. Having a mean working experience of 8.7 years means that the participants might have leveraged the skills and knowledge they acquired over time, along with lessons they learned from previous exposure to various disease outbreaks, such as the Middle East Respiratory Syndrome Coronavirus and avian influenza.[25] In addition, Continuous Pharmacy Education sessions were implemented within MOH hospitals and clinics to educate pharmacy staff regarding the treatment and management of COVID-19, particularly during the national immunization program[24] and rollout of paxlovid (ritonavir, nirmatrelvir) treatment. Prior to the sessions, a designated COVID-19 website was developed and updated occasionally by the MOH to serve as an information center for relevant guidelines, infographics, official news, case statistics, etc. On the other hand, a study on pharmacists' satisfaction with their role in the management of COVID-19 patients in Saudi Arabia revealed that most pharmacists skipped participating in the development or assessment of therapeutic plans for patients and did not provide therapeutic mentoring for COVID-19 patients.[26] This failure to participate deprived the pharmacists of the opportunity to apply their knowledge and skills in patient care. Alarmingly, a study across 31 commonwealth countries reported that pharmacists, pharmacy technicians, and dispensers notably lacked prior experience and training in handling international health emergencies.[27] Notably, participation in a webinar organized by the Commonwealth Pharmacists' Association improved their knowledge of COVID-19 resources, treatment updates, and antimicrobial stewardship smartphone app contents, which suggests a positive impact on their comprehension of crucial information related to the pandemic.[28]

Supply chain disruptions, which were especially highlighted during the pandemic, have been occurring for some time now and have been a persistent challenge in the pharmaceutical industry's history. The COVID-19 pandemic amplified disruptions on a global scale, and the participants' responses indicated this as a major barrier. The initial pandemic phases, which involved lockdowns, border closures, and movement restrictions, led to transportation delays, production slowdowns, and customs bottlenecks.[28] This condition aligns with the findings of a study indicating a rise in medication shortages during the initial stages of the pandemic, followed by a decline to prepandemic levels post-May 2020; such outcome was potentially due to the newly implemented policies that granted the United States Food and Drug Administration authority for direct intervention.[29] Factors, such as underreporting, temporary halts in quality assurance, and lack of penalties for nonreporting, were considered potential contributors to a drug shortage.[29] Branded drugs exhibited a higher likelihood of shortages compared with their generic counterparts due to distinct reasons, such as a heightened demand or limitations in manufacturer capacity.[29] Priority should be focused on the initiatives aimed at strengthening of local generic medicine and biopharmaceuticals sector to ensure sustainable access to crucial medications. Such initiatives include the implementation of policies that support domestic pharmaceutical manufacturing, investing in research and development to promote innovation and quality standards, and provision of incentives to attract investments in the sector, as outlined under the 12th Malaysia Plan.[30] In addition, a collaboration among government agencies, industry stakeholders, and academic institutions can facilitate knowledge sharing and capacity building.

The present work unveiled several clinical barriers. Numerous clinical trials were conducted globally during the pandemic to assess the efficacy and safety of potential COVID-19 treatments. The findings of these trials contributed to our comprehension of effective COVID-19 treatments. In the early stages of the pandemic, healthcare providers often made treatment decisions based on limited evidence and expert opinion. The lack of standardized treatment protocols for the off-label administration of drugs, such as hydroxychloroquine and azithromycin, led to varying clinical practices.[31] To the best of the authors' knowledge, despite the availability of vaccines for COVID-19 prevention, the supplies of specific antiviral treatments were limited. Prior to the emergence

of treatment drugs, such as nirmatrelvir/ritonavir, remdesivir, and molnupiravir,[32] no single drug has been hailed as an effective treatment against COVID-19 treatment. Consequently, clinical pharmacists working in a Malaysian infectious disease hospital rapidly realized the salience of the transition from antimicrobial to antiviral stewardship at their facility. This transition facilitated the development of local treatment protocols for repurposed antivirals, which provided practitioners with guidance on recommended doses and treatment regimens.[33] The close collaboration with pharmaceutical resources and information unit and infectious disease physicians, which was aimed at the creation of a localized, rapid, and comprehensive COVID-19 treatment guide that covered novel experimental agents, proved to be useful in streamlining decision-making for all healthcare practitioners.[33] Considering shortages, clinical pharmacists also maintained close contact with inpatient and procurement pharmacists to ensure the continuous supply of COVID-19 medicine. The extension of access to such valuable guidelines can improve the standardization of care practices across institutions, optimize treatment outcomes, promote knowledge sharing among healthcare professionals, and contribute to collective efforts aiming to combat the pandemic.

Barriers within the pharmacy department during the pandemic were also investigated, focusing on medicine inventory management, which may often be overlooked. A conventional strategy employed during a crisis involves forecasting medicine usage based on previous purchasing data.[16] However, this strategy proved insufficient during the COVID-19 period. Swift communication and information relay were inadequate in some areas, such as the reporting of available inventory and shortages; in addition, communication with drug suppliers on the projected numbers[16] possibly hindered the ability of pharmacists' to respond effectively to fluctuating medication demand and secure the essential medicines and resources during the pandemic. During the pandemic peak, a nearly 10-fold rise in the use of intravenous opioid sedatives and vasopressors prompted a multicenter pharmacy in the United States; the pharmacy reported that daily virtual meetings with pharmacy personnel from different hospital sites were instrumental in the identification of medication shortages, redistribution of excess stocks, and efficient coordination of deliveries.[34] This finding illustrates the importance of agile communication and collaboration among pharmacy teams to address medication supply shortages during peak demand periods.

This present work highlighted strategies that can further facilitate the resilience and preparedness of pharmacists when providing services during a pandemic. A clear theme that emerged is empowerment through comprehensive drug therapy guides creates an experienced sharing platform and provides reliable educational materials and resources and continuous education, which serve as exemplary facilitators showing advancement in the post-pandemic era. This condition is in line with that of a previous work that evaluated the use of an online on-the-job training program, specifically the Objective, Activation, Multi-learning, Assessment and Summary teaching model and flipped classroom strategy for the continuing education of community pharmacists, which proved to be effective in current times.[35] This training program is particularly helpful in situations where isolation is required and physical access to training facilities is limited or costly. Not only does this type of continuous education platform offer flexibility and convenience for its participants, but it also allows for a seamless balance between work, home responsibilities, and training requirement. Moreover, pharmacists may receive real-time feedback, track their progress, and revisit materials as needed, which increases the overall efficiency of the training process.[35] In addition, the use of a pharmacy-led system incident management command structure, along with the projection of patient volume and medication needs, alignment of procurement strategies with treatment recommendations, leveraging of data and creation of a system knowledge base, and effective communication with pharmacy staff and other healthcare providers, were determined as facilitators to the management of drug shortages and optimization of patient care.[16] Proactive medication management strategies led by pharmacy teams can potentially streamline processes and reduce red tape in the healthcare system. Pharmacists can also advocate for policy changes to simplify regulatory requirements and reduce unimportant bureaucratic processes. The implementation of continuous quality-improvement initiatives in pharmacies can help in detecting and addressing inefficiencies. Regular evaluations of processes and workflows can result in continuous improvements, which reduces the need for redundant or unnecessary documentation.

The current research encountered certain limitations that warrant acknowledgment. First, this study used a slightly lower sample size than the targeted value and was performed using convenient sampling, which restricted the extent to which the findings could be generalized across various phases of the COVID-19 pandemic. Moreover, the study sample exclusively comprised hospital-based pharmacists in Malaysia, which implies that the results may not be readily extrapolated to other groups of pharmacists in various geographic locations. Regardless, the current work gives insights into possible steps that can help reduce barriers during a pandemic, which may ultimately form a basis for the smooth transition of the medication management process during a pandemic. Future efforts should be directed toward multicenter and multidiscipline collaborations to improve the generalizability and depth of findings and develop comprehensive guidance and resources that will support

pharmacists and the pharmacy workforce during emergencies.

CONCLUSIONS

COVID-19 thrusted pharmacists into an unfamiliar territory, demanding rapid knowledge acquisition, adaptation, and expanded roles. Although challenges persisted, particularly in the management of drug shortages and navigation of evolving clinical practices, ongoing education, clear guidelines, and robust communication are still needed to empower pharmacists during future public health crises. Prioritization of local pharmaceutical production, fostering collaboration, and implementation of proactive medication management strategies can equip healthcare systems better to support pharmacists and boost patient care during pandemics. The present research has several implications for key decision makers, including governments, policy makers, administrators, and pharmacy managers, in the emergence of potentially new outbreaks as aggressive as COVID-19. This research provides an overview of the various barriers encountered during the pandemic and an avenue for introspection of current practices. The empowerment of pharmacists with the requisite resources, skills, and support to perform their roles and responsibilities effectively would serve as a game changer in addressing future health crisis.

REFERENCES

1. Filip R, Gheorghita Puscaselu R, Anchidin-Norocel L, Dimian M, Savage WK. Global challenges to public health care systems during the COVID-19 pandemic: A Review of pandemic measures and problems. *J Pers Med*. 2022;12:1295.
2. Schondelmeyer SW, Seifert J, Margraf DJ, Mueller M, Mueller I, Dickson C, *et al*. *COVID-19: The CIDRAP viewpoint Part 6: Ensuring a resilient US prescription drug supply*. Minneapolis, MN: Regents of the University of Minnesota, 2020.
3. Tirivangani T, Alpo B, Kibuule D, Gaeseb J, Adenuga BA. Impact of COVID-19 pandemic on pharmaceutical systems and supply chain-a phenomenological study. *Explor Res Clin Soc Pharm*. 2021;2:100037.
4. Hing NYL, Leong CT, Subramaniam Kalianan R, Lim WY, Loo CE, Woon YL. Impacts of the COVID-19 pandemic on healthcare services in Malaysia from the Perspective of healthcare providers: A cross-sectional analysis. *Preprints*. 2022:2022030378.
5. Yang D, Ma X, Fu S, Zhao J, Aierken A, Teng L, *et al*. COVID-19 Knowledge and pandemic-associated distress among the hospital pharmacist workforce in China. *Disaster Med Public*. 2021;17:e75.
6. Song Z, Hu Y, Zheng S, Yang L, Zhao R. Hospital pharmacists' pharmaceutical care for hospitalized patients with COVID-19: Recommendations and guidance from clinical experience. *Res Social Adm Pharm*. 2021;17:2027–31.
7. Collins CD, West N, Sudekum DM, Hecht JP. Perspectives from the frontline: A pharmacy department's response to the COVID-19 pandemic. *Am J Health-Syst Ph*. 2020;77:1409–16.
8. Austin Z, Gregory P. Resilience in the time of pandemic: The experience of community pharmacists during COVID-19. *Res Social Adm Pharm*. 2021;17:1867–75.
9. Moss JD, Schwenk HT, Chen M, Gaskari S. Drug Shortage and critical medication inventory management at a children's hospital during the COVID-19 pandemic. *J Pediatr Pharmacol Ther*. 2021;26:21–5.
10. Kuo S, Ou HT, Wang CJ. Managing medication supply chains: Lessons learned from Taiwan during the COVID-19 pandemic and preparedness planning for the future. *J Am Pharm Assoc*. 2021;61:e12–5.
11. Hua X, Gu M, Zeng F, Hu H, Zhou T, Zhang Y, *et al*. Pharmacy administration and pharmaceutical care practice in a module hospital during the COVID-19 epidemic. *J Am Pharm Assoc*. 2020;60:431–8.e1.
12. Ahmad H, Halim H. Determining sample size for research activities: The Case of organizational research. *Selangor Bus Rev*. 2017;2:20–34.
13. Pharmacy Board Malaysia. *Pharmacist Registration Management System: Number of pharmacist holding annual certificate in 2021*. Malaysia: Pharmacy Board Malaysia, 2021.
14. Damuzzo V, Bertin R, Mengato D, Chiumente M, Rivano M, Palozzo AC. Hospital pharmacy response to Covid-19 pandemic in Italy: What we learned from the first outbreak wave. *J Pharm Pract*. 2023;36:87–95.
15. Rehman SU, Rehman SU, Yoo HH. COVID-19 challenges and its therapeutics. *Biomed Pharmacother*. 2021;142:112015.
16. Pulk RA, Leber M, Tran L, Ammar M, Amin N, Miller L, *et al*. Dynamic pharmacy leadership during the COVID-19 crisis: Optimizing patient care through formulary and drug shortage management. *Am J Health-Syst Ph*. 2020;77:1874–84.
17. Masuwai A, Zulkifli H, Hamzah MI. Evaluation of content validity and face validity of secondary school Islamic

education teacher self-assessment instrument. *Cogent Educ*. 2024;11:2308410.

18. Sangoseni O, Hellman M, Hill C. Development and validation of a questionnaire to assess the effect of online learning on behaviors, attitudes, and clinical practices of physical therapists in the United States regarding evidenced-based clinical practice. *Internet J Allied Health Sci Pract*. 2013;11:1439.

19. Tavakol M, Dennick R. Making sense of Cronbach's alpha. *Int J Med Educ*. 2011;2:53–5.

20. Alvarez-Risco A, Dawson J, Johnson W, Conteh-Barrat M, Aslani P, Del-Aguila-Arcentales S, *et al*. Ebola virus disease outbreak: A global approach for health systems. *Rev Cubana Farm*. 2020;53:1–11.

21. Austin Z, Martin JC, Gregory PA. Pharmacy practice in times of civil crisis: The experience of SARS and the blackout in Ontario, Canada. *Res Social Adm Pharm*. 2007;3:320–35.

22. Abdel Jalil M, Alsous MM, Abu Hammour K, Saleh MM, Mousa R, Hammad EA. Role of pharmacists in COVID-19 disease: A Jordanian perspective. *Disaster Med Public*. 2020;14:782–8.

23. Thong KS, Selvaratanam M, Tan CP, Cheah MF, Oh HL, Lee PM, *et al*. Pharmacy preparedness in handling COVID-19 pandemic: A sharing experience from a Malaysian tertiary hospital. *J Pharm Policy Pract*. 2021;14:61.

24. The Pharmaceutical Services Programme Ministry of Health Malaysia. *COVID-19 Pandemic in Malaysia: The journey*. Selangor, Malaysia: The Pharmaceutical Services Programme Ministry of Health Malaysia, 2020.

25. Saba Villarroel PM, Gumpangseth N, Songhong T, Yainoy S, Monteil A, Leaungwutiwong P, *et al*. Emerging and re-emerging zoonotic viral diseases in Southeast Asia: One Health challenge. *Front Public Health*. 2023;11:1141483.

26. Assiri A, Iqbal MJ, Gramish J, Assiri A, Meraya A, Alhossan A, *et al*. Pharmacists' satisfaction with their involvement in the management of COVID-19 patients in Saudi Arabia. *Saudi Pharm J*. 2021;29:85–90.

27. Ashiru-Oredope D, Chan AHY, Olaoye O, Rutter V, Babar ZU; C. P. A. COVID-19 Action Team. Needs assessment and impact of COVID-19 on pharmacy professionals in 31 commonwealth countries. *J Pharm Policy Pract*. 2020;13:72.

28. Xu Z, Elomri A, Kerbache L, El Omri A. Impacts of COVID-19 on Global Supply Chains: Facts and Perspectives. *IEEE Eng Manag Rev*. 2020;48:153–66.

29. Callaway Kim K, Rothenberger SD, Tadrous M, Hernandez I, Gellad WF, Devine JW, *et al*. Drug shortages prior to and during the COVID-19 pandemic. *JAMA Netw Open*. 2024;7:e244246.

30. Malaysian Investment Development Authority. *Malaysia's pharmaceutical industry: A Fast-growing force*. Kuala Lumpur, Malaysia: Malaysian Investment Development Authority, 2022.

31. Belleudi V, Finocchietti M, Fortinguerra F, Di Filippo A, Trotta F, Davoli M, *et al*. Drug prescriptions in the outpatient management of COVID-19: Evidence-based recommendations versus real practice. *Front Pharmacol*. 2022;13:825479.

32. Tiseo G, Barbieri C, Galfo V, Occhineri S, Matucci T, Almerigogna F, *et al*. Efficacy and safety of nirmatrelvir/ritonavir, molnupiravir, and remdesivir in a real-world cohort of outpatients with COVID-19 at high risk of progression: The PISA outpatient clinic experience. *Infect Dis Ther*. 2023;12:257–71.

33. Pee LT, Rosli HI, Chong PF. Clinical pharmacist in a COVID-19 hospital- A Malaysian experience. *Malays J Pharm*. 2021;7:3–6.

34. Merchan C, Soliman J, Ahuja T, Arnouk S, Keeley K, Tracy J, *et al*. COVID-19 pandemic preparedness: A practical guide from an operational pharmacy perspective. *Am J Health-Syst Ph*. 2020;77:1598–605.

35. Shen B, Liu J, He JH, Zhu Z, Zhou B. Development and evaluation of an online training program based on the O-AMAS teaching model for community pharmacists in the post-COVID-19 era. *Front Public Health*. 2022;10:906504.