DRUG DISCOVERY

Contribution of a pharmaceutical professional during the pandemic COVID-19

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ABSTRACT

When the (SARS-CoV-2) initially surfaced in Wuhan (China) in December 2019, the Coronavirus Disease 2019 (COVID-19), an ailment it caused, spread quickly throughout the world. The pandemic has put a considerable strain on the healthcare sector and presented several challenges. Worldwide experiences shared by the human race nevertheless also created new opportunities that have altered the design of the world's healthcare system. New circumstances variation and a gradual extension of knowledge and abilities, especially for the frontline healthcare service, are needed by all healthcare personnel providers. Pharmacists around the world are concerned about the new legislation, methods and services since the way that pharmaceutical treatment is provided has completely changed as a result of the epidemic. More duties are being assumed by pharmacists to stop and manage this pandemic a result of many nations stressing the significance of pharmacists, they are being included in more interesting jobs at healthcare facilities. Because they are not given the necessary assistance, pharmacists in underdeveloped nations often work without the essential safety precautions and are unable to reach their full potential. Academics, policymakers and anyone involved in regulatory issues should attend ahead to create more practical models to make use of their skills and improve patient workflow providing care. The activities that pharmacists performed to manage COVID-19 scenarios were the only ones considered in this review; ordinary pharmacy operations were not taken into account. Not all of the articles relevant to our study may be included because they weren't all indexed in the databases we searched or weren't all available on the same website. Additionally, as more articles are published on COVID-19 regularly, some may be missed since they may become available after the designated search time range. The goal of this review was to demonstrate the commitment and engagement of pharmaceutical professionals who are a part of the frontline savior team, not to examine the quality of the published papers.

Keywords: COVID-19, pandemic, Pharmacists, healthcare, Coronavirus

DISCOVERY
SCIENTIFIC SOCIETY

1. INTRODUCTION

When the (SARS-CoV-2) initially surfaced in Wuhan (China) in December 2019, the Coronavirus Disease 2019 (COVID-19), an ailment it caused, spread quickly throughout the world. The World Health Organization (WHO) proclaimed COVID-19 to be a pandemic on March 11, 2020 (Oredope et al., 2020).

The global community is baffled by the outbreak. All industries are experiencing severe setbacks due to stagnation including ten percent drops in significant equity markets (Ali et al., 2020). The probability increases with globalization and increased movement of people the pandemic is expected to increase (Musso et al., 2018). Pandemics like COVID-19 are related to their high morbidity and mortality and adverse effects on the socio-economic status and livelihood of the community, especially in a country with limited resources. In these settings, the pharmaceutical department restricted access to quality and cost-effectiveness, with no exception drugs to combat illness in areas where the burden of infection is already high illness and weak health systems (Barneveld et al., 2020).

Faced with national and international public health emergencies clinical pharmacists cooperated to take advantage of it actively from pharmacological and therapeutic expertise to maximize the value of COVID-19 medical activities and pharmacist value and responsibility. Pharmacy professionals play a critical role in the pandemic and can provide reliable information on the prevention, detection and treatment management of coronavirus infection. Multiple challenges, as a result, emerging pharmacists are adopting innovative strategies to overcome them (Visacria et al., 2020).

Among many the country defines pharmacies at the national level it was a select few indispensable services it managed to stay open and was open to the public. Countries were blocked by recommendation. In some countries pharmacies need to remain open managed 7 days a week and regular holidays COVID-19 Pandemic (Oredope et al., 2020). Additionally, pharmacists are easily accessible as healthcare providers and in certain nations (Watson et al., 2019). Pharmacists' conflicting responsibilities as healthcare professionals and businesspeople (Scahill et al., 2018).

Pharmacists not only provide consumables and health-related products, but they can also distribute medications and deliver immunizations (Smith, 1962). Despite a substantial body of research, pharmacists are frequently overlooked and underutilized despite being in a prime position to support a pandemic response (Cookson and Stirk, 2019). It can also have short-term and long-term adverse effects. Impact on the general pharmaceutical sector. Short term Impacts include Supply and demand fluctuations Bottleneck, panic hoarding and warehousing, regulation communication and promotion changes and changes to remote interaction through technology and research and changes in the development process.

Delays in approval, a shift towards self-sufficiency in the pharmaceutical product supply chain, a slowdown in industry growth and potential shifts in consumer habits are just a few of the potential long-term effects (Ayati et al., 2020). Pharmacists, together with other healthcare experts, they play a vital role in monitoring and observing adverse drug and medicine reactions as well as disseminating high-quality information that is understandable to laypeople. The pharmacist encourages the patient's commitment to medical treatments and ensures the accurate usage, proper storage and delivery of the prescribed medications (Bragazzi et al., 2020).

In developed nations, the pharmacist is involved in giving drug instructions and supervising dispensing (the UK, Germany and France). To protect patient privacy, pharmacists must significantly improve their skills and confidentiality standards. In hospitals in poor nations, the pharmacist performs pharmacological administration by gaining access to patient medical files (Thailand and Malaysia) (Inoue et al., 2015). The pharmacist and are designed to make it easier for patients to pick up their medications conveniently and to relieve the workload of the pharmacy staff.

Value-added services (VAS) or expanded drugstore services are the two terms most frequently used to describe these services. In the American United States (USA), numerous medications are given to patients via mail order or as a "drive-thru service". Australia has implemented some value-added services (VAS), such as home delivery services, forward dispensing, prescription reminder systems, One-stop-Shops, Rolls-Royce services and chronic disease cards (Hussain et al., 2021).

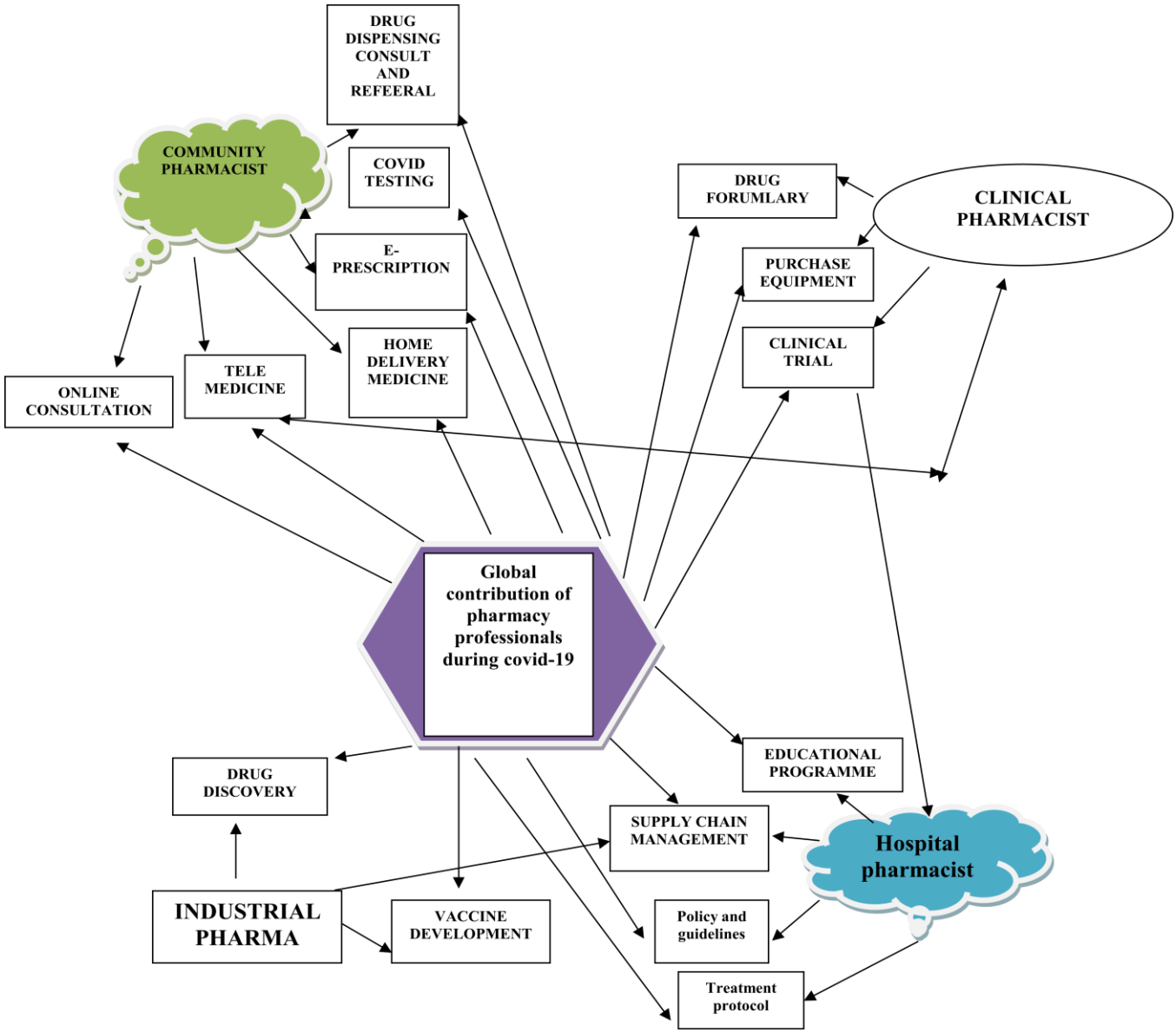

Figure 1 Overview of the global contribution of pharmacy professionals during covid-19 (Sami et al., 2021)

Contributions of community pharmacists in COVID-19

Community pharmacists have served and continue to play a crucial role in managing and containing the COVID-19 epidemic. The pharmacy workforce actively contributes to improving the health and wellness of the community (Urick and Meggs, 2019). Community pharmacists function as mentors, educators and counselors in addition to being health care providers (Musso et al., 2018). Drug-drug interactions will become more common as COVID-19 therapy choices become available and they must be handled. As pharmaceutical specialists, pharmacists are essential in identifying interactions and offering patients alternate medications (Adunlin et al., 2021).

Community pharmacists continue to play an important role in assisting with response efforts and ensuring that the public receives uninterrupted access to a consistent supply of medications. To help pharmacy professionals with workflow and service optimization during the COVID-19 epidemic, pharmacy associations both domestically and internationally have released guidelines and advisories (Aruru et al., 2021). Community pharmacies might conceivably have a huge impact on how easily people in rural locations can get healthcare services. As a result, community pharmacies seem to be especially well-positioned to implement healthcare initiatives and can be accessible to patients without an appointment (Todd et al., 2014).

Pharmacies were the second-most utilized site for influenza vaccination among adults in the US (Burson et al., 2016). Community pharmacists are playing an important role in public health as an adviser by giving pertinent information, suggesting

safety measures and offering advice. Those who are not suspected of having COVID-19 should exercise social distancing, stay away from confined areas and keep a safe distance from anyone who may have the virus. Encourage people to wash their hands frequently and effectively, wash their hands with soap and water and refrain from touching their mouths, noses or eyes before or after doing so (Al-Quteimat and Amer, 2021).

It is the responsibility of pharmacists to create emergency medication formularies for their organizations. They keep an eye on drug supplies, find workable substitutes and address drug shortages. Moreover, pharmacists offer free online consultations to individuals and medical professionals (Liao et al., 2020). A community pharmacist may take up the duty of helping to identify probable COVID-19 cases early and recommend them to the relevant specialists to help stop the virus's spread throughout the community as a whole (Amariles et al., 2021).

Because of the mild COVID-19 symptoms, many patients mistake them for a typical cold, flu or fever and seek treatment from neighborhood pharmacies. Since there are no nearby hospitals, locals first turn to community pharmacists for the treatment of minor illnesses (Khatiwada and Shrestha, 2020). The following are some of the needs for neighborhood pharmacies during the COVID-19 pandemic: Instructing patients to avoid redundant hospital visits throughout the pandemic and take-home medications. Support self-monitoring of the patients for the effectiveness and safety of current therapy.

Pharmacists should recompense thought to patients' emotional and psychological conditions and identify patients with undue anxiety, concern or fear (Merks et al., 2021). Community pharmacists have provided crucial services. Local pharmacists are establishing COVID-19 clinics, utilizing telehealth to manage chronic care and offering COVID-19 testing and assistance once results are known. To educate the public about COVID-19 public health, pharmacists are also putting their in-depth expertise and training in medication use, management and problem-solving to use (Goff et al., 2020).

The following describes a possible role for community pharmacists in the COVID-19 pandemic.

1. Education and counseling: Pharmacists being frontline health care professionals can Counsel people about the illness, its causes, sign, symptoms and routes of transmission, thus supporting counteract the confusion in the general community (Mallhi et al., 2020).

2. Education on Hand and Respiratory Hygiene: Pharmacists through practical demonstration could be able to learn the proper hand-washing technics. In addition to teaching customers the value of physical distance, isolating pharmacy employees from clients with a glass screen or polythene material also safeguards the staff's safety (Mallhi et al., 2020).

3. Encouraging Social or Physical Distancing: Each pharmacy employee should remain at least one meter (3 feet) away from the other at all times. While handling regular matters, clients should be advised to keep at least a minimal distance (Dyal et al., 2020).

4. Telepharmacy Services: Telepharmacy is helpful for everyone, not just COVID-19 patients who have limited mobility during the lockdown but also chronic patients and the entire public. Reduce the number of people visiting medical facilities for treatment as well (Mallhi et al., 2020).

5. Pharmacovigilance at the Community Level: Community pharmacists should effectively monitor any potential negative effects of repurposed medications used in the prevention and treatment of COVID-19 to ensure the safe use of medications. Pharmacists should have a heedful examination of the safety profile of those drugs that might be used frequently during pandemics (Zheng et al., 2021).

6. Busting the Myths and Neutralizing the ambiguous Narratives: It is the novel responsibility of the community pharmacist to bust myths by providing dependable information to the public regarding treatment and prevention as community pharmacist is considered as most trusted persons (Mallhi et al., 2020).

The role of community pharmacists to tackle the COVID-19 health crisis in various countries is described (Table 1).

Table 1 Community pharmacists' assistance during the COVID-19 pandemic

S.No.	Country	Responsibility of community pharmacist
1	Saudi Arabia (Ahmad et al., 2020)	Supplied prescription drugs via mailing and ongoing remote therapy throughout COVID-19 Enhanced patient outcomes and reduced medication abuse Prescriptions for over-the-counter medicines decreased the number of unnecessary hospital visits Online counseling, prescription delivery to

		your door, etc. to make the MOH guidelines for the condition more understandable, created educational materials including posters, brochures, smartphone notifications and text messages
2	Nepal (Khatiwada and Shrestha, 2020)	The early detection and appropriate referral of patients, the provision of medications and the dissemination of information to the general population Make sure there is an adequate quantity of masks available to the public at a fair price
3	China (Liao et al., 2020)	Medical items such as masks, OTC medications, thermometers and disinfectants Give advice and information on appropriate hygiene practices, as well as emotional support
4	Africa (Stergachis et al., 2011)	During the COVID-19 pandemic, rumors of medication review, medical counseling
	A. Nigeria	Initiatives that shed light on myths around the use of unlicensed medications, such as chloroquine, to treat COVID-19
	B. Kenya	Lobbying for the elimination of all drug taxes to make medications more affordable during the pandemic
	C. Egypt	Tele-pharmacy to the patient of chronic disease
5	Ethiopia (Yimenu et al., 2021)	When face masks are given out, doctors should advise patients on how to use them properly and offer advice on how to practice self-defense or get psychological support
6	India (Meghana et al., 2021)	Create and carry out strategies to guarantee the best possible pharmaceutical safety and use; deliver medications and supplies
7	New zeland (Bukhari et al., 2020)	To cut down on public visits, use phone consultations and prescription ordering for home supplies.
8	Pakistan (Bukhari et al., 2020)	Providing personal protective equipment (PPEs) for medical professionals, such as doctors, nurses and paramedics
9	United Kingdom (Goff et al., 2020)	Virtual meetings with patients and the provision of some regulated medications to patients without a prescription.
10	United States (Hasan and Nead, 2020)	Testing for COVID-19 Supplying community members with basic pharmacy and health services remote data entry and taking new orders
11	Canada (Elbeddini et al., 2020)	Educating patients about telehealth services, providing free medicine delivery, determining which patients need to renew their chronic medication, providing consultations for mild

		illnesses, dispelling myths about COVID-19 therapies and helping with COVID-19 screening
12	Italy (Merks et al., 2021)	Preparation of disinfectant products and Medicine home delivery service Introduction of e-prescriptions
13	Spain (Merks et al., 2021)	Distribution of medications to patients who are in quarantine, have mobility issues or suffer from chronic respiratory ailments, diabetes or cardiovascular diseases
14	Netherlands (Merks et al., 2021)	Creating four professional-use preparation guidelines for a viscous gel and liquid hand alcohol. using the guidelines offered by the Royal Netherlands Pharmacists Association to implement
15	Australia (Goff et al., 2020)	Pharmacists kept up with the clinical care and pharmaceutical supply. Help with recordkeeping, ordering pathology testing and medication prescribing
16	Jordan (Abdel-Jalil et al., 2020)	Increasing public awareness of the COVID-19 disease among all Jordanians, providing counseling and referrals, and preventing panic. Make sure there is a sufficient supply of medical supplies and safety gear
17	Taiwan (Ou and Yang, 2020)	Distributing and rationing masks directly to the public. Community pharmacist provided information and advice about covid-19
18	Brazil (Parreiras-Martins et al., 2020)	Provide prescription refills, chronic illness management counseling, and reduce risky self-medication practices using otc drugs. Telehealth services might improve medication therapy outcomes and risk-reduction techniques
19	Germany	Home delivery services during the pandemic
20	Croatia (Merks et al., 2021)	Distributing a small supply of medications (replacement or substitution) to needy people's homes
21	Belgium (PGEU, 2021)	Helping with the COVID-19 vaccine formulation before giving it to a citizen. Awareness-raising discussion with this patient
22	France (PGEU, 2021)	Participate in the national COVID-19 vaccination campaign

Contributions of hospital pharmacists in COVID-19

Pharmacists have a very extensive range of roles within the hospital (Chamoun et al., 2020). Essential responsibilities of pharmacists include suitable medicines in stock; washing hands to avoid diseases; checking for infection in the hospital and providing patient care and support (Mallhi et al., 2020). Pharmacists should assist physicians in monitoring patients' mental health and well-being (Meng et al., 2020).

Following is the activity of hospital pharmacists during the pandemic of COVID-19

1. Inventory Management: Drug switching and supplementary therapy are two ways that hospital pharmacists and clinicians work together to handle drug shortages (Mallhi et al., 2020).

2. Pharmacovigilance at the Hospital Level: Efficient drug safety monitoring not only improves therapeutic outcomes but also reduced costs (Toklu and Mensah, 2016). Currently, the drugs which are involved in the treatment of COVID-19 are associated with serious side effects for example chloroquine, hydroxyl chloroquine and some antiviral drugs cause arrhythmia (Liu et al., 2020).

3. Drug Utilization Evaluation (DUE): This is a beneficial role of hospital pharmacists during this pandemic it is an effective strategy to improve the clinical conditions of the patients (Mullins et al., 2020).

4. Active Member of the Clinical Trial Team: Hospital pharmacists are involved in the clinical trial process for the evaluation of investigational new drugs (Mallhi et al., 2020).

5. Antimicrobial Stewardship Program: To improve patient outcomes, lower microbial resistance and stop the spread of infections brought on by multidrug-resistant organisms, pharmacists work in coordination with doctors, nurses and other healthcare professionals to implement a coordinated program for the appropriate use of antimicrobials (including antibiotics) (Garau and Bassetti, 2018).

6. Hospital Pharmacists' Educational Services: Hospital pharmacists can also advise paramedical and nursing staff regarding the safe use of medicines (Gross and Mac-Dougall, 2020).

7. Authentic and Updated Research Data: Hospital pharmacists can communicate to health care experts regarding the safe use of medicines (Gross and Mac-Dougall, 2020).

8. Disinfection and Sterilization Services: Hospital pharmacist initiates several measures to prevent infection (Arain et al., 2021).

The role of hospital pharmacists to tackle the COVID-19 health crisis in various countries is described (Table 2).

Table 2 Hospital pharmacists' assistance during the COVID-19 pandemic

S.No	Country	responsibility of the Hospital pharmacist
1	China	Chinese Pharmaceutical Association developed Hospital Pharmacists and the Pharmacy Workforce (2nd Edition)" which were responsible for effectively managing medicine shortages, developing new workflows for handling the COVID-19 pandemic, cleaning the pharmacy environment adequately with selected disinfectants, using PPEs for self-protection, and creating emergency protocols for quickly issuing inpatient prescriptions (Hasan and Nead, 2020)
2	Qatar	The major legislative healthcare state of Qatar is called Hamad Medical Company (HMC), which has 232 specialist hospitals in addition to 12 general hospitals. Under the direction of incredibly committed and effective pharmacy executive executives. Promoted social safety and started a drive-through service to track international normalized ratios (INRs) during the COVID-19 epidemic (Goff et al., 2020)
3	South Africa	The 54 Netcare private hospitals in South Africa that make up the Netcare Hospital Group Ltd. played a significant part in providing pharmaceutical services during COVID-19 to guarantee the fast and seamless delivery of medication within the wards (Goff et al., 2020).
4	Canada	During the pandemic, the pharmacist at Public Health Ontario in Toronto, Ontario, gave healthcare providers tips on how to use medications safely (Goff et al., 2020). Hospital and community pharmacists in Canada served as the frontline medical staff in the fight against the SARS outbreak, providing correct medicine distribution and other essential pharmaceutical care directly to the patients (Hasan and Nead, 2020)

5	Australia	The clinical treatment provided by pharmacists, technicians, intern pharmacists, pharmacy students, and pharmacy support staff at Alfred Health Melbourne, Victoria, promptly adjusted and maintained pre-pandemic levels throughout the pandemic. The Society of Hospital Pharmacists Australia (SHPA) is the center for COVID-19 information which also offers continuous professional development opportunities and resources for pharmacy departments (Goff et al., 2020)
6	Saudi Arabia	King Abdulaziz University (KAU) and Hospital (KAUH) pharmacists and pharmacy technicians are maximizing pharmacy services for COVID-19 in the in-patient and out-patient departments (Goff et al., 2020)
7	Spain	13% of the Pharmacy Department (PD) was probably guided by at least one clinical study because the Spanish Society of Hospital Pharmacy (SEFH) sponsors clinical studies. This study will evaluate the efficacy and security of a novel treatment using inhaled anti-infectives. A crucial player in biomedical research is the hospital pharmacist. Hospital pharmacists support logical, efficient and secure clinical decision-making by contributing their critical evaluation abilities and leading research for the creation of evidence. Hospital pharmacists have contributed to research during the epidemic, as seen by their involvement in CTs funded by regional and international sponsors. Another illustration is the extensive hospital pharmacist engagement in the observational study RERFAR-COVID-19 (Castro-Balado et al., 2020)
8	United States of America	To identify and implement crucial pharmacy services for COVID-19 in patients and outpatients, pharmacists at The Ohio State University Wexner Medical Center (OSUWMC) in Columbus, Ohio, collaborated with the hospital's top leadership and the disaster preparedness team. Ensure that pharmacists are qualified to start time-sensitive treatments, such as antivirals, under pharmacy practice legislation. Plan and coordinate emergency response with pharmacist participation (Adunlin et al., 2021)
9	Lebanon	Via social media channels, a representative sample of hospital pharmacists in Lebanon was asked about their knowledge, attitudes, practices, and level of preparedness for the COVID-19 pandemic. Findings revealed that participants knew more than 90% about COVID-19. the majority of hospital pharmacists questioned indicated favorable practices for safety and preventative measures against COVID-19 infection (Chamoun et al., 2020).
10	United Kingdom	Hospital pharmacists in the United Kingdom were expected to do duties such as supervising COVID-19 clinical studies, scaling up sterile production facilities to produce and deliver more ready-to-use parenteral medications and overseeing ICUs (Goff et al., 2020)
11	Nigeria	Pharmacists from the Department of Clinical Pharmacy at the Africa Resource Centre Nigeria Hub are assisting in the creation of adaptable health supply chain systems for the effective delivery of medications and PPE for various state governments (Goff et al., 2020)

Contributions of Clinical pharmacists in COVID-19

Clinical pharmacists are trained and certified professionals with a focus on complete drug management who work in a variety of patient care settings. As a member of a multidisciplinary team, they can manage drug therapy since they have an in-depth understanding of medications and illness situations. Clinical pharmacists are accountable for patient outcomes and pharmaceutical therapy (Jacobi, 2016). Clinical pharmacy (CPh) is integrated into the health care system to provide comprehensive and effective tools with the use of medication and patient care, encompassing a broad area, involving both community and hospital.

A clinical pharmacist who has received further training in oncology can propose optimal treatments and halt avoidable harmful effects (Bajwa and Ashiq, 2020). They must also be ready to give all healthcare professionals the best advice that is currently accessible (Al-Quteimat and Amer, 2021). During the COVID-19 epidemic, teleconferencing helps pharmacists to continue offering top-notch healthcare services. With the aid of remote pharmacy services, pharmacists can evaluate patient profiles to determine the efficacy and safety of pharmaceutical therapy. Although not all pharmacies can operate using this method, pharmacies and pharmacists can take precautions to reduce the danger of infection (Claire-Elson et al., 2020).

Clinical pharmacists take involved in-patient care as medication experts who advise patients on drug options and offer medication education. They also make sure that patients' existing treatments are safe and effective through laboratory monitoring and adverse effect evaluation. Professional pharmacists do COVID-19 screenings and stress the value of keeping patients on therapy even when illness is not detected. Patients getting infusions can learn about the safety measures used in infusion centers from clinical pharmacists. Clinical pharmacists can also monitor refill requests and keep track of infusion sessions to ensure medication adherence.

If non-adherence is found, they can offer targeted interventions to lower the risk of flare-ups and hospitalizations. Clinical pharmacists offer clinical follow-ups to guarantee the effectiveness and safety of treatments (Bhat et al., 2021). By utilizing their pharmacological and therapeutic knowledge, clinical pharmacists from home and abroad can combat COVID-19. Clinical pharmacists should offer central services for compounding cytotoxic medications in addition to therapeutic drug monitoring (TDM). The purpose of including clinical pharmacy in the healthcare system is to provide comprehensive management tools for using medicine and patient care (Bajwa and Ashiq, 2020).

Clinical investigators must include clinical pharmacists if a clinical trial is to be completed successfully. The urgent search for a COVID-19 therapeutic option or preventative measure fell under the purview of the clinical pharmacist. During this widespread pandemic. For instance, they were involved in the clinical assessment of the patients for the study during the remdesivir clinical trial in the US, assessing patients' prior drug/disease history and gaining patient permission. Clinical pharmacists contributed to drug safety monitoring by taking part in the creation of national/hospital-based clinical COVID-19 treatment guidelines. By doing this, they helped to raise the standard of patient care and may have even helped to slow the COVID-19 pandemic (Hasan and Nead, 2020).

Clinical pharmacists play a crucial role in minimizing adverse drug events and reducing prescription administration errors (Leguelinel-Blache et al., 2018). Clinical pharmacists may also be transferred to supply-focused roles (Cheong, 2020). When providing direct patient care, clinical pharmacists take duty and accountability for managing drug therapy, whether acting alone or in consultation with or in partnership with other health care professionals (Bauman, 2020). The role of Clinical pharmacists to tackle the COVID-19 health crisis in various countries is described (Table 3).

Table 3 Clinical pharmacists' assistance during the COVID-19 pandemic

S.No	Country	Responsibility of the Clinical pharmacist
1	France	French Society of Pharmacology and Therapeutics organized A nationwide Question and Answer (Q & A) on the appropriate use of medications during COVID-19 posted online in this clinical pharmacist take part and manage, analyze, and answered questions (Larrouquere et al., 2020)
2	United Kingdom	Royal Pharmaceutical Society of the United Kingdom makes policies regarding national guidance for pharmacy professionals' guidance to upskill redeployed pharmacists to manage COVID-19 clinical trials (Goff et al., 2020)

3	Saudi Arabia	When the virulent disease status varies, clinical pharmacists have a critical role in analyzing, reporting, updating, and developing COVID-19 treatment guidelines. A position paper on the role and accountability of clinical pharmacists during pandemics in Saudi Arabia was produced by the Saudi Society of Clinical Pharmacy (SSCP) (Goff et al., 2020)
4	Qatar	The primary healthcare legislative body in the state of Qatar is called Hamad Medical Corporation (HMC). The nation's core team for COVID-19 response included a group of clinical pharmacists. clinical pharmacists took part in daily rounds and offered medical assistance (Goff et al., 2020)
5	Thailand	Clinical pharmacists make prescription decisions based on scientific evidence and monitor and assess medication effectiveness. Clinical pharmacists can provide pharmaceutical treatment through telemonitoring. Medication dose design was the clinical pharmacists' primary responsibility when providing care for COVID-19 patients (Surapat et al., 2020)
6	Pakistan	Clinical pharmacists play a more beneficial and effective function in the COVID-19 project. Clinical pharmacists have examined outpatient drug profiles using an electronic pharmacy and health information management system. Any information needed can be obtained from the pharmacist, and all medication changes follow the advice of the pharmacist. The clinical pharmacy lead developed several 24-hour communication channels. All of the clinical pharmacists and front-line doctors were put into a Whatsapp group to facilitate quick communication and decision-making. After the approval of off-label medications, infectious disease (ID) faculty directly engaged ID-clinical pharmacists in real time for pharmacotherapy advice and speedy decision-making (Hussain et al., 2020)
7	Australia	In Australia, Clinical pharmacists produce national, scientifically supported recommendations for the clinical management of COVID-19 patients. Clinical pharmacists assist with ordering pathology tests, providing drugs and documenting ward rounds (Goff et al., 2020)
8	South Africa	The South African Society of Clinical Pharmacy issued a practice guide on the function of clinical pharmacists during the COVID-19 epidemic (SASOCP). Clinical pharmacist Quick updates to patient care requirements that required rapid action were guaranteed with the help of effective pharmaceutical advice. This allowed the pharmacist to schedule online patient education sessions with the assistance of the on-site nurses and support staff (Fan and Kamath, 2020)

9	Nigeria	Clinical Pharmacist the Nigeria Hub contributes significantly to the construction of flexible health supply chain systems for the effective delivery of medications and personal protective equipment for various state governments in the Africa Resource Center (Goff et al., 2020)
10	Lebanon	Clinical pharmacists worked directly with COVID-19 patients, doing daily thorough medication evaluations and pharmacotherapeutic monitoring. A clinical pharmacist also has an important role in hospital multidisciplinary teams (Chamoun et al., 2020)
11	United States of America	U.S clinical pharmacists provided an online platform to provide reliable information during the pandemic which describes the task of clinical pharmacists during a virulent disease (Goff et al., 2020). Clinical pharmacists boast an important role in the exploitation and shortages as well as clinical implications of depleting the medications which are used primarily during the covid -19 pandemic. by conferencing. To prevent therapeutic pauses, a clinical pharmacist makes sure there is a sufficient supply of drugs. Manufacturers and clinical teams now have a direct line of communication thanks to clinical pharmacists. They improved patient care while reducing stress for other front-line employees. They are in charge of evaluating potential providers and instructing them on how to utilize medications safely and effectively. In coordinating the healthcare system's response to the COVID-19 epidemic, clinical pharmacists were crucial. Controlling and reducing medicine shortages enabled medical professionals to maintain the best standard of care across the whole health system. Clinical pharmacists' expertise and experience enabled the quick creation and dissemination of crucial drug information (Ferguson et al., 2020)
12	Malaysia	Clinical pharmacists are employed in hospital wards in Malaysia where they provide patients with pharmaceutical care and support the medical staff by offering guidance and advice on how to administer medications properly (Cheong et al., 2020)

Contributions of industrial pharmacists and pharmaceutical companies to COVID-19

The pharmaceutical industry plays a crucial part in keeping the balance of the medicine supply during the crisis. The pharmaceutical sector aims to ensure the availability of essential medicine at an affordable price (Ayati et al., 2020).

Following are the potential role of industrial pharmacists during the pandemic of covid -19

1. Member of COVID-19 Research and Development: Industrial pharmacist responsible for ensuring the ethical aspect and efficient resource use during clinical research undertaken by the industry, as well as the appropriate and safe use of pharmaceuticals during clinical trials (Mallhi et al., 2020).

2. Improving Access to Medicines Industrial: Pharmacist has a key role in the timely distribution of essential drugs and those drugs which are used for primary health care needs (Kanavos et al., 2011).

3. Monitoring of Reported Adverse Drug Reactions (ADRs): Pharmaceutical organizations ensure the safety reporting of investigational drugs to the National Pharmacovigilance Database: Industrial pharmacists are responsible to collect safety data on drugs and conveniently reporting adverse events (Hartford et al., 2006).

4. The miscellaneous activity of industrial pharmacists: Industrial pharmacists should fulfill the legal requirements to continue the production and supply of medicines beside this pharmacists should ensure that supply should not be interrupted (Mallhi et al., 2020). Pharmaceutical industry activity during the COVID-19 epidemic is described (Table 4) (Sami et al., 2021)

Table 4 Pharmaceutical industry activity during the COVID-19 epidemic

S. NO.	Aera	Name of company	Activity
1	Treatment development	Novartis	Canakinumab is under clinical trial for the treatment of pneumonia caused by covid-19
		Pfizer	antiviral compounds that were used previously in the healing of contagion due to SARS-CoV-2 were evaluated
		Johnson & Johnson	Develop lead molecules as well as the screening of some existing molecules
		Astra Zeneca	Develop new monoclonal antibodies. That is effective against the coronavirus
2	Vaccine development	Johnson & Johnson	Developed potential novel coronavirus vaccines.by collaboration with Advanced Biomedical Research and Development Authority (BARDA) and Beth Israel Diaconis Medical Center (BIDMC)
		Pfizer	develop a BioNTech mRNA vaccine candidate to prevent COVID-19 infection
		Seqirus	Working with the University of Queensland to support the CEPI-funded COVID-19 vaccine program based on molecular clamp technology
3	Diagnostics	Roche	detect antibodies taken from human blood and determine the body's immune response to SARS-CoV-2
		Takeda	diagnose COVID-19 and develop inhibitors to prevent future outbreaks
4	Non-health services	Takeda UK	Donated over £100,000 to patient organizations and charities in urgent need

Contributions of drug regulatory and administrative pharmacists

Drug regulatory and administrative pharmacists are in charge of ensuring that pharmaceuticals are used properly and that they are timely and readily available when there is a need.

The role of drug regulatory and administrative pharmacists at the time of covid -19 is following

1. Adequate Drug Supply: Pharmacists as a part of drug regulatory and administrative services should ensure an adequate supply of drugs by reporting the reasons for the medicine scarcity and how to manage using alternative sources to purchase drugs (Mallhi et al., 2020).

2. Ensuring Good Selling Practices (GSPs): Pharmacists in managerial roles should ensure that pharmaceutical firms and other stakeholders understand their responsibilities and ensure the supply of both OTC and prescription drugs, as well as critical drugs. Drug shortages would be problematic for patients, hospital administration, drug distributors and doctors (Peschken, 2020).

3. Administrative Actions Against the increased price of ppes: Pharmacists at the administration level should initiate the following steps to solve these issues.

1. Identification and reporting of the hoarding-related agents

2. followed by a check to make sure the stock is still present on the property

3. Should get in touch with reliable suppliers and manufacturers to ramp up production and meet the demands of the rising demand (Livingston et al., 2020).

4. Quality Testing: By providing occasional quality testing of medications and with some relaxation in regulatory requirements pharmacists can increase the quality of production and supply should not be compromised to maintain the availability of medications during the pandemic (Mallhi et al., 2020).

5. obligatory Actions Against Unregistered Drugs, Sanitizers and Disinfectants: The ability to confiscate and prevent the sale of illegal drugs should be granted to drug inspectors and drug monitoring teams. Hand sanitizers and disinfectants and report to stop their hoarding and stockpiling. All pharmacists should be trained in small-scale manufacturing of hand sanitizers and disinfectants (Mallhi et al., 2020).

6. Ease Operational Barriers: Pharmacists will be helpful in covid -19 management effectively and make sure the availability of medicines (Broughel and Yatsyshina, 2020).

Pharmacists' inter-professional and intra-professional collaboration COVID-19

Interprofessional collaboration is the process by which the healthcare team works together to improve the quality and safety of patient care while leveraging complementary skills and knowledge and respecting one another's areas of expertise (Levett-Jones et al., 2018). In Saudi Arabia pharmacists in collaboration with other healthcare workers managed (MERS) middle east respiratory system (Albarrak et al., 2021). The degree of interprofessional cooperation and patient safety are significantly correlated (Zwarenstein and Bryant, 2000).

When managing drugs after patient admission or when preparing for discharge the collaboration between doctors, nurses and pharmacists mostly occurred within a single clinical setting (Manias et al., 2021). The pharmacist's collaboration with other professionals is a pivotal component in creating safe transitions for patients. In multidisciplinary teams, the pharmacist's responsibilities include serving as the subject-matter expert on medications, offering counsel and suggesting actions to ensure rational pharmacotherapy and patient safety. Both clinical outcomes, especially hard endpoints like hospital readmissions, have significantly benefited from this involvement and interdisciplinary collaboration (Lech et al., 2020).

A webinar was hosted by the FIP Young Pharmacists group in collaboration with the National and Regional Young Pharmacists Group during this diverse webinar. During the epidemic, there will be opportunities for cooperative problem-solving as well as techniques, resources and groups that YPG members can work with. The help given to their members throughout the pandemic was strengthened by collaboration across national and regional YPG organizations (Sousa-Pinto et al., 2021).

Global recognition of pharmacists in COVID-19 During disasters, pharmacists are specially positioned to offer affected people medication management and continuity of treatment. Being more accessible than supermarkets, it is usually considered that pharmacists are the healthcare provider with the greatest geographic reach (Watson et al., 2019). In several nations, pharmacists are becoming more actively involved in immunization campaigns by giving vaccines to patients. In Canada According to a 2015 nationwide study, 82.3% of pharmacists, 64.6% of the general population, 57.3 % of nurses and 38.1 % of physicians endorsed pharmacists as vaccine providers.

Overall, community pharmacies are accessible and convenient locations for patients to receive immunizations and pharmacists are acknowledged as qualified vaccine providers in many nations. The capacity to give vaccines to patients of various age groups conveniently, competently and securely makes the pharmacist an essential and accessible member of the healthcare team (Poudel et al., 2019). Community pharmacies in low- to middle-income nations give people who can't afford doctor visits the benefit of free medical advice (Elbeddini et al., 2020).

In Malaysia, pharmacists are in the best position to do a medication review and spot medication-related issues thanks to their training and abilities. Provide direct patient and nursing home staff medication information and education (100%), as well as assistance to prescribers regarding the choice of drug therapy (97%) (Mak et al., 2018). A South African tertiary hospital's interdisciplinary renal team relies heavily on the clinical treatment provided by pharmacists. While examining already prescribed medication, pharmacists are essential and to decrease the amount of unneeded medical care that individuals receive.

Pharmacists supervise dosage modifications and forbid the use of medications that are not appropriate: In addition to reviewing prescriptions, pharmacists and members of the renal MDT indicated that pharmacists support doctors during the prescribing process: Pharmacists can work closely with doctors when prescribing medications can closely collaborate with the doctor to establish the patient's pharmacological care. The medication can be explained to patients by pharmacists (Manyama et al., 2020).

Obstacles to pharmacy services during COVID-19 and prospects even though it has been an extremely difficult and stressful time community Pharmacy services have been acknowledged as crucial and front-line. During this time, those with mental health

issues are especially vulnerable. For this careful assessment of their pharmacological care needs. It's important to assess the pandemic's effects on the mental health of pharmacy employees and start providing support (Hayden and Parkin, 2020).

Clinical pharmacists faced a dilemma. They sought to provide healthcare services under that circumstance but lacked adequate support to deliver the patient's healthcare. Researchers found that pharmacists' burnout caused by heavy workloads is most prevalent in comparison to doctors and nurses even before this pandemic's initial outbreak (Neumann et al., 2018). Covid-19 frontline healthcare personnel reported increased rates of sadness, distress, anxiety and insomnia due to psychological effects (Larrouquere et al., 2020).

As a result of the expansion of their clinical roles and increased accountability for patient outcomes, pharmacists are currently being driven to change their perspectives toward patient-centered care. Patient consultation and medication are included in the scope of work. Management, providing other healthcare professionals with access to specialized pharmaceutical knowledge. This altering political climate has presented many difficulties and as of now, we don't know much about how pharmacists are handling these new demands (Scahill et al., 2018).

The list of frontline employees in Canada's most populous province does not include pharmacists, whether they are employed in a community or hospital and have been serving in frontline capacities, yet they have not been accepted as such by all. Despite not receiving the same praise as frontline workers, they are still able to perform their duties in a manner comparable to their coworkers (Elbeddini et al., 2020).

Limitation of review

The activities that pharmacists performed to manage COVID-19 scenarios were the only ones considered in this review; ordinary pharmacy operations were not taken into account. Not all of the articles relevant to our study may be included because they weren't all indexed in the databases we searched or weren't all available on the same website. Additionally, as more articles are published on COVID-19 regularly, some may be missed since they may become available after the designated search time range. The goal of this review was to demonstrate the commitment and engagement of pharmaceutical professionals who are a part of the frontline savior team, not to examine the quality of the published papers.

2. CONCLUSION

The pandemic has put a considerable strain on the healthcare sector and presented several challenges. Worldwide experiences shared by the human race nevertheless also created new opportunities that have altered the design of the world's healthcare system. Pharmacists around the world are concerned about the new legislation, methods and services since the way that pharmaceutical treatment is provided has completely changed as a result of the epidemic.

More duties are being assumed by pharmacists to stop and manage this pandemic a result of many nations stressing the significance of pharmacists, they are being included in more interesting jobs at healthcare facilities. Because they are not given the necessary assistance, pharmacists in underdeveloped nations often work without the essential safety precautions and are unable to reach their full potential. Academics, policy makers and anyone involved in regulatory issues should attend ahead to create more practical models to make use of their skills and improve patient workflow providing care.

Informed consent

Not applicable.

Ethical approval

Not applicable.

Conflicts of interests

The authors declare that there are no conflicts of interests.

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Data and materials availability

All data associated with this study are present in the paper.

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