

Hospital pharmacy practices during and after the covid-19 pandemicAdarsh Mishra¹, Ashok Kumar^{2*}, Esha Vatsa², Nidhi Chaudhary², Amandeep Singh³, Krati³¹Student, School of Pharmaceutical Sciences, Jigyasa University, Dehradun, Uttarakhand, India²Associate Professor, School of Pharmaceutical Sciences, Jigyasa University, Dehradun, Uttarakhand, India³Principal and Professor, School of Pharmaceutical Sciences, Jigyasa University, Dehradun, Uttarakhand, India⁴Assistant Professor, School of Pharmaceutical Sciences, Jigyasa University, Dehradun, Uttarakhand, India

Received: 20-01-2026 / Revised: 01-02-2026 / Accepted: 22-02-2026

Abstract

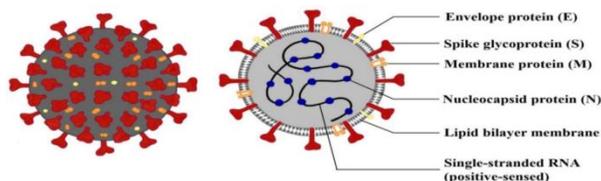
Millions of people nationwide are affected by the public health issue brought on by multiple COVID-19 outbreaks. Medical professionals are taking on a great deal of responsibility and is putting forth great effort to stop the disease's spread. The typical responsibilities of pharmacists must change in these extraordinary circumstances. Pharmacists must rise to the occasion and adjust their plans accordingly. Numerous countries are attempting to address the consequences of the second wave of COVID-19 and the most recent third wave caused by the OMICRON version, which has damaged the healthcare system and raised concerns about the governance and resource management shortcomings that have impacted thousands of lives. In several areas, especially in middle- and low-income countries, it is challenging to control the situation. Therefore, in order to successfully provide all healthcare services, healthcare workers—especially pharmacists—must implement adjustments related to operations, supply management, safety precautions, raising awareness, immunization campaigns, etc. The duties and responsibilities that pharmacists can perform both during and after this epidemic are highlighted in this article. Additionally, it examines how they operate, what functions they can adopt, and where their roles can be increased or changed in compliance with national regulations. Hospital pharmacists emerged as critical participants in ensuring medication supply, patient care, and infection control during the COVID-19 pandemic, which put healthcare systems around the world to the test. Their responsibilities changed from dispensers to decision-makers, and they were resilient and creative in the face of swift change.

Keywords: COVID-19, hospital pharmacy, pharmacy practice, and the significance of pharmacists

This is an Open Access article that uses a funding model which does not charge readers or their institutions for access and distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>) and the Budapest Open Access Initiative (<http://www.budapestopenaccessinitiative.org/read>), which permit unrestricted use, distribution, and reproduction in any medium, provided original work is properly credited.

Introduction**Covid-19**

The World Health Organization's (WHO) China Country Office was notified on December 31, 2019, of incidents of pneumonia of unknown etiology found in Wuhan City, Hubei Province, China. The WHO later dubbed this illness COVID-19, which stands for coronavirus disease.[1]

Structure of corona virus**Fig 1: Structure of Corona virus****Signs and Symptoms**

Not all potential symptoms are included in the list below. New COVID-19 variations may cause symptoms to shift, and vaccination status may also have an impact. Among the potential symptoms are:

Fever or chills
Cough
Shortness of breath or difficulty breathing
Sore throat
Congestion or runny nose
New loss of taste or smell
Fatigue
Muscle or body aches
Nausea or vomiting
Diarrhoea[2]

*Correspondence

Dr. Ashok KumarAssociate Professor, School of Pharmaceutical Sciences,
Jigyasa University, Dehradun, Uttarakhand, India



Fig. No. 2 Symptoms of COVID

Common colds have usually been caused by coronaviruses. However, SARS-CoV-2, a novel coronavirus, began to infect people in 2019 and cause serious sickness. Tens of thousands of individuals were admitted to hospitals every day in the United States alone during the height of the pandemic, when COVID was spreading over the world. There have been millions of deaths.

Since the beginning of the epidemic, medical experts' knowledge has increased significantly. The virus itself is constantly evolving; it has undergone alpha, beta, gamma, delta, and now omicron variations. Researchers have created vaccines and medicines that have decreased the amount of hospital admission.

However, COVID is not "over." It can still be lethal, create symptoms that persist for months or years, and make you very sick.

Causes of COVID

The SARS-CoV-2 virus is the cause of COVID. It is a member of the coronavirus family of viruses that also cause colds. This is not the first time a coronavirus has caused a serious disease, though. The 2002–2004 SARS outbreak, a dangerous respiratory disease, was caused by a different corona virus.[3,4]

COVID spreads through respiratory droplets. This suggests that coughing, sneezing, and talking can all transmit it. It can also be acquired by contact with contaminated objects and surfaces.[5]

1.5. Risk factors

You are more likely to be admitted to the hospital for COVID-19 if you:

- Have reached the age of 65 or above;
- expect a baby.
- Currently smoke or have smoked previously.
- A hematological condition like sickle cell disease or thalassemia.

- Tumorleiden.
- Cerebrovascular diseases, such as stroke
- Long-term illnesses impacting your heart, liver, kidneys, or lungs; [6]
- Conditions present from birth, such as Down syndrome or cerebral palsy
- Neurological disorders, including dementia or Alzheimer’s; [7]
- Excess weight. [8]
- Conditions related to dependence on substances like cocaine, alcohol, or opioids; [9]
- Tuberculosis. [10]

Complications of COVID

COVID can cause serious problems even if you don't feel very sick. These include:

- Pneumonia and acute respiratory distress syndrome (ARDS)
- Blood clots, including pulmonary embolism (PE) and deep vein thrombosis (DVT). [11,12]
- Children with multisystem inflammatory syndrome (MIS-C). [13]
- Heart inflammation (myocarditis/pericarditis);
- Cardiac arrest. [14,15]
- Long COVID, a condition where after a COVID infection, symptoms such extreme fatigue and pain last for months or years.[16]

Diagnosis and Tests

The way doctors identify COVID-19.

Medical practitioners utilize a nucleic acid amplification test (NAAT), such as a PCR test, to diagnose COVID by swabbing your nose with a soft-tipped stick. Additionally, you can perform a fast antigen test at home.[17,18]

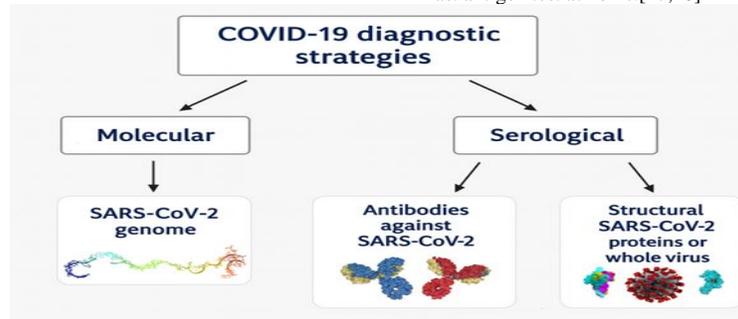


Fig 3. Diagnosis of COVID-19

Management and Treatment

How is COVID handled?

Antiviral medications can be used to treat COVID. This includes nirmatrelvir/ritonavir (Paxlovid®), remdesivir (Veklury®), and molnupiravir (Lagevrio™). When taken during the first five days, antivirals can enhance your mood and lower your risk of serious illness and long-term COVID. [19]Upon being admitted to the hospital due to a serious illness, your doctor may provide you with:

Treatment using monoclonal antibodies; supplemental oxygen; corticosteroids; mechanical ventilation; and recovery period. [20] A lot of individuals find relief from symptoms such as congestion, sore throats, and coughing within roughly two weeks. In contrast, signs such as fatigue and dyspnea may persist for weeks or months. For how long have you been able to spread COVID-19? COVID-19 can be transmitted a few days prior to the onset of symptoms. [16]

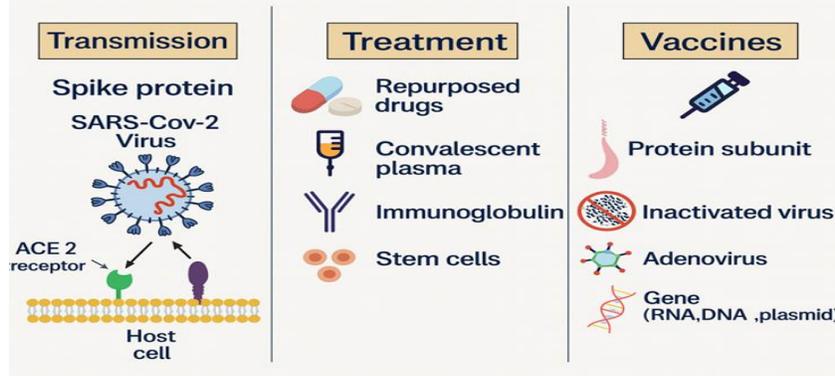


Fig 4. Treatment of COVID-19

Pathophysiology

Transmission of infections

Respiratory droplets are the primary means of illness transmission between individuals. The oral-faecal pathway is feasible. Sputum, pharyngeal swabs, and feces have all been found to have the virus. SARS-CoV-2 vertical transmission has been documented and

verified by a positive nasopharyngeal swab for COVID-19.[22,23]The majority of patients will see symptoms between 11.5 to 15.5 days, with a median incubation period of 5.2 days for COVID-19. Consequently, a 14-day quarantine has been advised for individuals who have been exposed to infection.[17]

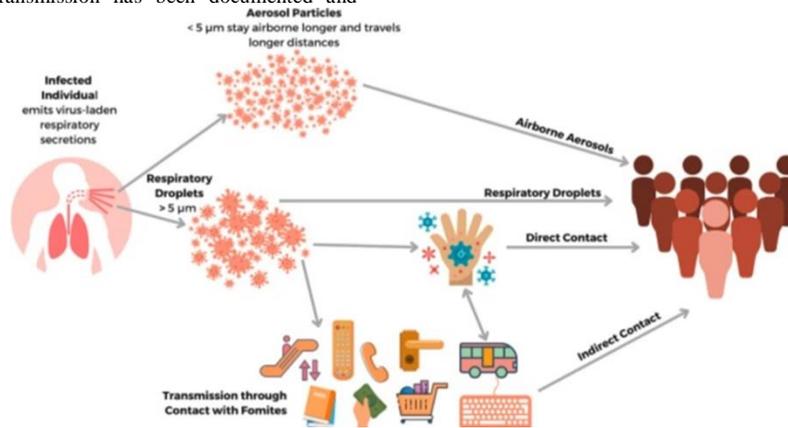


Fig. No 5 Pathophysiology

Pathogenesis

With the help of TMPRSS2 protease and binding to ACE2 for internalization, the SARS-CoV-2 infection enters the host cells via the S spike protein. Mutations in the receptor binding domain and the acquisition of a furin cleavage site in the S spike protein are linked to the virus's high infectivity. In people who are susceptible, the virus's interaction with ACE2 may increase the effects of angiotensin II and decrease the anti-inflammatory function. Some have advocated for the use (or discontinuation) of ACE medications and angiotensin II receptor type 1 (AT1 receptor) blockers during the therapy of COVID-19 in patients with hypertension due to the difficulty we confront.

The European Society of Cardiology's Council on Hypertension now advises patients to stick with their antihypertensive medication since there is no evidence to warrant stopping it. However, more investigation is required to provide greater proof for these suggestions.

Oedema, degeneration, and necrotic alterations are among the inflammatory changes brought on by the virus's invasion of lung cells, myocytes, and vascular system endothelial cells. Proinflammatory cytokines such as interleukin (IL)-6, IL-10, and tumor necrosis factor α , granulocyte colony stimulating factor, monocyte chemoattractant protein 1, macrophage inflammatory protein 1 α , and elevated expression of programmed cell death 1, T-cell immunoglobulin, and mucin domain 3 (Tim-3) are primarily responsible for these alterations. The pathophysiology of lung injury, hypoxia-related myocyte damage, the body's immunological response, enhanced myocardial cell damage, and intestinal and cardiopulmonary abnormalities are all influenced by these alterations. Hypoxia has also been linked to SARS-CoV-2 infection. These alterations result in the buildup of oxygen free radicals, variations in intracellular pH, lactic acid buildup, electrolyte imbalances, and more cellular damage.[18]

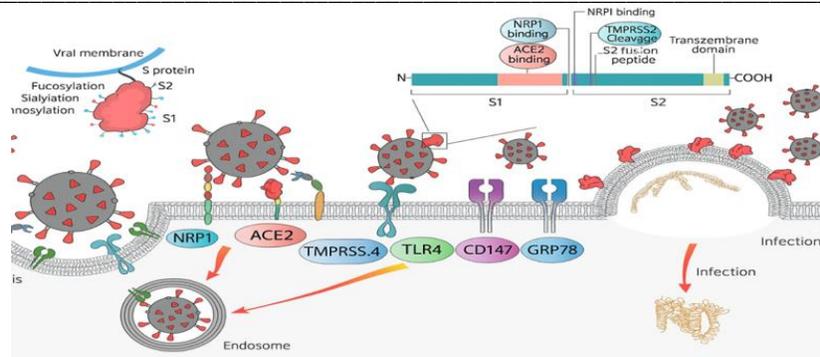


Fig. No. 6. Pathogenesis Mechanism

Introduction of hospital pharmacy practices

A hospital pharmacy is a specialized area of pharmacy practice focused on the management and distribution of medications in a hospital environment. It comprises a wide range of pharmaceutical services to provide safe, effective, and optimal medication therapy for patients admitted to the hospital. In addition to managing medication delivery systems and providing pharmaceutical care, hospital pharmacists collaborate with healthcare teams to support patient care.

Scope of hospital pharmacy practices

1. Medication Management
2. Clinical Pharmacy Services
3. Drug Information Services
4. Pharmacy Operations
5. Compounding and Parenteral Nutrition
6. Quality Assurance and Patient Safety
7. Drug Utilization Evaluation
8. Education and Training
9. Regulatory Compliance.

Medication Management

Medication management is a tactic for working with patients and caregivers to use the brown bag approach to produce an accurate and comprehensive medication list. Addressing medication reconciliation and medication management concerns starts with a thorough and accurate prescription list. Additionally, these tools will assist in identifying patient behaviors—such as overdosing, underdosing, missing prescriptions, or other significant contextual variables restricting adherence that may be putting patients at risk for an adverse drug event.

Key Activities

- Monitoring drug dosage levels and drug-side effect interactions;
- Modifying medicine in consultation with patients and their healthcare providers.
- Appropriate drug management lowers expenses, improves patient quality of life, and prevents hospitalization.

Clinical Pharmacy Services

Clinical pharmacy is defined as a health science strictness in which pharmacists provide patient care that provide medication therapy and assist health, wellness, and disease fend off. Because clinical pharmacy is in charge of making sure that patients receive the appropriate medication at the appropriate time through an effective and cost-effective system, it is considered an essential part of this process.

Key activities

- Supervising medication treatment (MTM)
- Caring for patients and collaborating with doctors, nurses, and other personnel.
- It serves as a useful resource for drug-related education and information for both patients and other healthcare professionals.
- Monitoring patient safety and steering clear of adverse drug interactions and responses.

Drug Information Services

Pharmacological information services are specialist services that pharmacists and other medical professionals offer to give

objective, therapeutically relevant pharmacological information. By encouraging sensible prescribing, lowering pharmaceutical errors, and providing information on subjects including drug interactions, side effects, usage in certain populations, and dose, these services seek to enhance patient care.

Key activities

- Comprehensive pharmacological information;
- Interactions between drugs and foods;
- Patient counseling
- Information about safety and precautions during pregnancy and nursing.[19]

Pharmacy Operations

The procedures and everyday duties that guarantee the effective and secure provision of pharmaceutical services are known as pharmacy operations. Prescription dispensing, inventory control, customer service, and regulatory compliance are important topics. To deliver high-quality patient care, efficient operations depend on well-organized workflows, appropriate layout, technology, and a cooperative team of technicians and pharmacists.

Key activities

- Inventory control to keep an eye on the stock of pharmaceuticals and the supply and removal of expired drugs.
- To correctly fill, mark, and confirm the patient's prescription, including the dosage.
- Prescription work loading and record keeping are handled by the pharmacy software system.[20]

Compounding and Parenteral Nutrition

The process of combining individual nutrients, such as dextrose, amino acids, lipids, and electrolytes, into a sterile intravenous solution tailored to a patient's particular requirements is known as compounding parenteral nutrition (PN). This method requires rigorous aseptic conditions and experienced workers to prevent errors and contamination, ensuring the safety and efficacy of this sophisticated therapy that bypasses the digestive system to feed nourishment directly into the bloodstream.

Key activities

- The process of creating drugs in specific dosages, formulations, or strengths is known as pharmaceutical compounding.
- For patients who do not take oral or enteral nutrients, the compounded total parenteral nutrition (TPN) solution.
- To prevent contamination, sterile injectable medications should be prepared in a specific environment.[20,21]

Quality Assurance and Patient Safety

In healthcare, patient safety and quality assurance (QA) are methodical ways to guarantee excellent, error-free treatment. Implementing procedures like patient identification, communication, and infection control to reduce errors and fostering an environment where employees feel comfortable reporting problems are essential elements. Both seek to fulfill predetermined standards; however, QA concentrates on the more general process of fulfilling quality requirements, whereas patient safety is a particular component aimed at preventing patient damage.

Key activities

- To identify the causes of medication errors and implement preventative strategies.
- Putting policies in place and keeping an eye on them to prevent the spread of illness.
- The assessment of the quality and effectiveness of pharmacy services.[22]

Drug Utilization Evaluation

Drug Utilization Review (DUR) is a continuous, methodical quality-improvement process designed to guarantee the proper and efficient use of medications. Another way to think of it is as a formulary system management method. In order to maximize patient outcomes, it includes a thorough examination of a patient's health and medication history before to, during, and following medication distribution. Consequently, it offers extra evaluations, corrective action, prescriber feedback, and quality assurance. Therefore, DURs carried out by pharmacists lower total healthcare costs by improving therapeutic outcomes, preventing adverse drug reactions, and improving patient care.

Key activities

- Following treatment, patient records are monitored to evaluate medication use and potential.
- Assessing patients by administering the appropriate dosage of medication.[23]

Education and Training

Pharmacists' roles in education and training programs, internal and external training programs, nursing and clinic services, community pharmacy code of ethics, interdepartmental communication, and community health education.

Key activities

- Educating and properly educating other staff members including the pharmacy intern.
- Providing nurses and physicians with the necessary medical education.
- The pharmacy student's hands-on instruction.
- The proper guidelines for patients about how to take drugs and any side effects. [24]

Regulatory Compliance

The process of abiding by laws, rules, and guidelines set forth by authorities to guarantee the efficacy, safety, and quality of pharmaceutical products is known as pharmaceutical regulatory. Regulatory agencies like the Food and Drug Administration (FDA), the European Medicines Agency (EMA), and the World

Health Organization (WHO) monitor pharmaceutical companies' adherence to strict safety regulations before they are put on the market.

Good Manufacturing Practices (GMP), Good Clinical Practices (GCP), and Good Distribution Practices (GDP) are important rules that control pharmaceutical regulatory compliance. From preliminary research and development to production, distribution, and post-market surveillance, these standards address every facet of medication development.

Key activities

- Audits and inspections by regulatory agencies.
 - Monitoring all substances under control.
- SOPs, or standard operating procedures, are developed and maintained

Staffing and workflow

Health Care system, so that vendor was enlisted to help standardize the order verification process. Pharmacists were not on-site 24 hours a day, so having a single contact for order verification helped minimize confusion for nursing staff and providers. Additionally, pharmacy managers determined that in the event the hospital reached maximum capacity, this arrangement would allow for expansion of staff resources beyond the initial FH staffing model. To characterize the operational workflow specific to the FH, policies and procedures were developed.

There was a need for a policy that would make it clear how to handle the problem of patients taking their drugs at home. Home medications are not permitted in patient rooms at the main hospital and are kept in the central pharmacy. A modified policy at the FH permitted any home medication that was not readily available in an ADC to be stored at the patient's bedside so that nursing personnel could administer it appropriately. No further precautions were required for handling and disinfecting these drugs because everyone entering the FH was always wearing complete PPE.

Remote pharmacy employees verified home medications, and labels were created at the satellite pharmacy to be affixed to the drugs. The nurse noted the medicine on the admission checklist in the EMR and the pharmacy staff kept it in the safe if an admitted patient had a controlled substance from home. After confirming that a controlled substance was on the admission checklist in the EMR, a nurse informed the pharmacist to return it to the patient along with any additional home prescriptions at the time of the patient's discharge from the FH.

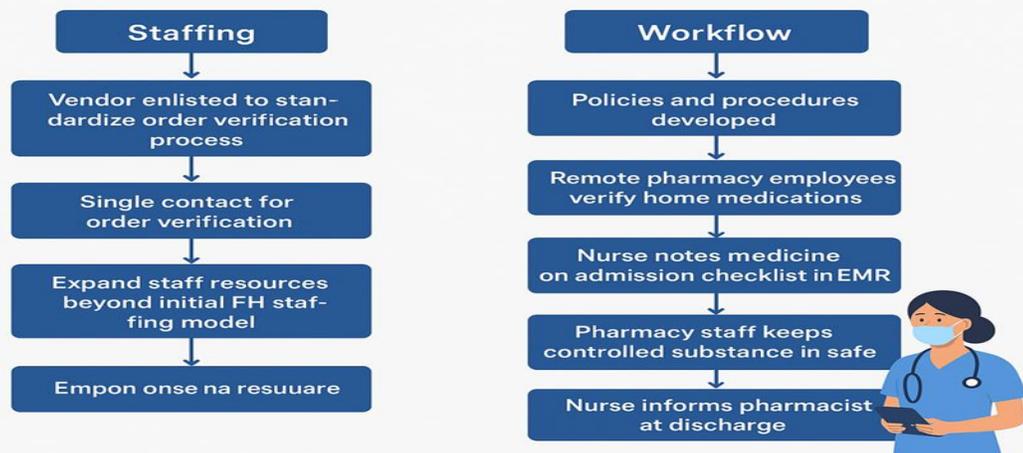


Fig. No. 7. Staffing and Workflow

Hospital Staff Roles & Responsibilities

Healthcare is a team effort. Every hospital staff member contributes to providing patients with high-quality, safe treatment. A hospital's medical staff includes leaders like board members and administrators who direct the facility's decisions and direction. Included are doctors, nurses, and other healthcare professionals who provide direct care.

This guide explains the primary responsibilities of the leaders and people who maintain a hospital.

A hospital's medical staff consists of licensed healthcare professionals like physicians, nurses, and allied health experts. Both state legislation and the hospital's own bylaws provide it permission to treat patients.

When combined, these professionals ensure both patient safety and superior clinical performance. Doctors have a big influence on the hospital's operations even though they are independent practitioners rather than full-time employees.

Giving patients the best care possible is their main responsibility. They work together as a team and communicate important issues to hospital managers and the governing board.



Fig. No. 8. Hospital Staff Responsibilities

Hospital Pharmacy Practices During the Pandemic

- Drug management and emergency preparedness: anticipating drug requirements, controlling shortages, and keeping supplies of necessary medications like corticosteroids and antivirals.
- Infection prevention and safety include preparing sanitizers, ensuring PPE is utilized, and modifying pharmacy layouts to reduce transmission.
- Patient counseling and telepharmacy: Remote counseling is provided through phone calls and hospital portals to ensure medication adherence and education.
- Cooperation with medical teams: Assisting physicians and nurses in intensive care.
- Uses for therapeutic planning, medication interactions, and dose modifications.[25]

Especially given the current situations, a hospital pharmacist includes multiple essential responsibilities, like:

Medication reconciliation; making evidence-based, safe, and accepted therapy recommendations during inpatient rounds; and foreseeing negative consequences from switching treatment options

- Advising on drug use in extracorporeal devices (such as extracorporeal membrane oxygenation);
- Ensuring medication safety and medication delivery safety (minimizing aerosolization);
- Providing prompt and efficient drug administration guidance to the nursing staff.[26]

Hospital Pharmacy Practices after the Pandemic

- Enhancing digital infrastructure by putting in place automated dispensing systems, AI-based inventory management, and electronic health records (EHRs).
- A focus on education and training: holding seminars, role-playing exercises, and ongoing education in emergency response and infectious illness management.
- Patient-centered treatment and mental health: emphasizing counseling, empathy, and the restoration of trust via emotional and mental health assistance.
- Resilient and sustainable supply chains: To avoid shortages, local sourcing, green logistics, and sustainable buying techniques are encouraged.

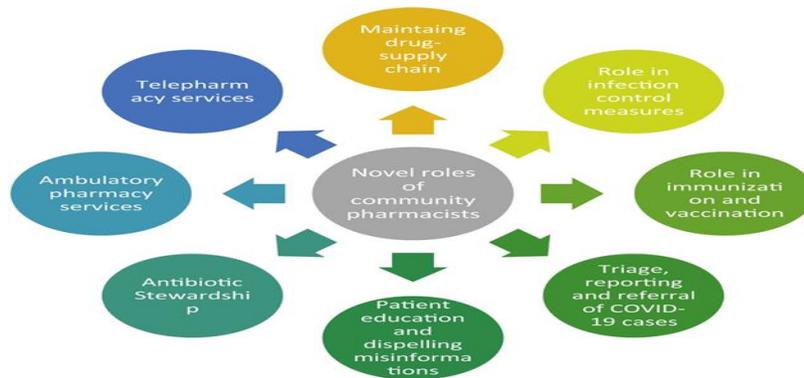


Fig. No. 9 . Novel roles of community pharmacists

Globally, pharmacists are still at the forefront of the battle against COVID-19. elucidate the significance of pharmacists' clinical role in China and provide a framework for pharmaceutical care for hospitalized COVID-19 patients that includes recommendations on a number of topics, including therapy monitoring, management of drug interactions, and evidence-based treatment options. More unified, translated instructions for pharmacy staff have also been developed as a result of international cooperation between pharmacists in Pakistan and the United Kingdom.

Recommendations for post-pandemic hospital pharmacy practice

- . Immediate / short term (operationalize)
- Utilize telepharmacy as a long-term adjunct for remote clinician assessments, medication histories, and counseling.
- Maintain and enhance the therapeutic exchange guidelines and emergency formularies.
- Keep competency logs current and perform regular cross-training for key positions (compounding, ICU support).

- Develop initiatives aimed at specifically helping pharmacy staff with their mental health and mitigating burnout.

Medium term (infrastructure & policy)

- Put resources into stock management systems that use predictive analytics, and combine these with regional health networks to develop a common understanding of the situation.
- Expand procurement strategies (involve various suppliers, establish partnerships for local manufacturing) and participate in regional stockpiling initiatives.
- Where there is evidence of safety and quality, review and incorporate temporary regulatory flexibilities (like technician roles and remote verification) into established policy.

- Create standardized methods for rapidly expanding the scale of compounding (SOPs, quality control measures, compliance with regulations).

Long term (system resilience & research)

- Assist in creating national or regional strategic medication reserves for essential categories of drugs.
- Conduct outcomes research on interventions (effectiveness of telepharmacy, substitution policies, results of cross-training).
- Incorporate pharmacy pharmacists into the planning of public health and into the structures of institutional emergency command.
- Build cooperative networks for shared procurement, exchanging information, and providing mutual assistance during future crises.[27]

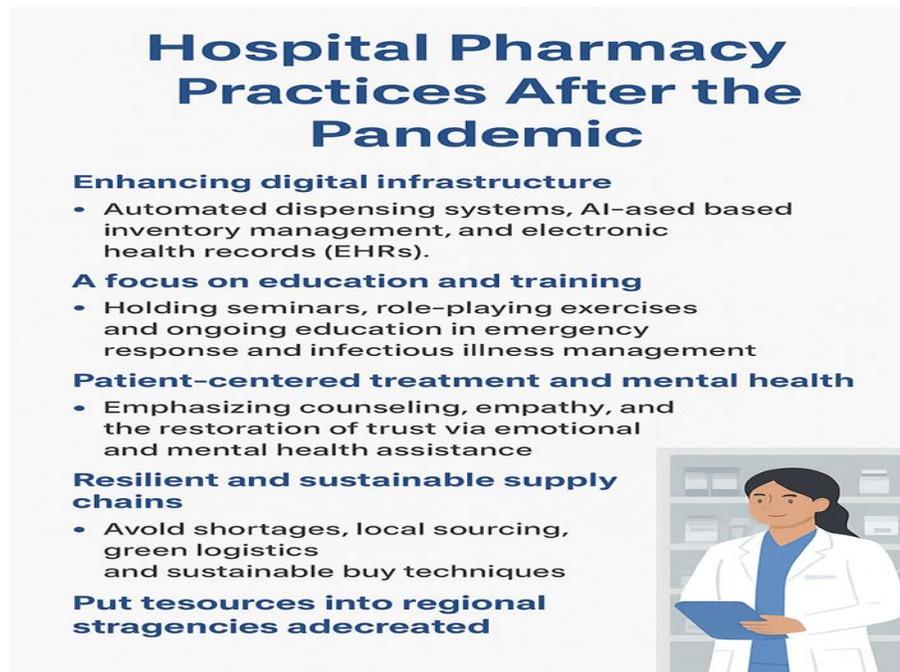


Fig. No. 10. Hospital Pharmacy Practice

Differences between corona virus and normal virus

The primary distinction lies in the fact that COVID-19 is a particular illness caused by a specific virus (SARS-CoV-2), whereas "normal virus" encompasses a large and varied collection of other viruses responsible for various diseases, including the common cold, influenza, and measles. Although certain symptoms, such as fever and cough, may coincide, SARS-CoV-2 is characterized by its greater transmissibility, distinct symptoms like loss of taste or smell, and a unique genetic composition.

COVID-19 (ausgelöst durch SARS-CoV-2) Specificity:

The illness known as COVID-19 is caused by a single, specific virus: SARS-CoV-2.

Symptoms: Elevated risk of fever, cough, and difficulty breathing. Loss of taste or smell can be a distinctive symptom, though it is not always observed.

Transmission: Spreads quickly and may be more contagious than numerous other viruses.

Genetic composition: A variant of the coronavirus, distinguished by its genetic structure from other viruses.

"Normal" viruses Diversity: This encompasses a wide range of viruses responsible for numerous diseases. Examples include viruses responsible for the common cold (such as rhinoviruses), flu (influenza viruses), and measles (measles virus), all of which are considered "normal" viruses.

Symptoms: Can differ greatly based on the particular virus, but may encompass cough, fever, body aches, runny nose, and rashes.

Transmission: Differs across various viruses.

Genetic composition: The genetic structures vary across different virus types.

Conclusion

The COVID-19 pandemic has changed the pharmacy industry by emphasizing pharmacists as vital medical professionals during emergencies. Through effective medication management, patient counseling, telepharmacy services, and tight coordination with other medical specialists, pharmacists were essential in maintaining the continuity of treatment throughout the pandemic. They actively supported immunization campaigns, infection control, and public health education while utilizing digital tools like artificial intelligence and electronic health records to improve patient safety and treatment results. The event highlighted the necessity of continuing professional development, mental health assistance, and the creation of robust and sustainable supply systems for medications. As healthcare systems transition into the post-pandemic era, the lessons learned must be harnessed to further expand pharmacists' clinical roles, strengthen digital infrastructure, and promote interdisciplinary collaboration. Ultimately, the pandemic reaffirmed pharmacists' indispensable role as adaptable, patient-centered, and scientifically driven professionals who are integral to the resilience and advancement of global healthcare. There were a respectable number of papers that discussed pharmacists' roles during the COVID-19 pandemic. Several kinds of communication were performed in different situations of intervention. Furthermore, despite the inadequate description, every study detailed the actions conducted by pharmacists,

primarily pharmacological information and patient counseling. Therefore, in order to direct pharmacists' efforts during this and/or future pandemics, more thorough research that assesses the effects of pharmacist assistance is required.

References

- Sanders JM, Monogue ML, Jodlowski TZ, Cutrell JB. Pharmacologic treatments for coronavirus disease 2019 (COVID-19): a review. *JAMA*. 2020;323(18):1824–1836.
- Delang L, Neyts J. Medical treatment options for COVID-19. *Eur Heart J Acute Cardiovasc Care*. 2020;9(3):209–214.
- Herzik KA, Bethishou L. The impact of COVID-19 on pharmacy transitions of care services. *Res Soc Adm Pharm*. 2021;17(1):1908–1912.
- Moynihan R, Sanders S, Michaleff ZA, Scott AM, Clark J, To EJ, et al. Impact of COVID-19 pandemic on utilisation of healthcare services: a systematic review. *BMJ Open*. 2021;11(3):e045343.
- Abbas Zaher W, Ahamed F, Ganesan S, Warren K, Koshy A. COVID-19 crisis management: lessons from the United Arab Emirates leaders. *Front Public Health*. 2021;9:724494.
- da Silva FCT, Barbosa CP. The impact of the COVID-19 pandemic in an intensive care unit (ICU): psychiatric symptoms in healthcare professionals. *Prog Neuro-Psychopharmacol Biol Psychiatry*. 2021;110:110299.
- Candel FJ, Canora R, Zapatero A, Barba R, González Del Castillo J, García-Casasola G, et al. Temporary hospitals in times of the COVID pandemic. An example and a practical view. *Revista española de quimioterapia*. 2021;34(4):280.
- Bergman ZR, Usher M, Olson A, Chipman JG, Brunsvold ME, Beilman G, et al. Comparison of outcomes and process of care for patients treated at hospitals dedicated for COVID-19 care vs other hospitals. *JAMA Netw Open*. 2022;5(3):e220873.
- Ndayishimiye C, Sowada C, Dyjach P, Stasiak A, Middleton J, Lopes H, et al. Associations between the COVID-19 pandemic and hospital infrastructure adaptation and planning—a scoping review. *Int J Environ Res Public Health*. 2022;19(13):8195.
- Carley S, Horner D, Body R, MacKway-Jones K. Evidence-based medicine and COVID-19: what to believe and when to change. *Emerg Med J*. 2020;37(9):572–575. doi: 10.1136/emermed-2020-210098. [DOI] [PubMed] [Google Scholar]
- Mian A, Khan S. Coronavirus: the spread of misinformation. *BMC Med*. 2020;18:1–2.
- McCabe R, Schmit N, Christen P, D'Aeth JC, Løchen A, Rizmie D, et al. Adapting hospital capacity to meet changing demands during the COVID-19 pandemic. *BMC Med*. 2020;18(1):1–2.
- Ferguson NC, Quinn NJ, Khaliq S, Sinnett M, Eisen L, Goriacko P. Clinical pharmacists: an invaluable part of the coronavirus disease 2019 frontline response. *Crit Care Explor*. 2020;2(10):e0243.
- Cheong MWL. “To be or not to be in the ward”: the impact of COVID-19 on the role of hospital-based clinical pharmacists—a qualitative study. *JACCP*. 2020;3(8):1458–1463. doi: 10.1002/jac5.1315. [DOI] [PMC free article] [PubMed] [Google Scholar]
- Goff DA, Ashiru-Oredope D, Cairns KA, Eljaaly K, Gauthier TP, Langford BJ, et al. Global contributions of pharmacists during the COVID-19 pandemic. *JACCP*. 2020;3(8):1480–1492. doi: 10.1002/jac5.1329. [DOI] [PMC free article] [PubMed] [Google Scholar]
- Li R, Rivers C, Tan Q, Murray MB, Toner E, Lipsitch M. Estimated demand for US hospital inpatient and intensive care unit beds for patients with COVID-19 based on comparisons with Wuhan and Guangzhou, China. *JAMA Netw Open*. 2020;3(5):e208297. doi: 10.1001/jamanetworkopen.2020.8297. [DOI] [PMC free article] [PubMed] [Google Scholar]
- Cook T, Gupta K, Dyer C, Fackrell R, Wexler S, Boyes H, et al. Development of a structured process for fair allocation of critical care resources in the setting of insufficient capacity: a discussion paper. *J Med Ethics*. 2021;47(7):456–463.
- Willan J, King AJ, Jeffery K, Bienz N. Challenges for NHS hospitals during covid-19 epidemic. *BMJ*. 2020 doi: 10.1136/bmj.m1117.
- Al-mahdi S, Bachoo Z, Dombrowsky K, Fleet E, Gudka P, Parmar P, et al. Our experience as intensive care pharmacists during the COVID-19 pandemic. *J Pharm Manag Arch*. 2021;37(3):93–102. [Google Scholar]
- Lemtiri J, Matusik E, Cousein E, Lambiotte F, Elbeki N. The role of the critical care pharmacist during the COVID-19 pandemic. *Ann Pharm Fr*. 2020;78(6):464–468. doi: 10.1016/j.pharma.2020.09.001. [DOI] [PMC free article] [PubMed] [Google Scholar]
- Sholzberg M, Tang GH, Rahhal H, Alhamzah M, Kreuziger LB, Ainle FN, et al. Effectiveness of therapeutic heparin versus prophylactic heparin on death, mechanical ventilation, or intensive care unit admission in moderately ill patients with covid-19 admitted to hospital: RAPID randomised clinical trial. *BMJ*. 2021 doi: 10.1136/bmj.n2400.
- Nair SC, Gasmelseed HI, Khan AA, Khafagy IN, Sreedharan J, Saleem AA, et al. Assessment of mortality from COVID-19 in a multicultural multi-ethnic patient population. *BMC Infect Dis*. 2021;21(1):1–9.
- Pedersen CA, Schneider PJ, Ganio MC, Scheckelhoff DJ. ASHP national survey of pharmacy practice in hospital settings: impact of COVID-19 pandemic on pharmacy operations—2020. *Am J Health Pharm*. 2021;78(18):1701–1712.
- Al Hosany F, Ganesan S, Al Memari S, Al Mazrouei S, Ahamed F, Koshy A, et al. Response to COVID-19 pandemic in the UAE: a public health perspective. *J Glob Health*. 2021;11:03050.
- Alsuwaidi AR, Al Hosani FI, ElGhazali G, Al-Ramadi BK. The COVID-19 response in the United Arab Emirates: challenges and opportunities. *Nat Immunol*. 2021;22:1066–1067. doi: 10.1038/s41590-021-01000-5. [DOI] [PubMed] [Google Scholar]
- Paudyal V, Cadogan C, Fialová D, Henman MC, Hazen A, Okuyan B, et al. Provision of clinical pharmacy services during the COVID-19 pandemic: experiences of pharmacists from 16 European countries. *Res Soc Adm Pharm*. 2021;17(8):1507–1517
- Gross AE, MacDougall C. Roles of the clinical pharmacist during the COVID-19 pandemic. *JACCP*. 2020;3(3):564–566. doi: 10.1002/jac5.1253.

Conflict of Interest: Nil

Source of support: None