Utilizing Pharmacists to Optimize Medication Management Strategies During the COVID-19 Pandemic

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Abstract
As the COVID-19 pandemic swept through the United States, our health-system mobilized clinical pharmacy services to address critical clinical medication management needs. Reinforcing recommended medication management strategies for clinical pharmacists was key to successful implementation. Best practice strategies include converting patients from intravenous (IV) to oral medication, transitioning to IV push medication administration, evaluating standard medication administration timing, reviewing metered dose inhaler (MDI) and nebulizer utilization, using alternatives for medications in short supply, reviewing coronavirus disease COVID-19 treatment recommendations, reviewing COVID-19 patient care on interdisciplinary rounds, de-prescribing and de-escalating to eliminate unnecessary medications, and assessing for appropriate venous thromboembolism prophylaxis. These strategies served to help protect medication supply, reduce number of staff entries into patient rooms to conserve personal protective equipment, limit nursing time in patient rooms to reduce COVID-19 exposure risk, and to conserve compounding supplies. Here we present example medication management guidance as used by a large healthcare system during the COVID-19 pandemic.

Keywords
COVID-19, pharmacist, medication management, guidance

Introduction

The 2019 novel coronavirus [severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2)] was declared a public-health emergency for the United States on January 31, 2020.1 As a result of this declaration, the Food and Drug Administration (FDA) anticipated the COVID-19 pandemic would impact the United States (U.S.) medical product supply chain.2 As the number of COVID-19 infected patients admitted to hospitals increased, health-systems identified opportunities to provide effective patient care and prevent the transmission of COVID-19 to others, while coping with constant medication supply concerns.

Clinical pharmacists have an opportunity during the COVID-19 pandemic to use their unique skillset to provide patient care strategies that mitigate medication shortages and supply chain disruptions.3 These efforts also helped limit the time nurses spent in isolation rooms administering medications. Additionally, until the recent Emergency Use Authorization for remdesivir on May 1, 2020, there were no therapies approved by the FDA for the treatment of COVID-19; clinical pharmacists can identify the most effective and safe therapy for individual patients diagnosed with COVID-19 by performing systematic literature reviews and critical appraisal of the literature.4 This article describes clinical pharmacist medication management guidance provided by a health-system during the COVID-19 pandemic that other hospitals could consider adapting to their own practice environments to help mitigate challenges faced with COVID-19.

Medication Management Strategies

Medication management strategies deployed by our health-system include converting patients from intravenous (IV) to oral medication, transitioning to IV push medication...
administration, evaluating standard medication administration timing, reviewing metered dose inhaler (MDI) and nebulizer utilization, using alternatives for medications in short supply, reviewing COVID-19 treatment recommendations, reviewing COVID-19 patient care on interdisciplinary rounds, de-prescribing and de-escalating to eliminate unnecessary medications, and assessing for appropriate venous thromboembolism prophylaxis. (Figure 1.) Each critical medication management strategy was identified based on literature and anticipated COVID-19 positive and persons under investigation (PUI) care needs. Many of best practice initiatives had been previously part of our clinical pharmacy programs but were further optimized during the COVID-19 pandemic. Our health-system implementation efforts along with applicable examples and results are described. Clinical pharmacist medication management example guidance is provided to assist others to successfully implement these medication management strategies.

Throughout the COVID-19 response our health-system, the pharmacy services team employed a robust communication strategy to ensure the timely delivery of vital information to our directors of pharmacy, clinical pharmacy managers, and frontline providers. Daily team touchpoints were held in March and April to ensure urgent requests were completed and the pharmacy teams were aligned to maximize rapid turnaround for work product deliverables. Weekly leadership calls were conducted for each region of hospitals and for the broader health-system. A resource hub was created on the health-system’s internal intranet, provider newsletters were distributed twice weekly, and pharmacy newsletter communications were distributed weekly. Specific content pertaining to treatment recommendations and clinical care for frontline pharmacists was also posted in the clinical pharmacist workflow software system landing page.

**Convert Patients From Intravenous (IV) to Oral Medication**

The impact and value of clinical pharmacists to convert patients from IV to Oral medications during hospitalization has been extensively studied and demonstrated improved clinical and economic outcomes. Clinical pharmacist IV to Oral interventions during the COVID-19 pandemic can aid in efforts to optimize intensive care unit (ICU) and surge capacity by adjusting patients’ medication regimens and to maintain an adequate supply of medications and medication delivery supplies (e.g., IV pumps) based on emergency medication formularies and treatment guidelines.

Our health-system implemented IV to oral medication guidance in 2014, and re-emphasized the importance of converting medications from IV to oral for all eligible patients during the COVID-19 pandemic. IV to oral conversion for 174 hospitals was assessed in March 2020. Of 22,395 medications eligible for conversion, 17,296 (75.7%) were converted. Greater than 35% of conversions occurred in 0-24 hours after the patient met criteria for conversion.

**IV to Oral Medication Example Guidance**

When possible, use oral first for all medications. Only use IV medications when needed and change from IV to oral in a...
timely manner. Identify IV to oral medication management opportunities in the electronic health record (EHR) and develop policies to ensure pharmacists are able to convert all recommended medications (drugs with high bioavailability, oral has been shown to be clinically effective to IV, etc.). Evaluate current IV to oral conversion policies and remove unneeded criteria (i.e., reducing white blood cells or afebrile criteria before converting antibiotics from IV to oral).

Transition to IV Push Medication Administration

A majority of hospitalized patients receive some form of infusion therapy. Clinical pharmacists play a critical role as experts in IV push medication safe practices, current evidence, and potential serious harm avoidance with IV push medication preparation and administration.\textsuperscript{11} During the COVID-19 pandemic, medication, IV pumps, and personal protective equipment (PPE) supply shortages have occurred, so clinical pharmacists are tasked to provide guidance to transition to IV push medication delivery as a mechanism to protect patient and caregiver safety.\textsuperscript{9,10}

Our healthcare system re-released guidance related to the transition to IV push medication administration in January 2018. This guidance was highlighted in communications during the COVID-19 pandemic in the form of a table of generic and brand medication names, reconstitution/administration time, and luer lock syringe size. Medications targeted for IV push administration were not high-alert medications and were in accordance with hospital IV push medication guidelines. Additional reconstitution diluents were added if available to assist with shortages; for most medications, Sterile Water for Injection (SWI) was preferred, if available. Coordination and limitation of medication administration times were strategies incorporated to minimize staff exposure and limit nurse time spent in patient rooms.

IV Push Medication Example Guidance

Rationale: IV push medication administration reduces IV pump usage to reserve them for critical patient drips; in addition, nursing time in the patient room is also decreased. This administration is NOT the same as using IV syringe pumps for medication administration. Triage may be necessary in the event of IV infusion pump shortages and should be prioritized by medication, patient population, units of care, and patient level of care. A table of generic and brand medication names, reconstitution/administration times, and luer lock syringe size is recommended to be developed by clinical pharmacists, with subsequent review and approval by the Pharmacy & Therapeutics Committee and the Medical Executive Committee. Once approved, the table should be communicated to nursing, pharmacy and provides, with additional education provided to nursing colleagues.

Evaluate Standard Medication Administration Timing

COVID-19 is transmitted between individuals through droplets. The risk for acquiring COVID-19 is high for those individuals taking care of patients or those who are in contact with patients with COVID-19. Health care workers should utilize PPE and limit their exposure time to infected individuals when possible.\textsuperscript{12} Clinical pharmacists can support these efforts by evaluating standard medication administration times to limit nursing time spent in patient rooms, thereby conserving PPE and reducing risk.

Our healthcare system implemented recommendations for standard medication administration times. All medication orders were aligned with standard administration times when possible, and frequency intervals for medications were maximized. Medications were bundled with laboratory when possible, timing troughs and other laboratory needs with normal morning laboratory. Variables to consider include aligning medication times (e.g., medications before meals, with meals and after meals) with meal tray times, and standardizing medication pass times through the medication safety/patient safety committee. Successful implementation efforts involve including nursing and dietary interdisciplinary teams.

Standard Medication Administration Times Example Guidance

Align all medication orders with standard administration times, when possible. Maximize frequency intervals for medications: extend the dosing interval or change to an alternative medication with a longer duration of action to decrease medication frequency (e.g., Change heparin subcutaneous every 8-12 hours to enoxaparin daily regimens as appropriate; prioritize antibiotic regimens with every 24 hours or every 12 hour frequencies.). Bundle medications and laboratory when possible: schedule all every 24 hour and daily medications at the same time; schedule all every 12 hour or twice daily medications at the same time; change medication dose times to correspond with corrective insulin dosing; and time any trough or other laboratory needed with normal morning laboratory.

Review Metered Dose Inhaler (MDI) and Nebulizer Utilization

Bronchodilators (e.g., albuterol, levalbuterol) may be prescribed to patients diagnosed with COVID-19. Nebulized bronchodilators may cause respiratory droplets to remain in the air and potentially spread the virus. As a result, metered dose inhaler (MDI) utilization increased leading to medication shortages. However, medication shortages of MDIs require hospital pharmacy services to identify strategies to conserve supplies.\textsuperscript{13}

In our healthcare system, clinical pharmacists, as part of the interdisciplinary team, developed evidence-based guidelines and canister reassignment aimed at conserving the use of MDIs.
during the COVID-19 pandemic. Clinical pharmacists reviewed medication orders for bronchodilators supplied as MDIs and as nebulized solutions, ensuring proper formulation, dosage form, and route. Assurance of appropriate medication route decreased risk of aerosolized medication droplets from nebulized bronchodilator administration for health-care professionals caring for patients diagnosed with COVID-19 and PUI.

MDI and Nebulizer Example Guidance

Review medication orders for bronchodilators based on patient diagnosis (e.g., diagnosed COVID-19, PUI). Ensure proper formulation, dosage form and route; patients with diagnosed COVID-19 and PUI should receive bronchodilators via MDI. To further conserve MDIs, allow patients to use their own home MDIs, discourage the use of MDIs for one-time use, and use canister reassignment (i.e., reassign MDI canisters after cleaning) to conserve hospital supply.

Use Alternatives for Medications in Short Supply

On February 27, 2020, the FDA reported the first medication shortage related to the COVID-19 pandemic. Clinical pharmacists anticipate additional medication shortages because of the rapid spread of COVID-19 within the United States and the increasing demand for certain medications. Using systematic reviews of the literature, clinical pharmacists have identified alternative treatment modalities for many disease states, provided recommendations for medication substitution and prepared formulary guidance documents.

Managing medication shortages requires relationships with key stakeholders, processes for rapid approval of therapeutic interchanges through committees, order set revisions, and communication to providers. Previous shortages provided the foundation for our work during the COVID-19 pandemic and allowed pharmacy to develop a framework. The difference in COVID-19 was the need for rapid implementation and proactive preparation based on what was being seen in COVID-19 “hot spots” throughout the country. In our healthcare system, we implemented proactive guidance regarding medications that may be in short supply. In addition, with our system centralized warehouses we had capacity to move medications to the parts of the U.S. hardest hit during the COVID-19 pandemic from the allocations we had in other parts of the U.S. as necessary. As a result, medications were available for all of our patients during this unprecedented time.

Alternatives for Medications in Short Supply Example Guidance

Consider alternative treatment options to substitute for medications during shortage situations. Create a list medications that may be difficult to obtain and identify several medication alternatives that may be used instead, including supporting evidence for use as appropriate (e.g., medication class, medication, first option, second option, third option, formulary status, comments, resources). For example, the Anxiolytic & Sedatives IV Medication Class was separated into Opioid Medication and Anxiolytic Medication as follows. Opioid Medication: first option fentanyl, second option hydromorphone, third option morphine or remifentanil; Anxiolytic Medication: first option dexmedetomidine, second option propofol, third option benzodiazepine—midazolam, lorazepam, or diazepam. Additional anxiolytic options available depending on patient circumstances included: phenobarbital or pentobarbital, ketamine, etomidate, and inhaled anesthetics.

Review COVID-19 Treatment Recommendations

Clinical pharmacists are responsible for ensuring the appropriate use of off-label medications in COVID-19 and evaluating and synthesizing the latest evidence available regarding potential treatment options. Daily COVID-19 evidence analyses and literature reviews regarding potential medication treatment options are critical as the evidence changes rapidly.

In our healthcare system, specific pharmacists were tasked with daily systematic literature searches using relevant keywords of PubMed.gov, CINAHL Plus, Medline Complete, ClinicalTrials.gov, and Google Scholar. Professional societies and academic medical center COVID-19 content were also included in the review. In addition, to capture preprints and preliminary reports, a search of medRxiv.org and bioRxiv.org was conducted. This task group provided regular information to clinicians and other pharmacists to prevent duplicate work throughout the system. An evidence analysis report and treatment guidance document were the 2 main forms of communication regarding the latest potential treatment considerations for COVID-19; these were updated and distributed throughout the health-system twice weekly. The evidence analysis report served as an objective detailed review and supporting rationale to the treatment guidance document which communicated recommendations and guidance. Before content was distributed, it was reviewed by leading infectious disease pharmacists and physicians as well as health-system clinical/operational leadership and the emergency operations committee. This process and content provided frontline clinicians with the most accurate, up-to-date, and relevant information for patients diagnosed with COVID-19 and PUI, while saving those on the frontlines the time of doing the work themselves during the pandemic.

COVID-19 Treatment Recommendations Example Guidance

Monitor the literature daily to share the latest information for the management of patients diagnosed with COVID-19. Create treatment guidance, clinical decision support, order sets (e.g., COVID PUI, COVID Treatment), acute respiratory distress syndrome (ARDS)/sepsis, and ST segment elevation myocardial
Infarction (STEMI)/ non-ST segment myocardial infarction (NSTEMI) care. Place documents in an easily accessible location for the interdisciplinary team, such as the health-system internal intranet page.

**Pharmacists on Interdisciplinary Rounds for COVID-19 Patients**

Clinical pharmacist role on interdisciplinary rounds for patients has been well established. During the COVID-19 pandemic there was concern for the use of PPE, limiting visitors and non-essential clinicians from patient units and patient contact. Our health-system reinforced the importance of clinical pharmacy and a patient care unit-based pharmacy model during this pandemic. As vital team members for patient care, pharmacists continued to attend interdisciplinary rounds. Patients with COVID-19 have complicated medication regimens; drug therapy was reviewed closely and optimized by pharmacists with the team.

**COVID-19 Pharmacist Role on Interdisciplinary Rounds Example Guidance**

Clinical Pharmacists are essential members of the interdisciplinary team and should continue to participate in team rounds for COVID-19 patients. Medication regimen reviews are performed daily with substantial interventions discussed with the care team.

**De-Prescribing and De-Escalating: Eliminate Any Unnecessary Medications**

De-prescribing and de-escalating involves the optimization of medication regimens through cessation of potentially inappropriate medications with a goal of improving patient outcomes. Polypharmacy increases risks of falls, delirium, lethargy, depression, adverse medication events, hospital admissions, and death. When evaluating de-prescribing and de-escalating opportunities, clinical pharmacists should consider the patient’s list of medications and indication for therapy, the overall risk of medication-induced harm, potential for discontinuation and priority, and implementation and monitoring of medication discontinuation regimen.

Our health-system assessed de-prescribing and de-escalating for 174 of its hospitals. Of 4,451 patients eligible for de-prescribing of H2 receptor antagonists and proton pump inhibitors in intensive care unit patients, de-prescribing occurred in 2,479 (55.7%). Of 6,916 antibiotic de-escalation opportunities in March 2020, 3,952 patients (57.1%) were de-escalated.

**De-Prescribing and De-Escalating to Eliminate Unnecessary Medications Example Guidance**

When evaluating patients, assess the patient’s past medical history and prescribed medications. Stop stress ulcer prophylaxis if no longer warranted; optimize insulin therapy to reduce frequency of administration; and review antibiotics for de-escalation or discontinuation opportunities.

**Assess for Appropriate Venous Thromboembolism Prophylaxis**

Critically ill patients are at increased risk for VTE, and case reports suggested a high rate of VTE in patients with diagnosed COVID-19. The American Society of Hematology recommended pharmacologic VTE prophylaxis with low molecular weight heparin (LMWH) or fondaparinux in all hospitalized patients with COVID-19 unless contraindicated due to bleeding risk. World Health Organization guidance for the management of suspected COVID-19 positive patients recommended pharmacologic VTE prophylaxis in adolescents or adults without contraindications, and mechanical prophylaxis (e.g., intermittent pneumatic compression devices (ICDs)) for patients with contraindications to pharmacologic VTE prophylaxis.

In our healthcare system, clinical pharmacists evaluated patient VTE risk and incorporated evidence-based VTE prevention strategies into the treatment plan when clinically indicated using an algorithm developed by our health-system to assist with the clinical decision making process.

**Appropriate VTE Prophylaxis Example Guidance**

Routinely evaluate patients to ensure appropriate mechanical and/or pharmacologic VTE prophylaxis methods are being used. Hospitalized adult and adolescent patients diagnosed with COVID-19 and PUI should receive pharmacologic VTE prophylaxis unless bleeding risk contraindications exist. Mechanical prophylaxis (e.g., ICDs) should be initiated when pharmacologic VTE prophylaxis is contraindicated. Assure appropriate venous thromboembolism (VTE) prophylaxis doses based on patient clinical parameters.

**Conclusion**

Clinical pharmacists have responded to meet the challenges presented as a result of the COVID-19 pandemic. Clinical pharmacists are an essential member of the interdisciplinary team in planning and caring for patients diagnosed with COVID-19 and PUI. As a result of medication management strategies implemented and optimization of best practices incorporated into daily practice, our health-system was able to provide supportive medications needed for patient care while conserving medication supply. The example guidelines presented here can serve as a template for clinical pharmacists to use and adapt in order to support patient care as the COVID-19 pandemic continues.

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