

Inappropriate polypharmacy during the COVID-19 pandemic: impact, challenges, and solutions – a narrative review

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Abstract

The COVID-19 pandemic has brought unprecedented challenges to healthcare systems worldwide, impacting various aspects of patient care. Polypharmacy, the concurrent use of multiple medications by a single patient, is a significant concern exacerbated by the pandemic. The dual threat of COVID-19 infection and polypharmacy for the same vulnerable group – the elderly and those with pre-existing multimorbidity – is particularly problematic, as polypharmacy has been shown to lead to suboptimal treatment outcomes in many chronic diseases. This comprehensive review explores the multifaceted issues surrounding polypharmacy during the COVID-19 pandemic, addressing its causes, consequences, and potential solutions.

Keywords

COVID-19, drug-related problems, healthcare costs, non-adherence, polypharmacy

Introduction

The COVID-19 pandemic has forced healthcare providers to adapt rapidly, often leading to complex and dynamic changes in patient management. Managing a crisis like a pandemic requires quick decision-making. One such critical concern is the growing problem of polypharmacy. Although the prevalence of polypharmacy is rising globally, the term lacks a clear definition.^[1] It is common to describe polypharmacy as an overuse of medicines. However, there are cases when the concomitant use of medicines is beneficial and safe for the patient. However, the irrational or inappropriate use of five or more medications can significantly impact patient outcomes, quality of life, and impose an economic burden on healthcare systems.

The spectrum of diseases associated with SARS-CoV-2 infection ranges from mild to severe and, in some cases,

fatal infections. Advanced age is recognized as a major risk factor for a severe course of coronavirus infections. **Table 1** illustrates the levels of increased risk of hospitalization and death across different age groups, comparing them with the risk in individuals aged 18–29 years.^[2]

Individuals with specific underlying health conditions face an increased risk of severe COVID-19. The Centers for Disease Control and Prevention (CDC) provides an updated list of high-risk underlying conditions, incorporating information reported in the literature as of August 31, 2021.^[2]

Several prognostic factors associated with higher mortality from COVID-19 have been identified, including age^[3], male gender^[4], ethnicity^[5], obesity^[6], and pre-existing chronic conditions such as hypertension, diabetes, chronic kidney disease^[7], and multimorbidity^[2,8-11].

This comprehensive review delves into the multifaceted issues surrounding polypharmacy during the

Table 1. Levels of increased risks for COVID-19 complications in different age groups

Level of risk compared to people aged 18-29	0-4	5-17	18-29	30-39	40-49	50-64	65-74	75-84	85+
Infection	<1×	1×	RG	1×	1×	1×	1×	1×	1×
Hospitalization	<1×	<1×	RG	2×	2×	4×	5×	8×	10×
Death cases	<1×	<1×	RG	4×	10×	25×	65×	150×	370×

RG: reference group

COVID-19 pandemic. It seeks to explore the causes, consequences, and potential solutions to this problem, shedding light on its complex interaction with the current global health crisis.

Methods

A systematic review design was selected to comprehensively assess existing studies, articles, and reports on polypharmacy during the COVID-19 pandemic. The review included primary research articles, systematic reviews, observational studies, and clinical guidelines published in English from January 2020 to December 2024. Studies that focused on polypharmacy in patients with chronic diseases, multimorbidity, or the elderly during the pandemic were eligible. Articles were excluded if they did not address polypharmacy in the context of COVID-19 or if the study population did not include the elderly or individuals with pre-existing conditions. A comprehensive search of electronic databases, including PubMed, Scopus, Web of Science, and Google Scholar, was conducted. Keywords such as “polypharmacy,” “COVID-19,” “elderly,” “multimorbidity,” “chronic disease,” and “pharmacotherapy” were used to identify relevant publications. A narrative synthesis approach was employed to summarize and interpret the findings from the included studies. Thematic analysis was used to identify recurrent themes and patterns in the literature, such as the impact of COVID-19 on medication adherence, the role of telemedicine in medication management, and the increased risk of adverse outcomes due to polypharmacy. While this review aims to provide an in-depth analysis of polypharmacy during the COVID-19 pandemic, limitations include potential publication bias and the challenge of generalizing results from diverse study designs.

Factors affecting inappropriate polypharmacy during COVID-19

Medication-related challenges during the pandemic

The treatment of COVID-19 remains primarily supportive and symptomatic, encompassing the identification and management of concurrent bacterial infections and/or sep-

sis. The goals of COVID-19 treatment focus on infection prevention, symptom relief, and the avoidance of complications when possible.

The lack of medications or other specific therapeutic techniques for treating COVID-19 has necessitated the use of available therapies for other viral diseases with similar characteristics and pathogenesis. Drug repositioning, a scientific strategy investigating established drugs for additional clinical indications, offers advantages by providing benefits to patients and expanding indications for existing drugs at lower costs compared to de novo drug development. Polypharmacy and drug-drug interactions are common issues in the treatment of acute diseases of any kind. The most common drug class prescribed for the treatment of COVID-19 in both community and hospital settings were antibiotics.^[12] An association between the incidence of adverse drug reactions (ADRs) and polypharmacy has been reported. Patients with COVID-19 who experienced ADRs took a higher mean number of medications than the control group.

Telemedicine and remote prescribing

During the COVID-19 pandemic, advancements have been made in the utilization of telemedicine to screen individuals for infection, monitor those affected, and ensure ongoing care for individuals with chronic illnesses.^[13] However, the adoption of telemedicine varied across different countries impacted by the pandemic.^[14] Some countries recognized the significance of telemedicine more than others. Moreover, the variations in the quality of infrastructure, the level of digital literacy among healthcare professionals and patients, and differences in reimbursement plans contribute to the levels of implementation of telemedicine.^[15]

In New Zealand, the contribution of pharmacists was recognized by the government through additional remuneration for their support. Hotline numbers have been established to encourage phone consultations and medication orders, aiming to reduce public visits that should be avoided in cases of suspicion or confirmed COVID-19 cases.^[16] In Australia, pharmacies were encouraged to maintain remote prescription dispensing using prescriptions received via mail/fax/email or through electronic prescription transfer technology with home delivery services, especially for the elderly and vulnerable populations.^[17]

A study conducted at J.W. Ruby Memorial Hospital investigated the barriers and effectiveness of transitioning

pharmacists to remote work. Pharmacists specializing in pediatric care provided virtual consultations with medical teams in pediatric intensive care and neonatology departments within a week of transitioning to remote clinical pharmacy services. Over time, technological changes were made to ensure the best possible user experience. Clinical dietitians were later added to virtual consultations, building on the success of clinical pharmacists. Pharmacists provided effective patient care and achieved their goals while performing their duties remotely. Support from the information services department, pharmacy leadership, and physicians significantly contributed to the success of virtual clinical pharmacy services.^[18]

In China, to minimize unnecessary hospital visits, online pharmacy services, including free medical consultations through WeChat, were established.^[19] WeChat is a multifunctional media platform that enables private or group chats, voice or video calls, text or voice messages, and additional features, allowing clinical pharmacists to assess patients' needs, their status, and any reported adverse reactions.

Prescribing practices conventionally rely on single-disease treatment models, which may not be suitable for elderly patients managing multiple long-term conditions. Randomized controlled clinical trials might include older individuals as subjects, but they usually focus on the safety and efficacy of medicines considering a particular disease state such as hypertension or osteoporosis.^[20] Inappropriate prescribing for geriatric patients occurs when the prescriber assumes the patient will respond to medication similarly to an average adult. Although pharmacokinetic and pharmacodynamic changes in geriatric patients are well-studied, dosage adjustments are not considered as the patient ages. To evaluate and identify inappropriate prescribing patterns, prescribing quality indicators have been developed. These indicators can be categorized as quantitative, qualitative, and evidence based.^[21]

Medication shortages and substitutions

Drug shortages are a phenomenon that represented a global problem in the pharmaceutical supply chain even before the pandemic.^[22] The spread of COVID-19 generated a surge in the number of critically ill patients and fear-driven hoarding of drugs, further contributing to existing shortages.^[23] In the early days of the pandemic, countries restricted transport as they struggled to stop the spread of the new disease. This reduction in transport had cascading effects on the production, supply, and distribution of medicines. The COVID-19 pandemic has the potential to create a domino effect in drug shortages, where the unavailability of drug A leads to the use of drug B as a substitute, subsequently causing a shortage of drug B.^[24] In the outpatient environment, shortages are caused by fear and overstocking of citizens with painkillers that are dispensed without a doctor's prescription. The increased demand for medicines to treat COVID-19 may in some cases threaten their

availability to patients who need them to treat their chronic and/or rare diseases.^[25] Drug shortages disrupt care and raise concerns about patient safety. Due to the off-label use of hydroxychloroquine and chloroquine as candidates for COVID-19 treatment, they have become inaccessible to patients who suffer from rheumatoid arthritis, systemic lupus erythematosus and other autoimmune diseases.^[24,26]

Psychological distress and mental health medications

Since 2020, numerous studies have focused on the impact of the pandemic on people's quality of life. Measures to combat the pandemic and limit the spread of the virus are related to isolation, compliance with rules, restriction of travel and movement of people. COVID-19 patients exhibit elevated levels of posttraumatic stress symptoms and an increased incidence of depression.^[27,28] Individuals with pre-existing mental disorders have reported a worsening of psychiatric symptoms.^[29,30] Healthcare workers also have shown higher levels of psychiatric symptoms.^[31,32]

Consequences of inappropriate polypharmacy

A clear relationship has been found between polypharmacy and an elevated risk of testing positive for COVID-19.^[33] Classes of drugs associated with severe COVID-19 include proton pump inhibitors, laxatives, various classes of drugs acting on the central nervous system, food supplements, and nonsteroidal anti-inflammatory drugs.^[34] Additionally, there is a correlation between the incidence of ADRs and the number of drugs prescribed; patients with COVID-19 who experienced ADRs were administered a higher average number of drugs compared to those without ADRs (Fig. 1).^[35]



Figure 1. Consequences of inappropriate polypharmacy. (Created with Microsoft Office Professional 2021).

Management of polypharmacy in the context of the COVID-19 pandemic

Effective management of polypharmacy involves a comprehensive and patient-centered approach. Several key strategies can be employed for managing polypharmacy.

Medication reconciliation and review

Medication reconciliation stands as a crucial process within healthcare systems, aiming to enhance patient safety by ensuring accurate and up-to-date medication information.^[36] This process involves creating a comprehensive and precise list of all medications a patient is taking, encompassing prescription medications, over-the-counter drugs, herbal supplements, and vitamins. This list is then compared to the medications that have been prescribed, dispensed, or administered to the patient at various points in the health-

care system, such as transitions of care.^[37]

Medication reconciliation is not a one-time event but an ongoing process that requires collaboration among healthcare providers, patients, and caregivers. It holds particular importance in situations where patients are managing chronic conditions, receiving care from multiple providers, or undergoing changes in their health status.^[38] This process significantly contributes to the overall quality and safety of healthcare delivery.

The role of technology

Technology plays a significant role in enhancing medication management, promoting adherence, and improving patient outcomes.^[39] By leveraging these technologies, healthcare providers and patients can enhance medication management, reduce errors, and improve overall adherence, leading to better health outcomes.^[40] However, it is essential to

Table 2. Examples of innovative solutions in medication management

Solution	Characteristics
Medication reminder apps	<ul style="list-style-type: none"> • Mobile applications can provide medication reminders through alarms, notifications, or text messages, helping patients remember to take their medications at the right time. • Some apps allow users to customize their medication schedules, set dosage reminders, and receive alerts for prescription refills.
Smart pill dispensers / Digital medication dispensing systems	<ul style="list-style-type: none"> • These devices are equipped with electronic features that dispense medications at scheduled times. Some smart dispensers include visual or auditory alerts to remind patients to take their medication. • Some devices also have features that notify caregivers or family members if a dose is missed.
Electronic health records (EHRs)	<ul style="list-style-type: none"> • EHR systems enable healthcare providers to access and update a patient’s medication list electronically. This promotes accurate and real-time communication among healthcare professionals. • EHRs can also provide alerts for potential drug interactions, allergies, or contraindications, enhancing patient safety.
Telehealth and Remote monitoring	<ul style="list-style-type: none"> • Telehealth platforms allow healthcare providers to remotely monitor patients and conduct virtual medication management sessions. • Remote monitoring technologies can track medication adherence, vital signs, and other relevant health metrics, providing healthcare providers with valuable data to assess and adjust treatment plans.
Medication management platforms	<ul style="list-style-type: none"> • Dedicated medication management platforms or software can assist in organizing and tracking medications. These platforms often include features such as medication lists, dosage instructions, and refill reminders. • Some platforms allow for the input of medication-related information by both patients and healthcare providers.
Wearable devices	<ul style="list-style-type: none"> • Smartwatches and other wearable devices can be programmed to send medication reminders and track adherence. • Some wearables can monitor physiological indicators that may be relevant to medication management, such as heart rate and activity levels.
Mobile health (mHealth) interventions	<ul style="list-style-type: none"> • Mobile health interventions, including text message-based interventions, can provide educational information, motivational messages, and support for medication adherence. • These interventions can be particularly effective for reaching patients in diverse demographics.
Augmented Reality (AR) and Virtual Reality (VR)	<ul style="list-style-type: none"> • AR and VR technologies can be used to provide immersive educational experiences for patients, helping them understand the importance of medication adherence and potential side effects.

consider the individual needs and preferences of patients when implementing technology solutions in medication management.^[41] Several ways exist in which technology can assist in medication management (Table 2).

Deprescribing initiatives

Deprescribing initiatives are systematic approaches to reducing or discontinuing medications.^[42] The goal of deprescribing is to improve patient outcomes by minimizing medication-related harm, addressing drug interactions, and improving overall quality of life.^[43] Deprescribing starts with a comprehensive assessment of the patient’s overall health, functional status, and life expectancy. Healthcare providers consider the potential benefits and risks of each medication in the context of the patient’s specific circumstances (Fig. 2).

Patient and caregiver education

Polypharmacy management in elderly patients is a multi-step process, that should be individualized and patient-oriented and should ensure long-term monitoring of outcomes. The first step usually includes medication reconciliation especially in care transitions from hospitals and ambulatory.^[44] After that adherence assessment identifies difficulties patients experience when taking medications.^[45] Screening tools such as Beers Criteria, Screening Tool of Older Person’s Prescriptions (STOPP) guidelines, and Drug

Burden Index, can be used to identify drugs that can be considered more harmful than beneficial for elderly patients.

Artificial Intelligence in polypharmacy management

Artificial Intelligence (AI) is a scientific field focused on intelligent machine learning, predominantly involving the development of smart computer programs. These programs aim to deliver outcomes that mirror the human attention process.^[46] In hospital settings, AI has been used for maintaining patient records.^[47] AI algorithm has been used to enhance the prescription of medications for diabetic patients with diverse characteristics, various comorbidities, and concurrent use of multiple drugs. The program identified the most effective combination of diabetic medications through evaluation of the comparative effectiveness of these medications within a similar patient cohort.^[48]

Developing guidelines for polypharmacy management during pandemics

Recent guidelines on optimizing medication management considering COVID-19 have been released by authorities in the United States, and internationally.^[49,50] According to Scott et al., reducing the use of unnecessary medications, simplifying administration schedules, and monitoring needs, and modifying formulations are approaches to

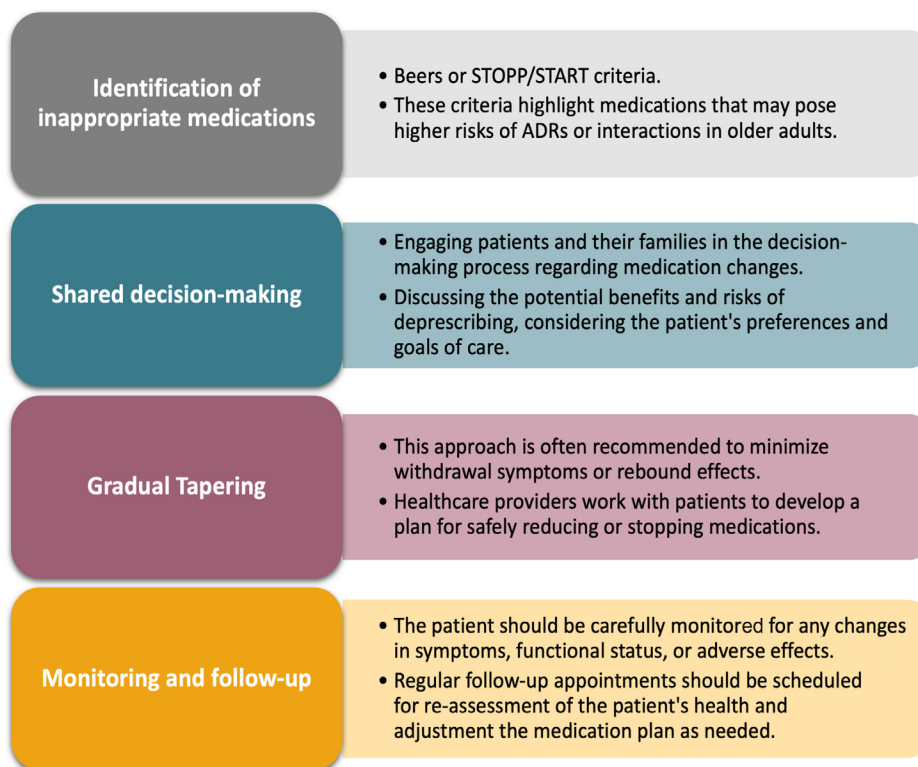


Figure 2. The main steps in the deprescribing process.

mitigate the risk of infection transmission to hospital staff amid the COVID-19 pandemic.^[51] A new idea called comprehensive polypharmacy stewardship, which involves a well-coordinated intervention aimed at enhancing the management of multiple health conditions was proposed by Irish authors.^[52] This intervention considers factors such as potentially inappropriate medications, possible prescribing omissions, interactions between drugs and diseases, and prescribing cascades. The objective is to align treatment plans with the specific condition, prognosis, and preferences of individual patients. While the safety and effectiveness of polypharmacy stewardship need validation through well-designed clinical trials, we suggest that this approach has the potential to reduce medication-related harm in older individuals with multiple health conditions who are exposed to polypharmacy.

Strengthening primary care and multi-disciplinary collaboration

Numerous studies have explored the advantages of collaborative efforts involving multiple disciplines in primary healthcare. In general, the outcomes of collaboration were observed to be either positive or neutral.^[53] Multiple investigations have indicated favorable outcomes associated with collaborative teamwork, encompassing enhanced care continuity, improved coordination, positive changes in patient behavior, alleviation of patient symptoms, and increased satisfaction due to better responsiveness to their needs.^[54-56] Nonetheless, research also indicates that implementing such collaborative practices can be challenging.^[57,58] In real-world scenarios, interprofessional collaboration may face obstacles when healthcare professionals are not fully convinced of its benefits for patients.

Polypharmacy research and the COVID-19 pandemic

The specific impact of polypharmacy during the COVID-19 pandemic was an area of emerging interest. Researchers and healthcare professionals were recognizing the potential challenges associated with managing complex medication regimens in the context of a pandemic. Several factors contribute to the importance of researching polypharmacy during pandemics:

Vulnerable populations

Elderly individuals and those with chronic conditions, who are often prescribed multiple medications, are at higher risk during pandemics.^[59] Understanding the impact of polypharmacy on their outcomes is crucial.^[60]

Healthcare system strain

Pandemics can place significant strain on healthcare systems.^[61] Managing patients with polypharmacy adds

an extra layer of complexity to the healthcare delivery process.^[62]

Treatment interactions

The use of multiple medications may lead to potential drug interactions or contraindications with treatments for the pandemic, raising concerns about treatment efficacy and patient safety.^[63]

Telehealth challenges

With the increased reliance on telehealth during pandemics, managing polypharmacy becomes more challenging.^[64] Limited face-to-face interactions may affect the ability to conduct thorough medication reviews.^[65,66] In anticipation of future pandemics, the need for continued research and data collection on polypharmacy and its management is essential.^[41]

Discussion

With polypharmacy posing significant risks in the general population, its complications are exacerbated during a pandemic, adding further complexity to the already strained healthcare systems. Primary care settings benefit greatly from the integration of diverse healthcare professionals, including pharmacists, physicians, and nurses, working together to optimize medication management. Studies have shown that such collaboration improves care continuity, enhances patient satisfaction, and can lead to better health outcomes.^[54,56] However, the implementation of collaborative care models is not without challenges. In real-world scenarios, healthcare professionals may not always be convinced of the benefits of interprofessional collaboration, and logistical barriers such as time constraints, poor communication, and lack of coordination can hinder the effectiveness of such approaches.^[57]

In the context of polypharmacy during the pandemic, the need for collaboration is heightened. Multidisciplinary teams can work together to ensure that patients' medication regimens are regularly reviewed and optimized.

Conclusion

Polypharmacy during the COVID-19 pandemic is a complex and evolving issue with significant implications for patient safety and healthcare systems. Effective management of polypharmacy is crucial to ensure the best possible care for patients. This review paper highlights the causes, consequences, and potential solutions to address the challenges of polypharmacy during the ongoing pandemic and emphasizes the importance of continued research and policy development in this area.

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