CHAPTER 7

Challenges/Barriers of Deprescribing during COVID-19

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Abstract

COVID-19 pandemic has affected all aspects of life significantly, including healthcare systems. It is important to use medications effectively to minimize hospitalizations and strain on the healthcare system. Deprescribing practice could present an opportunity for reducing drug-related harm, contact between patient and healthcare professionals, and minimise the unnecessary use of medications at risk of short supply. While evidence from randomised studies is needed to provide the potential benefits of deprescribing, theoretically, and available data has demonstrated that deprescribing could optimise the use of medications and prevent risk of contracting COVID-19 infection. This chapter discussed an overview of challenges unique to the COVID-19 pandemic, increased demands on the health care system. Also, the chapter explores deprescribing practice during pandemic, including its barriers and strategies to address the challenges.

An overview of healthcare challenges unique to Covid 19 pandemic

The spread of coronavirus disease 2019 (COVID-19) continues to have a profound impact around the globe, making it difficult to balance personal safety and work priorities (Almeharish, Assiri, Alfattani, & De Vol, 2020). The World Health Organization (WHO) has recommended several major cities and towns at risk to implement lockdown measures and other restrictions to reduce the spread of the infection (Nassisi et al., 2020). Isolation, contact restrictions and economic shutdown impose a complete change to the psychosocial environment of affected countries (Fegert, Vitiello, Plener, & Clemens, 2020).

Several countries have seen a re-organization of hospital services, with provisional care (including re-assigning doctors and nurses not usually involved in critical care). There have been closures, partial closures or reduced services of inpatient and daycare facilities, with outpatient contacts reduced in some places to emergency cases only. Some hospitals have been unable to accept new inpatients due to the risk of infection (Fegert et al., 2020). Since the pandemic was announced, at the community level, there has been disruption of, or more limited access to basic services, such as kindergarten, schools, and routine medical care (Flaxman et al., 2020). Kindergartens and schools have been closed, social contacts strongly limited and out-of-home leisure time activities canceled. Parents are asked to support their children with home schooling, while at the same time working from home. External support by other family members and social support systems have fallen away.

Beside worries and anxieties related to COVID-19, the economic situation has worsened with high and rising levels of unemployment in all affected countries. This has put a lot of pressure on

children, adolescents and their families which could result in distress, mental health problems and violence (Fegert et al., 2020). In many instances, researchers who practice in fields related to COVID-19 have tended to change their scope of research during this period of time (Almeharish et al., 2020). Due to the pandemic's adverse economic impact, several studies were affected because a sizable portion of the hospital's budget, particularly research funds, were reallocated to cover patient care expenses. These expenses included personal protective equipment (PPE) and overtime pay for nurses (Almeharish et al., 2020). Importantly, even the activity of child protection services and currently existing programs of support or supervision by youth welfare agencies have been disrupted. The lack of access to these basic services can be particularly harmful for vulnerable children and/or families. In most countries, children have not been allowed to use regular playgrounds, social group activities are prohibited, and sports clubs are closed (Flaxman et al., 2020). Social relations have been strongly limited to closest family members. This can have a negative impact on children and adolescents given the importance of peer contact for their well-being (Fegert et al., 2020). In summary, the COVID-19 pandemic has made a significant impact on social, economic, logistic, health and well-being of the individuals, and healthcare systems. Globally, some strategies have been provided to prevent COVID-19 infection among the public.

Physical Distancing Guidelines

A major route of transmission of SARS-CoV2 is via droplet spread which requires close contact (Jarvis et al., 2020). Social distancing is a blanket term covering any measure that attempts to reduce contacts between individuals, without regards to their infection status. Within two weeks of identifying the original outbreak in Wuhan, a *cordon sanitaire* had been implemented around the entire Hubei province, prohibiting travel in or out of the region and requiring individuals to remain in their houses except to buy essential supplies. Elsewhere, schools and universities have

been closed, international travel has been limited, restaurants and retailers shuttered, mask-wearing encouraged or required, and stay-at-home orders put in place.

As the number of COVID-19 cases continue to rise and with an accompanying absence of substantive pharmaceutical interventions (treatment of the virus), social distancing is being used worldwide to curb the spread of COVID-19. The WHO recommended that physical distancing at a distance of at least one meter from each other and avoidance of crowded places and groups can protect a person and break the chain of transmission (WHO, 2021b). A systematic review commissioned by the WHO attempted to analyze physical distancing measures in relation to coronavirus transmission and found out that physical distancing of less than one meter was could results in a transmission risk of 12.8%, compared with 2.6% at distances more than one meter (Jarvis et al., 2020). This finding supports the recommendation of physical distancing rules of one meter or more.

Mathematical models of COVID-19 transmission provided early support for the idea that social distancing measures could "flatten the curve" and reduce the potential for COVID-19 cases to overwhelm healthcare resources. An influential report from the Imperial College COVID-19 modeling team showed that suppression of the pandemic to levels low enough to avoid overflow of healthcare capacity would require an "intensive intervention package" that combined school closures, case isolation, and social distancing of the entire population, applied for the majority of time over two years (Nande, Adlam, Sheen, Levy, & Hill, 2021). Real-time and retrospective analyses of the growth rate of cases and deaths have suggested that in some settings the pandemic eventually slowed after the implementation of strong social distancing measures (example, in Wuhan and other Chinese cities, Hong Kong, across European countries, French regions, and some states in the US (Bi et al., 2020). However, the observed dynamics of COVID-19 outbreaks

following social distancing policies have been inconsistent, unpredictable, and the source of much confusion and debate in the public and among epidemiologists. This may be because social distancing measures reduce potentially transmissive contacts occurring in schools, workplaces, social settings, or casual encounters, but they generally do so by confining individuals to their households without additional precautions. Thus, the impact of social distancing measures might depend on the relative contribution of within-household transmission to disease spread, the distribution of household sizes, the number of households containing at least one infected individual at the time an isolation measure is enacted, and the amount of residual contact between households for the duration of the intervention (Nande et al., 2021).

The role of household transmission in the spread of COVID-19 is variable across settings. Several studies with detailed contact tracing have attempted to estimate the household "secondary attack rate". For instance, the probability of transmission per susceptible household member when there is a single infected individual in the house. In a large study in Shenzhen, China, Bi *et al* estimated this rate at 11% (Bi et al., 2020). In Guangzhou, China the estimate was 20% (Jing et al., 2020), in Beijing 23% (Wang et al., 2020), in Zhuhai 32% (Wu et al., 2020), in Seoul, South Korea 16% (Park et al., 2020), and in Taiwan, around 5% (Cheng et al., 2020). In a small German town with a large outbreak due to a superspreading event at a carnival, the household secondary attack rate was closer to 30% but decreased in larger households (Streeck et al., 2020). Liu *et al* considered a collection of known clusters involving close contacts in a single gathering (not just household, often group meals), and estimated a 35% secondary attack rate. Lewis *et al* find a rate of 28% in Wisconsin and Utah (Lewis et al., 2021), while Grijalva *et al* found 53% in Wisconsin and Tennessee (Grijalva et al., 2020). Several other studies have offered prospective evidence regarding the importance of social distancing not only at the aggregate level but also critically at

the level of the individual (Fazio et al., 2021). However, evidence from randomized controlled trials is needed to confirm these findings.

Increased Demands on the Health Care System

The ongoing COVID-19 pandemic has posed a major challenge to public health systems in many countries with the imminent risk of saturated hospitals and patients not receiving proper medical care (Capistran, Capella, & Christen, 2021). While health systems around the world are being challenged by increasing demand for care of COVID-19 patients, it is critical to maintain preventive and curative services, especially for the most vulnerable populations, such as children, older persons, people living with chronic conditions, minorities and people living with disabilities (Hassoun, 2021). To prepare for a surge in hospitalized patients with COVID -19, hospitals needed to create more negative pressure rooms, hire a backup workforce, pay overtime to staff, educate staff, obtain PPE, and address PPE shortages. All non-emergent and elective surgeries and procedures were canceled to free up essential hospital staff and hospital beds (Burgess et al., 2020). A survey carried out by the WHO among 155 countries revealed that health services have been partially or completely disrupted in many countries. More than half (53%) of the countries surveyed have partially or completely disrupted services for hypertension treatment; 49% for treatment for diabetes and diabetes-related complications; 42% for cancer treatment, and 31% for cardiovascular emergencies. Rehabilitation services have been disrupted in almost two-thirds (63%) of countries, even though rehabilitation is key to a healthy recovery following severe illness from COVID-19 (WHO, 2021a). In addition, a key informant pulse survey showed that disruptions of essential health services have happened in nearly all responding countries, and more so in lower-income than higher-income countries (WHO, 2021a). A wide range of services are affected, including essential services for communicable diseases, noncommunicable diseases, mental

health, reproductive, maternal, newborn, child and adolescent health, and nutrition services (Raab & Michel, 2020).

During COVID-19 pandemic, hospitals have to plan for an increased demand of their services. This requires identifying staff with specialized knowledge, skills and decision making to work with patients with respiratory complications (WHO, 2020b). While covid-19 has had some strong impacts on health systems and policy, it also, created an avenue to reimagine the key dimensions of global healthcare—to rethink models of care, supply chain management, training and workforce development, business models and the critical importance of objective accreditation, to name a few (Kaye et al., 2021).

The Impact of COVID-19 on Mental Health

It should be recognized that, even in the normal course of events, people with established mental illness have a lower life expectancy and poorer physical health outcomes than the general population. As a result, people with pre-existing mental health and substance use disorders will be at increased risk of infection with Covid-19 (Cullen, Gulati, & Kelly, 2020). Disorders involving anxiety and depression have been on the rise since the onset of the pandemic and a survey conducted by the Center for Disease Control (CDC) saw that at least 40.9% of participants experienced at least one adverse mental health condition. This included symptoms related to increase substance abuse, anxiety, depression, suicidal ideation, trauma-and stress or-related disorders.

Healthcare and frontline workers have been affected by this pandemic and are considered high-risk groups for adverse psychological effects. This may lead to healthcare workers being subjected to stigmatization which can provoke discrimination and marginalization, leading to victims feeling

stereotyped, treated differently, heightened suspicion, and the feeling of lost status. This can further lead to unhelpful behavior such as seeking medical care late, which may result in a higher probability of spreading the virus (Semo & Frissa, 2020). A report from a systematic review revealed relatively high rates of symptoms of anxiety (6.33% to 50.9%), depression (14.6% to 48.3%), post-traumatic stress disorder (7% to 53.8%), psychological distress (34.43% to 38%), and stress (8.1% to 81.9%) in the general population during the COVID-19 pandemic in China, Spain, Italy, Iran, the US, Turkey, Nepal, and Denmark (Xiong et al., 2020). Risk factors associated with distress measures included female gender, younger age group (≤40 years), presence of chronic/psychiatric illnesses, unemployment, student status, and frequent exposure to social media/news concerning COVID-19 (Xiong et al., 2020). A WHO survey of 130 countries provides the first global data showing the devastating impact of COVID-19 on access to mental health services and underscores the urgent need for increased funding. The pandemic has disrupted or halted critical mental health services in 93% of countries worldwide while the demand for mental health is increasing, bereavement, isolation, loss of income and fear are triggering mental health conditions or exacerbating existing ones (WHO, 2020a).

Despite the numerous challenges posed by the covid-19 pandemic, some sectors have observed an overall positive impact. For instance, the lockdown has decreased the electricity demand by 30% in Italy, India, Germany, and the USA, and by 12–20% in France, Spain, and the UK. Additionally, the expenditure of the fuel supply has been decreased by 4% in 2020 as compared to the previous years (2012–2019) (Mousazadeh et al., 2021); (Ha, 2021). In particular, the global demand for coal fuel has been reduced by 8% in March and April 2020 as compared to the same time in 2019. In terms of harmful emissions, the lockdowns reduced the emissions of nitrous oxides by 20–30% in China, Italy, France, Spain, and by 77.3% in São Paulo, Brazil (Mousazadeh et al., 2021); (Ha,

2021). Similarly, the particulate matter level has been reduced from 5–15% in Western Europe, to 200% in New Delhi, India, which in turn has enhanced the air quality in a never-seen manner in recent times (Mousazadeh et al., 2021); (Ha, 2021). In some places, such as New York, USA, carbon dioxide ($CO_{2)}$ emission was also reduced by 5–10%. The water quality, in several polluted areas, has also been remarkably enhanced, for example, the dissolved oxygen content in the Ganga River, India, has increased by about 80%.ccc (Mousazadeh et al., 2021); (Ha, 2021)

Deprescribing practice during the COVID-19 pandemic

Older population are more vulnerable to chronic diseases and infections such as COVID-19 due the decline in immune and other body systems. Older age has consistently associated with high prevalence of cardiovascular diseases, diabetes, and nervous, neuromuscular, and respiratory system diseases (Jain & Yuan, 2020). Recent literature suggests that COVID-19 infection (a respiratory system diseases) among this group of people is more prevalent, and severe among elderly population (Jain & Yuan, 2020). Giving these comorbidities, the use of multiple medications (polypharmacy) is frequent among this cohort. Also, to adhere with clinical guidelines, prescribers may recommend a complex medication regimen that could complicate the patients existing condition.

Polypharmacy even without a pandemic, has been associated with a high cases of potentially inappropriate medications (PIMs) that predisposes many patients (particularly the elderly) to drug interactions (drug-disease, drug-drug, drug-food and drug-disease), leading to many adverse events and hospitalizations (Anathhanam, Powis, Cracknell, & Robson, 2012). Thus, reducing medicines that are potentially risk to a patient through deprescribing practice could minimize adverse drug-related events and optimize clinical and economic outcomes.

Deprescribing practice involves harm-benefit analysis. This analysis entails removal of any drug (from the patient's prescription) that appeared to cause more harm than benefit to the patient. During pandemic the harm protection in clinical settings includes protection of the staff handling the medications (pharmacists, pharmacy technicians and the nurses) from contracting the COVID-19 infection, and appropriate utilization of those drugs at risk of short supply. Therefore, deprescribing practice during pandemic could benefit both the patient (through reducing adverse events), health professionals (protection against COVID 19 infection), and the healthcare system (effective use of resources). In this section, we discuss how deprescribing practice could be applied to reduce unnecessary medications with a bid to minimize opportunities for transmission of COVID-19 between patients and staff, and to reduce short supply of drugs.

When assessing opportunities for deprescribing, healthcare professionals should consider the following (Burgess et al., 2020): (i) the list of medications and indication for therapy for the patient, (ii) the overall risk of drug-induced related harm, (iii) potential for discontinuation and priority, (iv) implementation and monitoring of medication discontinuation regimen.

During pandemic, medications for discontinuation could be categorized into three groups: first, are those that do not treat an acute disease condition, can be stopped abruptly without harm, do not offer additional benefits, and do not require regular patient monitoring after discontinuation (Scott, Rigby, & Hilmer, 2020a). These medications may include some vitamin supplements, herbal medicines, glucosamine and so on.

The second category include medications that are considered safe to be cautiously discontinued or suspended without harm. Examples of these medications include supplements such as vitamin D analogues, vitamin B12, magnesium, calcium, and bisphosphonates. Other drugs in this category

are those that are often over prescribed. These medications could be tapered of discontinued based on the risk of symptom rebound. Examples are opiate analgesics, paracetamol, antiacids, Proton-pump inhibitors (PPI) and prophylactic antibiotics (Scott et al., 2020a).

The third category of candidate medications for deprescribing during the pandemic include those that handling them could significantly increase the risk of COVID-19 transmission from infected patients (Scott et al., 2020a). For instance, administration of nebulizers for the management of asthma and chronic obstructive pulmonary disease (COPD), nasal sprays for allergy, and nasal decongestants. Administration of these drugs generates aerosols, as such should be discontinued. Also, administration of parenteral medications such as intravenous fluids, intramuscular, and subcutaneous injections, could results in contact with COVID 19 infected person. These categories of medications should be safely suspended, or alternative dosage form can be considered to avoid physical contact with patients during pandemic. Some researchers in the US have assessed the impact of deprescribing practice in 174 hospitals. A total of 4,451 intensive care unit patients were found to be eligible for deprescribing of H_2 receptor antagonists and proton pump inhibitors. Of these patients, deprescribing occurred in 2,479 (55.7%) (Burgess et al., 2020).

Deprescribing practice could prevent or reduce contact between patients and healthcare professionals. For examples, in most times, polypharmacy and unnecessarily complex medication are common among elderly patients with comorbidities (Lindquist, Lindquist, Zickuhr, Friesema, & Wolf, 2014). Hence, their administration to patients at clinical settings may offer frequent contact with patients and thus, increasing chances of contracting the infection. Therefore, removing less important drugs from the patient's medication list, or simplifying the dosage regimen of frequently administered drugs to a once daily dose or a sustained release medications could minimize frequent contact between patients and healthcare professionals. The strategies to

reduce medication complexity in older patients have been demonstrated to be successful in clinical settings (Elliott, O'Callaghan, Paul, & George, 2013), and nursing homes (Sluggett et al., 2020).

Deprescribing could help improve judicious utilization of medication at risk of short supply during pandemic. The COVID-19 pandemic has affected many aspects of life including logistics and supply of drugs and consumables. Given the widespread lockdown, closure of airports, seaports and limited road transports, the availability of many medications become in short supply. The first medication shortage due to COVID 19 pandemic was formally reported in February 27, 2020, by the United State (US) Food and Drug Administration -FDA (FDA, 2020). Shortages during pandemic provided the need to rapidly develop and implement strategies (including deprescribing practice) to guide optimal utilization of medications that may be in limited supply. For example, deprescribing practice could be applied to save many drugs that appear to be unnecessary to some patients. As a results, these drugs may subsequently be available to those who are in need during.

A recent literature provided a guide that could assist pharmacists during deprescribing process to address medication shortages (Burgess et al., 2020). The guide suggests that healthcare professionals should consider evidence-based alternative treatment options to substitute for medications at risk of shortage during pandemic. This could be achieved by creating a list these medications and identify many appropriate alternatives (Burgess et al., 2020).

Overall, deprescribing practice, when applied appropriately could theoretically assist in optimizing medication supply, minimize the frequency of contact between healthcare professionals and patient, and consequently reduce COVID-19 exposure risk.

Challenges/barriers to deprescribing practice during COVID-19 pandemic

Barriers to deprescribing before the pandemic include prescriber, patient, and system related factors, such as resistance to change, patient's poor knowledge about deprescribing, lack of alternatives for treatment of disease, uncoordinated delivery of health services, prescriber's attitudes and/or experiences, limited availability of guidelines for deprescribing, lack of evidence on preventative therapy and a host of others (Elbeddini, Prabaharan, Almasalkhi, Tran, & Zhou, 2021).

The COVID-19 pandemic came with other unique qualities that may make deprescribing practice more challenge. Some of the new challenges include physical/social distancing, information overload and theoretical harm to certain medications.

Physical/social distancing

Social distancing was among the effective measures prescribed to limit the spread of the COVID-19 pandemic (Jones et al., 2020). Social distancing, otherwise known as ‘physical distancing’, implies establishing a safe distance between yourself and others who are not members of your family (Sørensen, Okan, Kondilis, & Levin-Zamir, 2021). Social distancing could make deprescribing undeliverable through in-person interactions during the COVID-19 pandemic, and hence makes virtual care as a viable option. The full integration of electronic health record (EHR) across the healthcare system's continuum can help this strategy succeed. However, conducting virtual deprescribing in the older population comes with multiple challenges. The elderly may face challenges with virtual deprescribing for a variety of reasons, including their inability of the elderly to efficiently use technology, a lack of resources (e.g., a smartphone), poor literacy level, a lack of social support, a predisposition for withdrawal symptoms, as well as a greater likelihood of being admitted to the hospital. Virtual care is the way of the future in healthcare, and in order to keep

the benefits of deprescribing, more measures need be put in place to solve the obstacles that older patients may face when accessing deprescribing remotely. Most elderly patients are unable to traverse technology as competently as the younger patients, so providing deprescribing services remotely might be challenging.

The need for extensive patient monitoring

Some medications require extensive monitoring following withdrawal from patient prescription. This monitoring may serve as a barrier to deprescription during the pandemic (Scott, Rigby, & Hilmer, 2020b). Supplements such as vitamins and herbs can be stopped without much difficulty. However, discontinuing psychoactive or anticholinergic medicines that predispose patients to delirium, agitation, and falls might be difficult. It is more problematic during a pandemic, because intimate physical contact (discouraged due to the pandemic) between patients and healthcare professional may be required during the monitoring process (Scott et al., 2020b).

Information overload /theoretical harm

The literature suggests that "Information overload can best be understood as that situation which arises when there is so much relevant and potentially useful information available that it becomes a hindrance rather than a help" (Bawden & Robinson, 2020; Mohammed et al., 2021). People may experience health information overload as a result of the constant COVID-19 information they receive on a daily basis (Mohammed et al., 2021). Information overload/theoretical harm of medications leaves the prescriber and patient with the difficult task of balancing the theoretical harm and known benefit of continuing with a medicine against the potential harm and unknown benefit of stopping or changing treatment (Phizackerley, 2020). For example, the concern that medicines that increase expression of Angiotensin Converting Enzymes II could raise the risk of

developing severe and fatal COVID-19 was so serious that it had to be countered by European Medicines agency and other organisations (Phizackerley, 2020).

There are also worries regarding drugs that have been linked to a modest increase in the risk of pneumonia and other respiratory complications. For example, the use of anticholinergics, antipsychotics, benzodiazepines, opioids, and proton pump inhibitors, in older people (Phizackerley, 2020). All such concerns may make deprescribing to be more challenging during the pandemic.

Strategies for overcoming barriers of deprescribing during COVID-19

The following interventions can help to overcome some of the barriers encountered during Covid-19: increased patient education, availability of deprescribing guidelines, online tools and resources, prioritization of non-pharmacological therapy, incorporation of electronic health record (EHR), continuous prescriber education, and development of research studies on deprescribing.

Application of COVID-19 guidance

The use of various COVID-19 guidance has proved to be effective in enhancing deprescribing during pandemic. For instance, the COVID-SAFER (Ross et al., 2020). Because COVID-19 medications are still trialed currently, the potential safety of medications can only be accessed when they are eventually licensed for use in COVID-19. Any medication that may increase the risk of spreading the virus should be avoided, e.g., medication whose administration generates aerosols, such as bronchodilator nebulisers for acute exacerbations of asthma or chronic obstructive pulmonary disease, and nasal sprays for allergic rhinitis, can substantially increase risk of COVID-19 transmission from infected patients, and should be avoided as much as possible.

Hand-held metered dose inhalers (MDI) combined with spacer devices are just as effective as nebulisers (Scott et al., 2020b).

Simplifying Medication Regimens

As there is exist physical distancing to reduce the risk of COVID-19 transmission, simplifying drug regimen may be an important strategy to curb the spread of infections. Switching from multiple single-ingredient to combination formulations is an interventions to reduce medication complexity in older people. Likewise, Immediate release formulations of medications such as metformin, some opioids, and gabapentin that require frequent dosing may be converted to once-daily modified release preparations. Short-acting bronchodilators (e.g. salbutamol and ipratropium) can be switched to long-acting agents (e.g. salmeterol and tiotropium) (Scott et al., 2020b).

Providing Stakeholders with adequate Information

Deprescribing practise requires notifying stakeholders of changes to medication regimens and monitoring for unintended adverse effects (Rahman et al., 2020). When changing prescription regimens, it is critical to communicate the reasons for the adjustments, including any local needs to deal with medicine shortages during the pandemic. Healthcare professionals must explain how and why changes are being made to patients and their families, as well as comprehend and address their concerns.

Physicians and pharmacists should keep track of all medications that have been discontinued or changed, as well as the rationale for each change, and re-evaluate the appropriateness of each change on a regular basis. Patients should also be informed of symptoms of disease relapse so that they can track where medications have been stopped or reduced (Scott et al., 2020b).

Conclusion

Deprescribing during the COVID-19 pandemic could provide opportunities for preventing spread of infection, minimizing medication-related harm, and optimizing the use of medications at risk of short supply. Despite its theoretical benefits, the implementation of deprescribing practices may be limited by physical distancing, lack of formal guidelines for deprescribing, the need for extensive patient monitoring following discontinuation of drugs, and information overload among both patients and clinicians. These barriers could be addressed through adhering to COVID-19 guidance, simplifying medication regimens, improving patient education, and updating knowledge among healthcare professionals. The information discussed in this chapter has been summarized in Figure 1.

References

Almeharish, A., Assiri, A. M., Alfattani, A., & De Vol, E. (2020). Coping with the COVID-19 Pandemic's Unique Challenges Associated with Medical Research: A Saudi Institution Approach. *Risk Manag Healthc Policy, 13*, 3173-3178. doi:10.2147/rmhp.s283582

Anathhanam, S., Powis, R. A., Cracknell, A. L., & Robson, J. (2012). Impact of prescribed medications on patient safety in older people. *Therapeutic Advances in Drug Safety, 3*(4), 165-174.

Bawden, D., & Robinson, L. (2020). Information overload: An overview.

Bi, Q., Wu, Y., Mei, S., Ye, C., Zou, X., Zhang, Z., . . . Feng, T. (2020). Epidemiology and transmission of COVID-19 in 391 cases and 1286 of their close contacts in Shenzhen, China: a retrospective cohort study. *The Lancet Infectious Diseases, 20*(8), 911-919. doi:10.1016/S1473-3099(20)30287-5

Burgess, L. H., Cooper, M. K., Wiggins, E. H., Miller, K. M., Murray, E., Harris, S., & Kramer, J. S. (2020). Utilizing Pharmacists to Optimize Medication Management Strategies During the COVID-19 Pandemic. *Journal of Pharmacy Practice, 0*(0), 0897190020961655. doi:10.1177/0897190020961655

Capistran, M. A., Capella, A., & Christen, J. A. (2021). Forecasting hospital demand in metropolitan areas during the current COVID-19 pandemic and estimates of lockdown-induced 2nd waves. *PLoS One, 16*(1), e0245669. doi:10.1371/journal.pone.0245669

Cheng, H. Y., Jian, S. W., Liu, D. P., Ng, T. C., Huang, W. T., & Lin, H. H. (2020). Contact Tracing Assessment of COVID-19 Transmission Dynamics in Taiwan and Risk at Different Exposure Periods Before and After Symptom Onset. *JAMA Intern Med, 180*(9), 1156-1163. doi:10.1001/jamainternmed.2020.2020

Cullen, W., Gulati, G., & Kelly, B. D. (2020). Mental health in the COVID-19 pandemic. *Qjm, 113*(5), 311-312. doi:10.1093/qjmed/hcaa110

Elbeddini, A., Prabaharan, T., Almasalkhi, S., Tran, C., & Zhou, Y. (2021). Barriers to conducting deprescribing in the elderly population amid the COVID-19 pandemic. *Research in social & administrative pharmacy : RSAP, 17*(1), 1942-1945. doi:10.1016/j.sapharm.2020.05.025

Elliott, R. A., O'Callaghan, C., Paul, E., & George, J. (2013). Impact of an intervention to reduce medication regimen complexity for older hospital inpatients. *International Journal of Clinical Pharmacy, 35*(2), 217-224.

Fazio, R. H., Ruisch, B. C., Moore, C. A., Granados Samayoa, J. A., Boggs, S. T., & Ladanyi, J. T. (2021). Social distancing decreases an individual's likelihood of contracting COVID-19. *Proc Natl Acad Sci U S A, 118*(8). doi:10.1073/pnas.2023131118

FDA. (2020). The U.S. Food and Medication Administration. Coronavirus (COVID-19) Supply Chain Update (2020). Accessed January 04, 2022. https://www.fda.gov/news-events/press-announcements/coronavirus-covid-19-supply-chain-update.

Fegert, J. M., Vitiello, B., Plener, P. L., & Clemens, V. (2020). Challenges and burden of the Coronavirus 2019 (COVID-19) pandemic for child and adolescent mental health: a narrative review to highlight clinical and research needs in the acute phase and the long return to normality. *Child Adolesc Psychiatry Ment Health, 14*, 20. doi:10.1186/s13034-020-00329-3

Flaxman, S., Mishra, S., Gandy, A., Unwin, H. J. T., Mellan, T. A., Coupland, H., . . . Bhatt, S. (2020). Estimating the effects of non-pharmaceutical interventions on COVID-19 in Europe. *Nature, 584*(7820), 257-261. doi:10.1038/s41586-020-2405-7

Grijalva, C. G., Rolfes, M. A., Zhu, Y., McLean, H. Q., Hanson, K. E., Belongia, E. A., . . . Talbot, H. K. (2020). Transmission of SARS-COV-2 Infections in Households - Tennessee and Wisconsin, April-September 2020. *MMWR Morb Mortal Wkly Rep, 69*(44), 1631-1634. doi:10.15585/mmwr.mm6944e1

Ha, K. M. (2021). The Reliance on Positive Impacts of COVID-19 Outbreak for Psychological Mitigation. *Psychosom Med, 83*(4), 398-399. doi:10.1097/psy.0000000000000933

Hassoun, H. T. (2021). The Impact of COVID-19 on Global Healthcare (2021). Available from https://www.cedars-sinai.org/blog/impact-of-covid-19-on-global-healthcare.html. Accessed September 19, 2021.

Jain, V., & Yuan, J.-M. (2020). Predictive symptoms and comorbidities for severe COVID-19 and intensive care unit admission: a systematic review and meta-analysis. *International Journal of Public Health, 65*(5), 533-546. doi:10.1007/s00038-020-01390-7

Jarvis, C. I., Van Zandvoort, K., Gimma, A., Prem, K., Auzenbergs, M., O'Reilly, K., . . . group, C. C.-w. (2020). Quantifying the impact of physical distance measures on the transmission of COVID-19 in the UK. *BMC Medicine, 18*(1), 124. doi:10.1186/s12916-020-01597-8

Jing, Q. L., Liu, M. J., Zhang, Z. B., Fang, L. Q., Yuan, J., Zhang, A. R., . . . Yang, Y. (2020). Household secondary attack rate of COVID-19 and associated determinants in Guangzhou, China: a retrospective cohort study. *Lancet Infect Dis, 20*(10), 1141-1150. doi:10.1016/s1473-3099(20)30471-0

Jones, N. R., Qureshi, Z. U., Temple, R. J., Larwood, J. P. J., Greenhalgh, T., & Bourouiba, L. (2020). Two metres or one: what is the evidence for physical distancing in covid-19? *BMJ*, m3223. doi:10.1136/bmj.m3223

Kaye, A. D., Okeagu, C. N., Pham, A. D., Silva, R. A., Hurley, J. J., Arron, B. L., . . . Cornett, E. M. (2021). Economic impact of COVID-19 pandemic on healthcare facilities and systems: International perspectives. *Best Pract Res Clin Anaesthesiol, 35*(3), 293-306. doi:10.1016/j.bpa.2020.11.009

Lewis, N. M., Chu, V. T., Ye, D., Conners, E. E., Gharpure, R., Laws, R. L., . . . Kirking, H. L. (2021). Household Transmission of Severe Acute Respiratory Syndrome Coronavirus-2 in the United States. *Clin Infect Dis, 73*(7), 1805-1813. doi:10.1093/cid/ciaa1166

Lindquist, L. A., Lindquist, L. M., Zickuhr, L., Friesema, E., & Wolf, M. S. (2014). Unnecessary complexity of home medication regimens among seniors. *Patient Education and Counseling, 96*(1), 93-97.

Mohammed, M., Sha'aban, A., Jatau, A. I., Yunusa, I., Isa, A. M., Wada, A. S., . . . Ibrahim, B. (2021). Assessment of COVID-19 Information Overload Among the General Public. *Journal of racial and ethnic health disparities*, 1-9. doi:10.1007/s40615-020-00942-0

Mousazadeh, M., Paital, B., Naghdali, Z., Mortezania, Z., Hashemi, M., Karamati Niaragh, E., . . . Emamjomeh, M. M. (2021). Positive environmental effects of the coronavirus 2020 episode: a review. *Environ Dev Sustain*, 1-23. doi:10.1007/s10668-021-01240-3

Nande, A., Adlam, B., Sheen, J., Levy, M. Z., & Hill, A. L. (2021). Dynamics of COVID-19 under social distancing measures are driven by transmission network structure. *PLoS Comput Biol, 17*(2), e1008684. doi:10.1371/journal.pcbi.1008684

Nassisi, M., Audo, I., Zeitz, C., Varin, J., Wohlschlegel, J., Smirnov, V., . . . Sahel, J. A. (2020). Impact of the COVID-19 lockdown on basic science research in ophthalmology: the

experience of a highly specialized research facility in France. *Eye (Lond)*, *34*(7), 1187-1188. doi:10.1038/s41433-020-0944-7

Park, S. Y., Kim, Y. M., Yi, S., Lee, S., Na, B. J., Kim, C. B., . . . Jeong, E. K. (2020). Coronavirus Disease Outbreak in Call Center, South Korea. *Emerg Infect Dis*, *26*(8), 1666-1670. doi:10.3201/eid2608.201274

Phizackerley, D. (2020). Deprescribing in the time of covid-19. *Drug and Therapeutics Bulletin*, *58*(6), 82-82. doi:10.1136/dtb.2020.000027

Raab, A. M., & Michel, F. (2020). Significant demands on healthcare resources during the COVID crisis. *Spinal Cord*, *58*(6), 728-729. doi:10.1038/s41393-020-0482-y

Rahman, S., Singh, K., Dhingra, S., Charan, J., Sharma, P., Islam, S., . . . Haque, M. (2020). The Double Burden of the COVID-19 Pandemic and Polypharmacy on Geriatric Population – Public Health Implications . *Therapeutics and Clinical Risk Management*, *Volume 16*, 1007-1022. doi:10.2147/tcrm.s272908

Ross, S. B., Wilson, M. G., Papillon-Ferland, L., Elsayed, S., Wu, P. E., Battu, K., . . . McDonald, E. G. (2020). COVID-SAFER : Deprescribing Guidance for Hydroxychloroquine Drug Interactions in Older Adults. *Journal of the American Geriatrics Society*, *68*(8), 1636-1646. doi:10.1111/jgs.16623

Scott, I. A., Rigby, D., & Hilmer, S. N. (2020a). Optimising medication management during the COVID-19 pandemic. *Journal of Pharmacy Practice and Research*, *50*(3), 186-189. doi:https://doi.org/10.1002/jppr.1668

Scott, I. A., Rigby, D., & Hilmer, S. N. (2020b). Optimising medication management during the COVID-19 pandemic. *Journal of Pharmacy Practice and Research*, *50*(3), 186-189. doi:10.1002/jppr.1668

Semo, B. W., & Frissa, S. M. (2020). The Mental Health Impact of the COVID-19 Pandemic: Implications for Sub-Saharan Africa. *Psychol Res Behav Manag*, *13*, 713-720. doi:10.2147/prbm.s264286

Sluggett, J. K., Chen, E. Y., Ilomäki, J., Corlis, M., Van Emden, J., Hogan, M., . . . Ooi, C. E. (2020). Reducing the burden of complex medication regimens: SImplification of Medications Prescribed to Long-tErm care Residents (SIMPLER) cluster randomized controlled trial. *Journal of the American Medical Directors Association*, *21*(8), 1114-1120. e1114.

Sørensen, K., Okan, O., Kondilis, B., & Levin-Zamir, D. (2021). Rebranding social distancing to physical distancing: calling for a change in the health promotion vocabulary to enhance clear communication during a pandemic. *Global Health Promotion*, *28*(1), 5-14. doi:10.1177/1757975920986126

Streeck, H., Schulte, B., Kümmerer, B. M., Richter, E., Höller, T., Fuhrmann, C., . . . Hartmann, G. (2020). Infection fatality rate of SARS-CoV2 in a super-spreading event in Germany. *Nat Commun*, *11*(1), 5829. doi:10.1038/s41467-020-19509-y

Wang, Y., Tian, H., Zhang, L., Zhang, M., Guo, D., Wu, W., . . . MacIntyre, C. R. (2020). Reduction of secondary transmission of SARS-CoV-2 in households by face mask use, disinfection and social distancing: a cohort study in Beijing, China. *BMJ Glob Health*, *5*(5). doi:10.1136/bmjgh-2020-002794

WHO. (2020a). COVID-19 disrupting mental health services in most countries, WHO survey. Available from https://www.who.int/news/item/05-10-2020-covid-19-disrupting-mental-health-services-in-most-countries-who-survey. Accessed September 19, 2021.

WHO. (2020b). Maintaining essential health services during the COVID-19 outbreak. Available from https://www.who.int/emergencies/diseases/novel-coronavirus-2019/related-health-issue. Accessed September 18, 2021.

WHO. (2021a). Impact of COVID-19 pandemic on essential health services (2021). Available from https://www.who.int/publications/i/item/WHO-2019-nCoV-EHS-continuity-survey-2021.1 Accessed September 18, 2021.

WHO. (2021b). Physical distancing. Available from https://www.who.int/westernpacific/emergencies/covid-19/information/physical-distancing. Accessed September 13, 2021.

Wu, J., Huang, Y., Tu, C., Bi, C., Chen, Z., Luo, L., . . . Liu, J. (2020). Household Transmission of SARS-CoV-2, Zhuhai, China, 2020. *Clin Infect Dis, 71*(16), 2099-2108. doi:10.1093/cid/ciaa557

Xiong, J., Lipsitz, O., Nasri, F., Lui, L. M. W., Gill, H., Phan, L., . . . McIntyre, R. S. (2020). Impact of COVID-19 pandemic on mental health in the general population: A systematic review. *J Affect Disord, 277*, 55-64. doi:10.1016/j.jad.2020.08.001

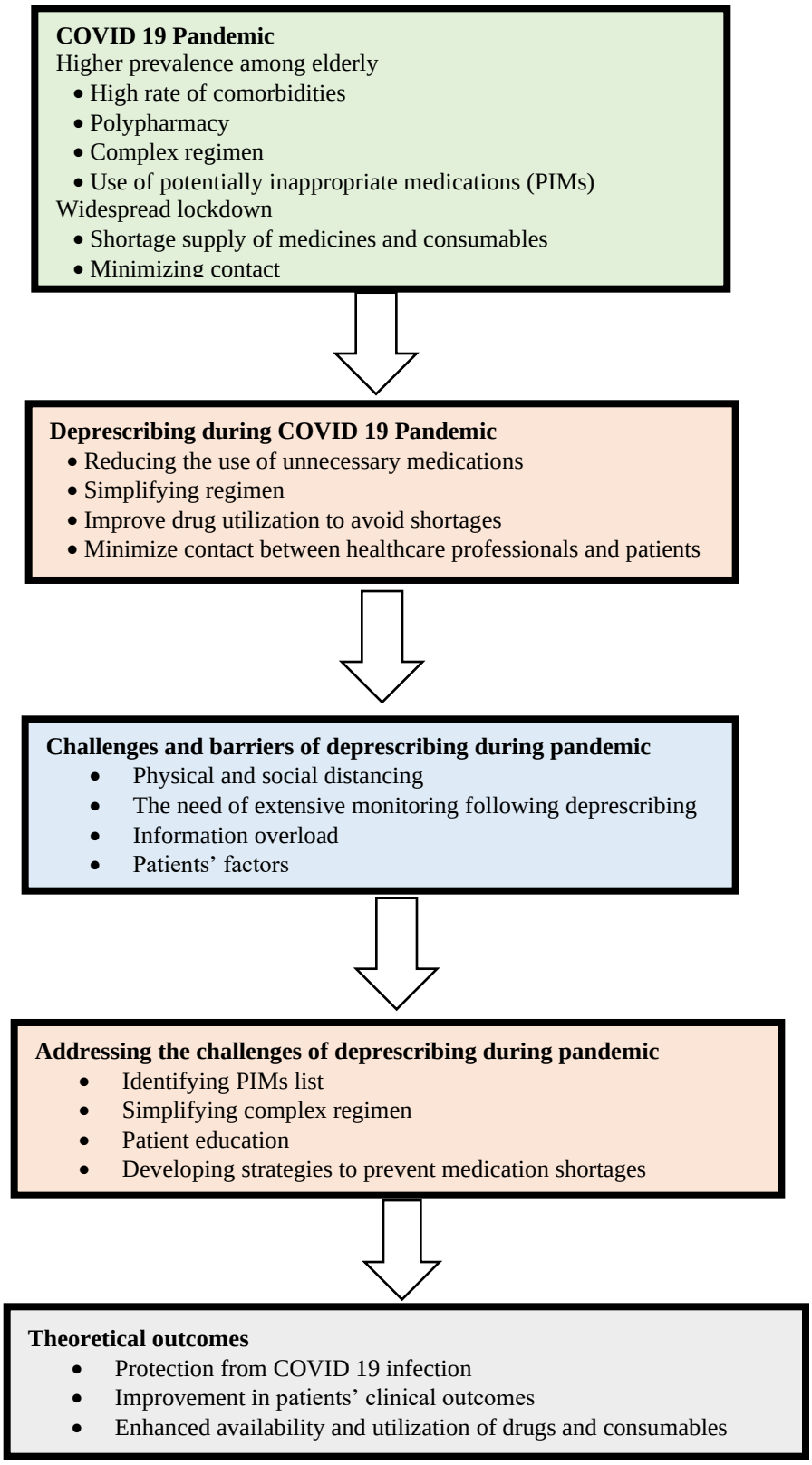

Figure 1. Deprescribing practice during COVID 19 pandemic