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## **Navigating Chronic Disease Management with Digital Healthcare Solutions amidst the COVID-19 Pandemic: A Systematic Literature Review**

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### **Abstract**

The purpose of this paper is to critically evaluate data collected from various studies on Chronic Disease Management during the COVID-19 pandemic and the emergence of Digital Healthcare as a means of providing innovative approaches for the management of chronic diseases. A systematic literature review was conducted based on studies found in the Pubmed database, while the search included studies with no publication date time limit, given that COVID-19 emerged in 2019. A Prisma diagram was created to record the way and the criteria by which we included and excluded studies for our research. Out of the 567 records identified through various sources 85 were used for a qualitative synthesis. During the first wave of the pandemic, a significant reduction or complete cancellation of scheduled health appointments was observed. At the beginning of the COVID-19 pandemic,

shortages of medication used to manage chronic conditions were also recorded due to global supply chain disruptions. Since the beginning, governments acted rapidly to promote the use of teleconsultations by introducing enabling legislation and revising laws ensuring continuity of care for people with chronic diseases, thus transitioning rapidly to remote care and monitoring. The use of telemedicine and the involvement of community pharmacists for the management of chronic patients are key factors for sustained adherence. Long-term policies are vital to prevent pandemic-driven health disparities, while lessons should be derived for future preparedness, managing subsequent waves, and ensuring testing in primary care.

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**Keywords:** Chronic Disease; Digital Healthcare; Telemedicine; COVID-19

## **Introduction**

The COVID-19 disease first appeared in December 2019, when hospitals in the city of Wuhan, China recorded a large number of cases of severe acute respiratory syndrome coronavirus 2 (SARS-COV-2). The high transmissibility enhanced by the asymptomatic nature of the virus (Oran *et al.*, 2020) led almost all countries in the world to implement a series of public health protection measures. Containment and mitigation strategies were grouped into three broad policy categories: 1) Social distancing measures, notably: closing workplaces and non-essential services, closing schools, banning mass gatherings, travel restrictions and total lockdowns. 2) Improved personal and environmental hygiene, including the use of personal protective equipment such as face masks. 3) Control, monitoring and tracing of infected individuals, and containment of infected ones. This could involve targeted or large-scale sampling and quarantine policies (OECD and European Union, 2020). Countries made significant efforts to respond to this crisis, which has affected all sectors of society. Pandemic preparedness has generally been inadequate, particularly in light of the large human and economic costs associated with a global health crisis such as the COVID-19 pandemic (OECD, 2022).

Governments took swift and massive measures to mitigate the economic and financial impacts of the pandemic, but these were significant and multifaceted (OECD, 2022). The public health crisis has led to a major economic crisis, which has serious consequences for individual and social well-being both now and in the future. COVID-19 has exposed latent weaknesses in the health system that existed before its outbreak (OECD and European Union, 2020).

Healthcare services, particularly in routine care, have undergone a clear impact, greatly affecting individuals managing chronic illnesses. This encompasses diminished availability of primary care, deferral of elective

medical and surgical procedures, and disruptions in screening initiatives (Iftekhhar *et al.*, 2021),(Wyper *et al.*, 2020).

Results from a worldwide survey revealed that healthcare practitioners have embraced novel methods of providing medical assistance, employing telemedicine as a means to minimize in-person interactions. The growing utilization of telemedicine, coupled with the expanded engagement of community pharmacists in overseeing chronic patients, may serve as effective strategies to enhance adherence beyond the pandemic period (Olmastroni *et al.*, 2023).

The purpose of this paper is to introduce research related to the Chronic Disease Management during the COVID-19 pandemic and the emergence of Digital Healthcare as a means of providing innovative approaches to managing chronic diseases. The study tries to determine whether Telemedicine, Virtual Care, and other forms of digital solutions, which constitute the pillars of Digital Healthcare, enable healthcare providers to maintain a level of connection with their patients during the COVID-19 pandemic. This, in turn, helps address the disruptions that patients faced throughout the pandemic period. This presentation is done on two levels. In the first section, we present how the COVID-19 pandemic affected Chronic Disease Management. In the second section, we examine the effects of Telemedicine, and other forms of Digital Solutions. Both sections were based on relevant literature published in recent years.

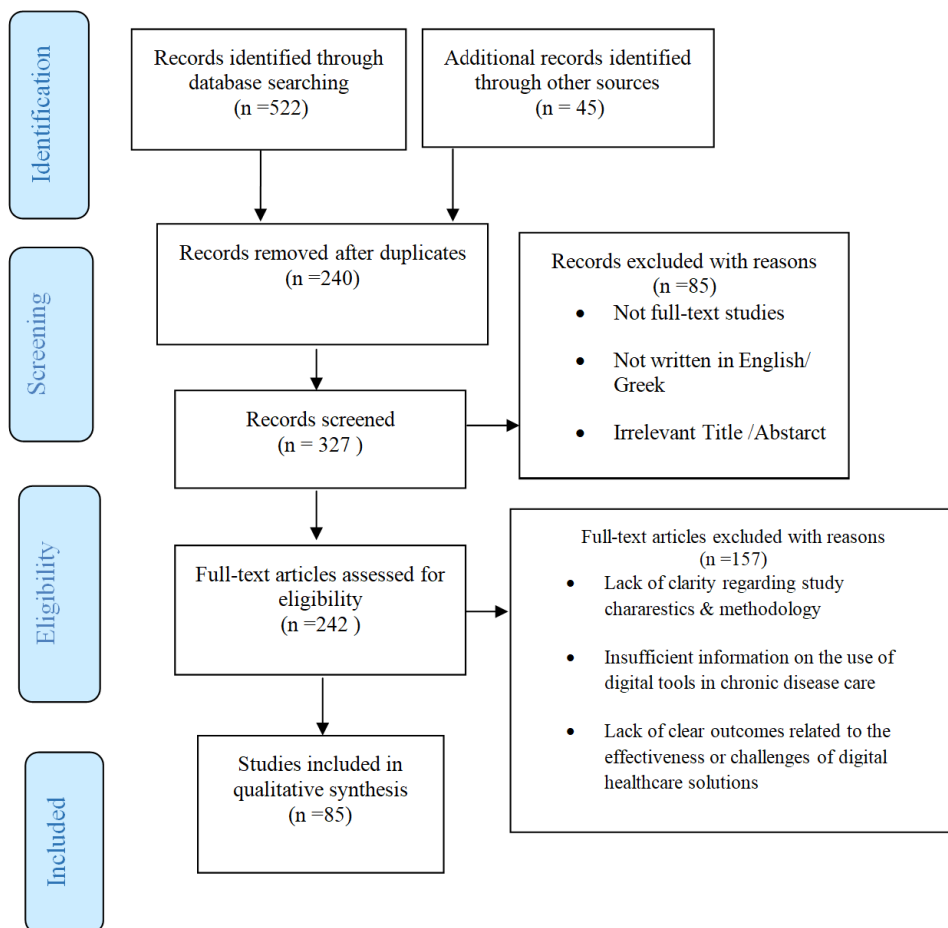
## **Methodology**

A systematic literature review of the Chronic Disease Management and Digital Healthcare during COVID-19 was conducted. The online database used was Pubmed with no publication date time limit, given that COVID-19 emerged in 2019. The database was searched using not only the appropriate terms but also their combinations. The search terms performed in the online database werethe following:

- ("Chronic Disease Management" OR "Chronic Disease") AND ("COVID-19 Pandemic" OR "COVID-19" OR "Coronavirus") AND ("Digital Healthcare" OR "Telemedicine" OR "Telehealth")
- ("Chronic Disease") AND ("COVID-19") AND ("Digital Healthcare" OR "Telemedicine")

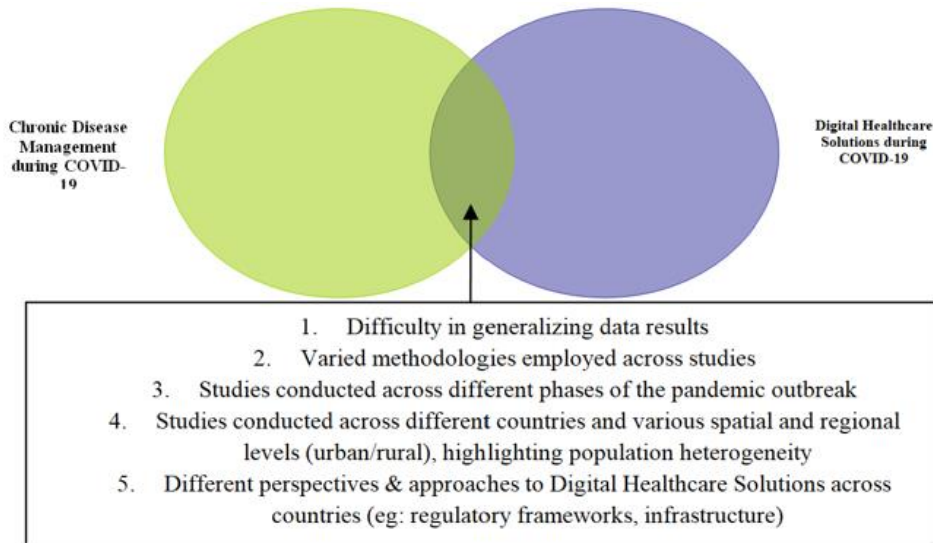
After the data were collected and categorized, a detailed summary of the findings was written. Publications containing empirical studies were also included. Publications were excluded if they did not include information relevant to the purpose of the study. Papers and references were also excluded when only the abstract and not the full text was available. Additionally, non-English or non-Greek posts were excluded. A detailed breakdown with all

selection criteria from identification to inclusion of papers is presented in the Prisma diagram below (Moher *et al.*, 2009).



**Figure 1:** Prisma Flow Diagram (Moher *et al.*, 2009)

To address the limitations of the studies, we employed a Venn diagram that uses overlapping circles to illustrate unions between areas. A Venn diagram was created comparing study limitations for both sections of our research: 1) Chronic Disease Management during COVID-19 and 2) Digital Healthcare solutions during COVID-19. The detailed diagram is presented below.



**Figure 2:** Venn Diagram Study Limitations

### **Chronic Disease Management & COVID-19**

Chronic diseases impose a tremendous burden on society and the economy (Yu *et al.*, 2023), while evidence suggests that disruptions in health services tend to occur during pandemics (Javanparast *et al.*, 2021). Indeed, the prevalence of COVID-19 infection has become a clinical threat to the general population and healthcare staff around the world (Haybar *et al.*, 2020). As an example, during the pandemic, there was drastic reduction in the number of hospital admissions for any medical conditions different to COVID-19 (Mauro *et al.*, 2020). Healthcare services experienced direct influence, especially in routine care, which was significantly affected for patients dealing with chronic diseases. This includes reduced access to primary care, postponement of elective medical and surgical interventions, and disturbances in screening programs (Iftekhar *et al.*, 2021), (Wyper *et al.*, 2020).

### **Disruptions in delivery of care**

During the first wave of the pandemic, a significant reduction or complete cancellation of scheduled health appointments was observed, as reported by a comprehensive survey involving health professionals from 47 countries (Chudasama *et al.*, 2020). This survey also revealed that only a small percentage of appointments, around 14%, were conducted in person, while the majority of visits were replaced by virtual sessions.

The Survey of Health, Ageing and Retirement in Europe (SHARE) found that people aged over 50 with a chronic condition were, on average, 40% more likely to report forgoing or postponing medical care during the first few months of the pandemic than those without a chronic condition

(OECD/European Union, 2022). On average, 37% of people with a chronic health condition had some care cancelled or postponed compared with 26% among those without a chronic condition (OECD/European Union, 2022).

Cancer screenings dropped during the pandemic. Decrease in screenings has resulted in the diagnoses of fewer cancers and precancers. The delayed screening and treatment for breast and colorectal cancer results in otherwise preventable deaths in the United States (Hacker *et al.*, 2021). A study on the impact of delays in cancer diagnosis in adults and children estimated that between 3,291 and 3,621 avoidable deaths will have occurred from 5 cancer types within 5 years after the pandemic compared to the pre-pandemic period. An additional 59,204–63,229 years of life lost will be attributable to delays in cancer diagnoses alone as a result of the first COVID-19 lockdown in the UK (Lignou *et al.*, 2022).

During the pandemic, there was an 81–90% reduction in regular laboratory re-examinations in two of the most common chronic diseases managed in Primary Healthcare: diabetes mellitus and dyslipidemia (Stachteas *et al.*, 2022).

Apart from poorer health outcomes due to COVID-19 infection, access to transplantation and dialysis for patients with kidney failure was limited during this period. Organ donation as well as transplantation rates fell notably during the early phases of the pandemic, due to logistical barriers in organ transportation, reduced number of donors as well as reductions in trauma and other emergency department admissions. Additionally, many transplantation centres suspended their programs due to concerns of post-transplant acquisition of COVID-19, thereby redeploying medical teams and limiting hospital capacity. Anticipating surgical procedure scale-backs and cancellations will not only affect patients with CKD requiring immediate vascular access, but also create greater strain on medical staff in the future to clear the growing backlog of cases (Deng *et al.*, 2022), (Kapuria *et al.*, 2021).

### **Mental health impact of COVID-19 to people with chronic diseases**

The social disruption accompanying the response to the COVID-19 pandemic in turn adversely affected the management of chronic diseases, as well as the socioeconomic circumstances of the poorest counties (Islam *et al.*, 2021). The COVID-19 pandemic required rapid adaptation of care delivery, supported by governmental and national body recommendations, but has created a conflict around where care priorities should lie (Wake *et al.*, 2020). Chronic diseases are influenced by a range of individual, social and economic factors, including our perceptions and behavior (Fekadu *et al.*, 2021). The psychological or mental health impact of the COVID-19 pandemic on both people with chronic diseases and their related healthcare providers affected the safety and quality of care (Mboweni & Risenga, 2022). Studies indicated

that individuals with a chronic illness experienced reduced psychological wellness and increased anxieties and concerns related to the COVID-19 pandemic (Rapelli *et al.*, 2020).

### **The role of pharmacists in the management of chronic diseases during the COVID-19 pandemic**

During the pandemic period, telephonic mode of counselling was widely being used by pharmacists in order to provide information regarding disease and medication related queries. As health care professionals, pharmacists are at the forefront of the pandemic in providing: 1) testing and education of the public about the virus, 2) the tests used to detect the virus and antibodies, and 3) the different treatment options for symptoms associated with the virus (Como *et al.*, 2020). Shortages of medication used to manage chronic conditions were also observed at the beginning of the COVID-19 pandemic due to global supply chain disruptions (Kendzerska *et al.*, 2021). Pharmacists reported that they faced shortage of medications which were used for chronic illness like diabetes, hypertension, HIV and oncology drugs (Ramakrishnan *et al.*, 2023).

In some cases, stockpiling was observed at the beginning of the lockdown, probably induced by patients' fear of running out of medication; this tendency was described for treatments of epilepsy and chronic cardiovascular diseases, and seemed to have somewhat preserved adherence in the following months. Some authors have suggested a potential downside to this behaviour, associating the tendency to stock-piling drugs believed to be potentially effective against COVID-19 (often in the absence of adequate evidence-based support) with shortage episodes (Olmastroni *et al.*, 2023).

### **Lifestyle disruptions of people with chronic disease during the COVID-19 pandemic**

Patients with chronic conditions faced lifestyle disruptions due to the COVID-19 pandemic, specifically in physical activity, sleep, stress, and mental health, which needed to be better addressed (Kendzerska *et al.*, 2021). Individuals dealing with chronic illnesses had to oversee their day-to-day tasks, dietary intake, physical activity, and maintain consistent ongoing monitoring. Navigating their preexisting conditions presented a formidable obstacle, particularly exacerbated by challenges in acquiring necessary provisions and encountering barriers to healthcare facilities and providers. The imposition of lockdown measures is anticipated to have disrupted their established disease management routines. A study showed that the implementation of lockdown to contain the COVID-19 has affected the routine life and health of patients with chronic diseases like diabetes, mental health and hypertension (Saqib *et al.*, 2020). The pandemic has highlighted the need

for targeted psychosocial intervention for vulnerable families, to mitigate current mental health burden and prevent chronic psychological distress. Parents expressed profound anxieties regarding their unwell child's heightened susceptibilities (McLoone *et al.*, 2022). Chronic conditions pose challenges for children, adolescents, and young adults, affecting their mental health and overall well-being, thus prompting a shift to telemental health from in-person care (N. Lau *et al.*, 2021).

### **Digital Healthcare for Chronic Diseases & COVID-19**

Pandemics and other public health emergencies typically lead to a surge in demand for medical care, which overwhelms local capabilities (Hong *et al.*, 2020). In health-care settings where resources are constrained, or where patient access is challenging, equivalence of telemedicine with usual care might represent a substantial benefit (Ramanathan *et al.*, 2022). Medical examination remains the cornerstone of practice, but telemedicine decreases the number of patient attendances as consultations take place by telephone, video calls, exchanges of photographic documentation, mobile phone messages, e-mail or other support applications for computers or mobile phones (Perrone *et al.*, 2020).

During the COVID-19 pandemic, in-person care for individuals with chronic conditions decreased due to government restriction of elective and non-urgent healthcare visits, greater instilling fear over potential COVID-19 exposure during in-person visits (Kendzerska *et al.*, 2021). A cause for concern associated with this pandemic is the severe and widespread disruption of prevention and treatment services for populations affected by chronic conditions. Outpatient care for children and adolescents with chronic conditions needs to be continuous and programmed, encompassing comprehensive care, with periodically scheduled consultations, exams, and procedures, to promote quality of life and reduce mortality (da Silva Casemiro *et al.*, 2022).

Governments acted rapidly at the beginning of the pandemic to promote the use of teleconsultations by introducing enabling legislation and revising laws ensuring continuity of care for people with chronic diseases, thus transitioning rapidly to remote care and monitoring. In parts of the United Kingdom, there was a rapid expansion of remote monitoring programs to keep track of people with chronic conditions in their own home. The data allowed health professionals to spot trends in a patient's condition and identify signs of deterioration before they require hospital admission (OECD/European Union, 2022).

During the recent COVID-19 pandemic, more attention had been drawn to telehealth to emphasize its role in reducing hospital visits from both COVID-19 and non-COVID-19 patients and supporting home isolation in



patients with mild symptoms. The needs of patients with chronic diseases tended to be overlooked during the pandemic. With reduced opportunities for routine clinic visits, patients with chronic diseases adopted various telehealth services. Telehealth for patients with chronic diseases during the pandemic was increasingly important, and researchers suggest that the innovative adoption of digital technologies could continuously provide valuable patient-clinician communication, not only for clinical care but also for maintaining adherence and behavior changes in patients (Liu *et al.*, 2020).

The widespread adoption of telehealth, for which many proponents have advocated for years, has been one of the most significant shifts in healthcare triggering regulatory changes that lowered the barriers to telehealth in several countries worldwide, resulting in the large-scale expansion of its use (Gonçalves *et al.*, 2023). Health systems have adopted telemedicine with remarkable speed not only for COVID-19 related care, but also for chronic disease management. But without proactive effort to ensure equity, the current wide-scale implementation of telemedicine may increase disparities in health care access for vulnerable populations with limited digital literacy or access, such as rural residents, racial/ethnic minorities, older adults, and those with low income, limited health literacy, or limited English proficiency (Khoong *et al.*, 2020). Virtual care, using a person's in-home technology, has created an opportunity for people with chronic conditions to maintain access to their health-care team while limiting in-person contacts. Virtual care presents the added benefits of reducing travel time and cost, and time away from school or work (Wittmeier *et al.*, 2021).

These issues have led to a renewed focus on telehealth, as a means of providing care to both patients with COVID-19 infections and those requiring other routine clinical services without increasing the risk of potential exposure for patients, clinicians, and staff (Lapão *et al.*, 2021). There is increasing uptake of digitally enabled remote care. A growing body of evidence suggests that care delivered via telemedicine can be both safe and effective, in some cases with better outcomes than conventional face-to-face care (Kaye *et al.*, 2020). During the COVID-19 pandemic, telehealth was expanded without the opportunity to extensively evaluate the adopted technology's usability (Gonçalves *et al.*, 2023). The existing provincial telehealth infrastructure has been able to accommodate some of the need for video-based appointments during the pandemic but lacks the flexibility and capacity to meet increasing demands, while still requires patients to attend a telehealth site in person to receive care. Nevertheless, its impact on telemedicine usage in rural and remote regions remains uncertain. While telemedicine adoption did surge in rural and remote areas during the pandemic, its growth was comparatively higher in urban and less rural locales. Future research should be conducted into potential obstacles that rural patients face in accessing telemedicine and

explore how rural telemedicine affects patient healthcare utilization and outcomes (Chu *et al.*, 2021).

### **Advantages of Digital Healthcare for patients with chronic diseases**

Application of information and communication technologies as the core component has contributed to the routing of COVID-19 patients resulting in lower infection level both among patients and healthcare providers (Samofalov *et al.*, 2020). Participants of studies have specifically noted that virtual care allowed them to receive care safely by preventing unnecessary exposure to the virus. Virtual care was seen as valuable for follow-up appointments or receiving prescriptions because they were not required to be physically present. Nearly half of all respondents noted the reduction or elimination of travel and associated costs to the hospital (e.g. parking, gas) as benefits of virtual care. In particular, respondents residing in rural areas expressed that virtual care reduced the burden associated with the travel, cost, and stress of travelling to in-person appointments (Chan-Nguyen *et al.*, 2022), (Smithson *et al.*, 2021). The absence of travel allowed patients to spend less time on their consultation in a primary care clinic. In addition, many patients have reported not having to ask their employer to be released from work, not having to deal with unexpected road conditions (traffic jams, winter driving), losing time to find a parking space and waiting several minutes in a waiting room (Poitras *et al.*, 2022).

Whether it is in the form of video visits, telephone calls, or other means, the use of virtual communication has sharply increased due to the COVID-19 pandemic. Results of studies have shown that the use of digital health services can be extensive and can be used for many different purposes and in different population groups. The development of digital services reflects a shift toward the provision of care regardless of time and place. It also reflects a shift toward emphasis on patient-centered care, meaning activating and engaging patients in their own care as they use digital services for various health-related purposes. Despite the development of digital services, many challenges (eg, inadequate infrastructure) still prevail worldwide (Rosenlund *et al.*, 2023). Although there is no singular strategy to apply digital health tools across the affected countries for pandemic control, these tools are among the primary policies that governmental and private companies have considered for disease control (Niakan Kalhori *et al.*, 2021).

Telemedicine has promoted the transition of chronic disease treatment from hospitalized treatment to interactive communicative remote/mobile treatment (Wang *et al.*, 2021). Recent changes to federal regulations have allowed more patients to receive care and more providers to deliver care through telehealth during the COVID-19 pandemic. Telehealth visits with a clinical pharmacist offer several advantages, including flexibility in

scheduling chemotherapy education, pain management, anticoagulation visits, primary care, and specialty care disease management; however, limitations involving patient factors and technological issues may be encountered (Segal *et al.*, 2020). A study explored the effect of tele-visit program on chronic patients' medication adherence during the COVID-19 pandemic, before and after the intervention. The present findings showed that there is no significant difference between phone-based tele-visit program for chronic patients versus face-to-face visits. This study revealed no statistically significant difference in patients' medication adherence before and after the tele-visit program (Norouzi *et al.*, 2023).

Between 2019 and 2020, in-person consultations fell by almost 20% on average across EU countries. In-person consultations fell by more than one-third in Lithuania and Spain, and by less than 10% in the Czech Republic and Finland. However, the declines in in-person consultations were completely offset by increasing numbers of teleconsultations in Poland, Denmark and Spain, and partly offset in many other countries. The share of teleconsultations doubled during the first year of the COVID-19 pandemic, from 11% in 2019 to 22% in 2020 (on average across EU countries). Before the pandemic, consultations via phone or video accounted for fewer than 10% in all but two EU countries. Denmark had the highest share of teleconsultations pre-pandemic, at 45%. The Eurofound e-survey data highlight that the proportion of adults who reported having a medical consultation online or by phone increased dramatically during the pandemic: by mid-2020, almost one in three adults had used a teleconsultation, a proportion that went up to 40% by early 2021. Countries where the use of teleconsultations was highest in mid-2020 also had higher growth rates between mid-2020 and early 2021, suggesting an increasing divergence (OECD/European Union, 2022).

A study that covers a wide range of patients with chronic disease interest in various types of telehealth showed a positive attitude towards telemedicine among participants. 91% of participants thought that telemedicine could save time, and that people with COVID-19 symptoms or diagnoses should use telemedicine for medical care. In total, 90% of the participants were willing to learn about telemedicine, and 86.9% thought that telemedicine had the potential to play an important role in providing healthcare. In this study, 85.3% of participants thought people with chronic diseases should use telemedicine for their mental healthcare (Haque *et al.*, 2022). Further research showed that when chronically ill patients believe that a telehealth care system's information, system and service quality are good, they feel that the telehealth care system is easy to operate and can be learned and used without much effort (Lan & Chen, 2022).

Virtual care will likely have many advantages that are not yet recognized. Many inter-professional teams transitioned to telehealth to

continue care providing while minimizing in-person interaction so as the risk of transmission to be reduced (Tewksbury *et al.*, 2021). Perhaps virtual care will be more tailored to the pedagogical demands of today's digital generation, and benefit health-care outcomes more profoundly than in-person visits, in which patients may be less inclined to engage. However, it will also introduce new barriers related to technology, connectivity, communication and relationship building that risk perpetuating care inequities (Wittmeier *et al.*, 2021).

### **Digital Healthcare & Pharmacists**

Several countries expanded the roles of community nurses and pharmacists to ensure care continuity during the pandemic (OECD/European Union, 2022). Telehealth tools are now integral to healthcare, improving access, enhancing patient experiences, and ensuring care continuity. Pharmacists can contribute to disease management telehealth efforts through the utilization of a comprehensive collaborative practice agreement, allowing medications to be started, stopped, or adjusted based on patients' needs (Stulock *et al.*, 2022). Implementing a telehealth model for medication management can also boost patient engagement, improve health outcomes, cut costs, and elevate clinical care. Tele-medication management clinic services offer improved patient care access, lowered hospital infection risks, and enhanced convenience, thus elevating care quality during health crises. The implementation of this model demonstrated a significant improvement in the clinical outcomes of patients and might help to improve the overall satisfaction during and after the peak pandemic period (Mohiuddin *et al.*, 2021).

Community pharmacists' roles and responsibilities during the COVID-19 emergency suggest that they are able to play an important role not only in the management of emerging infectious diseases, but also in preserving continuity of care for people with chronic disease. This process, which had already started in some countries a few years ago, was also greatly and effectively accelerated during the pandemic. In many countries, the community pharmacist is now in charge of some of the tasks usually covered by doctors, so that doctors are allowed to spend their time more effectively on most complex cases, minimizing the number of medical consultations. The increasing use of telemedicine, as well as the greater involvement of community pharmacists in the management of chronic patients, could be successful strategies for increasing adherence even after the pandemic (Olmastroni *et al.*, 2023).

### **Digital Healthcare Solutions & Chronic Diseases: Evidence from studies**

Individuals with kidney failure faced restricted availability of transplantation and dialysis treatments during the pandemic (Deng *et al.*,

2022). The process of organ donation and transplantation has been notably disrupted, particularly in the initial stages of the pandemic, owing to challenges in transporting organs, a decrease in the number of donors, and reductions in trauma and other emergency admissions to hospitals (COVIDSurg Collaborative, 2020). The COVID-19 pandemic required an urgent pivot from traditional office visits to alternate models of clinical care. Care was initially provided by telephone, which has not been evaluated for its effectiveness by patients and providers. A study reporting patients' and nephrologists' perceptions and preferences surrounding telephone consultation showed that patients were very comfortable with telephone consultation and felt their concerns and preferences were addressed equally well compared with in-person visits. Most patients preferred telephone consultation due to less time spent on waiting and traveling to the clinic and less financial resources spent on parking (Heyck Lee *et al.*, 2022).

The COVID-19 pandemic necessitated a swift shift from in-person visits to teleneurology consultations. While teleneurology is common in acute stroke care, its use in other neurological fields was limited. The requirement for "social distancing" led to a significant increase in teleneurology visits and this shift may mark a lasting move towards incorporating virtual technology into medical care (Roy *et al.*, 2020).

The use of telemedicine surged among rhinologic patients amid the COVID-19 pandemic. However, this shift in practice might raise concerns about perceived lower-quality interactions with healthcare providers, potentially affecting patient satisfaction. Remarkably, patient contentment with telemedicine during the pandemic mirrors that of in-person visits. Video consultations offer a feasible substitute to clinic appointments, ensuring elevated satisfaction levels are upheld (Morisada *et al.*, 2021).

Accurate monitoring of physiological parameters without the need for periodic testing or frequent hospital visits is highly beneficial, especially during the COVID-19 pandemic (Jiang *et al.*, 2022). Tele-monitoring interventions can range from low to high complexity and should match the risk profile of the patient. Regardless of the tele-monitoring platform, the integration with clinical support for medical therapy optimization cannot be overemphasized (Alvarez *et al.*, 2021).

Chronic obstructive pulmonary disease (COPD) is an escalating epidemic with significant economic implications. Education, physical activity, and pulmonary rehabilitation are crucial components of COPD management, often facilitated through telemedicine. According to a study during the pandemic regarding telemedical interventions for COPD management showed that such interventions have demonstrated comparable or even improved outcomes compared to conventional care (Koh *et al.*, 2023).

Research indicates the feasibility of remote consultations for Parkinson's disease, yet the practical experiences of individuals, particularly those with cognitive decline, remain underexplored. The complex interplay of communication challenges, cognitive impairments, and involving both patients and caregivers in discussions about the future pose unique challenges. Research highlights the pros and cons of remote consultations for this group, underscoring the need for enhanced support, training, preparation, and heightened awareness of pertinent issues to optimize these consultations (Pigott *et al.*, 2022).

The COVID-19 period represented a challenge for patients' quality of life particularly for social life and relationships. According to a study about psychological teleconsultations in patients suffering from chronic skin diseases during the COVID-19 era, results remark the importance and the benefits derived from both psychological supports and teledermatology services for patients suffering from chronic skin-diseases which may have constituted a major risk for the occurrence and recurrence (Marasca *et al.*, 2022).

COVID-19 pandemic has boosted telemedicine in medical clinical practice. A study evaluated patients' satisfaction and opinion about televisits in a large group of patients with chronic neurological disorders. Results showed that patients with chronic neurological disorders rated the experience with televisits as satisfactory (Rosellini *et al.*, 2023).

Another study explored telemental health providers' post-pandemic intentions to sustain telemedicine, a transformative shift prompted by COVID-19's impact on mental health care delivery. A significant portion expressed commitment to ongoing telemedicine utilization, indicating a potential long-term trend. Enhanced intention correlated with factors like social influence, perceived usefulness, telemedicine caseload, ease of use perception, and facilitating conditions (Wilczewski *et al.*, 2022).

The swift expansion of telemedicine during the COVID-19 pandemic has proven its efficacy, especially in cases of epilepsy compared to traditional in-person visits. This next study aimed to assess the clinical characteristics of pediatric epilepsy patients who received telephone-based consultations during the pandemic. Consequently, utilizing telemedicine through telephone calls could offer valuable support for managing childhood-onset epilepsy during the pandemic (Kikuchi *et al.*, 2022).

### **Barriers of Digital Healthcare**

Telemedicine visits were perceived as patient-centered, given that they occurred at more accessible times and settings for patients. However, challenges arose due to the absence of in-person interaction and the perceived increase in workload for clinical staff. While telemedicine raised privacy

concerns, it also provided a way to involve family members and other care team members in healthcare delivery (Harsono *et al.*, 2022).

A survey demonstrated that patients are willing to use telehealth, but barriers still exist (Portnoy *et al.*, 2020). Technological challenges were cited as a concern for older adults or those with little technological literacy (Chan-Nguyen *et al.*, 2022). It is interesting to note that, in another study a large number of eHealth users stated that they adopted eHealth only out of necessity, while others stated that they adopted it because no other services were available (Alsharif, 2022).

It is also important to note that the feasibility and effectiveness of remote interventions remain uncertain. A study addressed this gap, revealing that while remote treatment during COVID-19 can engage patients and families, the understanding of its efficacy, target groups, contexts, and comparison with in-person therapy is still evolving (N. Lau *et al.*, 2021).

Digital health and telemedicine solutions, which exploded during the pandemic, may address many inefficiencies and deficiencies in chronic disease management, such as increasing access to care. Optimizing healthcare, especially for diverse and vulnerable patients with chronic diseases during this COVID era, will move healthcare and medicine to actualize its highest virtues (Seixas *et al.*, 2021).

After examining patients' Willingness to Pay for telemedicine among those with chronic health conditions, a study determined that this willingness varied significantly across different studies for countries like the United States, Italy, Australia, United Kingdom, South Korea, Norway and Belgium, ranging from 19% to 70%. Among the reported factors, age and proximity to preferred healthcare facilities were the only variables significantly associated with Willingness to Pay for telemedicine interventions. Based on the findings, practical recommendations are suggested to enhance Willingness to Pay for telemedicine in future interventions (Chua *et al.*, 2022). Moving forward, a better understanding of telehealth acceptance is needed in the context of patient sociodemographic factors (e.g. age, digital literacy, type of chronic illness), and in terms of emerging concerns such as patient privacy and confidentiality of biodata. Moreover, prospective research should evaluate the long-term cost-effectiveness of adopting such systems, compared to the primary care clinical practices that telehealth seeks to supplement or even substitute (J. Lau *et al.*, 2021).

Relying solely on telehealth is not a universal solution for enhancing healthcare. This endeavor will require a united commitment from government bodies, institutions, and community volunteers to guarantee accessible and enhanced healthcare, encompassing both advanced and simpler technology solutions (McElroy *et al.*, 2020).

## Health inequalities & Digital Healthcare

Difficulties in accessing healthcare services are a long-standing challenge in the healthcare system. Health inequities are delineated by race, ethnicities, geographic regions, socioeconomic status, and other social determinants of health. Inequities in access have considerable influence on quality of life and related outcomes (Williams & Shang, 2023). Disparities in access to telemedicine care today can easily exacerbate the preexisting challenges in providing primary care and chronic disease management for vulnerable populations. By employing simple, effective strategies for increasing the reach and adoption of digital health now, we may mitigate disparities resulting from the current crisis and be better positioned to ensure more equitable telemedicine in the future (Khoong *et al.*, 2020). Findings highlight the potential for mHealth (mobile health) tools to improve disease self-management and reduce health disparities among individuals with chronic health conditions (Camacho-Rivera *et al.*, 2020). Telemedicine access differences may compound disparities in chronic disease and COVID-19 outcomes. Institutions should monitor video visit use across demographics and equip patients, clinicians, and practices to promote telemedicine equity (Rodriguez *et al.*, 2021).

In response to the COVID-19 pandemic, many low and middle-income countries (LMICs) expanded access to telemedicine to maintain essential health services. As COVID-19 spread, many governments expanded regulatory permissions rapidly, and some incorporated reimbursement policies to facilitate conversion of in-person visits to telemedicine consultations. Telemedicine can play a key role not only in maintaining essential health services for chronic disease patients in LMICs during the COVID-19 pandemic, but also in long-term primary health care strengthening. Despite the advantages of telemedicine for treating chronic, non-urgent medical problems, there must be a clear pathway to referral for in-person care when a face-to-face physical examination or procedure is indicated (Hoffer-Hawlik *et al.*, 2020). It is important to continue monitoring the access to health care services to prevent the growing of health inequities, particularly as cost sharing is reintroduced for telehealth for many health plan members (Gordon & Kim, 2022). Moving forward, medical and public health professionals may continue on taking active approaches to engage patients with underlying conditions in available telehealth services, particularly those who are members of lower socioeconomic status and aging populations (Horrell *et al.*, 2021).

## Results

Chronic diseases impose a tremendous burden on society and the economy (Yu *et al.*, 2023). During the first wave of the pandemic, a significant reduction or complete cancellation of scheduled health appointments was



observed, as reported by a comprehensive survey involving health professionals from 47 countries (Chudasama *et al.*, 2020).

The Survey of Health, Ageing and Retirement in Europe (SHARE) found that people aged over 50 with a chronic condition were, on average, 40% more likely to report forgoing or postponing medical care during the first few months of the pandemic than those without a chronic condition. On average, 37% of people with a chronic health condition had some care cancelled or postponed compared with 26% among those without a chronic condition (OECD/European Union, 2022). The psychological or mental health impact of the COVID-19 pandemic on both people with chronic diseases and their related healthcare providers affected the safety and quality of care (Mboweni & Risenga, 2022).

Shortages of medication used to manage chronic conditions were also observed at the beginning of the COVID-19 pandemic due to global supply chain disruptions (Kendzierska *et al.*, 2021). Pharmacists reported that they faced shortage of medications which were used for chronic illness like diabetes, hypertension, HIV and oncology drugs. Among the other drugs, Hydroxychloroquine (HCQ) was one of the drugs with great demand due to its prophylaxis use in the COVID-19 (Ramakrishnan *et al.*, 2023). Several countries expanded the roles of community nurses and pharmacists to ensure care continuity during the pandemic (OECD/European Union, 2022).

Telemedicine visits were perceived as patient-centered, given that they occurred at more accessible times and settings for patients. However, challenges arose due to the absence of in-person interaction and the perceived increase in workload for clinical staff. While telemedicine raised privacy concerns, it also provided an avenue to involve family members and other care team members in healthcare delivery (Harsono *et al.*, 2022). Technological challenges were cited as a concern for older adults or those with little technological literacy (Chan-Nguyen *et al.*, 2022). Interestingly, many eHealth users have stated that they adopted eHealth only out of necessity or because no other services were available (Alsharif, 2022).

## **Conclusion**

The COVID-19 pandemic has highlighted the fragility of healthcare systems and existing inequities in access to care and health outcomes for vulnerable populations across the globe (Mobula *et al.*, 2020). Effective COVID-19-era chronic disease management involves the development of synchronous and asynchronous virtual platforms that harness the power of virtual social networks to overcome social and economic barriers to access, supporting critical healthy lifestyle changes that form the bedrock of chronic care (Mirsky Jacob & Daniel, 2019). Findings from a global survey showed that healthcare professionals have adapted to new ways of delivering care

using telemedicine in order to reduce face-to-face contacts. Adapting new ways of virtual healthcare and digital technologies is imperative to allow healthcare professionals to continue routine appointments (Chudasama *et al.*, 2020). The increasing use of telemedicine, as well as the greater involvement of community pharmacists in the management of chronic patients, could be successful strategies for increasing adherence even after the pandemic (Olmastroni *et al.*, 2023). However, this course of action requires multiple partnerships to rebuild, reframe, and support community resilience (Balasuriya *et al.*, 2023). These changes should aim to maximize the capacity and effectiveness of primary care but must also ensure that health inequalities are narrowed, not widened (Levene *et al.*, 2020). In general, longer-term public health policy responses are needed to ensure that the COVID-19 pandemic does not increase health inequalities across different groups of patients (Kim *et al.*, 2022). Policy makers must learn from this experience for future pandemic preparedness, to manage future waves, and to ensure that sufficient and efficient testing is readily available in primary health-care facilities (The Lancet Respiratory Medicine, 2020).

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### References:

1. Alsharif, A. H. (2022). Attitudes of Patients with Chronic Diseases toward Management eHealth Applications Systems in Post-COVID-19 Times. *International Journal of Environmental Research and Public Health*, 19(7). <https://doi.org/10.3390/ijerph19074289>
2. Alvarez, P., Sianis, A., Brown, J., Ali, A., & Briasoulis, A. (2021). Chronic disease management in heart failure: Focus on telemedicine and remote monitoring. *Reviews in Cardiovascular Medicine*, 22(2), 403–413. <https://doi.org/10.31083/j.rcm2202046>
3. Balasuriya, L., Briss, P. A., Evelyn Twentyman, J. L. W., Lisa C. Richardson, E. T. B., Wright, J. S., Petersen, R., Hannan, C. J., Craig W. Thomas, Wanda D. Barfield, D. L. K., & Karen A. Hacker. (2023). Impacts of the COVID-19 Pandemic on Nationwide Chronic Disease Prevention and Health Promotion Activities. *American Journal of Preventive Medicine*, 64(3), 452–458, <https://doi.org/10.1016/j.amepre.2022.09.012>
4. Camacho-Rivera, M., Islam, J. Y., Rivera, A., & Vidot, D. C. (2020). Attitudes toward using COVID-19 mHealth tools among adults with

- chronic health conditions: Secondary data analysis of the COVID-19 impact survey. *JMIR MHealth and UHealth*, 8(12). <https://doi.org/10.2196/24693>
5. Chan-Nguyen, S., Ritsma, B., Nguyen, L., Srivastava, S., Shukla, G., & Appireddy, R. (2022). Virtual Care Access and Health Equity during the COVID-19 Pandemic, a qualitative study of patients with chronic diseases from Canada. *Digital Health*, 8. <https://doi.org/10.1177/20552076221074486>
  6. Chu, C., Cram, P., Pang, A., Stamenova, V., Tadrous, M., & Bhatia, R. S. (2021). Rural telemedicine use before and during the COVID-19 pandemic: Repeated cross-sectional study. *Journal of Medical Internet Research*, 23(4), 1–10. <https://doi.org/10.2196/26960>
  7. Chua, V., Koh, J. H., Koh, C. H. G., & Tyagi, S. (2022). The Willingness to Pay for Telemedicine Among Patients With Chronic Diseases: Systematic Review. *Journal of Medical Internet Research*, 24(4). <https://doi.org/10.2196/33372>
  8. Chudasama, Y. V., Gillies, C. L., Zaccardi, F., Coles, B., Davies, M. J., Seidu, S., & Khunti, K. (2020). Impact of COVID-19 on routine care for chronic diseases: A global survey of views from healthcare professionals. *Diabetes and Metabolic Syndrome: Clinical Research and Reviews*, 14(5), 965–967. <https://doi.org/10.1016/j.dsx.2020.06.042>
  9. Como, M., Carter, C. W., Larose-Pierre, M., O'Dare, K., Hall, C. R., Mobley, J., Robertson, G., Leonard, J., & Tew, L. (2020). Pharmacist-led chronic care management for medically underserved rural populations in Florida during the COVID-19 pandemic. *Preventing Chronic Disease*, 17, 1–4. <https://doi.org/10.5888/pcd17.200265>
  10. COVIDSurg Collaborative. (2020). Elective surgery cancellations due to the COVID-19 pandemic: global predictive modelling to inform surgical recovery plans. *British Journal of Surgery*, 107(11), 1440–2449. <https://doi.org/10.1002/bjs.11746>
  11. da Silva Casemiro, L. K. D., Lopes-Júnior, L. C., Jardim, F. A., Sulino, M. C., & de Lima, R. A. G. (2022). Telehealth in outpatient care for children and adolescents with chronic conditions during the COVID-19 pandemic: A scoping review protocol. *PLoS ONE*, 17(6 June), 1–9. <https://doi.org/10.1371/journal.pone.0269821>
  12. Daniel P. Oran, AM, and Eric J. Topol, M. (2020). Prevalence of Asymptomatic SARS-CoV-2 Infection A Narrative Review. *Annals of Internal Medicine*, 43(6). <https://doi.org/10.7326/M20-3012>
  13. Deng, D., Liang, A., Chui, J. N., Wong, G., & Cooper, T. E. (2022). The COVID-19 pandemic and access to health care in people with chronic kidney disease: A systematic review and meta-analysis.

- Nephrology*, 27(5), 410–420. <https://doi.org/10.1111/nep.14016>
14. Eve M. Segal, Laura Alwan, Caroline Pitney, Cathy Taketa, Amy Indorf, Lauren Held, Kathryn S. Lee, Matthew Son, Mary Chi, Erica Diamantides, Rena Gosser, R. G. (2020). Establishing clinical pharmacist telehealth services during the COVID-19 pandemic. *American Society of Health-System Pharmacists*, 5–24, <https://doi.org/10.1093/ajhp/zxaa184>
  15. Fekadu, G., Bekele, F., Tolossa, T., Fetensa, G., Turi, E., Getachew, M., Abdisa, E., Assefa, L., Afeta, M., Demisew, W., Dugassa, D., Diriba, D. C., & Labata, B. G. (2021). Impact of COVID-19 pandemic on chronic diseases care follow-up and current perspectives in low resource settings: a narrative review. *International Journal of Physiology, Pathophysiology and Pharmacology*, 13(3), 86–93. <http://www.ncbi.nlm.nih.gov/pubmed/34336132> <http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=PMC8310882>
  16. Gonçalves, R. L., Pagano, A. S., Reis, Z. S. N., Brackstone, K., Lopes, T. C. P., Cordeiro, S. A., Nunes, J. M., Afagbedzi, S. K., Head, M., Meira Jr, W., Batchelor, J., & Ribeiro, A. L. P. (2023). Usability of Telehealth Systems for Noncommunicable Diseases in Primary Care From the COVID-19 Pandemic Onward: Systematic Review. *Journal of Medical Internet Research*, 25, e44209. <https://doi.org/10.2196/44209>
  17. Gordon, A. S., & Kim, Y. (2022). Telehealth and Outpatient Visits Among Individuals with Chronic Conditions by Socioeconomic Status in the First Year of the COVID-19 Pandemic: Observational Cohort Study. *Telemedicine and E-Health*, 29(7), 1105–1110. <https://doi.org/10.1089/tmj.2022.0233>
  18. Hacker, K. A., Briss, P. A., Richardson, L., Wright, J., & Petersen, R. (2021). COVID-19 and Chronic Disease: The Impact Now and in the Future. *Preventing Chronic Disease*, 18, 1–6. <https://doi.org/10.5888/PCD18.210086>
  19. Haque, M. M. A., Jahan, Y., Khair, Z., Moriyama, M., Rahman, M. M., Sarker, M. H. R., Shaima, S. N., Chowdhury, S., Matin, K. F., Karim, I. J., Ahmed, M. T., Hossain, S. Z., Masud, M. A. H., Nabi, M. G., Aziz, A. B., Sharif, M., Chowdhury, M. F. I., Shams, K. L., Nizam, N. B., ... Hawlader, M. D. H. (2022). Perceptions about Telemedicine among Populations with Chronic Diseases amid COVID-19: Data from a Cross-Sectional Survey. *International Journal of Environmental Research and Public Health*, 19(7). <https://doi.org/10.3390/ijerph19074250>
  20. Harsono, D., Deng, Y., Chung, S., Barakat, L. A., Friedland, G., Meyer, J. P., Porter, E., Villanueva, M., Wolf, M. S., Yager, J. E., &

- Edelman, E. J. (2022). Experiences with Telemedicine for HIV Care During the COVID-19 Pandemic: A Mixed-Methods Study. *AIDS and Behavior*, 26(6), 2099–2111. <https://doi.org/10.1007/s10461-021-03556-7>
21. Haybar, H., Kazemnia, K., & Rahim, F. (2020). Underlying Chronic Disease and COVID-19 Infection: A State-of-the-Art Review. *Jundishapur Journal of Chronic Disease Care*, 9(2). <https://doi.org/10.5812/jjcdc.103452>
  22. Heyck Lee, S., Ramondino, S., Gallo, K., & Moist, L. M. (2022). A Quantitative and Qualitative Study on Patient and Physician Perceptions of Nephrology Telephone Consultation During COVID-19. *Canadian Journal of Kidney Health and Disease*, 9. <https://doi.org/10.1177/205435812111066720>
  23. Hoffer-Hawlik, M. A., Moran, A. E., Burka, D., Kaur, P., Cai, J., Frieden, T. R., & Gupta, R. (2020). Leveraging telemedicine for chronic disease management in low- And middle-income countries during Covid-19. *Global Heart*, 15(1), 1–5. <https://doi.org/10.5334/GH.852>
  24. Hong, Z., Li, N., Li, D., Li, J., Li, B., Xiong, W., Lu, L., Li, W., & Zhou, D. (2020). Telemedicine during the COVID-19 pandemic: Experiences from Western China. *Journal of Medical Internet Research*, 22(5), 1–5. <https://doi.org/10.2196/19577>
  25. Horrell, L. N., Hayes, S., Herbert, L. B., MacTurk, K., Lawhon, L., Valle, C. G., & Bhowmick, A. (2021). Telemedicine use and health-related concerns of patients with chronic conditions during COVID-19: Survey of members of online health communities. *Journal of Medical Internet Research*, 23(2). <https://doi.org/10.2196/23795>
  26. Iftexhar, E. N., Priesemann, V., Balling, R., Bauer, S., Beutels, P., Calero Valdez, A., Cuschieri, S., Czypionka, T., Dumpis, U., Glaab, E., Grill, E., Hanson, C., Hotulainen, P., Klimek, P., Kretzschmar, M., Krüger, T., Krutzinna, J., Low, N., Machado, H., ... Willeit, P. (2021). A look into the future of the COVID-19 pandemic in Europe: an expert consultation. *The Lancet Regional Health - Europe*, 8. <https://doi.org/10.1016/j.lanepe.2021.100185>
  27. Islam, N., Lacey, B., Shabnam, S., Erzurumluoglu, A. M., Dambha-Miller, H., Chowell, G., Kawachi, I., & Marmot, M. (2021). Social inequality and the syndemic of chronic disease and COVID-19: County-level analysis in the USA. *Journal of Epidemiology and Community Health*, 75(6), 496–500. <https://doi.org/10.1136/jech-2020-215626>
  28. Javanparast, S., Roeger, L., & Reed, R. L. (2021). Experiences of patients with chronic diseases of access to multidisciplinary care

- during COVID-19 in South Australia. *Australian Health Review*, 45(5), 525–532. <https://doi.org/10.1071/AH20328>
29. Jiang, W., Majumder, S., Kumar, S., Subramaniam, S., Li, X., Khedri, R., Mondal, T., Abolghasemian, M., Satia, I., & Deen, M. J. (2022). A Wearable Tele-Health System towards Monitoring COVID-19 and Chronic Diseases. *IEEE Reviews in Biomedical Engineering*, 15, 61–84. <https://doi.org/10.1109/RBME.2021.3069815>
  30. Kapuria, D., Bollipo, S., Rabiee, A., Ben-Yakov, G., Kumar, G., Siau, K., Lee, H. W., Congly, S., Turnes, J., Dhanasekaran, R., & Lui, R. N. (2021). Roadmap to resuming care for liver diseases after coronavirus disease-2019. *Journal of Gastroenterology and Hepatology (Australia)*, 36(4), 885–892. <https://doi.org/10.1111/jgh.15178>
  31. Kaye, R., Rosen-zvi, M., & Ron, R. (2020). Digitally-Enabled Remote Care for Cancer Patients: Here to Stay. *Seminars in Oncology Nursing*, 36(6), 151091. <https://doi.org/10.1016/j.soncn.2020.151091>
  32. Kendzerska, T., Zhu, D. T., Gershon, A. S., Edwards, J. D., Peixoto, C., Robillard, R., & Kendall, C. E. (2021). The effects of the health system response to the covid-19 pandemic on chronic disease management: A narrative review. *Risk Management and Healthcare Policy*, 14, 575–584. <https://doi.org/10.2147/RMHP.S293471>
  33. Khoong, E. C., Lyles, C. R., & Karliner, L. (2020). Addressing Equity in Telemedicine for Chronic Disease Management During the Covid-19 Pandemic Improving Outpatient diagnosis View project Medication Adherence View project. *NEJM Catalyst*, 1(3), 1–13. <https://doi.org/10.1056/CAT.20.0123>
  34. Kikuchi, K., Hamano, S. ichiro, Horiguchi, A., Nonoyama, H., Hirata, Y., Matsuura, R., Koichihara, R., Oka, A., & Hirano, D. (2022). Telemedicine in epilepsy management during the coronavirus disease 2019 pandemic. *Pediatrics International*, 64(1), <https://doi.org/10.1111/ped.14972> <https://doi.org/10.1111/ped.14972>
  35. Kim, Y., Gordon, A., Rowerdink, K., Herrera Scott, L., & Chi, W. (2022). The Impact of the COVID-19 Pandemic on Health Care Utilization Among Insured Individuals With Common Chronic Conditions. *Medical Care*, 60(9), 673–679. <https://doi.org/10.1097/MLR.0000000000001747>
  36. Koh, J. H., Chong, L. C. Y., Koh, G. C. H., & Tyagi, S. (2023). Telemedical Interventions for Chronic Obstructive Pulmonary Disease Management: Umbrella Review. *Journal of Medical Internet Research*, 25, 1–11. <https://doi.org/10.2196/33185>
  37. Lan, Y. L., & Chen, H. C. (2022). Telehealth care system for chronic disease management of middle-aged and older adults in remote areas. *Health Informatics Journal*, 28(4).

- <https://doi.org/10.1177/14604582221141835>
38. Lapão, L. V., Peyroteo, M., Maia, M., Seixas, J., Gregório, J., Da Silva, M. M., Heleno, B., & Correia, J. C. (2021). Implementation of digital monitoring services during the COVID-19 pandemic for patients with chronic diseases: Design science approach. *Journal of Medical Internet Research*, 23(8). <https://doi.org/10.2196/24181>
  39. Lau, J., Hsien-Yung Tan, D., & Tan, K. K. (2021). Inspired by COVID-19: Primary care of chronic diseases must also innovate. *Family Practice*, 37(6), 868–869. <https://doi.org/10.1093/FAMPRAC/MAAA067>
  40. Lau, N., Colt, S. F., Waldbaum, S., O’Daffer, A., Fladeboe, K., Yi-Frazier, J. P., McCauley, E., & Rosenberg, A. R. (2021). Telemental health for youth with chronic illnesses: Systematic review. *JMIR Mental Health*, 8(8). <https://doi.org/10.2196/30098>
  41. Lignou, S., Greenwood, J., Sheehan, M., & Wolfe, I. (2022). Changes in Healthcare Provision During Covid-19 and Their Impact on Children With Chronic Illness: A Scoping Review. *Inquiry (United States)*, 59, 1–14. <https://doi.org/10.1177/00469580221081445>
  42. Liu, N., Huang, R., Baldacchino, T., Sud, A., Sud, K., Khadra, M., & Kim, J. (2020). Telehealth for noncritical patients with chronic diseases during the COVID-19 pandemic. *Journal of Medical Internet Research*, 22(8), 8–11. <https://doi.org/10.2196/19493>
  43. Louis S Levene, Samuel Seidu, Trish Greenhalgh, K. K. (2020). Pandemic threatens primary care for long term conditions Change is required to ensure effective care during and after covid-19 Louis. *BMJ (Online)*, 371, 1–2. <https://doi.org/10.1136/bmj.1251>
  44. Marasca, C., De Rosa, A., Fabbrocini, G., Cantelli, M., Patrì, A., Vastarella, M., Gallo, L., di Vico, F., Poggi, S., & Ruggiero, A. (2022). Psychological teleconsultations in patients suffering from chronic skin diseases during the COVID-19 era: a service to improve patients’ quality of life. *Journal of Dermatological Treatment*, 33(3), 1736–1737. <https://doi.org/10.1080/09546634.2020.1809625>
  45. Mauro, V., Lorenzo, M., Paolo, C., & Sergio, H. (2020). Treat all COVID 19-positive patients, but do not forget those negative with chronic diseases. *Internal and Emergency Medicine*, 15(5), 787–790. <https://doi.org/10.1007/s11739-020-02395-z>
  46. Mboweni, S. H., & Risenga, P. R. (2022). The Impact of The COVID-19 Pandemic on the Management of Chronic Disease in South Africa: A Systematic Review. *The Open Public Health Journal*, 15(1), 1–12. <https://doi.org/10.2174/18749445-v15-e2206140>
  47. McElroy, J. A., Day, T. M., & Becevic, M. (2020). The influence of telehealth for better health across communities. *Preventing Chronic*

- Disease*, 17, 1–6. <https://doi.org/10.5888/PCD17.200254>
48. McLoone, J., Wakefield, C. E., Marshall, G. M., Pierce, K., Jaffe, A., Bye, A., Kennedy, S. E., Drew, D., & Lingam, R. (2022). It's made a really hard situation even more difficult: The impact of COVID-19 on families of children with chronic illness. *PLoS ONE*, 17(9 September), 1–13. <https://doi.org/10.1371/journal.pone.0273622>
49. Mirsky Jacob, H., & Daniel. (2019). Chronic Disease Management in the COVID-19 Era. *The American Journal of Managed Care*, 26(8), 294–295. <https://doi.org/10.1002/clc.23141>
50. Mobula, L. M., Heller, D. J., Commodore-Mensah, Y., Walker Harris, V., & Cooper, L. A. (2020). Protecting the vulnerable during COVID-19: Treating and preventing chronic disease disparities. *Gates Open Research*, 4, 1–8. <https://doi.org/10.12688/gatesopenres.13181.1>
51. Moher D, Liberati A, Tetzlaff J, A. D. (2009). Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. *The PRISMA Group*. <https://doi.org/doi:10.1371/journal.pmed1000097>
52. Mohiuddin, S. I., Thorakkattil, S. A., Abushoumi, F., Nemr, H. S., Jabbour, R., & Al-Ghamdi, F. (2021). Implementation of pharmacist-led tele medication management clinic in ambulatory care settings: A patient-centered care model in COVID-19 Era. *Exploratory Research in Clinical and Social Pharmacy*, 4, 100083. <https://doi.org/10.1016/j.rcsop.2021.100083>
53. Morisada, M. V., Hwang, J., Gill, A. S., Wilson, M. D., Strong, E. B., & Steele, T. O. (2021). Telemedicine, Patient Satisfaction, and Chronic Rhinosinusitis Care in the Era of COVID-19. *American Journal of Rhinology and Allergy*, 35(4), 494–499. <https://doi.org/10.1177/1945892420970460>
54. Niakan Kalhori, S. R., Bahaadinbeigy, K., Deldar, K., Gholamzadeh, M., Hajesmaeel-Gohari, S., & Ayyoubzadeh, S. M. (2021). Digital health solutions to control the COVID-19 pandemic in countries with high disease prevalence: Literature review. *Journal of Medical Internet Research*, 23(3), 1–12. <https://doi.org/10.2196/19473>
55. Norouzi, S., Arefi, F., Sistani, S., & Mirzaee, M. (2023). A pragmatically before-after trial of tele-visits vs face-to-face visits for chronic patients during the COVID-19 pandemic: patient-reported adherence. *International Journal of Medical Informatics*, 172(January). <https://doi.org/https://doi.org/10.1016/j.ijmedinf.2023.105003>
56. OECD/European Union. (2022). Health at a Glance: Europe 2022: State of Health in the EU Cycle. In *OECD Publishing, Paris*. <https://doi.org/https://doi.org/10.1787/507433b0-en>. ISBN



57. OECD. (2022). *First lessons from government evaluations of COVID-19 responses*. January, 1–45. In OECD Publishing, Paris. <https://www.oecd.org/coronavirus/policy-responses/first-lessons-from-government-evaluations-of-covid-19-responses-a-synthesis-483507d6/>
58. OECD and European Union. (2020). Health at a Glance: Europe 2020 State of health in the EU cycle. In *Health at a Glance 2020*. In OECD Publishing, Paris. <https://doi.org/10.1787/82129230-en>
59. Olmastroni, E., Galimberti, F., Tragni, E., Catapano, A. L., & Casula, M. (2023). Impact of COVID-19 Pandemic on Adherence to Chronic Therapies: A Systematic Review. *International Journal of Environmental Research and Public Health*, 20(5). <https://doi.org/10.3390/ijerph20053825>
60. Omboni, S. (2020). Telemedicine during the COVID-19 in Italy: A Missed Opportunity? *Telemedicine and E-Health*, 26(8), 973–975. <https://doi.org/10.1089/tmj.2020.0106>
61. Omboni, S., Ballatore, T., Rizzi, F., Tomassini, F., Panzeri, E., & Campolo, L. (2021). Telehealth at scale can improve chronic disease management in the community during a pandemic: An experience at the time of COVID-19. *PLoS ONE*, 16(9 September), 1–15. <https://doi.org/10.1371/journal.pone.0258015>
62. Palfreyman, S. (2012). How to do a Systematic Literature Review in Nursing – A Step-by-Step Guide. In *Nursing Standard* (Vol. 27, Issue 7). <https://doi.org/10.7748/ns2012.10.27.7.30.b1423>
63. Perrone, G., Zerbo, S., Bilotta, C., Malta, G., & Argo, A. (2020). Telemedicine during Covid-19 pandemic: Advantage or critical issue? *Medico-Legal Journal*, 88(2), 76–77. <https://doi.org/10.1177/0025817220926926>
64. Pigott, J. S., Armstrong, M., Chesterman, E., Read, J., Nimmons, D., Walters, K., Davies, N., & Schrag, A. (2022). Remote Consultations for People With Parkinson Disease and Cognitive Impairment: Interview Study With Patients, Caregivers, and Health Care Professionals. *JMIR Neurotechnology*, 1(1), e39974. <https://doi.org/10.2196/39974>
65. Poitras, M. E., Poirier, M. D., Couturier, Y., T Vaillancourt, V., Cormier, C., Gauthier, G., Massé, S., Gendron, A., Oswick, M. L., Morin, A., Blanchette, P., & Bernier, A. (2022). Chronic conditions patient's perception of post-COVID-19 pandemic teleconsulting continuation in primary care clinics: a qualitative descriptive study. *BMJ Open*, 12(12), 1–9. <https://doi.org/10.1136/bmjopen-2022-066871>

66. Portnoy, J., Waller, M., & Elliott, T. (2020). Telemedicine in the Era of COVID-19. *The Journal of Allergy and Clinical Immunology: In Practice*, 8(5), 1489-1491. <https://doi.org/10.1016/j.jaip.2020.03.008>
67. Ramakrishnan, M., Poojari, P. G., Rashid, M., & Nair, S. (2023). Impact of COVID-19 pandemic on medicine supply chain for patients with chronic diseases: Experiences of the community pharmacists. *Clinical Epidemiology and Global Health*, 20(101243). <https://doi.org/10.1016/j.cegh.2023.101243>
68. Ramanathan, K., Antognini, D., Combes, A., Paden, M., Zakhary, B., Ogino, M., Maclaren, G., & Brodie, D. (2022). Efficacy of telemedicine for the management of cardiovascular disease: a systematic review and meta-analysis. *Lancet Digit Health*, 4, 676–691, [https://doi.org/10.1016/S2589-7500\(22\)00124-8](https://doi.org/10.1016/S2589-7500(22)00124-8)
69. Rapelli, G., Lopez, G., Donato, S., Pagani, A. F., Parise, M., Bertoni, A., & Iafrate, R. (2020). A Postcard From Italy: Challenges and Psychosocial Resources of Partners Living With and Without a Chronic Disease During COVID-19 Epidemic. *Frontiers in Psychology*, 11(December), 1–14. <https://doi.org/10.3389/fpsyg.2020.567522>
70. Rodriguez, J. A., Betancourt, J. R., Sequist, T. D., & Ganguli, I. (2021). Differences in the use of telephone and video telemedicine visits during the COVID-19 pandemic. *American Journal of Managed Care*, 27(1), 21–26. <https://doi.org/10.37765/AJMC.2021.88573>
71. Rosellini, I., Vianello, M., Palmieri, A., Guidoni, S. V., Giopato, F., Ghazaryan, A., Fuccaro, M., Terrin, A., Vitaliani, R., Rigoni, M. T., Pietrobon, F., & Bonifati, D. M. (2023). Patient satisfaction with televisit in chronic neurologic disorders during Covid-19 pandemic. *Acta Neurologica Belgica*, 123(3), 983–991. <https://doi.org/10.1007/s13760-023-02173-6>
72. Rosenlund, M., Kinnunen, U. M., & Saranto, K. (2023). The Use of Digital Health Services Among Patients and Citizens Living at Home: Scoping Review. *Journal of Medical Internet Research*, 25. <https://doi.org/10.2196/44711>
73. Roy, B., Nowak, R. J., Roda, R., Khokhar, B., Patwa, H. S., Lloyd, T., & Rutkove, S. B. (2020). Teleneurology during the COVID-19 pandemic: A step forward in modernizing medical care. *Journal of Neurological Sciences*, 414(116930), <https://doi.org/10.1016/j.jns.2020.116930>
74. Samofalov, D. A., Izhytska, N. V., Dragomyretska, N. M., & Lyashenko, A. V. (2020). Information and Communication Technologies in Public Management of the Healthcare Institutions Network During Covid-19 Pandemics. *Wiadomosci Lekarskie*

- (Warsaw, Poland: 1960), 73(11), 2535–2542.  
<https://doi.org/10.36740/wlek202011136>
75. Saqib, M. A. N., Siddiqui, S., Qasim, M., Jamil, M. A., Rafique, I., Awan, U. A., Haroon, M., & Afzal, M. S. (2020). Effect of COVID-19 lockdown on patients with chronic diseases. *Diabetes and Metabolic Syndrome: Clinical Research and Reviews*, 14(6), 1621–1623. <https://doi.org/10.1016/j.dsx.2020.08.028>
76. Seixas, A. A., Olaye, I. M., Wall, S. P., & Dunn, P. (2021). Optimizing Healthcare Through Digital Health and Wellness Solutions to Meet the Needs of Patients With Chronic Disease During the COVID-19 Era. *Frontiers in Public Health*, 9(July), 1–7. <https://doi.org/10.3389/fpubh.2021.667654>
77. Smithson, R., Roche, E., & Wicker, C. (2021). Virtual models of chronic disease management: Lessons from the experiences of virtual care during the COVID-19 response. *Australian Health Review*, 45(3), 311–316. <https://doi.org/10.1071/AH20190>
78. Stachteas, P., Symvoulakis, M., Tsapas, A., & Smyrnakis, E. (2022). The impact of the COVID-19 pandemic on the management of patients with chronic diseases in Primary Health Care. *Population Medicine*, 4(August), 1–13. <https://doi.org/10.18332/popmed/152606>
79. Stulock, R., Montgomery, J., Parker, M., Soric, A., & Zeleznikar, E. (2022). Pharmacist involvement in a comprehensive remote monitoring and telemanagement program. *American Journal of Health-System Pharmacy*, 79(11), 888–895. <https://doi.org/10.1093/ajhp/zxac025>
80. Tewksbury, C., Deleener, M. E., Dumon, K. R., & Williams, N. N. (2021). Practical considerations of developing and conducting a successful telehealth practice in response to COVID-19. *Nutrition in Clinical Practice*, 36(4), 769–774. <https://doi.org/10.1002/ncp.10742>
81. The Lancet Respiratory Medicine. (2020). COVID-19 heralds a new era for chronic diseases in primary care. *The Lancet*, 8(7), 647. [https://doi.org/10.1016/S2213-2600\(20\)30274-5](https://doi.org/10.1016/S2213-2600(20)30274-5)
82. Wake, D. J., Gibb, F. W., Kar, P., Kennon, B., Klonoff, D. C., Rayman, G., Rutter, M. K., Sainsbury, C., & Semple, R. K. (2020). Remodelling diabetes services and emerging innovation. *European Journal of Endocrinology*, 183(2), G67–G77. <https://doi.org/10.1530/eje-20-0377>
83. Wang, H., Yuan, X., & Wang, J. (2021). Telemedicine maybe an effective solution for management of chronic disease during the COVID-19 epidemic. *Primary Health Care Research and Development*, 22, 1231–1235. <https://doi.org/10.1017/S1463423621000517>

84. Wilczewski, H., Paige, S. R., Ong, T., Soni, H., Barrera, J. F., Welch, B. M., & Bunnell, B. E. (2022). Providers' Perspectives on Telemental Health Usage After the COVID-19 Pandemic: Retrospective Analysis. *JMIR Formative Research*, 6(11), 1–10. <https://doi.org/10.2196/39634>
85. Williams, C., & Shang, D. (2023). Telehealth for Chronic Disease Management Among Vulnerable Populations. *Journal of Racial and Ethnic Health Disparities*, 0123456789. <https://doi.org/10.1007/s40615-023-01588-4>
86. Wittmeier, K. D. M., Protudjer, J. L. P., & Wicklow, B. A. (2021). Reflections on Virtual Care for Chronic Conditions During the COVID-19 Pandemic. *Canadian Journal of Diabetes*, 45(1), 1–2. <https://doi.org/10.1016/j.cjcd.2020.11.013>
87. Wyper, G. M. A., Assunção, R., Cuschieri, S., Devleeschauwer, B., Fletcher, E., Haagsma, J. A., Hilderink, H. B. M., Idavain, J., Lesnik, T., Von Der Lippe, E., Majdan, M., Milicevic, M. S., Pallari, E., Peñalvo, J. L., Pires, S. M., Plaß, D., Santos, J. V., Stockton, D. L., Thomsen, S. T., & Grant, I. (2020). Population vulnerability to COVID-19 in Europe: a burden of disease analysis. *Archives of Public Health*, 78(47), 1–8. <https://doi.org/10.1186/s13690-020-00437-8>
88. Yu, S., Wan, R., Bai, L., Zhao, B., Jiang, Q., Jiang, J., & Li, Y. (2023). Transformation of chronic disease management: Before and after the COVID-19 outbreak. *Frontiers in Public Health*, 11(March), 1–7. <https://doi.org/10.3389/fpubh.2023.1074364>