Cardiovascular Disease Prevention During the COVID-19 Pandemic: Lessons Learned and Future Opportunities

EAMON DUFFY, MD
MICHAEL CHILAZI, MD
MIGUEL CAINZOS-ACHIRICA, MD, MPH, PhD
ERIN D. MICHOS, MD, MHS

*Author affiliations can be found in the back matter of this article

ABSTRACT

The coronavirus disease 2019 (COVID-19) pandemic has been the defining healthcare issue since its outbreak, consuming healthcare systems and disrupting all aspects of human life throughout 2020 and continuing through 2021. When reviewing cardiovascular disease (CVD) prevention throughout the COVID-19 pandemic, the first tendency may be to focus on the negative disruption. Months of quarantine, isolation, and missed healthcare visits or delayed care may have exacerbated the epidemic of CVD in the United States. Looking back, however, perhaps it wasn’t a lost year as much as a health crisis that better prepared us for the battle to improve cardiovascular health. The pandemic brought new platforms for interacting with patients eager to engage, presenting a unique opportunity to reset how we approach preventive care.

In this review, we discuss what the pandemic has taught us about caring for those vulnerable patients who were most afflicted—older adults, persons of color, and people facing adverse socioeconomic circumstances—and who continue to be impacted by CVD. We also identify opportunities for enhanced CVD prevention now boosted by the overnight adoption of telemedicine and other innovative cardiac care models. Lastly, we discuss how the COVID-19 pandemic has motivated physicians and patients alike to prioritize our health above all else, if only transiently, and how we can leverage this increased health awareness and investment into long-term, meaningful disease prevention.
INTRODUCTION

Since its outbreak in 2020, the coronavirus disease 2019 (COVID-19) pandemic has been the defining healthcare issue consuming healthcare systems and disrupting all aspects of human life. Almost overnight, healthcare systems shifted resources and priorities toward the care of patients with COVID-19 and the prevention of viral spread throughout communities. By October 2020, COVID-19 had become the third-leading cause of death in the United States for adults aged 45 to 84 and the second-leading cause of death for those aged 85 years and older.1

With the connection between the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) and cardiovascular disease (CVD) already well established, CVD featured prominently throughout the pandemic as well. Indeed, CVD2 and its risk factors—obesity, diabetes mellitus, and hypertension3–5—were identified early on as common comorbidities among patients hospitalized with COVID-19 and as markers for more severe illness and death.6 As a result, vast initial research efforts were focused on understanding COVID-19-related myocardial injury and cardiogenic shock,6–8 the role of angiotensin-converting enzyme inhibitors in viral pathogenesis and cell entry,9,10 the concerning reduction in patients presenting with acute coronary syndromes,11 and the impact of the pandemic on cardiology training, academic productivity, and wellness across the field.12–15

The magnitude of the pandemic has simultaneously overshadowed and emphasized the importance of CVD prevention.16,17 As all providers were called to arms, cardiology’s pendulum swung even further toward reaction, intervention, and treatment and away from prevention, motivation, and counseling. But as mortality rates skyrocketed in the chronically ill, the U.S. was forced to reckon with its own health and ask difficult questions about why so many Americans have poor cardiovascular health. Obesity, diabetes mellitus, and CVD were no longer silent chronic diseases but risk factors for a deadly virus, thus elevating their prevalence in the national consciousness. Furthermore, the pandemic revealed not only the state of the nation’s health but also the state of its health care, with the burden of illness proportionally greatest among historically marginalized racial/ethnic minority groups18 who also experience poorer cardiovascular health, healthcare inequities, and structural racism.19 And while the pandemic exposed a healthcare system, it also exposed the field of cardiology, which too often prioritizes treating over preventing disease, reimburses for in-person procedures but not for telephone conversations about those procedures, and was largely unprepared for a pandemic of this scale and complexity.

With vaccines now widely available, we must mine the lessons of the pandemic to identify how healthcare delivery has changed and how it can improve to meet community demands during both pandemic and peacetime—with a special focus on the prevention of CVD and its risk factors. In this review, we discuss how the COVID-19 pandemic has disrupted cardiovascular care and how months of quarantine, isolation, and physical inactivity may now exacerbate the epidemic of CVD. We discuss what the pandemic has taught us about caring for patients who were most impacted—older adults, persons of color and other adults from historically marginalized communities, and those facing adverse socioeconomic circumstances—and who continue to be the most affected by CVD. We also identify opportunities for enhanced CVD prevention now boosted by the immediate adoption of telemedicine and other innovative cardiac care models. Lastly, we discuss how the COVID-19 pandemic motivated us to prioritize our health above all else and how we can leverage this increased health awareness and investment into long-term, meaningful disease prevention.

DISRUPTION OF CVD CARE DURING THE PANDEMIC

At the advice of the Centers for Disease Control and Prevention and mandated by state and local governments, a large percentage of the population, particularly those with chronic illnesses, remained at home for much of 2020 and into 2021. This has led to significant, unintended reductions in inpatient and outpatient cardiac care. Across the country, admissions for acute coronary syndrome (as well as cath lab activations), heart failure, and stroke decreased dramatically.20 In the immediate period after the outbreak, in-person cardiology office visits dropped by over 60% in some areas of the country.21 Those patients who did make in-person visits presented significantly later in the course of a myocardial infarction, with studies showing more than a 3-fold increase in time from the onset of symptoms to revascularization.22 Primary care visits, which account for much of CVD prevention efforts, dropped more than 20% during the pandemic despite the broad adoption of telemedicine. Concerningly, studies showed a 50% reduction in blood pressure evaluations and 38% reduction in cholesterol level evaluations during the pandemic.23,24 Furthermore, cardiac rehabilitation programs were halted overnight, canceling millions of sessions, leading to staff reductions, and leaving patients without access to a resource that may reduce total and cardiovascular mortality by up to 30% compared with standard treatment.25
These concerning trends may continue throughout the long tail of the pandemic, depending largely on the success of vaccination efforts and effective patient education regarding the importance of seeking appropriate acute cardiovascular care when needed. It is critical that patients understand the need to seek care for chest pain or acute neurological symptoms, even in the context of lockdowns or social distancing measures, and cardiologists should optimize interactions with their most vulnerable patients by reinforcing this message. Additionally, cardiologists should discuss vaccine status (COVID-19 and influenza) during each preventive cardiology visit, particularly for vulnerable populations who may hesitate to seek care.

For many of our most vulnerable patients, the COVID-19 vaccine could be one of the most important steps they take this year toward preventive cardiac care. Given the degree of misinformation surrounding vaccines, preventive cardiologists can play a pivotal role in helping to ground patients in the evidence regarding vaccine safety. Professional organizations promoting cardiovascular health, including the American Heart Association (AHA), can support preventive cardiologists by creating and routinely updating patient-centered educational materials regarding vaccine safety data and efficacy that can be shared during clinic visits. Aligning COVID-19 vaccination with patient goals for overall and cardiovascular health could help overcome vaccine hesitancy in some patients.

One of the numerous lessons from the disruption in cardiac care is the recognition of how rapidly the field can advance in response to such challenging circumstances. The overnight adoption of telemedicine for preventive cardiology is the most obvious example, but remarkable innovation took place across the field of cardiology. As elective coronary angiograms were stopped to maintain bed capacity and personal protective equipment, hospital systems reported a rapid adoption of coronary cardiac computed tomography as the primary means of evaluating chest pain in select patient populations. Although blood pressure evaluations dropped, studies showed that patients who enrolled in home blood pressure monitoring programs had no change in their frequency of measurements, highlighting the potential for such innovative programs. Furthermore, the Centers for Medicare and Medicaid Services (CMS) added virtual cardiac rehabilitation to the list of approved telehealth services, unlocking home-based programs for patients around the country.

**IMPACT ON LIFESTYLE AND IMPLICATIONS FOR CARDIOVASCULAR HEALTH**

The aim of preventive cardiology is to align a patient’s cardiovascular health with their entire lifestyle, including their diet, exercise, sleep, family support, substance use, stress, screen time, and preventive medication. But when our lives were upended by the pandemic, so too were our preventive efforts. During most of 2020 and the first half of 2021, widespread quarantining and lockdowns led to a significant decline in physical activity both globally and nationally, with some regions seeing declines over 50%. Studies showed a significant decline in children as young as 5 years old, a pattern that could become entrenched and have negative long-term health consequences if not aggressively addressed. Diets changed even more dramatically, with 85% of people reporting changes to their eating habits or food preparation. With entire families at home, there was

---

**Figure 1** Summary of the positive and negative impact of COVID-19 on lifestyle and opportunities for healthier living in the post-COVID-19 world.

- **Positive Changes**
  - Increase in outdoor exercise and home exercise equipment use
  - Increase in average sleep time and exercise heart rate
  - Increase in vegetable consumption and grocery home delivery
  - Increase in motivation to engage in self-care and quit smoking

- **Negative Changes**
  - Decline in physical activity in both adults and children
  - Increase in snacking, calorie consumption, and weight gain
  - Increase in screen time and sedentary behavior
  - Increased rates of stress, depression, and loneliness
the potential for individuals to snack more, think about food more, and consume more calories than usual.32,33 A study of lifestyle activities in 7,753 participants found weight gain in 27.5% of total participants and in 33.4% of obese participants.34 With the dramatic increase in time spent at home, it is no surprise that screen time skyrocketed across televisions, tablets, and smartphones, further contributing to the rise in sedentary behavior.35 Increasing rates of stress, anxiety, depression, loneliness, and social isolation, all known risk factors for CVD, accompanied each of these disruptions.36 A study of patients presenting with acute coronary syndromes found 4.6 times the rates of stress-related cardiomyopathy during the early months of the pandemic compared with a recent pre-pandemic period.37 Each of these trends would be concerning on their own, but the pandemic evoked them all at once, challenging CVD prevention efforts during this period and potentially for years to come.

**THE PANDEMIC AND RESHAPING PREVENTIVE CARDIOLOGY**

As the healthcare system recovers in the wake of the pandemic, we now have a unique opportunity to shift away from inertia and determine what can be leveraged from this experience to improve preventive cardiology going forward. Leaders in the field have called for redefining all preventive care in this country in the aftermath of the pandemic.38 Within cardiology, as mortality rates have plateaued in recent years after decades of decline,39 we as healthcare providers should take this opportunity to do the same. Here we discuss four approaches that can reshape primordial cardiovascular prevention and preventive care, each one sharpened by the challenges of the pandemic (Figure 2).

1) OPPORTUNITIES FOR HEALTHIER LIFESTYLES

The lifestyle changes required by the pandemic created important opportunities for primordial and primary CVD prevention that can and should be continued going forward (Figure 1). For instance, despite the decline in step counts and the closure of gyms across the country, the pandemic also inspired a “fitness revolution” of new runners and home exercisers.40 The rise of fitness technology companies like Peloton revealed that not all screen time is sedentary.41 The data released by Fitbit showing a drop in step count also showed a significant drop in the average heart rate of users, which could be attributed to additional data the company released showing increased high-intensity exercise and increased sleep time throughout the pandemic.42 The same studies that showed increased weight gain and stress also showed increased rates of cooking at home,43 and the studies showing increased snack consumption also showed increased vegetable consumption.44 Furthermore, a respiratory virus pandemic represented the perfect time to motivate smoking cessation; studies showed that almost 20% of smokers smoked fewer cigarettes and one-third were more motivated to quit.45 The societal disruption caused by the pandemic could have led to the failure of multiple metrics—diet, exercise, stress, or substance use—that combine to drive CVD prevention. Fortunately, the pandemic revealed new avenues for CVD prevention within its constraints. An analysis of Google search patterns reflecting online shopping behavior early in the pandemic revealed that there was an interest in overall healthier CVD lifestyle changes, although this was not sustained.46 It is now the responsibility of societies, public health leaders, and healthcare providers to recognize those new opportunities and carry them forward into post-pandemic care.

2) EXPANDING PREVENTATIVE CARDIOLOGY

**TELEHEALTH BEYOND THE PANDEMIC: THE NEW NORMAL**

Given their potential benefits, the adoption of telehealth platforms for preventive cardiology visits could continue to evolve into the standard of care beyond the pandemic. Although total blood pressure and cholesterol evaluations declined, the field of cardiology experienced the greatest migration to telehealth platforms by volume of any field in medicine except for primary care.47 Hypertension, hyperlipidemia, and diabetes ranked first, second, and fourth, respectively, in the top indications for telehealth appointments in the early months of the pandemic.48 Preventive cardiology visits, which focus heavily on lifestyle improvements, medication adherence, and patient motivation, lend themselves uniquely well to a virtual visit. While a physical exam can be useful during the initial visit, similar information can be obtained by eliciting the weight, height, and abdominal circumference

![Figure 2](image-url) Four approaches that can reshape primordial cardiovascular prevention and preventive care, each one sharpened by the challenges of the pandemic.
of the patient. Furthermore, telehealth platforms are well suited to leverage the multidisciplinary nature of preventive cardiology care: a single video visit can include sequential or simultaneous meetings with a physician to discuss starting a protein convertase subtilisin/kexin type-9 inhibitor, a nurse to provide instruction on self-administering the injection, and a social worker to evaluate insurance coverage.

For this to become a reality, the reimbursement landscape must support this approach. As the pandemic intensified, CMS added 85 telehealth services to the list covered by Medicare, with reimbursements at the same rate as in-person visits. This is progress, but likely only temporary, and when the pandemic subsides only 22% of states will have telehealth parity laws in place.46 Furthermore, telehealth platforms will need to be designed specifically for vulnerable patient populations to ensure they bridge rather than expand the digital divide. Families with income < $50,000 are significantly less likely to use video-based platforms for telehealth visits, the platforms of choice for most insurance companies.47 The staying power of telehealth will be determined by its ability to reach all families, connect them reliably with providers, and improve health outcomes.

3) CVD PREVENTATIVE CARE AT HOME

The COVID-19 pandemic confined patients to their homes for months on end and often required providers to manage sick patients remotely. Patients with COVID-19 were discharged from the emergency department with instructions to buy a pulse oximeter and follow up with their primary care physician. Cardiac patients were instructed to buy a home blood pressure cuff and a scale. This was a glimpse into the future of what chronic preventive cardiology care could look like—patients monitoring their own risk factors and established CVD from home, with providers interjecting when necessary. There are now remote algorithm-based cardiovascular risk management programs that adjust cholesterol, blood pressure, and even heart failure therapies, and attain significant improvement in outcomes without the direct involvement of a physician.48,49 However, equal energy focused on integrating these mobile health applications and remote monitoring systems into electronic medical records would help transform these new waves of patient data into actionable insight. More studies, as well as guidance from professional societies, are needed to help clinicians identify the best evidence-based mobile health technology (mHealth) approaches.

As discussed, the pandemic expedited the adoption of home-based cardiac rehabilitation. Additionally, it led to a spike in mail-order drug delivery, which jumped 21% during the first month of the pandemic.50 There are certainly many benefits of mail-order drug delivery, including a lower copay, 100-day medication supply with free shipping, and convenience online or by phone, with no need to drive to a pharmacy and wait in line every month. Preventive cardiologists should take note, as studies show that patients who receive their statin by mail may be more likely to remain adherent and see greater low-density lipoprotein (LDL)-cholesterol reduction than those who pick up that same statin from a pharmacy.51 In another study of stroke patients, users of mail-order pharmacy services were more likely to be adherent to preventive medications and had reduced hospital readmissions compared to those who made in-person pharmacy visits.52

Across the care continuum, from medications to remote monitoring and rehabilitation, the pandemic forced providers to meet patients in their homes. Within the comfort and safety of their own homes, patients may feel more relaxed to engage in preventive discussions outside of the typical office setting. A home environment also can provide additional opportunities, such as engaging partners or other social supporters about prevention, “touring” a patient’s pantry to provide nutrition counseling, reviewing medication labels to confirm a medication list and dosing, watching a patient take their own blood pressure with their home device to confirm adequacy of technique, and so forth. This paradigm shift, empowered by telehealth platforms, represents an exciting growth opportunity for the field if developed wisely in the post–COVID-19 world.

4) PATIENT EMPOWERMENT

The pandemic’s most important contribution to CVD care and prevention is not the expansion of telemedicine, new devices, or home fitness routines. While CVD providers must leverage all of these opportunities for enhanced disease prevention and care, the most important resource to leverage is the awareness, motivation, and empowerment of each individual patient to be healthy (Figure 3). This is the paramount lesson of the COVID-19 pandemic and one that aligns directly with the goals of CVD prevention providers. The investment that patients have made in their health, such as social distancing, mask-wearing, and getting vaccinated, can translate to diet, exercise, and medication adherence. Recent national surveys report that 80% of Americans intend to be more mindful about regular self-care practices after the pandemic, and over 40% of Americans desire more guidance and support for practicing self-care.53

In addition, patients’ increased engagement with personal health boosted their engagement with health systems; as questions about health multiplied, so too did activation of patient portal accounts and messages to providers. In California, the volume of patient-to-provider messages multiplied by over 28-fold over a 65-day period early in the pandemic.54 While physicians and public health officials recommended mask-wearing, social distancing, and vaccination, most patients heeded this advice on their own, without the need for monitoring or prescribing. This dynamic may be possible with CVD prevention, only it plays out over decades.
CONSIDERATIONS FOR VULNERABLE POPULATIONS

“The brunt of COVID-19 will be borne by the poor, elderly, and sick, and it is up to us to ensure they are not left behind,” said former U.S. Surgeon General Vivek Murthy. Findings from the AHA’s COVID-19 CVD Registry soberly demonstrated the disproportionate morbidity and mortality experienced by vulnerable populations in the pandemic. Minority communities had the highest rates of cardiovascular comorbidities, including hypertension, diabetes, and obesity, all of which have been associated with severe COVID-19 courses. The disproportionate burden of cardiovascular morbidity and mortality among Black, Indigenous, and people of color had been well established prior to COVID-19, but the pandemic acted as a stress test that unearthed the great deal of work to be done in cardiovascular prevention for these vulnerable groups.

Importantly, the pandemic highlighted the socio-economic issues that vulnerable communities face when seeking health care, such as limited access and housing and food insecurity. For women in particular, who already bear a disproportionate caregiving burden, the pandemic increased exposure to sick loved ones and, with the closure of schools and daycares, imposed barriers to participating in routine health visits and investing in personal well-being. In a study by Al Rifai in 2020, the prevalence of internet use in patients with atherosclerotic CVD was lower among racial/ethnic minority groups. We must be mindful that increased utilization of telemedicine and mobile health technology will likely widen the digital divide and create even greater inequities in access to care.

Improving cardiovascular prevention for vulnerable groups will depend in part on the collective efforts of the cardiology community to dismantle systemic barriers. Advocacy from professional organizations, such as the Association of Black Cardiologists (ABC), should be supported and emulated. For example, the ABC is modeling community-based interventions, such as their Release the Pressure campaign, to address hypertension in Black women through collaboration with key organizations, including churches and community centers; this is modeled after similar successful interventions addressing hypertension in Black men by partnering with local barbershops. The AHA recently outlined its commitment to mitigating the effect of structural racism on cardiovascular health by investing in research and community programs and identified health equity as a guiding principle for its 2030 Impact Goal to increase longevity. The cardiology community must leverage the collective voice of these organizations to lobby for meaningful policy changes.

While organizations advocate for change in the public sphere, providers can seize opportunities to improve
Although less than a third of seniors 64+ healthcare models protocolized screening to.

Although much attention and healthcare resources 65 64 While the pandemic's 68 The pandemic proved that telehealth can emerging from different sectors. From the technology sector, digital solutions such as teleconference platforms connected older adult patients with loved ones.46 Community organizations bridged the void where digital solutions fell short, enlisting volunteers to call elderly patients and organizing socially distant outdoor events.45 Healthcare models protocolized screening to link at-risk older patients with community resources and reimbursed services connecting seniors with companions who monitored medication adherence.46 While COVID-19 magnified the pre-existing association between loneliness and CVD among geriatric patients, it highlighted the need for cardiologists to become familiar with emerging services to support seniors.

Additionally, social isolation erected significant barriers to exercise, with older adults at highest risk of deconditioning and falls. Adaptation of exercise regimens, validated for hospitalized seniors to home settings, can empower older patients to maintain physical well-being.67 The momentum of home and virtual fitness among older adults should be seized by cardiologists to improve prevention and cardiopulmonary fitness in the years to come.

The care delivery landscape changed dramatically with use of telehealth among US seniors, which increased 10-fold in 2020.68 The pandemic proved that telehealth can be a viable strategy to improve care access for seniors. Nonetheless, more must be done to align technology with geriatric needs. With adults over 65 projected to represent 20% of the US population by 2030 and outnumber children for the first time in history,69 emerging technology must be informed by the unique audiovisual, physical, and cognitive needs of seniors. Cardiologists should seek opportunities to integrate evidence-based remote patient monitoring devices such as ambulatory blood pressure cuffs, smartphone-electrocardiograms, and wearable glucose monitors into the preventive care of geriatric patients.46 Although less than a third of seniors reported telehealth encounters with specialists, there is an opportunity for cardiologists to expand their digital footprint in a population that has proven itself more than willing and capable of engaging with telemedicine.68

OLDER ADULTS
Social distancing emerged as a core public health strategy and is expected to remain a mainstay of future pandemic responses. However, COVID-19 illustrated the disproportionate toll of social isolation on older adult populations. Long before this pandemic, social isolation in older adults has been linked to CVD, increasing the risk of hypertension, coronary artery disease, stroke, heart failure, and all-cause mortality.61 While the pandemic's effect on adults of advanced age are yet to be fully characterized, already higher rates of CVD are being observed among isolated populations.62

The AHA recently published a scientific statement emphasizing the interconnectivity of the mind, heart, and body and focusing on the “whole person” to improve cardiovascular health.63 Indeed, solutions to mitigate the negative impact of social isolation on older adults have emerged from different sectors. From the technology sector, digital solutions such as teleconference platforms connected older adult patients with loved ones.46 Community organizations bridged the void where digital solutions fell short, enlisting volunteers to call elderly patients and organizing socially distant outdoor events.45 Healthcare models protocolized screening to link at-risk older patients with community resources and reimbursed services connecting seniors with companions who monitored medication adherence.46 While COVID-19 magnified the pre-existing association between loneliness and CVD among geriatric patients, it highlighted the need for cardiologists to become familiar with emerging services to support seniors.

Additionally, social isolation erected significant barriers to exercise, with older adults at highest risk of deconditioning and falls. Adaptation of exercise regimens, validated for hospitalized seniors to home settings, can empower older patients to maintain physical well-being.67

The momentum of home and virtual fitness among older adults should be seized by cardiologists to improve prevention and cardiopulmonary fitness in the years to come.

The care delivery landscape changed dramatically with use of telehealth among US seniors, which increased 10-fold in 2020.68 The pandemic proved that telehealth can be a viable strategy to improve care access for seniors. Nonetheless, more must be done to align technology with geriatric needs. With adults over 65 projected to represent 20% of the US population by 2030 and outnumber children for the first time in history,69 emerging technology must be informed by the unique audiovisual, physical, and cognitive needs of seniors. Cardiologists should seek opportunities to integrate evidence-based remote patient monitoring devices such as ambulatory blood pressure cuffs, smartphone-electrocardiograms, and wearable glucose monitors into the preventive care of geriatric patients.46 Although less than a third of seniors reported telehealth encounters with specialists, there is an opportunity for cardiologists to expand their digital footprint in a population that has proven itself more than willing and capable of engaging with telemedicine.68

CONCLUSIONS
When reviewing CVD prevention throughout the COVID-19 pandemic, the first tendency may be to focus on the negative disruption: visits missed, care diverted, medications left unfilled. It is easy to imagine 2020, a year in quarantine before vaccinations, as a lost year or a step backward for many of our patients, a time when preventing immediate disease superseded preventing chronic disease. CVD prevention is an uphill battle against structural forces in our society and the unknowable complexities of our patients' lives. Looking back, we should see not a lost year but a pandemic that better prepared us for future battles, with new platforms for interacting with patients who are more engaged than ever. We should see a unique opportunity to reset preventive care in this country. In doing so, we can adjust the course of CVD away from a pro-obesogenic society and toward a new normal that prioritizes the prevention of disease and empowers patients to live their healthiest lives.

KEY POINTS
• Although much attention and healthcare resources were appropriately diverted to managing the COVID-19 pandemic, cardiologists must refocus on efforts devoted to cardiovascular disease (CVD) prevention to battle the pandemic of cardiometabolic diseases.
COVID-19 caused negative disruptions to CVD prevention, including (1) reduced physical activity; (2) increased snacking, calorie consumption, and weight gain; (3) increased screen time and sedentary behavior; (4) increased rates of social isolation, mental stress, depression, and loneliness; and (5) missed clinic visits, resulting in delayed acute and preventive care.

The COVID-19 pandemic also spurred favorable changes in CVD prevention, including (1) increases in the use of home exercise equipment, sleep time, vegetable consumption, and home grocery delivery; (2) rapid adoption of telehealth; (3) greater patient-physician communication; (4) increased use of medication home delivery; (5) greater understanding of risk factors and impact of chronic diseases; and (6) motivation to engage in self-care.

COMPETING INTERESTS

The authors have no competing interests to declare.

AUTHOR AFFILIATIONS

Eamon Duffy, MD orcid.org/0000-0002-2354-6394
Johns Hopkins University School of Medicine, Baltimore, Maryland, US

Michael Chilazi, MD orcid.org/0000-0002-8942-2407
Johns Hopkins University School of Medicine, Baltimore, Maryland, US

Miguel Cainzos-Achirica, MD, MPH, PhD orcid.org/0000-0002-8073-2337
Houston Methodist DeBakey Heart & Vascular Center, Houston Methodist Hospital, Houston, Texas; Center for Outcomes Research, Houston Methodist, Houston, Texas; Center for Outcomes Prevention, including (1) reduced physical activity; (2) increased snacking, calorie consumption, and weight gain; (3) increased screen time and sedentary behavior; (4) increased rates of social isolation, mental stress, depression, and loneliness; and (5) missed clinic visits, resulting in delayed acute and preventive care.

The COVID-19 pandemic also spurred favorable changes in CVD prevention, including (1) increases in the use of home exercise equipment, sleep time, vegetable consumption, and home grocery delivery; (2) rapid adoption of telehealth; (3) greater patient-physician communication; (4) increased use of medication home delivery; (5) greater understanding of risk factors and impact of chronic diseases; and (6) motivation to engage in self-care.

COMPETING INTERESTS

The authors have no competing interests to declare.

AUTHOR AFFILIATIONS

Eamon Duffy, MD orcid.org/0000-0002-2354-6394
Johns Hopkins University School of Medicine, Baltimore, Maryland, US

Michael Chilazi, MD orcid.org/0000-0002-8942-2407
Johns Hopkins University School of Medicine, Baltimore, Maryland, US

Miguel Cainzos-Achirica, MD, MPH, PhD orcid.org/0000-0002-8073-2337
Houston Methodist DeBakey Heart & Vascular Center, Houston Methodist Hospital, Houston, Texas; Center for Outcomes Research, Houston Methodist, Houston, Texas; Center for Outcomes

REFERENCES

1. Woolf SH, Chapman DA, Lee JH. COVID-19 as theLeading Cause of Death in the United States. JAMA. 2021 Jan 12;325(2):123–124. doi: 10.1001/jama.2020.24865

2. Khan MS, Shahid I, Anker SD, et al. Cardiovascular implications of COVID-19 versus influenza infection: a review. BMC Med. 2020 Dec 18;18(1):x03. doi: 10.1186/s12916-020-01816-2

3. Hendren NS, de Lemos JA, Ayers C, et al. Association of Body Mass Index and Age With Morbidity and Mortality in Patients Hospitalized With COVID-19: Results From the American Heart Association COVID-19 Cardiovascular Disease Registry. Circulation. 2021 Jan 12;143(2):135–144. doi: 10.1161/CIRCULATIONAHA.120.051936

4. Apicella M, Campopiano MC, Mantuano M, Mazoni L, Coppelli A, Del Prato S. COVID-19 in people with diabetes: understanding the reasons for worse outcomes. Lancet Diabetes Endocrinol. 2020 Sep;8(9):782–92. doi: 10.1016/S2213-8587(20)30238-2

5. Hosseinzadeh R, Goharrizi M, Bahardoust M, et al. Should all patients with hypertension be worried about developing severe coronavirus disease 2019 (COVID-19)? Clin Hypertens. 2021 Jan 15;27(1):3. doi: 10.11186/s40885-021-00161-7

6. Xie J, Tong Z, Guan X, Du B, Qiu H. Clinical Characteristics of Patients Who Died of Coronavirus Disease 2019 in China. JAMA Netw Open. 2020 Apr 1;3(4):e205619. doi: 10.1001/jamanetworkopen.2020.5619

7. Metkus TS, Sokoll LJ, Barth AS, et al. Myocardial Injury in Severe COVID-19 Compared With Non-COVID-19 Acute Respiratory Distress Syndrome. Circulation. 2021 Feb 9;143(6):553–565. doi: 10.1161/CIRCULATIONAHA.120.050543

8. Hendren NS, Drazner MH, Bozkurt B, Cooper LT Jr. Description and Proposed Management of the Acute COVID-19 Cardiovascular Syndrome. Circulation. 2020 Jun 9;141(23):1903–1914. doi: 10.1161/CIRCULATIONAHA.120.047349

9. Usman MS, Siddiqi TJ, Khan MS, et al. A Meta-analysis of the Relationship Between Renin-Angiotensin-Aldosterone System Inhibitors and COVID-19. Am J Cardiol. 2020 Sep 1;130:159–161. doi: 10.1016/j.amjcard.2020.05.038

10. Wang K, Gheblawi M, Oudit GY. Angiotensins Converting Enzyme 2: A Double-Edged Sword. Circulation. 2020 Aug 4;142(5):426–8. doi: 10.1161/CIRCULATIONAHA.120.047049

11. Garcia S, Stanberry L, Schmidt C, et al. Impact of COVID-19 pandemic on STEMI care: An expanded analysis from the United States. Catheter Cardiovasc Interv. 2020 Aug 7. doi: 10.1002/cdi.29154

12. Dineen EH, Hsu JJ, Saeed A. Reinforcing Cardiology Training During a Pandemic: An Open Letter to Our Leaders. Circulation. 2020 Jul 14;142(2):95–97. doi: 10.1161/CIRCULATIONAHA.120.047593

13. Reza N, DeFilippis EM, Michos ED. Cascading Effects of COVID-19 on Women in Cardiology. Circulation. 2021 Feb 16;143(7):615–617. doi: 10.1161/CIRCULATIONAHA.120.049792

14. Kalra A, Michos ED, Chinnaiyan KM. COVID-19 and the healthcare workers. Eur Heart J. 2020 Aug 14;41(31):2936–2937. doi: 10.1093/eurheartj/ehaa489

15. Chong JH, Chahal A, Ricci F, et al. The Transformation of Cardiology Training in Response to the COVID-19 Pandemic: Enhancing Current and Future Standards to Deliver Optimal Patient Care. Can J Cardiol. 2021 Mar;37(3):519–522. doi: 10.1016/j.cjca.2021.01.009

16. Khera A, Baum SJ, Gluckman TJ, et al. Continuity of care and outpatient management for patients with and at high risk for cardiovascular disease during the COVID-19 pandemic: A scientific statement from the American
Society for Preventive Cardiology. Am J Prev Cardiol. 2020 Mar;1:100009. doi: 10.1016/j.ajpc.2020.100009

17. Duffy EY, Caínzos-Achirica M, Michos ED. Primary and Secondary Prevention of Cardiovascular Disease in the Era of the Coronavirus Pandemic. Circulation. 2020 Jun 16;141(24):1943–1945. doi: 10.1161/CIRCULATIONAHA.120.047194

18. Rodríguez F, Solomon N, de Lemos JA, et al. Racial and Ethnic Differences in Presentation and Outcomes for Patients Hospitalized with COVID-19: Findings from the American Heart Association’s COVID-19 Cardiovascular Disease Registry. Circulation. 2020 Nov 17. doi: 10.1161/CIRCULATIONAHA.120.052278

19. Churchwell K, Elkind MSV, Benjamin RM, et al.; American Heart Association. Call to Action: Structural Racism as a Fundamental Driver of Health Disparities: A Presidential Advisory From the American Heart Association. Circulation. 2020 Dec 15;142(24):e454–e468. doi: 10.1161/CIR.0000000000000936

20. Bhatt AS, Moscone A, McElrath EE, et al. Fewer Hospitalizations for Acute Cardiovascular Conditions During the COVID-19 Pandemic. J Am Cardiol. 2020 Jul 21;76(3):280–288. doi: 10.1016/j.jacc.2020.05.038

21. Harrington JL, Jollis JG, Patel MR, Joiner A, Granger CB. Abstract 17083: SARS-CoV-2 Dramatically Decreases Healthcare Access for Patients With Cardiovascular Disease. Circulation. 2020 Nov 17;142(Suppl 3):A17083–A17083. doi: 10.1161/CIR.0000000000000936

22. Aldujeli A, Hamadeh A, Briedis K, et al. Delays in Presentation in Patients With Acute Myocardial Infarction During the COVID-19 Pandemic. Cardiol Res. 2020 Dec;11(6):386–391. doi: 10.14740/cr1175

23. Alexander GC, Tajanlangit M, Heyward J, Mansour O, Qato DM, Stafford RS. Use and Content of Primary Care Office-Based vs Telemedicine Care Visits During the COVID-19 Pandemic in the US. JAMA Netw Open. 2020 Oct 1;3(10):e2021476. doi: 10.1001/jamanetworkopen.2020.21476

24. Gumuser ED, Haidermota S, Finneran P, Natarajan P, Honigberg MC. Trends in cholesterol testing during the COVID-19 pandemic: COVID-19 and cholesterol testing. Am J Prev Cardiol. 2021 Jun;6:100152. doi: 10.1016/j.ajpc.2021.100152

25. Anderson LJ, Taylor RS. Cardiac rehabilitation for people with heart disease: an overview of Cochrane systematic reviews. Int J Cardiol. 2014 Dec 15;177(2):348–61. doi: 10.1016/j.ijcard.2014.10.011

26. Yadlapati SH, Khan SU, Talluri S, et al. Effects of Influenza Vaccine on Mortality and Cardiovascular Outcomes in Patients With Cardiovascular Disease: A Systematic Review and Meta-Analysis. J Am Heart Assoc. 2021 Mar 16;10(6):e019636. doi: 10.1161/JAHA.120.019636

27. Poon M, Leipsic J, Kim M, Welt F, Rose G. Impact of Cardiovascular Care of COVID-19: Lessons Learned, Current Challenges, and Future Opportunities. Radial Cardiologist Imaging. 2020 Jul 23;2(4):e200251. doi: 10.1148/ryct.2020200251

28. Peterson ED, James RA, Barrett M, Schneider J, Shah BR. Abstract 15946: The Impact of COVID-19 on Blood Pressure Trends Utilizing a National Remote Monitoring Platform. Circulation. 2020 Nov 17;142(Suppl 3):A15946–A15946.

29. American College of Cardiology [Internet]. Washington, DC: American College of Cardiology; c2021. CMS approves telehealth cardiac rehab during COVID-19 pandemic; 2020 Oct 15 [cited 2021 Jun 15]. Available from: https://www.acc.org/latest-in-cardiology/articles/2020/10/15/17/10/cms-approves-telehealth-cardiac-rehab-during-covid-19-pandemic

30. Tison GH, Avram R, Kuhar P, et al. Worldwide Effect of COVID-19 on Physical Activity: A Descriptive Study. Ann Intern Med. 2020 Nov 3;173(9):767–770. doi: 10.7326/M20-2665

31. Dunton GF, Do B, Wang SD. Early effects of the COVID-19 pandemic on physical activity and sedentary behavior in children living in the U.S. BMC Public Health. 2020 Sep 4;20(1):1351. doi: 10.1186/s12889-020-09429-3

32. Food Insight [Internet]. Washington, DC: International Food Information Council; c2021. 2020 Food & Health Survey; 2020 Jun 9 [cited 2021 Jun 15]. Available from: https://foodinsight.org/2020-food-and-health-survey/

33. Ruiz-Roso MB, Knott-Torcal C, Matilla-Escalante DC, et al. COVID-19 Lockdown and Changes of the Dietary Pattern and Physical Activity Habits in a Cohort of Patients with Type 2 Diabetes Mellitus. Nutrients. 2020 Aug 4;12(8):2327. doi: 10.3390/nu12082327

34. Flanagan EW, Beyl RA, Fearnbach SN, Altazan AD, Martin CK, Redman LM. The Impact of COVID-19 Stay-At-Home Orders on Health Behaviors in Adults. Obesity (Silver Spring). 2021 Feb;29(2):438–445. doi: 10.1002/oby.23066

35. SocArXiv [Internet]. College Park, MD: University of Maryland; c2021. Sultana A, Tasnim S, Bhattacharya S, Hussain M, Paruhi N. Digital Screen Time During COVID-19 Pandemic: A Public Health Concern; 2020 Sep 1 [cited 2021 Jun 15]. Available from: https://osf.io/preprints/socarxiv/ e8sg7/. doi: 10.31235/osf.io/e8sg7

36. Čosić K, Popović S, Šarić Ž, Kesedžić I. Impact of Human Disasters and COVID-19 Pandemic on Mental Health: Potential of Digital Psychiatry. Psychiatr Danub. Spring, 2020;32(1):25–31. doi: 10.24869/psyd.2020.25

37. Jabri A, Kalra A, Kumar A, et al. Incidence of Stress Cardiomyopathy During the Coronavirus Disease 2019 Pandemic. JAMA Netw Open. 2020 Jul 1;3(7):e2014780. doi: 10.1001/jamanetworkopen.2020.14780

38. Horn DM, Haas JS. Covid-19 and the Mandate to Redefine Preventive Care. N Engl J Med. 2020 Oct 15;383(16):1505–1507. doi: 10.1056/NEJMp2018749

39. Mehta NK, Abrams LR, Myrskylä M. US life expectancy stalls due to cardiovascular disease, not drug deaths. Proc Natl Acad Sci U S A. 2020 Mar 31;117(13):6998–7000. doi: 10.1073/pnas.1920391117

40. Nyenhuis SM, Greiwe J, Zeiger JS, Nanda A, Cooke A. Exercise and Fitness in the Age of Social Distancing During
the COVID-19 Pandemic. J Allergy Clin Immunol Pract. Jul–Aug 2020;8(7):2152–2155. doi: 10.1016/j.jaip.2020.04.039

41. Duffy et al. [INTERNET]. New York, NY: New York Times; c2021. Griffith E. People Are Panic-Buying Meat, Toilet Paper ... And Pelotons?; 2020 May 6 [cited 2021 Jun 15]. Available from: https://www.nytimes.com/2020/05/06/technology/Peloton-Boom-Workout-Virus.html

42. Fitbit [INTERNET]. San Francisco, CA: Fitbit, Inc.; c2021. Heart health improves even when steps decline; 2020 Apr 17 [cited 2021 Jun 15]. Available from: https://blog.fitbit.com/covid-19-heart-health/

43. Elling JM, Crutzen R, Talhouit R, de Vries H. Tobacco smoking and smoking cessation in times of COVID-19. Tob Prev Cessat. 2020 Jul 1;6:39. doi: 10.18332/tpc/122753

44. Dzaye O, Adelhoefer S, Boakye E, Blaha MJ. Cardiovascular-related health behaviors and lifestyle during the COVID-19 pandemic: An infodemiology study. Am J Prev Cardiol. 2021 Mar;5:100148. doi: 10.1016/j.ajpc.2021.100148

45. EHRN [INTERNET]. Verona, WI: Epic Systems Corp; c2021. Fox B, Sizemore O. As office visits fall, telehealth takes hold; 2020 Jun 12 [cited 2021 Jun 15]. Available from: https://ehrhn.org/articles/as-office-visits-fall-telehealth-takes-hold

46. CCHP [INTERNET]. West Sacramento, CA: Center for Connected Health Policy; c2021. COVID-19 telehealth coverage policies; 2021 Mar [cited 2021 Jun 15]. Available from: https://www.cchpca.org/resources/covid-19-telehealth-coverage-policies

47. Eberly LA, Khotana SAM, Nathan AS, et al. Telemedicine Outpatient Cardiovascular Care During the COVID-19 Pandemic: Bridging or Opening the Digital Divide? Circulation. 2020 Aug 4;142(5):510–512. doi: 10.1161/CIRCULATIONAHA.120.048185

48. Scirica BM, Cannon CP, Fisher NDL, et al. Digital Care Transformation: Interim Report From the First 5000 Patients Enrolled in a Remote Algorithm-Based Cardiovascular Risk Management Program to Improve Lipid and Hypertension Control. Circulation. 2021 Feb 2;143(5):507–509. doi: 10.1161/CIRCULATIONAHA.120.051913

49. Desai AS, Maclean T, Blood AJ, et al. Remote Optimization of Guideline-Directed Medical Therapy in Patients With Heart Failure With Reduced Ejection Fraction. JAMA Cardiol. 2020 Sep 16;5(12):1–5. doi: 10.1001/jamacardiol.2020.3757

50. Wall Street Journal [INTERNET]. New York, NY: Dow Jones & Co.; c2021. Hopkins JS. Mail order drug delivery rises during coronavirus lockdown; 2020 May 12 [cited 2021 Jun 15]. Available from: https://www.wsj.com/articles/mail-order-drug-delivery-rises-during-coronavirus-lockdown-11589281203

51. Schmittiedl JA, Karter AJ, Dyer W, et al. The comparative effectiveness of mail order pharmacy use vs. local pharmacy use on LDL-C control in new statin users. J Gen Intern Med. 2011 Dec;26(12):1396–402. doi: 10.1007/s11606-011-1805-7

52. Neil WP, Shiokari CE, Burchette RJ, Stapleton D, Ovbiagile B. Mail order pharmacy use and adherence to secondary prevention drugs among stroke patients. J Neurol Sci. 2018 Jul 15;390:117–120. doi: 10.1016/j.jns.2018.04.001

53. EurekAlert [INTERNET]. Washington, DC: American Association for the Advancement of Science; c2021. COVID-19 spurs increase in self-care, new survey shows; 2020 Jun 3 [cited 2021 Jun 15]. Available from: https://www.eurekalert.org/pub_releases/2020-06/trg-cs060220.php

54. HIT Consultant [INTERNET]. Atlanta, GA: HIT Consultant Media; c2021. Pennic F. How the COVID-19 Pandemic is Changing Patient Communications; 2020 Apr 17 [cited 2021 Jun 15]. Available from: https://hitconsultant.net/2020/04/27/report-covid-19-pandemic-patient-communications/

55. AJMC [INTERNET]. Cranbury, NJ: Managed Care & Healthcare Communications, LLC; c2021. Shaw ML. Preventing Loneliness Among the Senior Population During the COVID-19 Crisis; 2020 Mar 25 [cited 2021 Jul 1]. Available from: https://www.ajmc.com/view/preventing-loneliness-among-the-senior-population-during-the-covid-19-crisis

56. Hoynes N, Cooper LA, Albert MA; Association of Black Cardiologists. At the Heart of the Matter: Unmasking and Addressing the Toll of COVID-19 on Diverse Populations. Circulation. 2020 Jul 14;142(2):105–107. doi: 10.1161/CIRCULATIONAHA.120.048126

57. NBER [INTERNET]. Cambridge, MA: National Bureau of Economic Research; c2021. Alon T, Doepke M, Olmstead-Rumsey J, Tertilt M. The Impact of COVID-19 on Gender Equality; 2020 Apr [cited 2021 Jun 15]. Available from: http://www.nber.org/papers/w26947

58. Al Rifai M, Shapiro MD, Sayani S, et al. Racial and Geographic Disparities in Internet Use in the United States Among Patients with Atherosclerotic Cardiovascular Disease. Am J Cardiol. 2020 Nov 1;134:146–147. doi: 10.1016/j.amjcard.2020.08.001

59. Victor RG, Lynch K, Li N, et al. A Cluster-Randomized Trial of Blood-Pressure Reduction in Black Barbershops. N Engl J Med. 2018 Apr 5;378(14):1291–1301. doi: 10.1056/NEJMoa1717250

60. Angell SY, McConnell MV, Anderson CAM, et al. The American Heart Association 2030 Impact Goal: A Presidential Advisory From the American Heart Association. Circulation. 2020 Mar 3;141(9):e120–e138. doi: 10.1161/CIRCULATIONAHA.120.050078

61. Valtorta NK, Kanaan M, Gilbody S, Ronzi S, Hanratty B. Loneliness and social isolation as risk factors for coronary heart disease and stroke: systematic review and meta-analysis of longitudinal observational studies. Heart. 2016 Jul 1;102(13):1009–16. doi: 10.1136/heartjnl-2015-308790

62. ESC [INTERNET]. Brussels, Belgium: European society of Cardiology; c2021. Social isolation during COVID-19 pandemic linked with high blood pressure; 2020 Nov 19 [cited 2021 Jun 15]. Available from: https://www.escardio.org/The-ESC/Press-Office/Press-releases/social-isolation-during-covid-19-pandemic-linked-with-high-blood-pressure

63. Levine GN, Cohen BE, Commodore-Mensah Y, et al. Psychological Health, Well-Being, and the Mind-Heart-Body Connection: A Scientific Statement From the American
Heart Association. Circulation. 2021 Mar;91(10):e763-e783. doi: 10.1161/CIR.0000000000000947

64. Krishnaswami A, Beavers C, Dorsch MP, et al. Gerotechnology for Older Adults With Cardiovascular Diseases: JACC State-of-the-Art Review. J Am Coll Cardiol. 2020 Dec 1;76(22):2650–2670. doi: 10.1016/j.jacc.2020.09.606

65. LTC Covid [Internet]. Seattle, WA: University of Washington; c2021. Berridge C, Parsey CM, Ramirez M, Freitag C, Johnson IM, Allard SW. Caring for Washington’s older adults in the COVID-19 pandemic: Interviews with organization leaders about the state of social and healthcare services; 2020 Oct 12 [cited 2021 Jun 15]. Available from: https://ltccovid.org/project/caring-for-washingtongs-older-adults-in-the-covid-19-pandemic-interviews-with-organization-leaders-about-the-state-of-social-and-healthcare-services/

66. Commonwealth Fund [Internet]. New York, NY: The Commonwealth Fund; c2021. Abrams MK, I Williams RD II, Tikkanen R, Shah T, Pantell M. Solutions from Around the World: Tackling Loneliness and Social Isolation During COVID-19; 2020 Apr 30 [cited 2021 Jun 15]. Available from: https://www.commonwealthfund.org/blog/2020/solutions-around-world-tackling-loneliness-and-social-isolation-during-covid-19

67. Aubertin-Leheudre M, Rolland Y. The Importance of Physical Activity to Care for Frail Older Adults During the COVID-19 Pandemic. J Am Med Dir Assoc. 2020 Jul;21(7):973–976. doi: 10.1016/j.jamda.2020.04.022

68. Healthy Aging [Internet]. Ann Arbor, MI: The Regents of the University of Michigan; c2021. Telehealth Use Among Older Adults Before and During COVID-19; 2020 Aug [cited 2021 Jun 15]. Available from: https://www.healthyagingpoll.org/report/telehealth-use-among-older-adults-and-during-covid-19

69. US Census Bureau [Internet]. Washington, DC: US Census Bureau; c2021. Older People Projected to Outnumber Children; 2018 Mar 13 [cited 2021 Jun 15]. Available from: https://www.census.gov/newsroom/press-releases/2018/cb18-41-population-projections.html

TO CITE THIS ARTICLE:
Duffy E, Chilazi M, Cainzos-Achirica M, Michos ED. Cardiovascular Disease Prevention During the COVID-19 Pandemic: Lessons Learned and Future Opportunities. Methodist DeBakey Cardiovasc J. 2021;17(4):68-78. doi: 10.14797/mdcvj.210

Submitted: 07 March 2021    Accepted: 12 June 2021    Published: 24 September 2021

COPYRIGHT:
© 2021 The Author(s). This is an open-access article distributed under the terms of the Attribution-NonCommercial 4.0 International (CC BY-NC 4.0), which permits unrestricted use, distribution, and reproduction in any noncommercial medium, provided the original author and source are credited. See https://creativecommons.org/licenses/by-nc/4.0/.
Methodist DeBakey Cardiovascular Journal is a peer-reviewed open access journal published by Houston Methodist DeBakey Heart & Vascular Center.