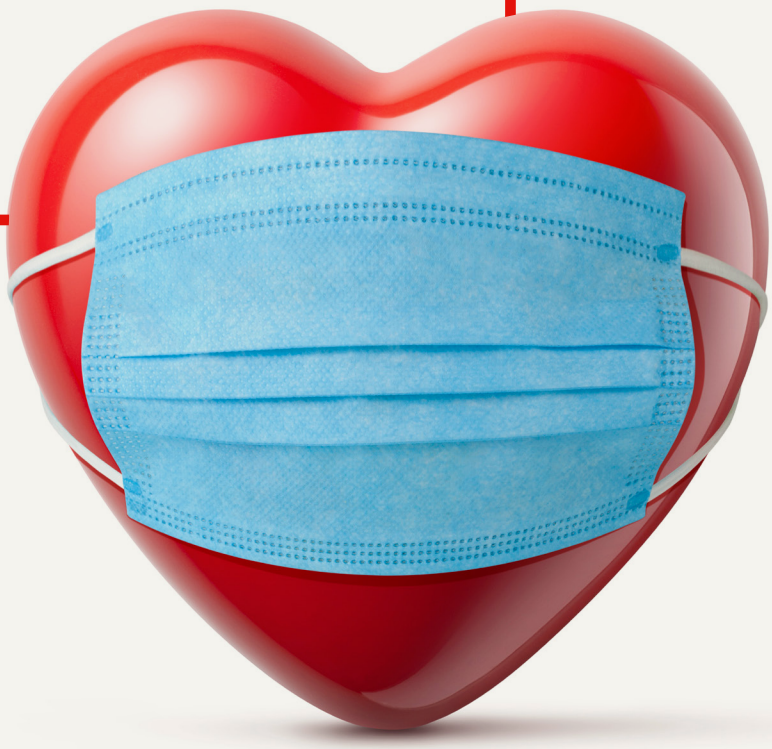
ECONOMIST IMPACT

Links between covid-19 and cardiovascular disease

Seeing the warning signs and preparing for a healthier future



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About this report

Links between covid-19 and cardiovascular disease: Seeing the warning signs and preparing for a healthier future is an Economist Impact report (formerly the EIU), supported by Daiichi Sankyo Europe, a pharmaceutical company. This independent research explores the links between covid-19 (mainly post-acute and long covid-19) and cardiovascular disease. The study focuses on Western Europe, in particular five countries: France, Germany, Italy, Spain, and the United Kingdom.

The findings of the report are based on a literature review, expert panel meeting and interviews with healthcare professionals. Our thanks are due to the following for their time and insights (listed alphabetically):

- **Professor Amitava Banerjee**, professor of clinical data science and honorary consultant cardiologist, Institute of Health Informatics, University College London, England
- **Dr Anna Bersano**, head of the cerebrovascular unit, Fondazione IRCCS Istituto Neurologico Carlo Besta, Milan, Italy
- **Dr Salvatore Brugaletta**, associate professor of medicine, University of Barcelona, Spain
- **Professor Nishi Chaturvedi**, professor of clinical epidemiology (cardiometabolic disease), Institute of Cardiovascular Science, Faculty of Population Health Sciences, University College London, England
- **Dr Salvatore De Rosa**, associate professor of cardiology, Department of Medical and Surgical Sciences, Magna Graecia University, Catanzaro, Italy
- **Katherine Thompson**, head of CVD Prevention Programmes, Public Health England (PHE)

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Executive Summary

It is increasingly clear that cardiovascular disease (CVD)—the world's deadliest family of non-communicable diseases—and covid-19—which has quickly become humanity's most prolific infectious killer—multiply each other's severity and, ultimately, lethality. Very early in the pandemic, it became apparent that CVD was one of the underlying conditions associated with worse covid-19 outcomes. Now, a growing body of studies indicates that those who have recovered from covid-19 face higher risks of multiple forms of CVD, as well as of major adverse cardiac events (heart failure, myocardial infarction, stroke or arrhythmia). This study concentrates on covid-19 as a driver of CVD risk and the implications for health policy.

It is increasingly clear that cardiovascular disease (CVD) and covid-19 multiply each other's severity and, ultimately, lethality.

A serious challenge in addressing these issues arises from the weaknesses within current research. Many studies are small, have significant risk of bias or cover groups that may be unrepresentative of wider populations. Moreover, diversity of study methodologies, such as dissimilar time periods covered in investigations, and even different definitions of key terms, combine to make comparison of results difficult.

However, a focus on the shortcomings of any individual study risks missing the clear message coming from the research as a whole: covid-19 itself, along with various measures taken to fight that pandemic, are likely to drive an overall increase in the CVD burden in the coming years. Healthcare officials are now in the position to see the threat materialising on the horizon; it is prudent to prepare for it, even if the exact scale and shape still defy precision.

This Economist Impact study, supported by Daiichi Sankyo Europe, describes current research looking at the direct effects of covid-19 on CVD risk, its indirect impact on CVD management during the pandemic, and the interactions between long-covid and CVD (the three warning beacons that signal the approaching challenge).

The study considers basic first steps to prepare for the growing health risk, taking a forward-looking view of how health systems might better integrate communicable disease and non-communicable disease care. To the extent possible, this study focuses on five large Western European countries: France, Italy, Germany, Spain and the UK. Where helpful, it also draws on research from elsewhere. Our key findings include:

Beacon I: The direct impact of covid-19 on CVD risk

- **Survivors of covid-19 have an elevated probability of developing various forms of CVD and experiencing related serious health events.** However varied the research, the message is consistent. Some of the more striking findings are: across the literature, chest pains are among the most frequent patient-reported after-effects (sequelae) of covid-19; a UK study of nearly 50,000 people hospitalised because of coronavirus infection found that 4.8% experienced a major adverse cardiovascular event during the five months after discharge, three times the rate seen in the control group; a review of several studies that looked at the echocardiography results of patients three to six months after infection with covid-19 reported that, on average, 40% of affected individuals displayed diastolic dysfunction; finally, a review of medical records of those diagnosed with covid-19 within the US Veterans' Health Administration (VHA) estimated an average of 45 more cases of negative cardiovascular outcomes per 1,000 such patients in the year following infection than would normally have occurred.
- **The severity of covid-19 infection correlates with greater danger of CVD sequelae, but even mild cases raise risks.** Perhaps predictably, those most affected by acute covid-19 more often suffer from further issues later on. The previously noted VHA study reports that, for every 1,000 patients treated in an intensive care unit for covid-19, 314 more suffered a negative cardiovascular event within a year than would normally have done so. That said, cardiac sequelae are not a problem restricted to those with the most severe covid-19. As one expert told our researchers, the heart risks for anyone who experienced the infection "are still raised and non-trivial."

Beacon II: The implications of the pandemic response for CVD

- **Limited capacity of overworked health systems and patient fear both impeded delivery of various forms of CVD-related care, in turn increasing immediate mortality and driving longer-term risk.** Nearly a year after the pandemic began, the World Health Organization (WHO) continued to report widespread disruption in blood-pressure management and emergency cardiac treatment. The most common explanations were the need to shift resources to covid-19 care and patients staying away from health facilities for fear of infection. This phenomenon took varying forms at different levels of care:

  - **CVD emergency care:** Reports from Italy, Germany and the UK indicate that the number of people presenting with myocardial infarction or stroke during the pandemic, or at least its initial stages, fell steeply compared with earlier comparable periods. In certain locations the decline was between 40% and 50%. Some people may have died because of covid-19 before having a major adverse cardiac event, but signs are that others simply did not get timely help. In central Germany, for example, deaths from cardiac conditions, pulmonary embolism and stroke collectively rose by 7.6% during the 2020 lockdown compared with the same period in 2019. Our experts tell us that patients are now presenting with signs of having experienced recent major CVD events without treatment, leaving them at elevated risk of further problems.

  - **CVD management:** Ongoing CVD care also saw a tremendous drop during the pandemic. Cancellation of elective surgery and other procedures was commonplace: to cite just one example, cardiac structural interventions in Spain dropped by 81% in the weeks after the pandemic began. Cardiac imaging and cardiac rehabilitation also occurred less frequently: in France and Italy, 66% and 80% of rehabilitation providers respectively reported disruption. As with emergency care, this hiatus has worrying implications for risk: one expert warned us that missed care "will probably translate, sooner rather than later, into…heart attacks and strokes."
  - **Diagnosis and risk-factor management:** Health systems focused on covid-19 saw much lower levels of CVD diagnosis, let alone provision of appropriate lifestyle advice to patients. The year-long suspension of the health checks in England's National Health Service (NHS), for example, likely led to around 400,000 cases of high blood pressure not being identified. Our experts report that, given the impact that intervention at this stage can have on long-term CVD outcomes, failure to act during the pandemic is likely to have an even more negative legacy than reductions in emergency care and CVD management.

- **Lifestyle changes, especially during lockdowns, raised overall CVD risk.** Lockdowns during the pandemic were public health measures, but they had their own dangers. Although some individuals adopted healthier lifestyles while in such situations, on balance the impact was negative. In particular, tobacco consumption rose, in certain cases within specific groups, but in others the increase seemed to be more widespread, as in France. Similarly, alcohol consumption and problem drinking also grew. Overall, German 2020 alcohol sales were up by 3.3% over 2019, and UK ones by 4.5%.

Beacon III: The knock-on effects of long covid

- **Long covid describes the still poorly understood but sometimes common sequelae of covid-19 infection.** Understanding long covid remains a work in progress. For now, it is clear that an as yet uncertain proportion of those recovering from acute infection suffer from a range of subsequent symptoms. No other explanation except earlier covid-19 infection exists. Common sequelae include fatigue, disturbed sleep and shortness of breath, but covid-19 also correlates with an increased risk of certain types of mental illness and diabetes.

- **Certain common manifestations of long covid, while not themselves cardiovascular diseases, increase the risk CVD for those affected.** Shortness of breath (dyspnoea) is associated with greater risk of heart failure and myocardial infarction; over half of people with diabetes eventually die from some form of CVD; individuals affected by anxiety and depression have a higher risk of developing CVD. The general health challenges arising from long covid could, in due course, increase the CVD burden.

Three first steps in mounting a response

In response to the threat of CVD associated with covid-19, each health system will need to make its own specific adjustments. However, several measures would be widely beneficial:

- **Better strategy.** For the past two years, officials have concentrated on the immediate challenge of covid-19. As a result, care in other areas has been reduced or delayed. While a necessary measure in the short term, countries have built up a backlog of unfinished treatments and increasing health risks. This emergency-driven narrow focus is unsustainable, but in many countries, planners are still paying more attention to communicable disease preparedness than to NCD care. Instead, officials need to look at the entire health burden and shape provision accordingly. They also must make sure that, in getting ready for future pandemics, planning goes beyond dealing with the pathogen of immediate concern to consideration of how to keep the entire health system functioning.
- **Better information.** We still know too little about covid-19's sequelae, including how to prevent and treat them. No substitute exists for the hard work of further research to inform more effective health policy.
- **Better tactics.** The pandemic and attendant lockdowns forced any number of changes in care provision. Health systems should consider which of these temporary expedients proved themselves as good as, or better than, business as usual. The most obvious candidate is the large increase in remote consultations. Best practice for these meetings remains to be determined, but their benefits—including lower cost and patient popularity for some kinds of meetings—make them worth pursuing. Meanwhile, at-home cardiac rehabilitation and blood pressure self-monitoring both appear to be improvements over previous offerings that involved patients going to medical facilities.

Introduction: Worrying signals for CVD in Western Europe

Given that it is a pandemic that has grabbed the world's attention for nearly two years, we know frustratingly little about some aspects of covid-19. The direct impact has certainly been large, but even here precision is lacking. Cumulatively, from the pandemic's arrival in 2020 to the end of 2021, the world saw 288m confirmed cases of covid-19, equivalent to more than 3.5% of the global population. In the same period, 5.4m deaths were attributed to the disease.[1] In comparison, tuberculosis, the next leading infectious killer, took 1.5m lives in 2020.[2]

However, these figures are certainly underestimates. The frequency of asymptomatic cases and limited testing capacity—a universal problem in early 2020—mean that the actual number affected is far higher.

Among those who develop covid-19, individuals with cardiovascular disease are up to 3.9 times more likely to experience severe symptoms and up to 2.7 times more likely to die than peers without CVD.

Similarly with mortality, during 2020 and 2021 combined, The Economist estimated in January 2022 that 18.8m more people died than would have been expected to in the absence of the pandemic, 13.4m more than the number of confirmed covid-19 deaths alone.[3] Some of this additional toll will have been due to the disease itself, but how much is unclear.

Exacerbating health-system burdens have been the widespread, deleterious short- and long-term effects of covid-19 on any number of human organ systems. This study focuses on the multi-faceted, complex relationship between humanity's biggest current infectious killer and today's deadliest condition of any kind—cardiovascular disease (CVD). Certain links stood out from the start. Already in March 2020, Chinese researchers warned that underlying CVD resulted in poorer covid-19 outcomes among patients at their hospital in Wuhan.[4] This was no fluke. Soon, notes Katherine Thompson, head of CVD Prevention Programmes at Public Health England (PHE), "a fair bit of literature was out there demonstrating higher levels of mortality from covid-19 amongst people with underlying cardiovascular health conditions." PHE commissioned a large meta-review of this research. It found that, among

those who develop covid-19, individuals with cardiovascular disease are up to 3.9 times more likely to experience severe symptoms and up to 2.7 times more likely to die than peers without CVD.[5]

Eventually, vaccine-induced and naturally acquired immunity should transform covid-19 from a pandemic to an endemic contagion. For CVD, though, the threat looms of longer-lasting, covid-driven health challenges. Infection by the virus is strongly associated with increased CVD risks and the likelihood of negative outcomes over time.

The problem with being more specific is that, as yet, published data examining these links often have notable weaknesses. Two relevant literature reviews from 2021 point out that most available studies suffer from a substantial risk of bias.[6, 13] Meanwhile, optimal research strategies in this field remain far from settled. For example, when considering the impact of covid-19, what should be the characteristics of members making up appropriate control groups? Does it make more sense to look at those who have been completely healthy, those who have experienced another infection (such as pneumonia) or those with certain CVD risk factors common in the population? Meanwhile, even the term "long covid", as discussed in a later section, lacks a universally agreed definition.

In many important areas related to longer-term impacts of covid, says Amitava Banerjee, a cardiologist and professor in clinical data science at University College London, "we are still just scratching the surface." Indeed, amid

the burden that the pandemic has placed on health systems and medical researchers, certain key questions remain to be examined. For example, Nishi Chaturvedi, professor of clinical epidemiology (cardiometabolic disease) at University College London, notes that it is reasonable to assume that vaccines against covid-19, by preventing infection in some cases and reducing its severity in others, are likely to diminish the risk of a negative aftereffects, "but we still need to do that analysis to see" for certain.

On the one hand, this paucity of hard information calls for humility in forecasting. "When you don't have reliable data, you should make it clear to the public," says Salvatore De Rosa, associate professor of cardiology at Magna Graecia University in Catanzaro, Italy. "We are trying to understand [the situation] better." On the other hand, the available information is not merely uninterpretable static: "Sometimes we have something which may be difficult to follow, but a signal is there," says Dr De Rosa.

Indeed, the growing, yet incomplete, knowledge of covid-19's effect on CVD is consistent enough to send a strong warning that is made more pressing by the increasing proportion of the world's population who have had the virus. Health policymakers are in a situation akin to that of a medieval ruler who sees warning beacons lit in the distance: we know that serious danger is at hand, even if its scope and nature are not fully clear. We should therefore look at how to prepare, even as the challenge comes into sharper focus.

This Economist Impact study, sponsored by Daiichi Sankyo Europe, looks at the current evidence of the impact of covid-19 on CVD risks and outcomes, as well as at broad first steps to address these dangers. It will focus on Western Europe—in particular France, Germany, Italy, Spain and the UK, where to date between roughly 9% and 21% of the population, at a minimum, have had the infection. When helpful, it will also bring in evidence from other countries, in particular the US.

Beacon I: The impact of the virus on CVD-related risks

Negative health affects after recovering from a disease—sequelae, to use the formal term—are common. They can be mild, such as short-term tiredness after recovery from a cold, or more lasting and serious. To use a cardiac-linked example, rheumatic fever can cause rheumatic heart disease, a permanent condition responsible for about 4% of disability adjusted life years attributed to CVD in Sub-Saharan Africa.[7]

Two of covid-19's close relatives—severe acute respiratory syndrome (SARS) and Middle East respiratory syndrome (MERS)—are implicated in the appearance, after recovery, of various forms of thrombosis.[8] It thus came as no surprise when, as Ms Thompson reports, an evidence review published by PHE highlighted emerging evidence in 2020 that cardiovascular complications occurred in individuals hospitalised with covid-19; but at that time there was no evidence that these heart problems went beyond this acute phase. However, growing evidence from the past two years points to a significant, longer-term rise in CVD-related risks.

The available information is neither exhaustive nor derived using consistent methodologies, but it all raises similar red flags. Examples from our Western European countries of interest illustrate the range of research. A small Italian study looked at 143 patients previously hospitalised with covid-19. Two months after the onset of infection, 22% still experienced chest pains.[9] Meanwhile, a single-centre German study examined imaging tests of patients roughly two to three months after recovery from covid-19.

It found that 60% had "ongoing myocardial inflammation ... independent of pre-existing conditions, severity and overall course of the acute illness."[10] In the UK, a cohort analysis compared nearly 50,000 people who had been hospitalised with covid-19 and a similar group that had been in hospital for other reasons. Within five months of discharge, 4.8% of those experiencing covid-19 had experienced a major cardiovascular adverse event—a composite outcome including heart failure, myocardial infarction, stroke and arrhythmia. This figure was three times that of the control group of matched individuals from the general public.[11] Meanwhile, the UK Office of National Statistics regularly publishes survey data on the self-reported experience of covid sequelae (or long covid). Of the country's entire population 2%, or 1.3m people, say that they have at least one symptom. Within this group, 13% report experiencing chest pains and 12% palpitations.[12]

These reports give a flavour of the range of data appearing. Each study has limitations, be it size, lack of control group, breadth of analysis or use of self-reported data. As with much medical research, these reports should be seen not as individually definitive but as contributions to a bigger picture.

Several systematic literature reviews of global publications have tried to sketch out what we can see in the collective mosaic of medical research output. One such overview, appearing in May 2021, looked at 43 studies, including 26 from our focus countries. Of the total body of research, six publications lent themselves to conducting a CVD-related meta-analysis. It found that 17% of former covid-19 patients experienced chest pains or tightness more than 12 weeks after recovery.[13] Another review, published in September 2021, looked at 35 studies of cardiac sequelae that collectively covered over 50,000 former covid-19 patients. The vast majority had been hospitalised while infected.[6] Most of this research found heart-related issues. Across the 20 articles that reported specifically on post-acute cardiac symptoms, 14% of patients overall experienced chest pains and 8% palpitations.

In the second review, most studies (29 out of the 35 included) used objective clinical assessments. The leading problems after three to six months are in Table 1. The figures suggest that elevated CVD risk is more widespread than patient-reported symptoms indicated.

Table 1: Common cardiac abnormalities found three to six months after covid-19 infection in studies

Cardiac abnormality	% of patients
Diastolic dysfunction (among patients in echocardiography studies)	40%
Reduced left ventricular global longitudinal strain (among patients in cardiac magnetic resonance imaging (CMR) studies)	30%
Elevated N-terminal proB-type natriuretic peptide (NT-proBNP)	18%

Source: Ramadan et al. 2021[6]

Finally, a US study gives the most comprehensive look at the impact of covid-19 on long-term health in general, including on cardiovascular systems.[14] It draws on extensive data from the country's largest integrated care provider, the Veterans' Health Administration (VHA), which cares for former active-duty military personnel. The research compared over 70,000 patients diagnosed (but not hospitalised) with covid-19 with a control group of nearly 5m people not diagnosed with the disease. In general, it found that members of the covid-affected group were more likely to require a wide range of health services during the period beginning 30-days post-recovery and lasting until the end of follow-up monitoring. On average, the latter took place four months after recovery.

Of relevance to our study, those who had experienced covid-19 were statistically more likely to have a range of CVD-related issues. Table 2 shows the excess burden per 1,000 covid-19 patients. As it indicates, in the four months after recovery, a group of this size would see, for example, anywhere from four more heart failures to 15 more cases of hypertension.

Table 2: Burden of post-acute sequelae of covid-19
(Excess burden per 1,000 patients with covid-19 of selected incident diagnoses and laboratory abnormalities ascertained from 30 days after infection until end of follow-up at six months after diagnosis)

Cardiovascular conditions	
Hypertension	15.2
Chest pain	10.1
Cardiac dysrhythmias	8.4
Circulatory signs & symptoms	6.7
Coronary atherosclerosis	4.4
Heart failure	3.9
Cardiovascular-related laboratory abnormalities	
Triglycerides >150mg/dl	9.9
Low density lipoprotein >130mg/dl	9.5
Total cholesterol > 200mg/dl	9.4
Prothrombin time >14.7s	3.0
International normalised ratio >1.2	2.9
Partial thromboplastin time >36.5s	2.7

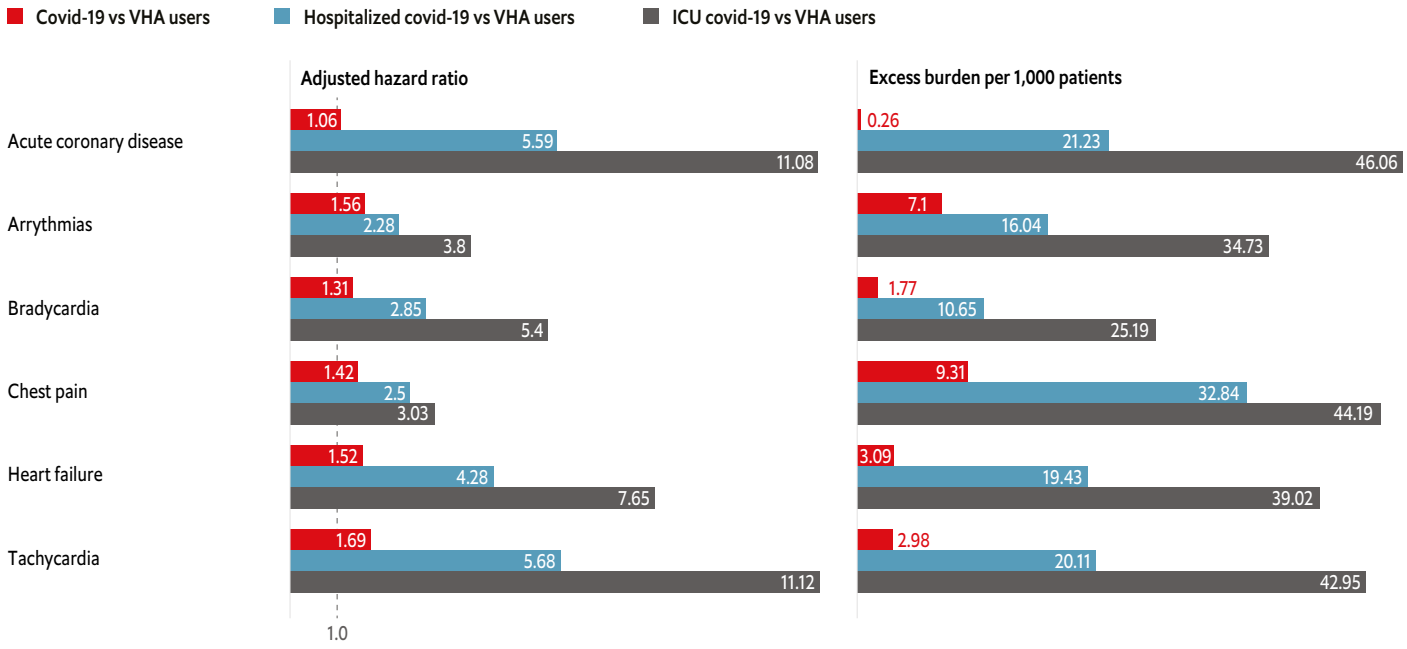
Source: Al-Aly et al. 2021[14]

The report also compared 13,654 patients who had been hospitalised with covid-19 with 13,997 individuals who were admitted for influenza. The median follow-up was five months. The covid-19 group had a higher burden of cardiovascular disorders than the influenza group; for example, 17.9 more people were experiencing circulatory signs and symptoms per 1,000 patients.

Finally, the authors examined the link between the severity of one's experience of covid-19 and the risk of cardiovascular sequelae in the six months after diagnosis. To do so, as a proxy for severity, it divided recovered covid-19 patients into three groups: those not hospitalised, those admitted to hospital but not put into intensive care and those who did spend time in such a unit (ICU). As Figure 1 shows, both the risk of a given negative cardiovascular outcome and the excess burden per 1,000 patients rises markedly with covid-19 severity. For example, those who spent time in an ICU with covid-19 were 7.7 times more likely to experience heart failure in the six months after diagnosis than people who avoided covid-19, and five times more likely to do so than people with covid-19 who were not hospitalised.

Figure 1: Risk of and excess burden of cardiovascular sequelae in the six months after diagnosis, by covid-19 severity.

(Adjusted hazard ratio shows how risk of an event in each covid-19 severity group during follow-up compares with risk among the group without covid-19. A hazard ratio of 1 indicates equivalent risk and >1 indicates higher risk in the covid-19 group.)



Source: Al-Aly et al. 2021[14]

A follow-up study by the same team found, a year after infection, an excess burden of 23 major adverse cardiovascular events per 1,000 covid-19 patients, and of 45 for any negative cardiovascular outcome. Among those whose infection has been serious enough for admission to an ICU, those figures rose to 136 and 314 respectively.[15]

As with all the research considered in this section, even these large studies are far from the last word: VHA patients, for example, tend to be older than the population as a whole and predominantly male. Nevertheless, the sheer collective weight of all these publications point to two important conclusions about the effect of covid-19 on cardiovascular health. First, as Dr Banerjee says, "studies have shown quite convincingly that, the more severe the disease, the greater the cardiac risk, in the medium term at least." Second, adds Dr Chaturvedi, "people who haven't been hospitalised with covid-19 have lower risks of certain heart conditions than people who have, but the risks for the former are still raised and non-trivial."

Put another way, the world's currently deadliest pathogen has increased the risks of the world's deadliest group of non-communicable diseases in a noticeable, if in a still imprecisely understood or measured way. Health systems will have extensive work to do in dealing with the fallout.

The world's currently deadliest pathogen has increased the risks of the world's deadliest group of non-communicable diseases in a noticeable, if in a still imprecisely understood or measured way.

Beacon II: The impact of pandemic responses on CVD

Amid the wide variety of cardiovascular conditions, one aspect of effective treatment is nearly universal—the benefit of speed. Whether a patient is presenting to a GP with high blood pressure or at a hospital emergency department with a stroke, the sooner care commences, the better the long-term outcomes. Waiting, on the other hand, not only worsens the impact of current problems, it increases the risks of worse to come. The context of the pandemic created impediments to the diagnosis and treatment of CVD and related risks. This development, given the known health costs of delay, bodes ill for the CVD burden in the years ahead.

Struggling health systems, scared patients

Barriers to effective interaction between CVD patients and health systems fall into two broad categories. The first consists of how covid-19 impeded care providers' ability to function. These begin with extensive resource demands across healthcare provision. Salvatore Brugaletta, associate professor of medicine at the University of Barcelona and a practising cardiologist, explains that in Spain, as elsewhere, "GPs stopped visits with patients because they were fully dedicated to covid." Beyond general practice, Dr Banerjee says that "in several countries, all clinicians, including research clinicians like me, were diverted to working in intensive care," leaving little time for activities not directly related to the immediate pandemic.

Meanwhile, pandemic-related changes to care protocols led to delays in treatment and shortened the time available for it.[16] They also led to shortened average stays in hospital. At the same time, the sheer volume of covid-19 patients caused issues. Dr Brugaletta points out that, because recovery pathways for even elective heart surgery typically require ICU admission, use of such beds for covid-19 care effectively blocked many such operations.

Clinicians experimented with ways to address the problem. As discussed below, remote consultations became far more common. These, though, also had an inevitable learning curve. Dr Brugaletta recalls of telephone appointments, "at the beginning, we were actually not aware how to do it, so we just started."

The second barrier was the marked fall in the number of patients showing up at medical facilities. Evidence from Germany suggests that restrictions on travel during periods of lockdown played a role in this.[17] However, declines in the use of health services usually began well before legal restrictions on activity were imposed.[18] "We saw cardiovascular patients almost disappear from our acute care ward, even though the pandemic was not hitting our region [of Italy] yet," says Dr De Rosa. "There was a kind of population reaction to the pandemic." Anna Bersano, a neurologist at the Cerebrovascular Unit of Fondazione IRCCS Istituto Neurologico Carlo Besta in Milan, had a similar experience with stroke patients. Dr Banerjee adds that, in his research, which looked at the UK, Italy and China, it was "striking" how the decline in activity coincided with the increase in covid-19 cases.[18]

The combination of increased patient reticence and reduced health system capacity had a widespread impact on every aspect of CVD care.

As Dr Brugaletta puts it, "people were scared to come to the hospital. It was seen as a place where you could get infected." Nor was this an unreasonable assumption, especially for those at added risk because of underlying CVD. It is hard to specify where, in a period of community transmission, an individual catches a disease. The best research on hospital-acquired, or nosocomial, infection rates for covid-19 comes from Wales. A study there found that during the first wave of the pandemic, 16% of individuals who tested positive for covid-19 while in hospital had been infected during their hospital stay. Moreover, this group on average had much longer stays for covid-19 treatment and a higher mortality rate (39% versus 32% for those with community-acquired infection).[19]

The combination of increased patient reticence and reduced health system capacity had a widespread impact on every aspect of CVD care. A World Health Organization (WHO) global survey found that, by the middle of 2020, 53% of countries were experiencing some covid-related disruption to their ability to provide hypertension management, and 31% to cardiovascular emergency services. Among the main reasons cited for healthcare dislocation overall were patients not presenting (76%) and insufficient staff numbers, either because staff were redeployed to deal with covid-19 (49%) or for other reasons (29%).[20] A follow-up survey, in early 2021, revealed some improvement but still substantial problems. Of respondent countries, 45% still faced disruption to hypertension management and 20% to cardiovascular emergency services. This time, 66% reported a lack of available staff as a key reason, and 57% specifically that patients were too afraid to present.[21]

What this disruption looks like, and the implications, took different forms for emergency care, ongoing CVD management and diagnosis (including of factors indicating elevated risk).

The impact on CVD emergency care

The most surprising was the drop in emergency presentations. For example, an Italian Society of Cardiology study of 54 facilities reported that hospitalisations for acute myocardial infarction fell by 48% during the period March 14th-21st 2020 compared with the same week in 2019. Even for the most damaging kind of heart attack—ST-segment elevation myocardial infarction (STEMI)—admissions declined by 27%. Admissions for less damaging, but still very serious, non-ST-segment elevation myocardial infarction (NSTEMI), were 65% lower.[22] Data from the US, China and the UK show a similar trend[18]—one consistent with the experience of all our expert interviewees. As Ms Thompson says of PHE figures, "emergency admissions really dropped off."

The situation for stroke care was similar. A study of four centres in Germany found that admissions for acute ischaemic stroke fell in two of them after mid-March 2020 (by 40% in one and by 46% in the other). Equivalent figures for transient ischaemic attack fell in three (by between 42% and 85%). The one centre that saw no reduction was in an area less affected by covid-19 at the time of the study than the other three.[17] Dr Bersano reports that, in Italy, as of December 2021, "a section of the population is still not presenting at emergency departments for haemorrhagic or ischaemic strokes."

The obvious question arises, in Ms Thompson's words: "where were those people having heart attacks and strokes, which are still happening?" Dr Chaturvedi points out that firm data remain elusive around the two main possibilities—"that covid was killing a lot of people with CVD very quickly, leaving the pool diminished, or that people were not coming forward with heart attacks because they were too frightened."

Although it may be a combination of both, clear signs exist that fear impeded presentation even for major adverse cardiac events. The Italian study noted above, for example, found that, in addition to a decline in presentation, mortality among those with heart attacks went up, suggesting that people were in worse shape when they arrived at hospital.[22] Similarly, research from Germany revealed that mortality from cardiac conditions, pulmonary embolism and stroke collectively rose by 7.6% in the central part of the country during the 2020 lockdown period compared with the equivalent weeks in 2019.[23] This is consistent with what Dr Brugaletta says of Spain: "we had a high incidence of the consequences of arriving late" such as left-ventricle rupture and increased mortality.

Not only did these delays in seeking treatment lead to higher mortality, for those who survived they have exacerbated long-term CVD risk. Dr De Rosa has noticed in his clinic more patients than before who present with complications "that are evidence of previous acute events which were not treated. We have to get back to all those patients who stayed behind." The reason is simple: this unidentified cohort are at greater danger of further CVD-related events, risks which secondary prevention interventions can reduce.

The impact on CVD management

CVD management, secondary prevention, and CVD risk management activities have suffered during the pandemic.

First, Dr Chaturvedi notes, in UK hospitals, scheduled admissions for CVD treatment were typically more likely to be cancelled than emergency ones. A study looking at all cancelled cardiac surgery in the UK between March and early May 2020, although unable to separate emergency and elective activities in its data, reported that the overall results were consistent with a projected likely decline in these activities of around 70%.[24] In a June 2020 survey of 1,400 UK adults with heart and circulatory disease, nearly half reported that it had become harder to get care since the onset of the pandemic. For 41% of that group, or roughly a fifth of all of those surveyed, a planned test, surgery or procedure had been postponed or cancelled.[25] Spanish data paint a similar picture. Within two weeks of the outbreak of the pandemic there, cardiac structural interventions had dropped by 81% and percutaneous coronary ones by 48%.[26]

In a June 2020 survey of 1,400 UK adults with heart and circulatory disease, nearly half reported that it had become harder to get care since the onset of the pandemic.

Although elective surgery does not address an immediate emergency, the impact of its cancellation can be dramatic. In Spain, a study looked at 2,158 patients with pending elective cardiac invasive procedures in 37 hospitals on March 14th, the day that the country went into lockdown and surgeries were cancelled. By April 31st, 1.7% of those patients had died.[27] Without a control group, it is difficult to say definitively how many deaths were due to delay, but these were still elective, not emergency, patients.

Meanwhile, again in the UK, a review by healthcare consultancy Carnall Farrar estimates that, during the pandemic, the NHS in England saw a decline of between 41% and 44% in different kinds of elective imaging.[28] It also notes a drop of 36% in group participation in cardiac rehabilitation (CR) programmes.[28] This may reflect patient reluctance to participate, but it did not help that, at some time point, around of half of nurses and a third of doctors engaged in CR were redeployed to deal with covid-19.[29] The UK did not have the worst performance in this area. A survey of rehabilitation providers in mid-2020 found that 49% of those in the UK had experienced interrupted delivery. The equivalent figures in France and Italy were 60% and 88% respectively.[30]

The health systems of England and Spain were not the only to struggle to manage CVD, our research simply turned up more data for the two countries. As noted above, through 2020 and into early 2021 around half of countries globally reported that management of hypertension had been disrupted.[20] Accordingly, Dr Brugaletta's warning for Spain could apply in any number of countries. "The fact that cardiovascular risk factors were not treated properly during the pandemic," he says, "will come back at some point. In five years, maybe, the number of patients coming to the hospital for acute myocardial infarction or unstable angina will boom." Similarly, Ms Thompson warns that the lack of care in these areas "will probably translate, sooner rather than later, into people having heart attacks and strokes."

The impact on diagnosis and early risk management

However widespread the declines in emergency treatment and ongoing CVD management, the drop in diagnosis—especially of important risk factors—appears to have been even greater. What Ms Thompson says of England applies widely: "Unless someone presented with symptoms, detecting new cases is likely to have stopped." The data back her up. A UK study of general practice care for a deprived population found a 43% reduction in expected diagnoses of circulatory-system diseases during the first wave of the pandemic and a 30-52% drop in new prescriptions of cardiovascular medications.[31] On a larger scale, the NHS suspended delivery of the NHS Health Check programme between March 2020 and March 2021. Ms Thompson explains that, as a result, an estimated 1.1m people who would normally have been assessed for their risk of CVD were not. This means, she adds, "we've missed about 400,000 people being identified with high blood pressure."

The UK is not an outlier. In Spain, explains Dr Brugaletta, health system use of GPs to combat covid-19 meant that "modification of lifestyle habits, like smoking, or very basic advice about food, etcetera, were not done for the general population." Dr De Rosa also expresses concern about the lack of such activity by primary care clinicians.

Indeed, this is an area of increased worry for our experts. Dr Banerjee speaks for many when he explains that "most of our impact on cardiovascular disease probably comes from treating people who have lower risk rather than just the acute presentations in hospital. We have to be looking at that end of the spectrum." Dr De Rosa adds that, however important the effect of late presentation of acute CVD cases during the pandemic, "a much larger impact is going to be expected from [how health systems have not sufficiently addressed] cardiovascular risk factors."

Box: Behaviour change during the pandemic gives mixed messages for CVD risk

The pandemic, and the social experience of it, changed people's behaviour in ways that have implications for the future CVD burden. As Dr Banerjee asks, "Are some of the increases in risk factors themselves being caused by coping with the circumstances we find ourselves in?" Concern about covid-19 in general and public health measures, such as lockdowns, induced substantial anxiety.[32] This, in turn, appears to have affected the extent of risk-laden activity.

The clearest examples are shifts to tobacco and alcohol consumption, both highly relevant to heart and circulatory health. The results were not always negative. Dr Chaturvedi points out that the situation led some individuals to "improve health-related behaviours, take more exercise, stop smoking, and other things." On balance, though, more people seem to have increased rather than decreased lifestyle-related CVD risk.

The evidence on tobacco varies by country. In Italy, 5.5% of adults quit smoking during the lockdown, but 9% started, while total cigarette consumption rose by 9.1%.[33] In France, meanwhile, more existing smokers increased consumption (27%) than decreased (19%).[34] More generally, for the first time since 2016, government data showed a higher combined proportion of occasional and daily smokers among the adult population, which grew to 31.8% from 30.4% in 2019.[35] In England, the picture was more mixed. Smoking prevalence among adults under 35 rose from 22% in August 2019-February 2020 to 27% in April-July 2020. However, among those aged 60 and over, it dropped from 10% to 8%. Across the population as a whole, it saw little change.[36] Spanish data give even more mixed messages—cigarette and cigar sales, for example, were down, but sales of rolling and pipe tobacco were up.[37]

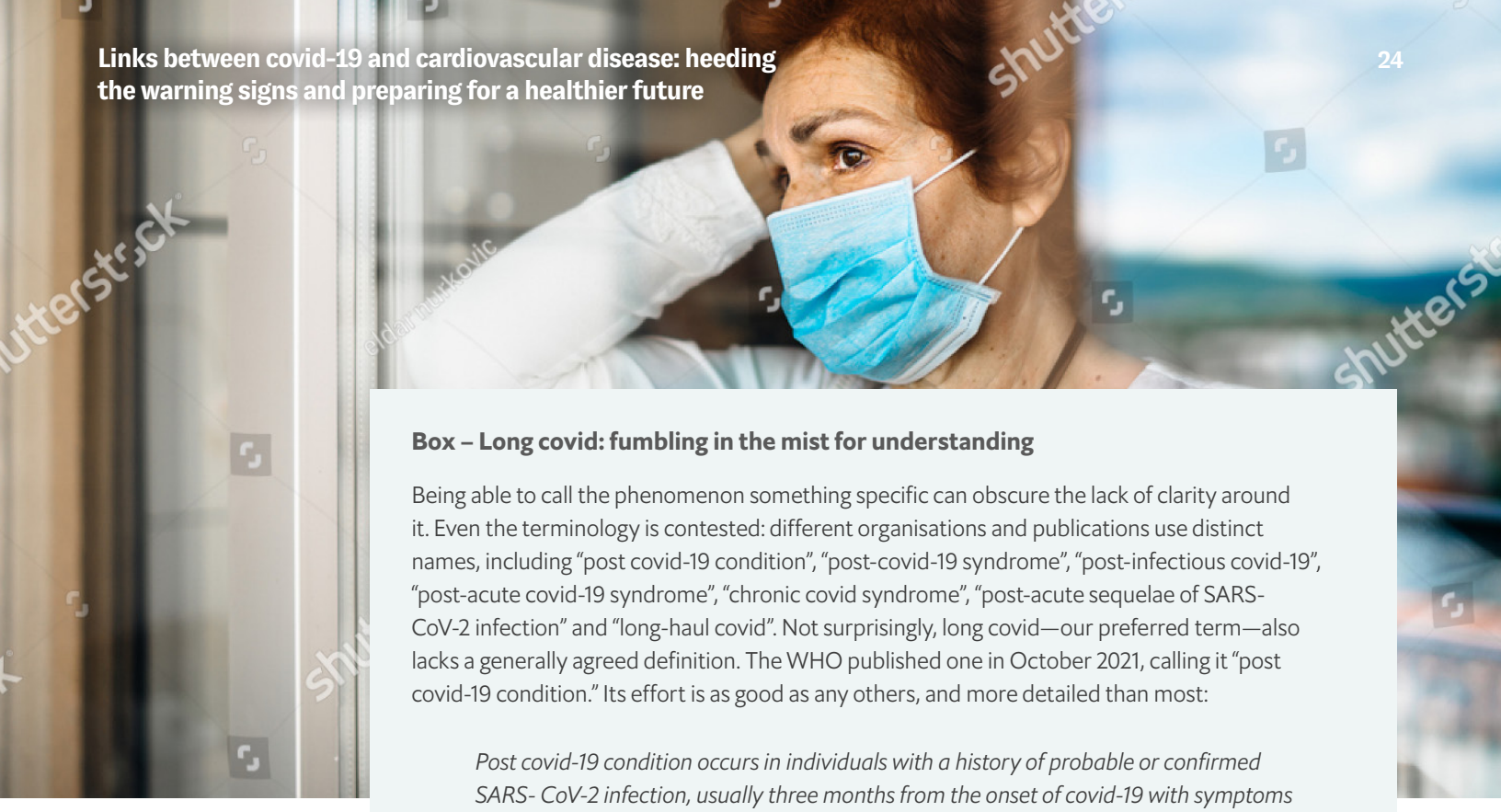
Alcohol consumption figures present a clearer picture with occasionally alarming highlights. The prevalence of high-risk drinking in England soared, from 26% of the adult population in August 2019-February 2020 to 36% in April-July 2020.[36] In a German survey, 36% of respondents increased their consumption, against 21% who drank less.[38] The net impact of behavioural changes in these countries was a noticeable increase in alcohol purchases, including a year-on-year rise of 3.3% in Germany in 2020 and 4.5% in the UK.[39] Figures from the Global Drug Survey, which covers 11 countries, present similar overall data. Of their global survey sample, 43% said that they had increased their drinking frequency since the pandemic had begun, and 25% had cut it. Similarly, 36% reported that they drank more on a typical day, compared with 22% who said they drank less.[40]

Disease burdens reflect how people live. Unless populations reverse negative changes that occurred amid the stress of the pandemic and lockdowns, it will leave a legacy of increased CVD.

Beacon III: Long covid's knock-on effect on CVD risks

Covid-19 has far more sequelae than those directly related to CVD. Indeed, the heightened cardiovascular risks and disease burden described in the previous section occur within a complex web of health issues. One or more of this wide range of problems can appear even long after recovery from symptomatic covid-19. The conditions are commonly grouped together under the term "long covid" [see box].

The heightened cardiovascular risks and disease burden described in the previous section occur within a complex web of health issues.



Box – Long covid: fumbling in the mist for understanding

Being able to call the phenomenon something specific can obscure the lack of clarity around it. Even the terminology is contested: different organisations and publications use distinct names, including "post covid-19 condition", "post-covid-19 syndrome", "post-infectious covid-19", "post-acute covid-19 syndrome", "chronic covid syndrome", "post-acute sequelae of SARS-CoV-2 infection" and "long-haul covid". Not surprisingly, long covid—our preferred term—also lacks a generally agreed definition. The WHO published one in October 2021, calling it "post covid-19 condition." Its effort is as good as any others, and more detailed than most:

> *Post covid-19 condition occurs in individuals with a history of probable or confirmed SARS- CoV-2 infection, usually three months from the onset of covid-19 with symptoms that last for at least two months and cannot be explained by an alternative diagnosis ... Symptoms may be new onset following initial recovery from an acute covid-19 episode or persist from the initial illness. Symptoms may also fluctuate or relapse over time.*[41]

Boiled down, this—like other current definitions—is as much an admission of what is unknown as a description of what is: after covid-19, some patients clearly experience a range of symptoms; where we have no other good explanation for why this occurs, covid-19 is the only cause left over; it is therefore the likely culprit. Usually left out of these descriptions is any indication of how covid-19 exacts this health toll. This kind of definition is at least progress. As one public health expert and person with the condition put it, "long covid is likely the first illness in history that has been defined by patients through social media platforms." Those affected did so because, at first, nobody seemed to be listening.[42]

Although now it is clear that some patients are affected by any number of covid-19 sequelae, researchers are only beginning to understand matters such as the extent to which various after-effects occur, who is most likely to experience them and the underlying biological or psychological mechanisms involved—let alone how best to manage affected patients. At a very basic level, estimates of long covid prevalence vary widely, with studies across the world ranging from around 33% to 96% of people originally infected. These figures are often not directly comparable, as they occur at different follow-up periods after the acute infection.[43] Nor are research findings on even basic questions always consistent. Usually, for example, those who have had more severe covid-19 symptoms are more likely to run a greater risk of sequelae. However, Dr Banerjee reports that in a study of 1,700 people at the University College London Hospital long covid clinic, those not hospitalised more often experienced poor overall health than those who had been admitted with the infection. Finally, the developing world remains a huge data blind spot.

In short, we know that long covid is a problem and can identify any number of its manifestations. But, so far, we know little else.

The CVD-related after-effects of covid-19 are part of this unfortunate package that affects some patients. This publication is too brief to discuss long covid in extensive detail, but one further aspect is relevant here: any number of the common sequelae of covid-19, even if not themselves cardiovascular conditions, raise the CVD-related risks of those affected.

A quick look at some common elements of long covid illustrates the issue. Among the most frequently reported manifestations is fatigue, with one pooled study finding that 48% of patients report experiencing it more than 12 weeks after initial infection.[13] If such tiredness lasts, it could, by impeding physical activity, have a negative effect on heart and circulatory health.[44] This is particularly a concern for those who explicitly report reduced exercise tolerance (an average of 15% of those recovering from covid-19).[45] Another common complaint is shortness of breath, or dyspnoea. According to the same pooled study, 39% of patients report having this problem after 12 weeks.[13] Dyspnoea, too, is associated with a greater risk of heart failure and myocardial infarction.[46]

This increase in mental illness may have been made worse, even among those who escaped infection, by public health measures such as lockdown.

Meanwhile, the VHA study described above finds that various other medical conditions with CVD implications are more common among those who have experienced covid-19.[14] Two of the most notable are type 2 diabetes and mental illness. Of the former, the study found that, overall, within six months of covid-19 infection, there were 8.2 more new cases per 1,000 patients than one would have expected. Among those with the most severe covid-19 infection, this rises to 58.6 more new cases per 1,000.

Over time, diabetes can often cause serious heart and circulatory problems: a global review of studies between 2007 and 2017 found that 50.3% of deaths among people with type 2 diabetes were from some form of CVD.[47] Although the publication does not provide comparative control figures, in 2019, even among individuals aged over 70, only 42% of total deaths were from CVD, while for those aged 50-69 years old—a range that includes the median figure for the diabetes study—the rate was 34%.[7]

Infection with covid-19, especially among those with the most severe cases, also appears to be related to new incidence of both clinical depression and anxiety. In the VHA study, those admitted to an ICU with covid-19 saw an additional 109.6 new cases of anxiety per 1,000 patients after six months (nearly 11%), and 88 per 1,000 of depression. Both conditions are associated, independent of other risk factors, with development of some form of cardiovascular condition: for anxiety, over half of patients develop CVD in the long term; although the data are less clear for depression, overall it seems to double the risk of developing new CVD.[48,49]

This increase in mental illness may have been made worse, even among those who escaped infection, by public health measures such as lockdown. Ms Thompson says that it is likely that covid-19 will have "quite an impact around loneliness, isolation, anxiety and stress." Dr Chaturvedi puts the implications simply: "people without [good] mental health have increased risk of cardiovascular disease. The pandemic is going to exacerbate that."

Dr Chaturvedi's words could apply to a range of sequelae associated with covid-19. Insufficient data exist to draw conclusions about the precise effect of long covid, as distinct from acute covid-19 infection, on CVD. Nor has enough time passed to tease out longer-term impacts. Once again, though, what we know is far more worrying than reassuring.

First steps in mounting a response

The CVD warning beacons are well and truly aflame. The health burden from this group of conditions is likely to grow both in the near future and the medium-term. Amid the clear warning signs, how should health systems respond?

The body of necessary changes will vary by individual health system. Nevertheless, three steps seem essential in most countries, including those of Western Europe, to minimise the CVD-related health damage that the population will face.

1. Move from crisis-driven reaction to a holistic healthcare strategy

Covid-19 blindsided health systems in Western Europe, as it did in most of the world. The resultant shift of resources to meet the immediate threat inevitably meant some degree of putting off activities designed to deal with less-imminent dangers.

The pandemic has shown repeatedly that making firm predictions about its course is foolhardy. Nevertheless, even if covid-19 takes substantial time to shift from being a pandemic to an endemic disease, the healthcare costs of too narrow a focus on it will start to mount.

The backlog for all kinds of care alone are daunting. For example, a Lancet examination of data from 61 countries found that where lockdowns occurred one in seven cancer operations were delayed, leaving a substantial pool of untreated patients.[50] In England alone, by November 2021 the waiting list for cardiac operations and procedures had risen for 17 consecutive months and included 284,000 people, 22% more than when the pandemic began.[25] As UK the health minister, Sajid Javid, told the press in September 2021, when discussing the backlog for care across the health system, "we can all understand why [it] has grown. We've had to meet the greatest public health challenge that this country has seen in living memory. And I know from speaking to other health ministers in places

like France, Germany and Italy and elsewhere that we're all in the same boat."[51] Not only will health systems have to catch up with unfinished business; as discussed above, delayed interventions have raised risks, meaning more patients in more serious condition than they would otherwise have been.

However, in addressing this challenge, resources may be constrained. The Economist Intelligence Unit expects healthcare spending per person to grow globally by 4.1% in 2022, but thereafter for the rate of growth to decrease. As a proportion of GDP, health spending is predicted to stay the same, at 10.5%.[52]

Countries will need to make strategic spending and investment decisions based on their respective health burdens as a whole.

With funds limited, countries will need to make strategic spending and investment decisions based on their respective health burdens as a whole. Unfortunately, CVD—the largest killer in Western Europe, accounting for 34% of deaths in 2019—may be getting insufficient attention.[7] For example, looking at healthcare recovery plans in France and Germany, one analysis found that, amid a focus on hospitals and communicable disease preparedness, "commitments to strengthening primary care and chronic disease management appear to be largely absent."[53] In the UK meanwhile, Ms Thompson notes that "other services are considered to be more important and are being prioritised. Cardiovascular disease isn't yet up there."

Health systems have any number of issues to address. The pandemic showed the cost of not being prepared for the return of untreatable communicable disease. This does not mean, though, that CVD has gone away. Now, as Dr Brugaletta puts it, "health policy should think about being prepared to have more heart patients in the next five years." A failure to refocus on the bigger health picture—including the burden of CVDs and NCDs more generally—will cost lives.

Another lesson of the pandemic is that such a holistic view should be used in preparing for the unexpected as well. The plans for public health emergencies implemented in response to the pandemic rarely had any consideration of how to maintain general health services. The results were predictable. "Non-communicable and cardiovascular disease management, and primary care, have not had any role in emergency preparedness," says Dr Banerjee. "These meetings are full of only virologists and other people from infectious disease. They are not fit for the kind of pandemic which has such broad effects across the health system. We should never let that happen again." If a greater range of stakeholders, and the more holistic perspective which they bring, do not feature in the discussions, health systems will be insufficiently prepared for the next pandemic—whether it occurs in a decade or a century.

2. Expand long covid research horizons

As already discussed, our understanding of covid-19's long-term impact, on cardiovascular health as well as other areas, is at a very early stage. The current literature's weaknesses reflect understandable choices about use of limited resources. Dr Banerjee says of research on the long-term impact of covid-19 treatments and patient pathways, "for nearly two years we have, as a world, focused on the acute impacts [of covid-19]. We're not looking at the long-term effects today. That's part of the prioritisation."

Certain data may not even be available. "Finding a long-term effect from a disease can be a fishing expedition," says Dr De Rosa. "It's very, very difficult. You need a very large sample to have meaningful data."[54]

This leaves health officials flying at least somewhat blind. As a December 2021 briefing for UK parliamentarians put it, "there are still a series of unknowns related to long covid that need to be addressed to adequately shape a public health response."[55] Progress is happening, but slowly. In July 2021, a global covid-19 research tracker contained 121 long covid-related projects out of a total of over 10,000 projects in its database.[56] Most of the long-covid work focused on manifestations of the condition and how they arose. Only 15 looked at possible treatments. However, the National Institute for Health and Care Excellence (NICE), which provides national guidance and advice on health and social care in the UK, says that the latter is the most pressing need in dealing with the long-term effects of covid-19.[57] Meanwhile, only a small number of the long-covid projects, 14, deal with the cardiovascular system in any way.[56]

The most high-profile development in telehealth during the pandemic has been an increased use of virtual or remote consultations

"We can't look at everything at the moment," says Dr Banerjee. "But we will need multiple studies" of the impact of long covid. Without better information, the holistic strategy that health systems require will need to rely on an uncomfortable degree of guesswork.

3. Build on lessons learned in the pandemic

The pandemic, in particular periods of lockdown, forced healthcare providers—CVD specialists included—to shift how they provided care. In particular, models that required patients to go somewhere, either to a physician's office for a consultation or to a lab or hospital for a test, no longer worked.

The most high-profile of these changes was the shift to greater telephone and online communication and interaction. Generalising here can lead to simplistic conclusions. "Digital health and telemedicine mean different things to different people," warns Dr Banerjee. "It's a catch-all term that goes from teleconsultations all the way to text messaging to remind me to go to an appointment." Elements of this body of interventions were already widely used before the pandemic: in 2019 in Germany, for example, 66% of adults used the internet over a three months period to find health information, and in Spain 60% did. Nevertheless, covid-19 gave a push even to well-established digital usage: in 2020 the equivalent figures for these countries were 70% and 67%.[58]

The most high-profile development in telehealth during the pandemic has been an increased use of virtual or remote consultations, whether by telephone or—more rarely—using video calls. The numbers are striking. In Barcelona, between March and June 2020, 68% of primary care consultations were dealt with by telephone or email, services only instituted because of the pandemic.[59] A less pronounced but longer-term shift is visible in England. During the second half of 2019 and until February 2020, the number of in-person primary care appointments with doctors hovered around 10m per month. It declined sharply once

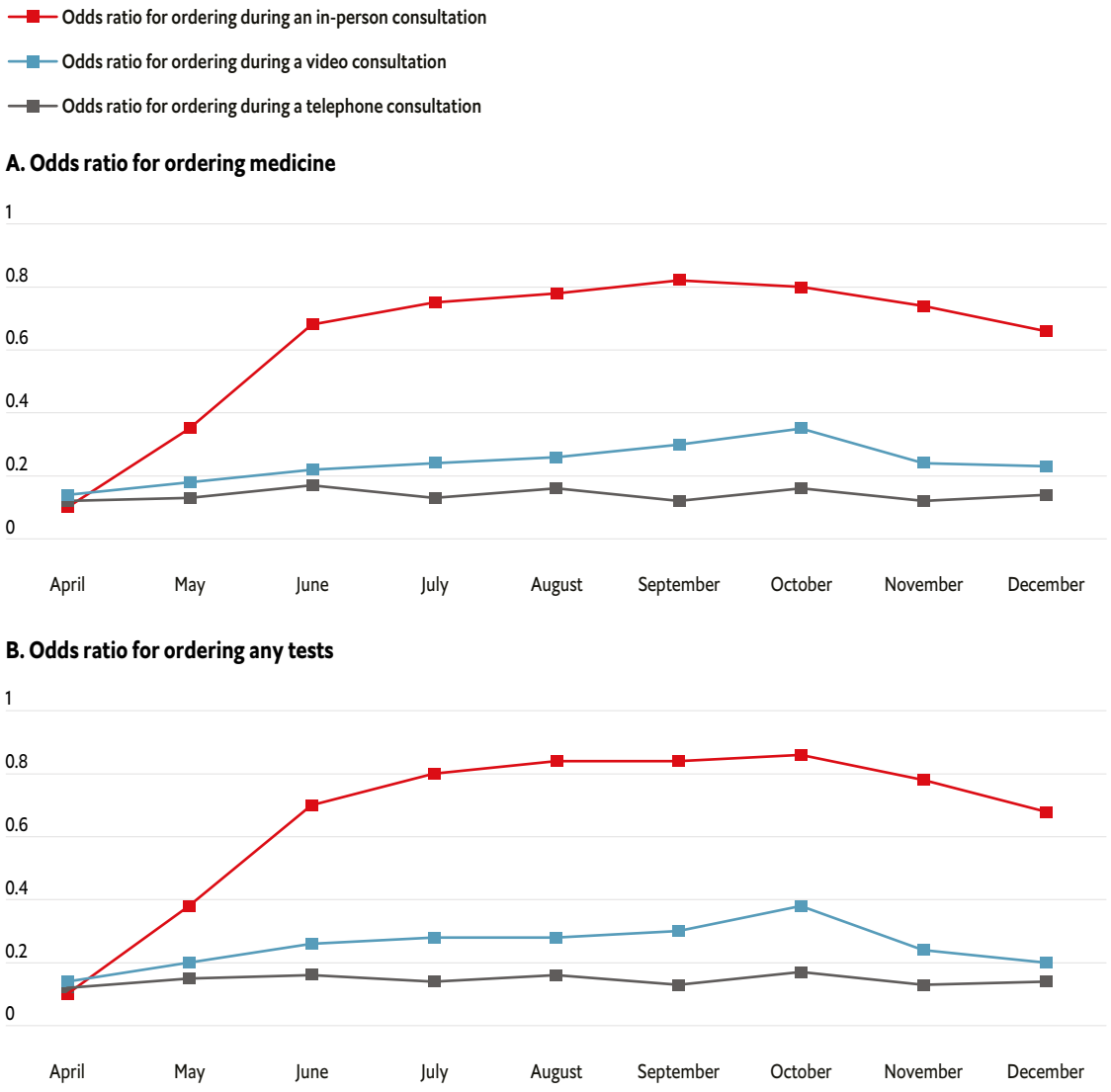
the pandemic hit, bottoming out at just over 3m in April 2020. From there it grew slowly and unevenly, reaching 7.5m in November 2021. Telephone consultations, on the other hand, were usually a little over 2m per month before March 2020, but by July that year had hit around 7m, where they have continued to hover even as the number of in-person appointments have risen.[60]

Less information exists for virtual cardiac consultations, but they also show marked change. In the short term, data from a Scottish district hospital show that, while all CVD referrals led to face-to-face consultations before the pandemic hit, by April and May 2020, about three-quarters of such meetings were by telephone.[61] The best currently available longer-term information comes from a recent US study. It compared all ambulatory cardiac visits to a large Los Angeles health system in April-December 2020 with those during the same period of the preceding year. Every 2019 visit was in person, whereas those in 2020 included 10.6% that took place on the telephone and 5.3% by video.[62] It is likely that the European Society of Cardiology's strong encouragement in early 2020 of the use of telemedicine during the pandemic, especially for vulnerable groups, led to a rise in such appointments in that region as well.[63]

The pandemic showed that health systems and patients could interact remotely on a large scale. But is it a good idea to continue? Virtual environments appear to affect care decisions. In an Irish study, cardiac clinicians were more likely to change medications or other management of treatment at face-to-face encounters (39% of visits) than during telephone ones (20%). They were also more likely to order further tests when seeing someone in person (56% to 39%).[64] Similarly, the Los Angeles study cited above found that, while all test ordering and prescribing activity per patient declined in 2020 compared with 2019, the odds of either taking place at in-person appointments were markedly higher than for video ones, which, in turn, were greater than for telephone consultations [see Figure 2].[62]

Figure 2: Odds of ordering medications or tests in cardiology clinic visits during the covid-19 pandemic compared to pre-pandemic, according to visit type.

(The odds ratio [OR] shows how odds in each month in 2020 compared with odds in the same month in 2019. An OR of 1 indicates equivalent odds and <1 indicates lower odds in 2020.)



Source: Yuan et al. 2021[62]

However, both articles note that without outcomes data it is impossible to say whether this lower level of activity provides better or worse care. A 2021 rapid review of 12 trials and seven systematic reviews—for which the underlying research took place between 1990 and 2018—begins to fill that void. It found that virtual appointments had outcomes that were either not inferior in statistically significant ways or, in some cases, were better at reducing hospitalisations and visits to emergency departments in CVD patients. However, the authors did stress that more research was necessary to see when virtual and in-person meetings had superior outcomes.[65]

Any differences between in-person and virtual interaction do not appear to put patients off. In Dr Brugaletta's experience, "they like telephone appointments because you maintain some interaction with the doctors but you're not at the hospital", and do not have to spend time travelling back and forth. Various surveys also find that patient satisfaction is similar to that for in-person meetings, and that greater convenience and lower cost were notable advantages. However, patient attitudes vary depending on the purpose of a given consultation.[18, 66,67]

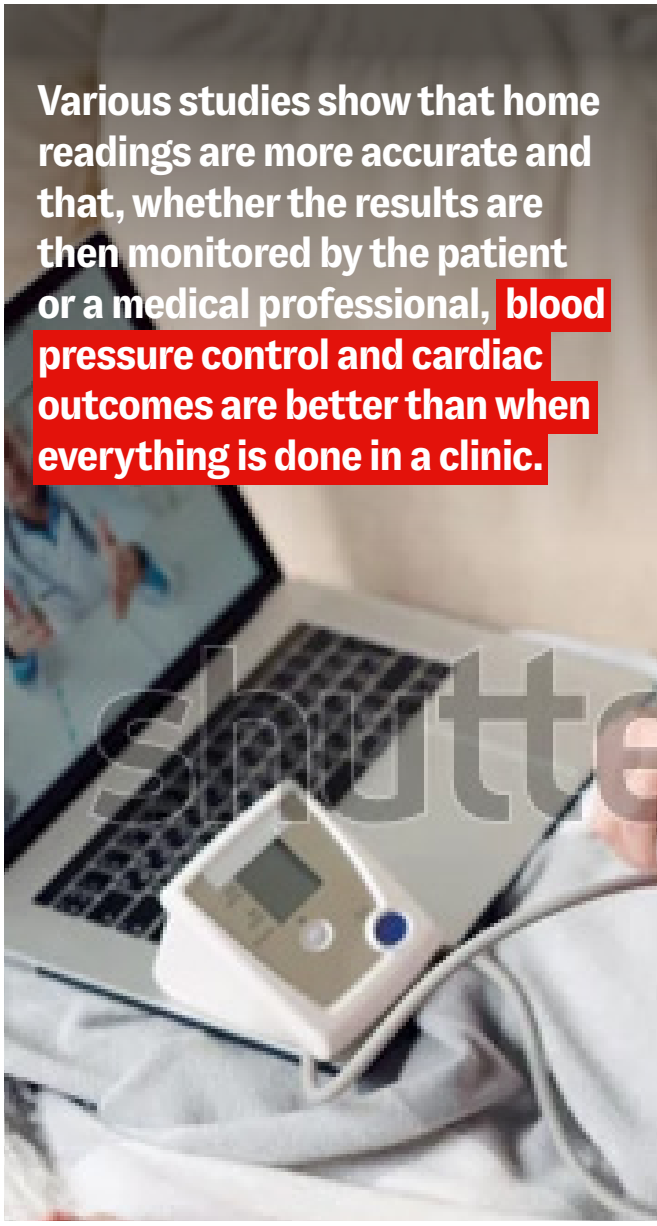
Another issue related to remote appointments is concern about whether they would harm groups who are assumed to have less access to, or are less able to use, communication technology. The Irish and US studies cited earlier provided some initial reassurance. The former found no difference in age between those using remote and in-person interaction.[64] The latter showed that, contrary to other US research, members of minority racial groups were more likely to use telephone and video consultations than white people.[62] Even though we should not assume that certain individuals or groups will fail to adapt to new technologies, inevitably some people will find it impossible to do so. Accordingly, as Dr Banerjee says, "we should have a digital-first rather than a digital-only policy."

The bottom line is that, in Dr De Rosa's words, "we don't have best practices, yet." Greater use of remote patient interaction holds great potential. Now is the time to figure out how best to use it. "It is something that we should have done before, but we didn't," says Dr Brugaletta. "Now, with the pandemic, everything has accelerated."

He adds that expanded application of information technology in CVD care should not stop there but "we should do even more. We need to go to the next level." Here, the pandemic experience points to two particularly promising areas.

The first is cardiac rehabilitation (CR). Traditionally a group-based activity conducted in a medical centre, CR faced substantial disruption during the pandemic. In England in 2019, the proportion doing rehabilitation programmes entirely from home was 16%; in 2020, it rose to 76%.[29] This is likely to improve rather than undermine results. Substantial research shows that home-based CR has better outcomes: one literature review of 30 trials found that its risk ratio of rehospitalisation or cardiac events was just 0.56 when compared with group-based CR programmes.[68] A home-based approach also may, by making the service more convenient, increase uptake of any CR—a perennial challenge. As a team of Canadian clinicians said, here covid-19 presented "an opportunity to promote a major shift in CR programmes with the use of telemedicine to advance the health of a larger number of individuals with cardiac disease."[69]

Similarly, during the pandemic, taking one's blood pressure at home became a far easier option than having it done in person during an appointment with a clinician. Various studies show that home readings are more accurate and that, whether the results are then monitored by the patient or a medical professional, blood pressure control and cardiac outcomes are better than when everything is done in a clinic.[70] Health systems are taking note. In November 2021 the NHS began handing out 220,000 monitors to people in England with hypertension. The expectation is that this programme will prevent 2,200 heart attacks and 3,300 strokes in the coming five years.[71]



During the pandemic, health systems underwent a huge, forced experiment in modes of care. They should make sure that they benefit from the results where possible.

Conclusion: Forewarned is forearmed

There is no doubt: the pandemic is driving higher CVD risks. Covid-19 itself correlates with a variety of heart and circulatory diseases, as well as major adverse cardiac events, during the months after recovery from the original infection. Our experience is still too short to know when, if ever, these risks abate. The drop in levels of CVD care as a result of the pandemic—be it emergency treatment, ongoing disease management, diagnosis of CVD itself or addressing heightened risk factors—was substantial. So too will be the impact, with some patients already dying within months of cancelled elective procedures. Finally, amid the various sequelae that make up long covid, conditions from fatigue to diabetes and anxiety, even while not forms of CVD themselves, bring increased dangers down the road. Although it is currently impossible to quantify the aggregate risk properly, health systems need to be prepared for a greater number of CVD cases than they expected to face before covid-19 appeared.

The best specific response will vary by country, but in Western Europe—as in much of the world—three improvements must shape the response against the threat of higher CVD risk.

- **Better strategy:** For the past two years, countries have largely, and understandably, focused on the single dominant challenge of covid-19. Efforts against other conditions, including CVD, cannot be reduced indefinitely without paying an increasingly high price in human suffering and lives. Instead, countries need to shape their health service offerings around a holistic appraisal of the entire health burden that they face—including both communicable and non-communicable diseases.
- **Better intelligence:** Advances against covid-19 have been far more rapid than against any similar threat in the past. Nevertheless, our knowledge of many aspects of this disease remains basic. In particular, we need far more extensive research into long covid, the dangers that it poses and how best to prevent or treat them.

- **Better tactics:** The pandemic forced experimentation with a range of models for delivering CVD care, using information technology at an unprecedented scale. The potential benefits of remote consultations are clear, but potential problems are also apparent. Now, health systems need to determine best practice to achieve optimal results. Meanwhile, home-based care for cardiac rehabilitation and blood pressure monitoring have already been shown to be beneficial. Care providers need to lock in the transformations in these areas brought about by the pandemic.

In CVD, the old normal will not return, but this is not a disaster. Medicine, by doing what it has always done, can identify the changing challenges that human populations face and expanding the tools available to treat them. Covid-19 will be a turning point, but it can take the road toward a world with better CVD care.

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ECONOMIST IMPACT

LONDON

20 Cabot Square
London, E14 4QW
United Kingdom
Tel: (44.20) 7576 8000
Fax: (44.20) 7576 8500
Email: london@eiu.com

GENEVA

Rue de l'Athénée 32
1206 Geneva
Switzerland
Tel: (41) 22 566 2470
Fax: (41) 22 346 93 47
Email: geneva@eiu.com

NEW YORK

750 Third Avenue
5th Floor
New York, NY 10017
United States
Tel: (1.212) 554 0600
Fax: (1.212) 586 1181/2
Email: americas@eiu.com

DUBAI

Office 1301a
Aurora Tower
Dubai Media City
Dubai
Tel: (971) 4 433 4202
Fax: (971) 4 438 0224
Email: dubai@eiu.com

HONG KONG

1301
12 Taikoo Wan Road
Taikoo Shing
Hong Kong
Tel: (852) 2585 3888
Fax: (852) 2802 7638
Email: asia@eiu.com

SINGAPORE

8 Cross Street
#23-01 Manulife Tower
Singapore
048424
Tel: (65) 6534 5177
Fax: (65) 6534 5077
Email: asia@eiu.com