Cardio vascular disease and COVID-19

Recovering cardiovascular disease diagnosis and treatment from the COVID-19 pandemic

March 2021

Executive summary

The burden of cardiovascular diseases (CVD) is huge in the UK. Approximately 7.6 million people in the UK are affected by CVD, which accounts for approximately 164,000 deaths per year. COVID-19 has substantially impacted CVD management across the board, including prevention, referrals, diagnosis, treatment and rehabilitation. In particular, **health checks** have dropped by 97%, which is a significant indicator of a decrease in screening and prevention, and consequently, to the initiation of preventative medicines, especially statins. While the shift to virtual appointments has been celebrated, **in-person primary care attendance** has decreased by 42%, which has significant implications on procedures that traditionally need in-person presence, such as measuring blood pressure and performing pulse checks. **CVD referrals** have also dropped by 43% which means that patients are not being referred for further specialist opinion. Indeed, this disruption has affected CVD services across the pathway, with a 19% to 45% reduction in **elective procedures**, a 41% to 44% drop in **elective imaging**, a 53% decrease in **emergency admissions**, and 36% drop in **cardiac rehabilitation** group exercise.

However, the disruption to acute services has had no impact on the ability to treat acute strokes and heart attacks. This includes maintaining the ability to conduct scans and thrombolysis within an hour, as well as providing access to a stroke nurse and to a stroke consultant within 24 hours. Therefore, when people have presented with a stroke or a heart attack, the quality of care does not appear to have been affected. However, for milder strokes or similar symptoms, 29% of patients delayed seeking medical attention. Additionally, 33% of clinicians indicated that there had been a reduction in rehabilitation and 39% of survivors from strokes in 2020 indicated they were not receiving enough therapy. This poses the risk of grave consequences on morbidity and disability. Nonetheless, some positive changes have emerged due to the COVID-19 pandemic. A number of innovations have been observed across the CVD pathway, such as a shift to virtual appointments, an increase in early supported discharge for scope, a shift to virtual rehabilitation, an increase in staff sharing, enhanced staff communication, and improved data availability. These innovative practices contribute to enhancing efficiency, team work, patient access to care, and decision-making, and as a result improving patient outcomes.

The disruptions to the CVD pathway are likely to have impacts on patient outcomes. Our analysis has shown that due to the missed activity, up to **470,000 patients** will not have been started on statins, anticoagulants, other cardiovascular drugs or diabetes drugs, using data from IQVIA, although given patients can be initiated on multiple therapies at once, this may be an overestimate.[1] As a result, **12,000 future heart attacks or strokes** that could have been preventable might occur. Additionally, the delays in diagnosis could result in **23,000** missed heart failure diagnoses, **between 16,000 and 57,000** missed atrial fibrillation diagnoses, and **around 26,000 to 90,000** missed coronary heart disease diagnoses. The hardest consequence has been a **6% increase in excess mortality**, out of which 4 in 10 had COVID on the death certificate. In all other diseases, excess mortality has fallen—in part because COVID deaths have claimed people who would have ordinarily fallen from other disease. The fact that CVD stands out with this excess mortality suggests that it is due to the impact of the disruption described above. This would be equivalent to **over 5,600 excess CVD deaths last year** in the period of March to the end of December 2020, a pattern in contrast to most other disease areas that had lower than expected deaths. These additional deaths are equivalent to more than **£42 million in net economic loss** to the system based on the lost economic contribution of working age and employed patients.

What needs to be done to address this now? The obvious answer is the recovery of services, which will be a major undertaking. This would entail recovering **GP services**, **elective services**, and **diagnostic capacity** – especially echocardiograms – as well as strengthening stroke and cardiac **rehabilitation**. This recovery needs to be run in parallel with the embracing of innovation to its full potential. This should include a move to more effective digital solutions beyond telephone and greater provision of real-time data that can lead to improved responses to emerging healthcare challenges.

This article, sponsored by Bristol Myers Squibb considers the challenge in relation to cardiovascular disease (CVD) – the UK's leading cause of death.[2]

Context

Cardiovascular diseases (CVD) include all diseases of the heart and circulation, including myocardial infarction (heart attack), heart failure, atrial fibrillation, coronary heart disease (or ischemic heart disease), and stroke. These diseases are inter-linked and varied, and include both chronic and acute conditions, but the majority of CVD care is delivered in primary care.[3] There are 7.6 million people living with CVD in the UK. CVD causes 164,000 deaths per year in the UK, accounting for 27% of all deaths.[4] Out of those, coronary heart disease accounts for around 38% of CVD deaths, and stroke for around 22%.

Figure 1. Cardiovascular disease prevalence, deaths and healthcare cost in the UK[4]

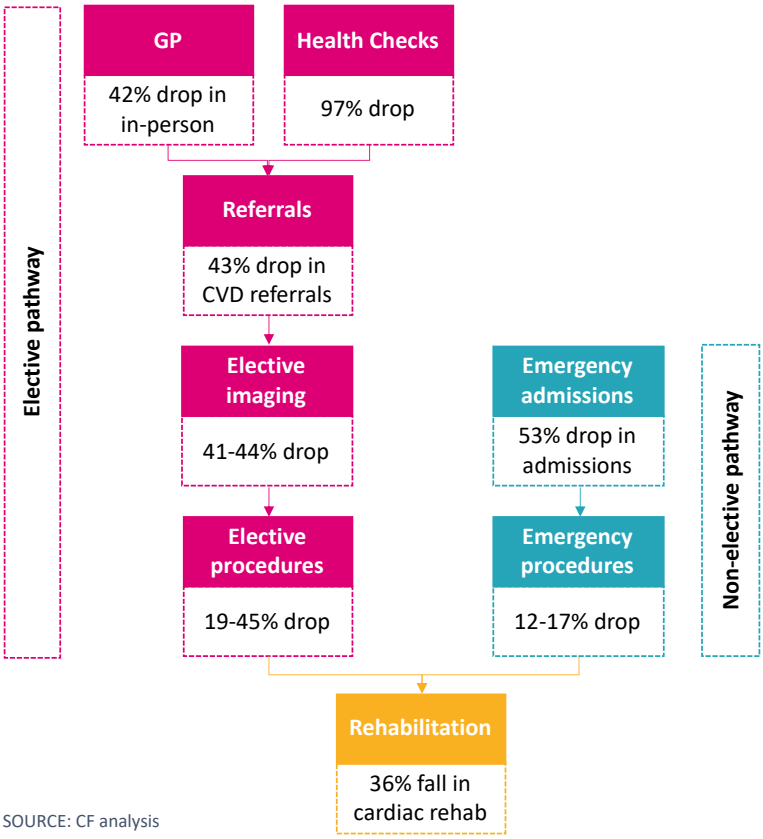
CVD is one of the biggest killers in the UK, and its burden has only been exacerbated by the COVID-19 pandemic. On 30 January 2020, the World Health Organization declared a public health emergency due to COVID, and on 23 March, the UK began a national lockdown, with the public instructed to 'stay at home' to protect the NHS. This messaging was later changed to 'stay alert', with particularly vulnerable patients advised to shield. Since then, regional rules have been in place, as well as a second and third national lockdown periods. The NHS is experiencing great pressure to address the backlog of patients awaiting diagnosis and treatment, with this pressure expected to last for many months.

The national response to the pandemic has involved a shift to virtual General Practitioner (GP) appointments and rehabilitation services, and a halt to non-urgent elective procedures as instructed by the NHS England guidelines published on 20 March.[5] This response has caused indirect effects on the presentation, diagnosis, management and outcomes of patients with CVD. There is also a direct relationship between COVID-19 and CVD, as patients with COVID-19 are at increased risk of experiencing cardiovascular complications, and, vice-versa, patients with pre-existing CVD are at increased risk of experiencing complications from COVID-19.[6]

Disruptions to the cardiovascular disease pathway

The entire CVD pathway has been indirectly impacted by COVID-19 to different degrees (**Figure 2**).

Figure 2. Effects of COVID-19 on the cardiovascular disease pathway, using latest available data since March 2020 compared to the same time periods in 2019



SOURCE: CF analysis

Prevention

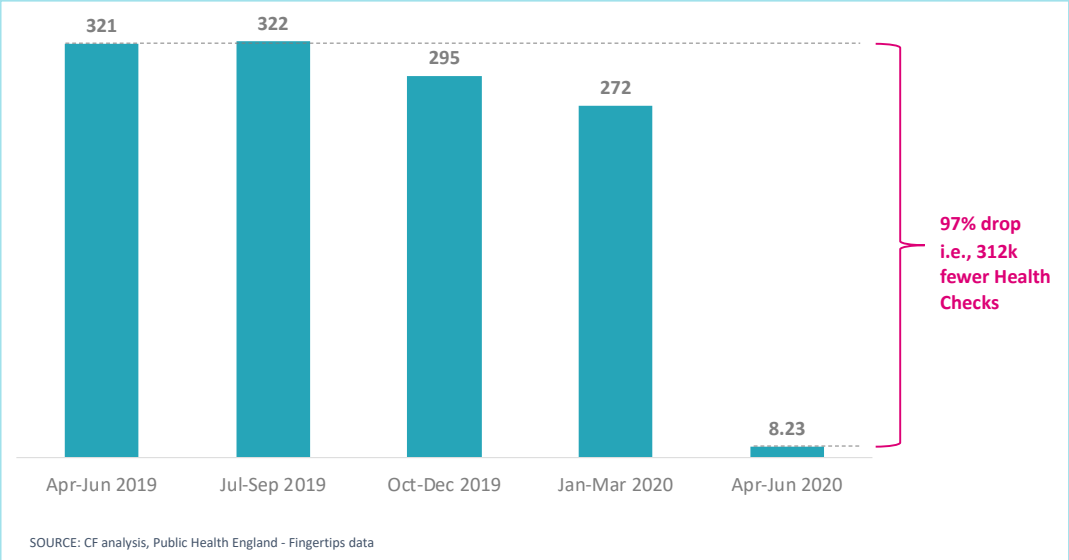
CVD prevention focusses on lowering risk through behavioural change, as well as on identification and medial therapy for at-risk patients such as those with high blood pressure, high cholesterol, atrial fibrillation, diabetes and chronic kidney disease.[7]

GP appointments present an opportunity to conduct checks on blood pressure, cholesterol, and BMI, listen to the heart and offer lifestyle advice. Due to the COVID-19 pandemic, there was a 12% decrease in the total number of GP appointments that took place between March and November 2020 relative to the same period last year.[8] There was also a significant shift from face-to-face to telephone consultations. Indeed, compared to last year, in-person GP appointments decreased by 42% between March and November 2020, which was met by a stark rise in telephone appointments. In-person appointments are better for identifying CVD risk factors, which means that this change in appointment mode might have led to missed CVD activity. Our analysis has shown a particular decline in appointments planned at least two days prior, where CVD prevention activity is most likely. Additionally, virtual appointments have likely resulted in a reduction in diagnostic accuracy which could have led to an increase in missed diagnoses.

The NHS Health Check programme – a structured screening programme for CVD risk factors in England – has also been affected. This programme conducts 1.5 million checks per year,[9] which are carried out for people aged 40 to 74 years without pre-existing diabetes or CVD. There was a 97% reduction in the

number of people who received a health check between April and June 2020 relative to the same period last year (**Figure 3**).[10]

Figure 3. Number of NHS Health Checks carried out by quarter, in thousands, England[10]



In addition, behavioural CVD prevention factors may have also been impacted by the lockdown, though not quantified here, including exercise, smoking, diet, alcohol consumption and medication adherence.

Certain medication prescriptions have been adjusted in response to COVID-19. For instance, the British Heart Foundation reported that a third of surveyed CVD patients have struggled to get the medicines that they need.[11] Furthermore, prescription data for patients newly started on specific drugs, projected by IQVIA to the UK level,[1] for the period of March to October 2020 compared to March to October 2019, reveals a reduction in the average number of new patients initiated on different medications, specifically a 20% reduction in initiations of diabetes drugs, a 30% reduction in initiations of selected cardiovascular drugs (including anti-hypertensives, diuretics, beta blockers, calcium antagonists, ACE inhibitors and angiotensin receptor blockers), a 30% reduction in initiations of statins, and a 16% reduction in initiations of anticoagulants (including direct-acting oral anticoagulants, warfarin, aspirin 75mg and low molecular weight heparin) (**Figure 4a**). Interestingly, when looking at the monthly average count of all patients, not just those newly initiated, there was a 2% increase in those prescribed diabetes drugs, no change in those prescribed selected cardiovascular drugs, a 1% increase in those prescribed statins, and no change in those prescribed anticoagulants (**Figure 4b**).[1]

Figure 4a. Average number of new patients initiated on diabetic drugs, selected cardiovascular drugs, statins and anticoagulants by month for the periods of March to October 2019 and 2020, in thousands, UK (IQVIA data)[1]

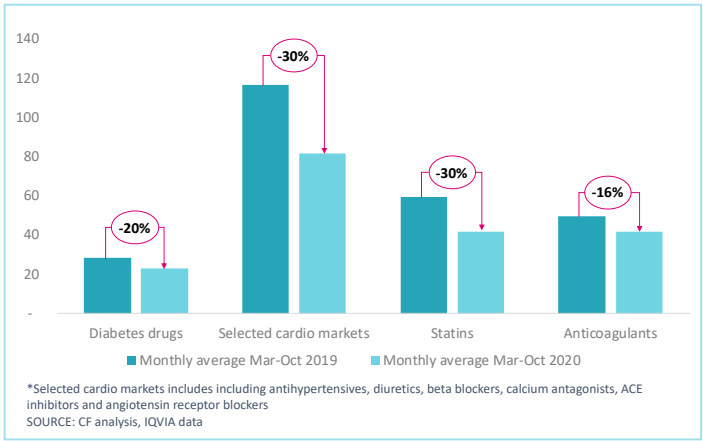
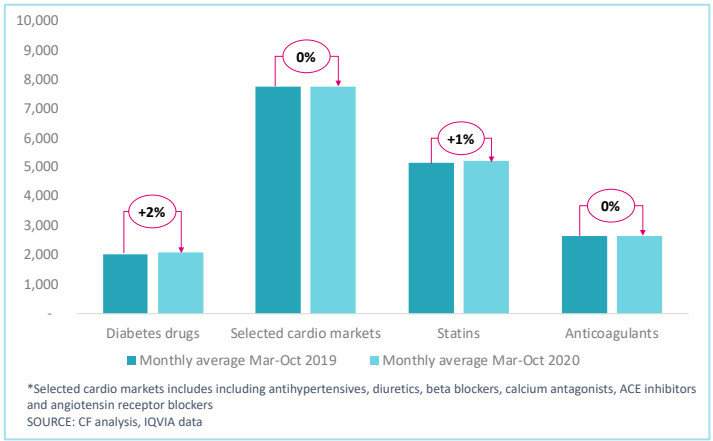


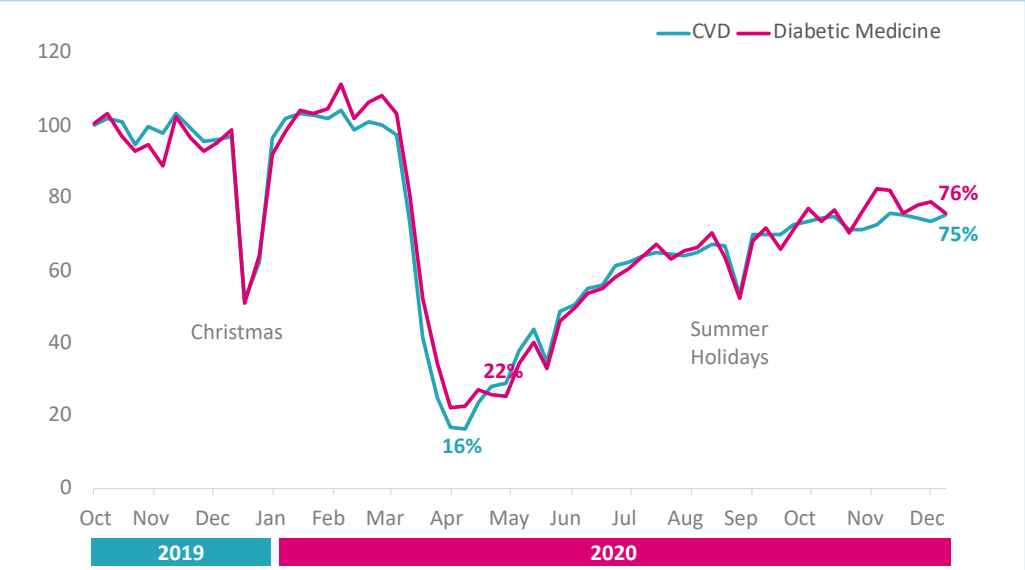
Figure 4b. Average total number patients prescribed diabetic drugs, selected cardiovascular drugs, statins and anticoagulants by month for the periods of March to October 2019 and 2020, in thousands, UK (IQVIA data)[1]



Referrals and imaging

Our own analysis of e-Referrals data in England, mainly from primary care for further investigation, shows that weekly CVD referrals were, on average, down by 43% between mid-March and mid-December 2020, relative to pre-COVID-19 levels (from October 2019 to mid-March, excluding the Christmas period).[12] The maximum drop was by 84% in mid-April. By mid-December, CVD referrals were still 25% lower than 2019 levels, indicating that a full recovery in CVD referrals had not yet happened (**Figure 5**).

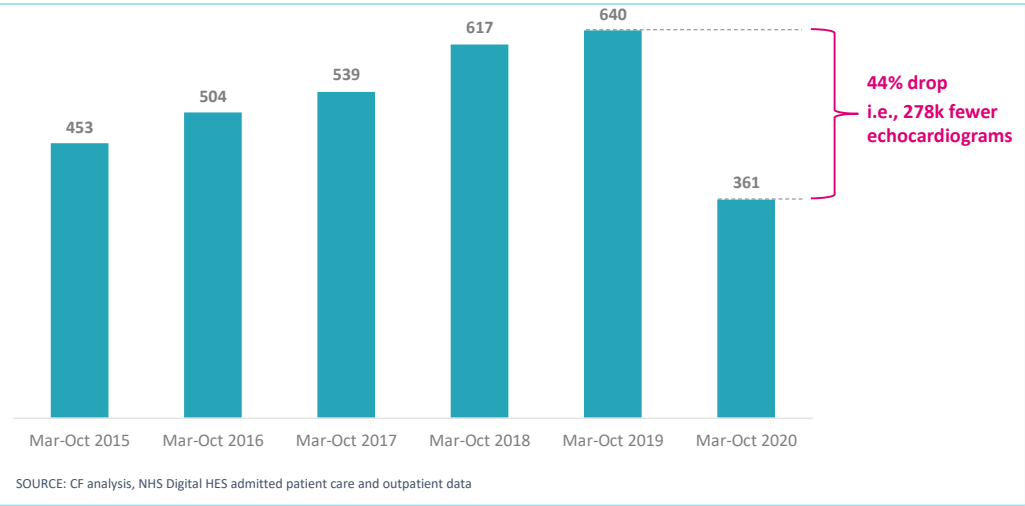
Figure 5. Weekly percentage of CVD and diabetic referrals, relative to pre-COVID (excluding Christmas period), e-Referrals data[12]



SOURCE: CF analysis, NHS Digital e-Referrals data

Similarly, we have found that imaging capacity has decreased due to COVID-19, with a 44% reduction in the number of echocardiograms carried out in elective day cases and outpatients between March and October 2020 compared to the same period last year (**Figure 6**).[13,14] There was also a 41% reduction in the number of elective angiograms carried out in admitted day cases in the same period, although there had been a downward trajectory in recent years prior to the pandemic.[13] Furthermore, there was a 41% drop in the number of cardiac MRIs conducted in admitted day cases and outpatients in the same period, though there had been an upward trajectory in previous years.

Figure 6. Echocardiograms carried out in day cases and outpatients from March to October over time, in thousands, HES admitted/outpatient data[13,14]



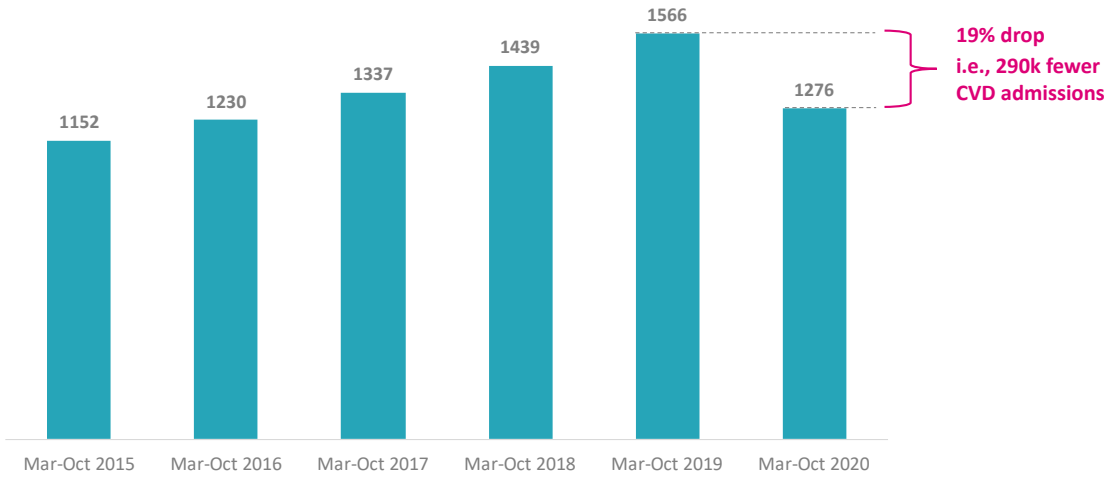
SOURCE: CF analysis, NHS Digital HES admitted patient care and outpatient data

Admissions and treatment

Overall, hospital admissions had reportedly decreased by 60% at the end May 2020, relative to pre-COVID-19 levels.[15] For CVD specifically, admissions fell between 31% and 88% depending on condition, including for stroke and myocardial infraction.[15] The greatest differences were seen for coronary artery bypass grafts (CABG), carotid endarterectomy, aortic aneurysm repair and peripheral arterial disease procedures.[15]

Analysis of Hospital Episode Statistics (HES) data showed that CVD-related admissions fell by 19% between March and October 2020 relative to the same period last year (**Figure 7**).[13] Given the rise in CVD-related admissions over the past few years, an increase in admissions could have been expected for 2020, therefore a reduction of 19% may be an underestimate.

Figure 7. CVD-related* admissions from March to October over time, in thousands, HES admitted patient care data[13]



*CVD-related admissions include those for acute coronary syndromes, heart failure, acute stroke/transient ischaemic attacks, deep vein thrombosis or pulmonary embolism, peripheral arterial disease and aortic aneurysms

SOURCE: CF analysis, NHS Digital HES admitted patient care

The pause of elective procedures has created a growing backlog of high-risk patients with pre-existing CVD awaiting procedures, such as percutaneous coronary interventions (PCI), coronary artery bypass grafts (CABG), and carotid endarterectomy procedures, which are used to improve blood flow and reduce the risk of heart attacks and strokes. There was a 25% reduction in elective PCIs carried out for day patients between March and October 2020 compared to March to October 2019. In the same period, there was a 45% reduction in elective bypass surgery (or CABG) procedures, and a 31% decrease in carotid endarterectomy procedures, used for stroke prevention. There was also a 19% drop in elective cardiac implant procedures, including pacemakers and defibrillators which are used for patients at high risk of cardiac arrest, reflecting the current emphasis on secondary prevention, not primary preventive implants.[16]

As for emergency admissions, they reportedly dropped by 53% at the end of May.[15] Particularly, fewer people with milder strokes[17] and less severe heart attacks presented to hospitals. Patients have reportedly avoided coming in to hospitals from fear of contracting COVID-19 and to avoid burdening the healthcare system.[18]

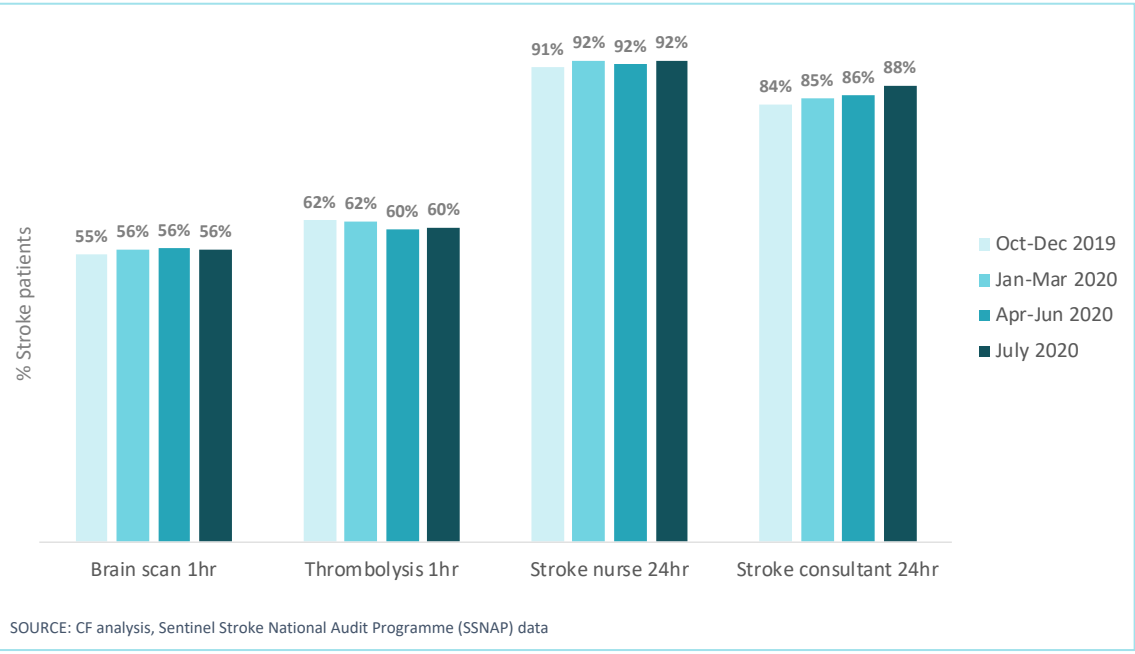
Indeed, according to stroke audit data, there has been a 10% fall in stroke admissions for older patients and those with less severe strokes between March and June 2020 relative to 2019, with the greatest drop experienced in April (17% reduction compared to April 2019).[19,20] A Stroke Association survey revealed that 29% of respondents delayed seeking emergency medical attention after their stroke due to the pandemic.[21] Our analysis of stroke audit data shows that there were fewer asymptomatic and mild stroke admissions in March and April compared to the months prior and following.[22]

As for heart attack admissions, they fell by 35% at the end of March 2020, and returned to normal levels in August.[23,24] Of these, less severe heart attacks (Non-ST-Elevation Myocardial Infarction, or NSTEMI)

dropped by 42%, and more severe heart attacks (ST-Elevation Myocardial Infarction, or STEMI) by 23%. We analysed published heart attack admissions data and found that from March to mid-October 2020, there was a 11% reduction in admissions for acute myocardial infarction compared to equivalent weeks in 2019.[23,24] Similarly, NSTEMI admissions dropped by 16%, and STEMI admissions by 5%. This has meant an increase in out-of-hospital heart attacks.[25] Indeed, this decrease in in-hospital activity can lead to severe consequences, as patients with an acute CVD who do not go to hospital cannot benefit from reperfusion therapy to restore blood flow and are at higher risk of irreversible damage, poorer outcomes and/or recurrent events. Furthermore, our analysis of emergency procedures found a reduction in emergency PCIs of 12% for March-October 2020 relative to March-October 2019, and a reduction in emergency thrombolysis for strokes of 17% for the same period.

Fortunately, acute treatment rates for stroke and heart attacks appear to be unchanged. PCIs remained the preferred reperfusion strategy for heart attacks, and very high levels of care were maintained.[26] The number of PCIs conducted at the end of March appears to correlate to the reduction in presentations.[23] It was however reported that delivery of CABG surgery in cardiac units became difficult as cardiac critical care unit resources had been re-allocated.[16] Similarly, important indicators of acute stroke care were not impacted by COVID-19 (**Figure 8**). The proportions of patients receiving imaging and thrombolysis within one hour, and those who were seen by a stroke nurse or stroke consultant within 24 hours also remained stable.[22] The ability to keep stroke and heart attack treatment at normal levels is a great display of resilience in hospitals. However, the drop in the presentation and treatment of less severe cases remains a real concern, and seems to be matched by an excess in CVD deaths.

Figure 8. Percentage of emergency stroke patients receiving timely stroke care from October 2019 to July 2020, Sentinel Stroke National Audit Programme (SSNAP) data[22]



SOURCE: CF analysis, Sentinel Stroke National Audit Programme (SSNAP) data

Rehabilitation

Cardiac and stroke rehabilitation has been severely affected, particularly face-to-face services, with much of the delivery switching to a home-based approach, including virtual, manual or web-based appointments. While virtual rehabilitation has allowed to continue in some form despite the pandemic, it is, however, not suitable for everyone, in particular patients who have communication issues and those with lower digital literacy.

In a survey conducted with stroke physicians, 33% of them reported a reduction in rehabilitation,[27] including physiotherapy, occupational health and speech and language therapy. The latter pertains to the identification of those with impaired communication and swallowing issues. Among last year's stroke survivors, 39% stated that they had not received sufficient rehabilitation therapy.[21] This figure is as high as 56% for those who had a stroke in January and February 2020. Additionally, 34% of patients surveyed who had their stroke in 2019 or earlier reported health and care support to be worse than

before the pandemic.[21] This reduction in rehabilitation services is expected to have consequences on outcomes, as it is likely to limit the independence and quality of life outcomes of some patients, resulting in patients with more complex needs.[21]

For heart attack survivors, patients with heart failure or following cardiac surgery, cardiac rehabilitation is an evidence-based therapy which is reported to reduce the risk of dying prematurely from a CVD event by 26%.[28] The National Audit of Cardiac Rehabilitation has shown that the response to COVID-19 resulted in a 36% drop in group-based exercise, a 29% drop in group-based education, and a 16% increase in staff-supported self-management options.[29] Many cardiac rehabilitation staff were redeployed to front-line duties.[29]

Direct effects

COVID-19 can also have a direct CVD impact on patients manifesting through immediate complications and potential for CVD events in the future. COVID-19 is believed to cause increased inflammation and blood clotting, and patients without a CVD history have experienced elevated troponin levels and cardiac arrests. The cardiovascular effects of COVID-19 have included thrombosis, acute myocarditis, heart failure, and arrhythmias.[6] COVID-19 patients are now being given anticoagulants (such as low molecular weight heparin) in high doses, to prevent blood clots. This could lead to long-term CVD consequences for patients with no prior CVD history, signifying that there will be a need to provide this cohort with cardiac rehabilitation.[30]

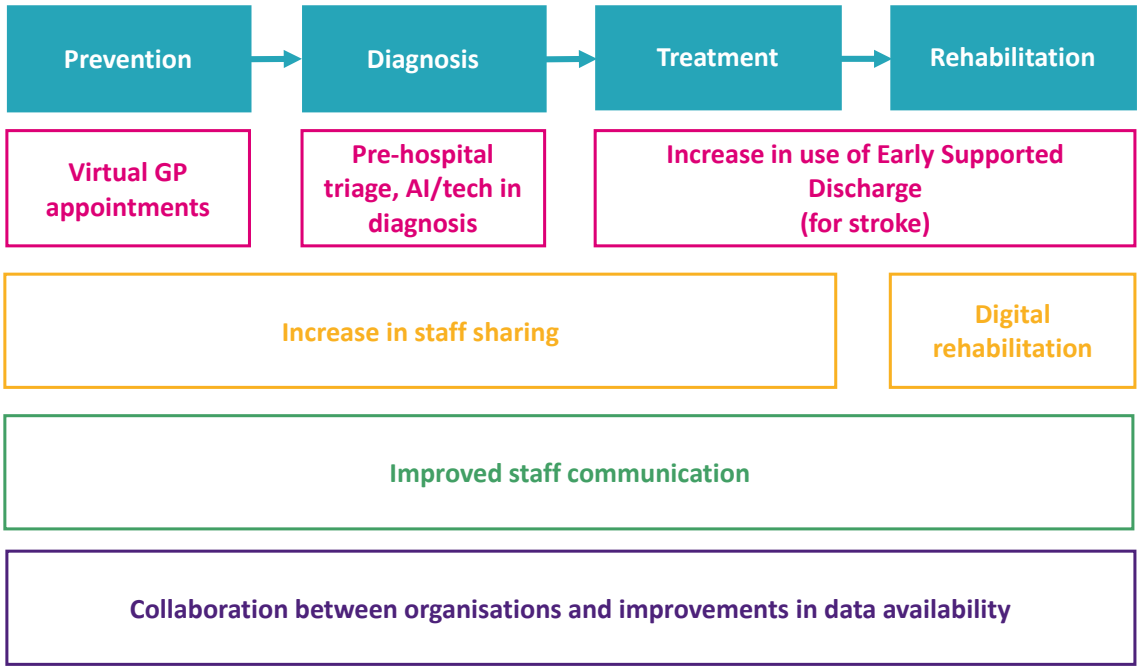
Vice-versa, having a pre-existing cardiovascular condition has also been identified as a risk factor for more severe COVID-19 outcomes.[6] Between March and April 2020, 9% of stroke deaths recorded in the stroke audit were accompanied by a positive COVID-19 test, but these were down to 2% in July 2020.[22]

These complications are disproportionately experienced by different demographic and cultural groups. Analysis of COVID-19 deaths revealed that being male, being older and being more deprived is associated with higher risk of death.[31] Black and South Asian people were also at higher risk of death compared to White people, including after adjustment for other factors.[31] Apart from COVID-19, South Asian, African and Caribbean people in the UK are already at higher risk of cardiovascular conditions, including high blood pressure, stroke, coronary heart disease and diabetes.[32]

Innovations

The COVID-19 pandemic has accelerated the adoption of innovative practices across the cardiovascular pathway (**Figure 9**).

Figure 9. Innovation across the cardiovascular care pathway as a result of COVID-19



The rapid rise in use of virtual appointments – especially telephone consultations – prompted by COVID-19, has broadened access to care for many patients.[21] The move to digital rehabilitation has also been deemed by some as more successful than anticipated. The need for virtual rehabilitation has led to the use of more innovative practice in both home and community settings.[30]

Within hospitals, pre-hospital triage services for stroke and increased use of Early Supported Discharge (one of the Long Term Plan ambitions for stroke care)[35] has meant that stroke patients have needed to spend less time in hospital.[21,27] Additionally, it has been suggested that the clinical quality for stroke treatment may have improved for some patients due to fewer admissions and greater bed availability.[14] The maintenance of core pathways within the hospital and the increase in ITU beds should also be recognised, along with the emergence of the innovative practice of staff sharing. Anecdotal evidence also suggests use of virtual technology has also enabled better communication between staff based in different locations, for example through remote staff meetings.

Moreover, improvements have been observed in data availability. Indeed, throughout the pandemic, data have been made available at pace, with interim monthly reports being made available in some cases,[22] and collaborations being set-up to remove data access barriers for research groups. One such collaborative group is between the National Institute for Cardiovascular Outcomes Research (NICOR), UK Health Data Research (HDR) Alliance, NHS Digital, SAIL Databank, HSC Public Health Agency, Public Health Scotland, The BHF Data Science Centre and, Health Data Research UK.[16] Although most CVD research was paused, COVID-19 has accelerated research into the use of artificial intelligence and machine learning, for example, in the interpretation of scans to speed up stroke diagnosis.

Worsening outcomes

In light of these healthcare disruptions to the CVD pathway caused by COVID-19, we have investigated the potential repercussions on outcomes, namely the fall in new diagnoses of chronic conditions, the initiation of new prescriptions of medical therapy, and the reduction in elective procedures.

Fall in diagnoses

The overall reduction in GP appointments (12% reduction in March to November 2020 relative to 2019), especially in-person GP appointments (42% reduction in March to November 2020 relative to 2019), would have limited the opportunities for investigations.[8]

Approximately 200,000 atrial fibrillation diagnoses, and 300,000 coronary heart disease diagnoses are made per year in the UK.[33] Assuming that these diagnoses are initiated in primary care, and that the fall in GP attendances (12% overall; 42% in-person) correlates directly with diagnosis events, around 16,000 to 57,000 atrial fibrillation diagnoses, and between 26,000-90,000 coronary heart disease diagnoses could have been missed between March and November 2020.

Additionally, approximately 200,000 heart failure diagnoses are made per year, meaning that 133,300 would be expected during an 8-month period. Typically, 79% of diagnoses are first recorded in hospital, and 21% in primary care.[34] Echocardiograms are used in 31% of diagnoses first recorded in hospital, and in 70% of diagnoses first recorded in primary care.[34] The estimated heart failure diagnoses in 8 months dependent on echocardiogram across hospitals and primary care is therefore approximately 52,000. The 44% reduction in echocardiograms between March and October 2020 relative to 2019 will have directly impacted heart failure diagnoses. If the fall in echocardiograms observed (44%) is proportional to the fall in diagnoses normally made using echocardiograms, approximately 23,000 patients with heart failure would have gone undiagnosed.

Fall in new prescription initiations

In total, there has been a reduction in new initiations of statins, other selected cardiovascular drugs, anticoagulants and diabetes drugs (approximately 470,000 patients when summed).[1] A caveat of this is that patients may have been initiated on multiple therapies at once, resulting in an overestimate.[1] This may have resulted in approximately 12,200 future strokes and heart attacks which could have been prevented.

Prescription data from IQVIA shows that around 143,000 fewer patients were initiated on statins in March to October 2020 compared to March to October 2019.[1] The number of people who need to be treated with a specific drug (for example a statin) to avoid one specific outcome (for example a heart attack) is known as the 'number needed to treat' (NNT). The NNT for statins over a five-year period is 154 patients to avoid a stroke, and 104 to avoid one heart attack.[35] Using these figures, we found that approximately 900 future strokes and 1,400 future heart attacks would not be prevented which could have been, as a result of the decline in new statin prescriptions over the 8 months observed. These estimates are over a period of years, and assume that these patients do not receive a statin prescription, whereas in reality, some of these patients will be initiated on statins at a later date.

Furthermore, using prescription data from IQVIA shows that around 278,000 fewer patients were initiated on selected cardiovascular drugs in March to October 2020 compared to the same period in 2019 (including antihypertensives, diuretics, beta blockers, calcium antagonists, ACE inhibitors and angiotensin receptor blockers).[1] Approximately 67 people need to be treated with antihypertensives for five years to avoid one stroke and 100 to avoid one heart attack.[36] Using these figures for antihypertensives represent the benefit of the other cardiovascular drug classes more broadly, approximately 4,100 future strokes and 2,800 future heart attacks would not be prevented which could have been, as a result of the decline in new prescriptions of selected cardiovascular drugs over the 8 months observed. The same caveat, that some patients may be initiated on these drugs at a later date, also applies.

Additionally, according to prescription data from IQVIA, around 63,000 fewer patients were initiated on anticoagulants in March to October 2020 compared to March to October 2019 (including warfarin,

direct-acting oral anticoagulants (DOACs), aspirin 75mg and low molecular weight heparin).[1] Of these, approximately 4,200 patients were not started on either DOACs or warfarin.[1] The same caveat applies that these patients may have been initiated on both DOACs and warfarin at different times, meaning 4,200 may be an overestimate of the true count.[1] Around 25 people need to be treated with warfarin for 1.5 years to avoid one stroke.[37] Applying this figure to the 4,200 patients not started on either DOACs and warfarin means approximately 170 future strokes would not be prevented which could have been, as a result of the decline in new prescriptions over the 8 months observed.

Treatment for diabetes through control of blood pressure, HbA1c and lipids, is an important part of CVD risk management in primary care.[7] Prescription data from IQVIA shows that around 44,000 fewer patients were initiated on diabetes drugs in March to October 2020 compared to the same period last year.[1] Approximately 16 people need to be treated with metformin (the most commonly prescribed diabetes drug) to avoid one stroke or heart attack.[38] Using this figure, approximately 2,800 future strokes or heart attacks would not be prevented as a result of the decline in new prescriptions over the 8 months observed, with the same caveat that some patients may be initiated on diabetes drugs at a later date.

NHS Health Checks were lower than expected by 312,000 from April to June 2020. Around 1 in 6 checks identifies a high risk patient (above 20% risk of CVD in 10 years),[9] meaning that approximately 52,000 patients were not identified as high risk during this period. Before the pandemic, the data showed that 19.3% of those people identified as high risk were newly prescribed statins and 8.8% were newly prescribed antihypertensives.[39] Therefore approximately 10,000 patients were not started on statins, and 4,600 not started on antihypertensives when they should have been. The number of people who need 154 people to be treated with statins to avoid one stroke is 154 and, 104 the ones who need to be treated with statins to avoid one heart attack is 104.[35] Around 67 people need to be treated with antihypertensives to avoid one stroke and 100 to avoid one heart attack.[36] Therefore, approximately 280 future preventable strokes or heart attacks could come to pass as a result of the steep decline in Health Checks between March and June 2020.

Excess deaths

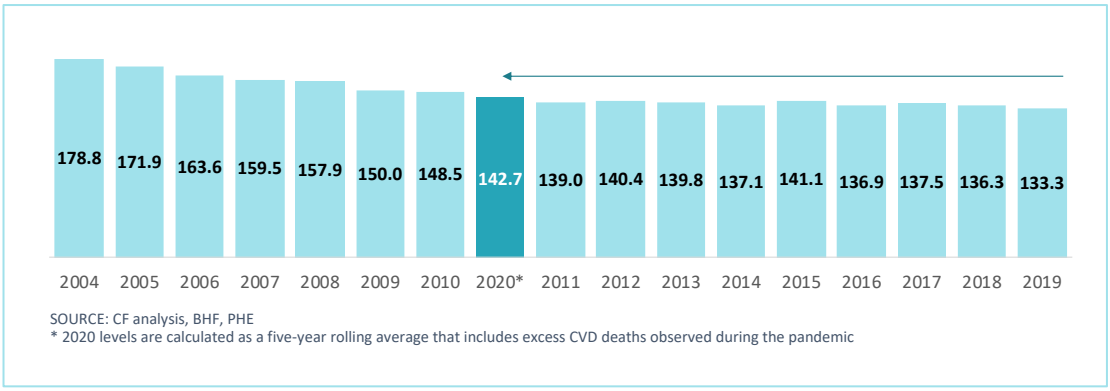
There has been a sharp rise in CVD deaths, especially out-of-hospital deaths**.** One study reported that there was an 8% excess CVD mortality at the end of June.[40] More recent data from the Office for National Statistics, for the period of 20 March to 1 January, shows that CVD deaths in England were 6% higher than expected, equivalent to 5,634 excess CVD deaths, and that, out of these excess deaths, 37% had COVID-19 stated on the death certificate. The excess deaths comprised 2,473 from coronary heart diseases (33% were COVID-19 deaths), 1,426 from stroke (40% were COVID-19 deaths), and 1,735 from other circulatory diseases (41% were COVID-19 deaths).[41] In contrast, deaths from other diseases during the pandemic were either lower than expected or not significantly different to the expected number, including cancer, acute respiratory infections (flu/pneumonia) and chronic lower respiratory diseases.[41]

This excess mortality has been disproportionately apparent in out-of-hospital deaths. For instance, at the end of June, there was an excess CVD mortality of 35% in homes, and 32% in care homes/hospices.[40] Since most CVD deaths were not directly related to COVID-19, the excess and displacement of deaths is thought to result from patients avoiding or delaying seeking care, as well as from delays to surgery and routine heart care, and patients not being referred to hospital.

Of those admitted to hospital, 30-day mortality for NSTEMI increased over the lockdown period from 5.4% to 7.5%.[26] Stroke audit data shows a significant increase in mortality, and a particular increase for stroke patients who also had COVID-19.[22]

Using the excess deaths figure, we calculated the total anticipated CVD deaths for 2020 as a five-year rolling average that includes excess CVD deaths observed during the pandemic, and compared this figure to CVD deaths across time in England.[42,41] Our estimate shows that deaths from CVD are now the highest they have been in a decade due to the excess deaths that have been brought on by the COVID-19 pandemic (**Figure 10**).

Figure 10. Total heart and circulatory diseases deaths in England by year from 2004 to 2019, and 2020 anticipated (in thousands)[42,41]



SOURCE: CF analysis, BHF, PHE
* 2020 levels are calculated as a five-year rolling average that includes excess CVD deaths observed during the pandemic

In addition to this profound human loss, we anticipate this also comes at a significant economic cost. Indeed, looking at these excess deaths CVD, we find that 18.6% of them would fall within working age (people aged 15 to 69 years).[43] Factoring in employment rate (75.2%),[44] we found that, for a Gross Value Added per workforce job of £53,200 in England,[45] these unnecessary deaths are equivalent to a net loss to the system of £41.8 million from missed economic contribution of working age and economically active CVD patients.

Maintaining and recovering cardiovascular activities

Recover GP services and referrals

The CVD Long Term Plan (LTP) outlines an aspiration to prevent up to 150,000 heart attacks, strokes and dementia cases over the next 10 years, through the early detection of risk factors.[46] COVID-19 has seriously impacted the ability of GPs to identify people at high risk, whether from high blood pressure or cholesterol, atrial fibrillation or for genetic CVD conditions. Similarly to cancer recovery,[47] working closely with GPs will be crucial to gain insight on how to best address certain issues, such as improving the stratification of the population by CVD risk in order to reach high-risk hard-to-reach groups such as non-English speaking older patients. The structured identification of high-risk patients through the NHS Health Check has been hugely impacted by the response to COVID-19. It is vital that the prevention activity to avoid the morbidity and mortality burden from CVD is not disregarded due to the response to ongoing pandemic waves. In addition to this, patients with stable heart conditions who have waited for treatment should be followed up urgently.[18]

Recover elective services

The recovery of elective CVD services is essential to move high-risk patients into a more stable condition. The impact on various elective procedures stems from critical NHS guidance to protect patients, however once safe to do so, procedures must be resumed for patients at very high risk of serious cardiac events.

Diagnostic capacity

Increased access to echocardiograms in primary and community care was outlined in the Long-Term Plan (LTP) for CVD.[46] Echocardiograms can create a bottleneck in CVD services if not done swiftly, limiting the diagnosis of key heart conditions. A BHF report on the effect of COVID-19 of CVD suggested that GPs may not be adding, or being able to add, patients to already large waiting lists.[18] Longer delays in referrals, diagnosis and treatment will result in greater future hospital burdens and worse outcomes for patients.[18]

Delivery networks

CVD services have had to respond rapidly to the disruption caused by COVID-19. Integrated Stroke Delivery Networks (ISDNs) and local system planning for CVD are outlined in the LTP,[46,48] to increase access to treatments such as mechanical thrombectomy for stroke. Local system planning for CVD may involve hospital provider and ambulance trust collaboration to reduce call-to-balloon times for PCI, or hospitals reorganising patient flows.[16] The service changes currently in place may enable greater collaboration and service reconfiguring to enable improvements in care for CVD patients.

Rehabilitation

Increased access to both stroke and cardiac rehabilitation was outlined in the LTP, with the aspiration for cardiac rehabilitation for 85% of those eligible to access care by 2028, from just over half in 2019.[46,48] As more evidence is published recognising the direct viral effects on the cardiovascular system and when there is better understanding of long COVID-19 as a CVD, long COVID services will need to be linked with CVD rehabilitation services. There is now an opportunity to innovate cardiac and stroke rehabilitations services to not only increase early, intensive and ongoing usage among those likely to use services, but to also reinstate community services to reach patients whose need for rehabilitation is greatest (such as those with impaired communication). Prevalent issues amongst stroke and heart attacks survivors include loneliness, depression and anxiety, and have been exacerbated by COVID-19 in many cases. One of the key recommendations of the latest National Audit of Cardiac Rehabilitation is for more support for rehabilitation programmes to adapt service delivery to tackle inequalities in accessing rehabilitation.[29]

Implications

The burden of cardiovascular diseases in the UK is massive, and it was only exacerbated by the COVID-19 pandemic, both directly and indirectly. There is a direct relationship between CVD and COVID-19; some people who have contracted COVID-19 have developed cardiovascular conditions and complications without prior CVD history, and vice-versa, people suffering from CVD are at higher risk of experiencing worse outcomes from COVID-19. The pandemic has also severely disrupted CVD services across the pathway, which has led to a number of indirect consequences including a decrease in screening and prevention, a decline in GP appointments, a drop in CVD referrals, as well as a decrease in elective procedures, emergency admissions, imaging and rehabilitation.

This disruption to cardiovascular care has taken a toll on patient outcomes. Our analysis shows that the repercussions will likely lead to up to 470,000 patients not being started on statins, other selected cardiovascular drugs, anticoagulants and diabetes drugs, the occurrence of approximately 12,000 future strokes and heart attacks which could have been prevented, as well as missed diagnoses, specifically 23,000 in heart failure, 16,000-57,000 in atrial fibrillation and 26,000-90,000 in coronary heart disease. These disruptions have already had an effect on mortality, with approximately an 6% increase in CVD deaths, which is equivalent to over 5,600 excess CVD excess deaths in the period of March to the end of December 2020. The cost of these excess deaths is equivalent to over £42 million in lost economic contribution of the working age and economically active patients that would have died unnecessarily.

Addressing CVD is now more critical than ever. This needs to start with the recovery of services, including primary care, elective procedures, diagnostics and rehabilitation. There is a unique opportunity for the UK to address existing bottlenecks and limitations in the CVD pathway, and to pioneer public health management in CVD, which will be strongly enabled by embracing innovation fully. We have indeed witnessed an accelerated adoption of innovative practices throughout the CVD pathway during the pandemic including the use of virtual appointments, pre-hospital triage, AI/tech in diagnosis, early supported discharge in stroke, staff sharing, digital rehabilitation, better staff communication, collaboration between organisations and data availability. These efforts have set a precedent for what can be achieved swiftly to improve patient care and should be used as the foundation for further innovation going forward. This will need to include greater usage of technology to improve diagnostics and a push towards enhanced and regular availability of real-time data. Use of technology alongside availability of data could lead to strategies for more targeted NHS Health Checks and therefore improved identification and treatment of individuals at high risk of cardiac conditions. Attention needs to be paid to the effect of system changes on existing and widening inequalities for different groups of CVD patients.

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