Rapid cardiovascular data: We need it now (and in the future)

How the collaborative approach to countering the impact of COVID-19 demonstrates the value of rapid analysis of national data in helping to improve outcomes for patients with cardiovascular disease

NICOR

NCAP
NATIONAL CARDIAC AUDIT PROGRAMME

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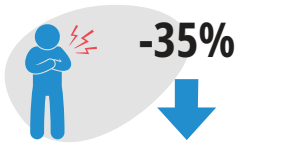
Executive summary

The COVID-19 pandemic has presented all parts of the NHS with major challenges. In a very short period of time, local health systems have been through a major reorganisation of their services to deal with the huge rise in patients requiring critical and specialist care for pneumonia, respiratory failure and sepsis. This has had a big impact on the care of people with cardiovascular disease (CVD).

The National Institute for Cardiovascular Outcomes Research (NICOR) has worked with the cardiovascular Professional Societies and individual hospitals to ensure a continuous flow of data to assess the effect of the pandemic on patients with CVD. A close collaboration between NHS Digital, NICOR and the Healthcare Quality Improvement Partnership with NHS England has also transformed the information governance landscape by creating a linked 'cardiovascular data spine'. This has enabled data to be collated and analysed rapidly to inform Government and NHS policy.

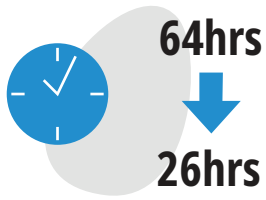
A Cardiovascular Specialty Strategic Group, set up to inform and perform a series of analyses using national datasets, has initiated a number of workstreams and this report sets out initial findings from the first of these: the impact of the pandemic on clinical pathways for routine cardiovascular care. This has found:



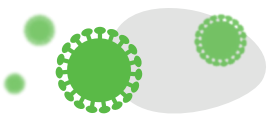
» From hospital coding data, there was a 35% fall in the number of admissions for myocardial infarction to hospital by the end of March, compared with the average for 2019. This reduction was about twice as large (42% reduction) in non-ST-elevation myocardial infarction (NSTEMI) as compared to STEMI (a 23% reduction). Data from NICOR suggested slightly larger falls in admissions (29% for STEMI, 49% for NSTEMI). The reduction in hospital attendance began before the UK lockdown and by the end of May the numbers of admissions had started to recover.

» Standards of clinical care for patients presenting with ST elevation myocardial infarction have been maintained, with no switch from guideline-driven PCI to less effective thrombolytic drug therapy. Secondary prevention drug treatments were maintained at high levels.

» For patients with STEMI, there was a fall in the proportion of patients who self-presented, but overall only minor delays to treatment, except for those requiring inter-hospital transfer. Proportionately, more patients received treatment with primary PCI. This suggests that there could have been a fall in the admission to hospital of those who are not normally eligible for reperfusion. Crude 30-day mortality fell overall from 10.2% to 7.7%, but as clinical pathways altered this rose in the recovery phase to 8.3%.

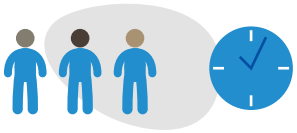


» Fewer patients with NSTEMI self-presented to hospital and there were fewer admissions of female, older, and diabetic patients and those with other comorbidities. Overall, symptom-to-call and call-to-door times were maintained, but there were fewer inter-hospital transfers for treatment. Fewer patients were managed with an invasive strategy, but for those undergoing this approach delays to coronary angiography fell dramatically from 64 hrs to 26 hrs. The median length of stay in hospital fell from 5 to just 2 days. However, crude 30-day mortality for patients with NSTEMI increased from 5.4% to 7.5%, but fell to 5% during the recovery phase.



» It is now known that there has been an overall excess in deaths over the numbers expected for the equivalent time periods in previous years, most of which have been due to COVID-19, but a significant number has occurred due to other causes including CV disease. Ongoing research is investigating not only the causes of death but where the deaths occurred.

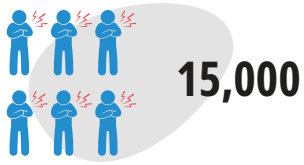
» There has also been an increase in the number of CVD patients presenting to hospital with an out-of-hospital cardiac arrest (OOHA) during the pandemic. These individuals were more likely to be older, female, of Black, Asian and Minority Ethnicities (BAME) and with a background of diabetes or hypertension



» There were some differences in the clinical pathways for BAME patients suffering a heart attack, with an exaggeration of the delays usually seen. These patients suffered worse outcomes. These differences are not fully understood.

» The fall in the number of patients presenting to hospital with heart failure was even more marked, dropping 66% by the end of April. Unlike myocardial infarction, by mid-May there had been no noticeable upturn seen in the number of heart failure patients presenting to hospital.

» By the end of April 2020, there had been a reduction in the reported number of all interventional procedures for CVD ranging from -50% for TAVI up to -92% for ablation procedures. The reduction in elective activity has been the greatest.

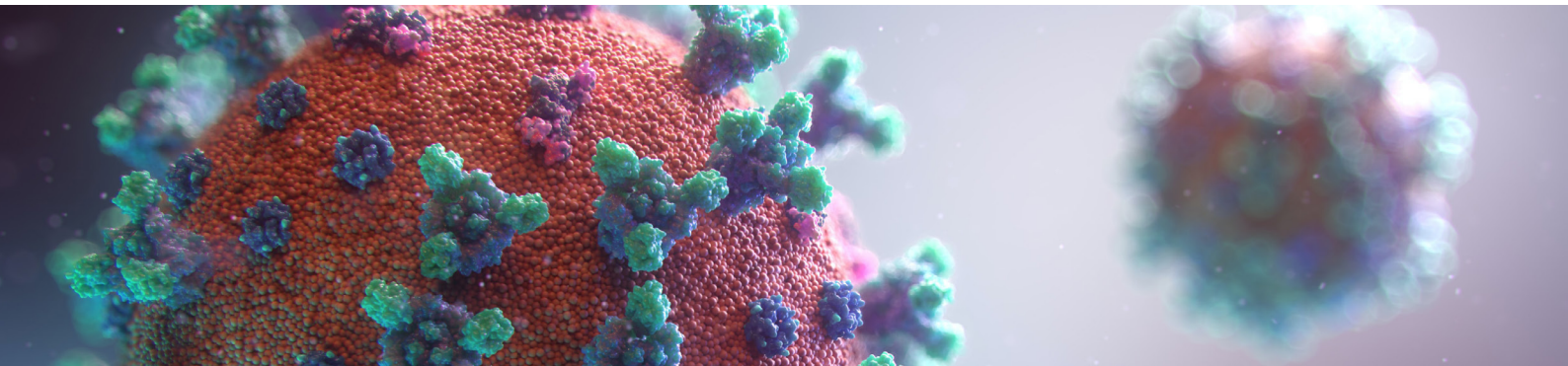


» This reduction in procedures has resulted in more than 15,000 patients having had first-choice procedures postponed, with no clear evidence of alternative treatments being offered (for example, transcatheter aortic valve implantation in place of surgical aortic valve replacement or PCI in place of coronary artery bypass grafting (CABG)). The longer this period of fewer than expected treatments persists, the greater the 'catch-up' pressures will be on subsequent waiting lists once the pandemic has passed.

NICOR is now participating in work that will attempt to use national datasets to develop CVD risk profiles for COVID-19 that may be able to help inform decisions around those who are most at risk in the working population. Beyond that, high quality research is needed to understand the longer-term impacts of COVID-19 on CVD. To this end NICOR is helping make data available to academic partners.

The lessons learned during the COVID-19 pandemic have helped inform much improved ways to provide very important and contemporaneous information to government, the NHS and hospitals across the country. These improved ways to gather and analyse data quickly should not be lost in the future, once the first wave of infection has passed. Continuous data entry, integrated analysis and timely reporting are essential to organise and provide optimal care for patients.

Our thanks go to all hospitals who maintained their data submissions, to the clinical leadership from the Professional Societies, to all in NHS Digital, our data controllers (the Healthcare Quality Improvement Partnership (HQIP), NHS England and Barts Health NHS Trust), all the NICOR staff who enabled this as well as our academic partners (Imperial College London - Professor Tom Lüscher, Keele University - Professor Mamas Mamas, University of Leeds - Professor Chris Gale, and University of Oxford – Professor Colin Baigent) who have led the analysis of the data.



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1. Introduction

Along with all other organisations in the healthcare sector, the COVID-19 pandemic has presented the National Institute for Cardiovascular Outcomes Research (NICOR) and its partners with tremendous challenges. NICOR exists to drive up the quality of care and outcomes for patients with cardiovascular disease (CVD) through the collection, analysis and dissemination of information on clinical practice. Not surprisingly, this unprecedented sudden national crisis has been a remarkable test of the processes and ways of working that benefit patients suffering heart attacks, heart failure, abnormal heart rhythms or congenital heart disease.

There has been a magnificent response from the clinical profession and its partners in national bodies, with inclusive, integrated and rapid action, underpinned by fully collaborative decision-making. This has been all the more important because not only is CVD a key determinant of the health outcomes for an individual with COVID-19 infection, but the pandemic has had a significant impact on CVD care amongst the general population.

At a national level, the UK cardiovascular community has collected data on CVD presentations and outcomes over many years, which NICOR maintains in the form of approximately 6 million records. Funded by NHS England, the Welsh Government and partially by NHS Scotland, these datasets are used to achieve a wide range of quality assurance (QA) and quality improvement (QI) goals across the whole of the UK.

Over a few weeks from mid-March 2020, work was carried out to enable linkages between this centralised resource and coding data from hospitals held by NHS Digital and the Office for National Statistics (ONS). This has facilitated a swift response to the needs of the Scientific Advisory Group for Emergencies (SAGE) and NHS leadership to assist with national policy on COVID-19 and has tackled critical questions under three headings:

1. **The impact of the pandemic on background CVD presentation, care delivery and outcomes;**

2. **The effect of different CVD risk profiles on the acute consequences of COVID-19 infection; and**

3. **The long-term consequences of COVID-19 on CVD service provision and outcomes.**

As well as feeding directly into policymaking circles, the outputs from the pieces of work which NICOR has coordinated with its partners have also been made widely available to others to expand the range of research and analysis which can inform further insights and actions. Several papers by our academic colleagues addressing the impact of the pandemic on background CVD presentation, care delivery and outcomes have been submitted to peer-reviewed journals, and accepted for publication.

Making this happen through a period when everyone's patterns of work have been changed, as with those of all people across the country, has required an incredible amount of cooperation and hard work. Our thanks go to all hospitals who maintained their data submissions, to the clinical leadership from the professional societies, to all in NHS Digital, our data controllers (the Healthcare Quality Improvement Partnership (HQIP), NHS England and Barts Health NHS Trust), all the NICOR staff who enabled this as well as our academic partners (Imperial College London - Professor Tom Lüscher, Keele University - Professor Mamas Mamas, University of Leeds - Professor Chris Gale, and University of Oxford – Professor Colin Baigent) who have led the analysis of the data.

The rest of this short paper describes the lessons from this experience, especially in terms of the value that a national dataset can bring and the way that the future collection and analysis of data and dissemination of information should be organised and governed.

Professor John Deanfield, NICOR Director

2. COVID-19 has had big implications for CVD presentation and care amongst the general population

The NHS, in close cooperation with primary care and community services, underwent a complete reconfiguration of services to enable it to cope with the expected flood of patients with COVID-19 pneumonia and sepsis. Respiratory and critical care units were bolstered by a re-alignment of beds, and doctors in other specialties took on new roles. Elective work was postponed to allow a focus on urgent and emergency cases. Hospital footfall was reduced by increased use of telemedicine and community clinics and primary care made appropriate changes to ensure safety within surgeries.

Although there has rightly been an immediate focus on the direct impact of the virus on those suffering with symptoms of COVID-19, from early on in the outbreak there was a growing anxiety about the knock-on effects on other clinical pathways across all specialties.

In the cardiovascular world, there were concerns that a reduced number of patients suffering a heart attack were attending hospital and that some patients were presenting later than they otherwise would have. There were similar fears around stroke patients. Within cardiac units, it was increasingly difficult to deliver urgent coronary artery bypass graft (CABG) surgery as cardiac critical care unit resources had been re-allocated to help deal with the pandemic. For those with abnormal heart rhythms, the focus was placed on the need for pacing services and secondary prevention use of complex devices, rather than primary preventive implants.

As these potential issues surfaced, it became important to have the data at hand to record what was actually happening and to help with policy decisions on returning services to normal. NICOR's role was then to ensure acceleration of the necessary data collection and to coordinate a system-wide approach to provide information needed for decision-making.

3. National data have been needed to understand the impact of COVID-19 on CVD patients

The importance of timely data collection and submission cannot be over-stressed. This has been developed remarkably quickly and we have utilized contemporary data to analyse the impact of COVID-19 at a population level on patients with CVD. Current data have been invaluable in helping us to understand the effect of national social isolation policies as well as the NHS restructuring in both the delivery and uptake of CVD services. Furthermore, the data have played a central role in understanding the relationship between prevalent CVD and COVID-19 outcomes.

Understanding and responding to these sorts of impacts can be performed, to some extent, with data at hospital level; however, it is only with analysis of national datasets that the full effects can be rigorously examined so that population-level decision-making can most reliably be informed.

Over the last few years, the National Cardiac Audit Programme (NCAP), delivered by NICOR, has been developing a system of continuous reporting of hospital data, which more readily supports improvement in service design and clinical practice at an individual hospital and system level. This new reporting system was launched on July 20th this year. This shift from one-off 'end-of-year' reports across its 6 domains to continuous availability of data for QI will prove invaluable in going further and faster to generate the information required to respond to the impact of COVID-19.

All stakeholders, and especially integrated care services and regional networks, now need a constant input of data (rather than intermittent 'data dumps'). During the pandemic, the existing national infrastructure and processes already in place were further enhanced to get the information to those who most need it. NICOR and its partner institutions were able to assist this in four ways:

- Maintain the availability of data
- Address the tight legal and information governance

controls
- Turn data into information that could rapidly inform policy
- Smooth the path to high quality research on the impact of COVID-19.

3.1 The availability of data has been maintained

NICOR coordinated a response with each of the professional societies to ensure every effort was made to continue data collection for the six domains of the national audits as well as the UK Transcatheter Aortic Valve Implantation (TAVI) registry, and to have this submitted wherever possible on a weekly basis. A general request was made for data submission and separate calls were made to ensure data collection specifically for the National Adult Cardiac Surgery (NACSA), Myocardial Ischaemia National Audit Project (MINAP) and National Audit of Percutaneous Coronary Intervention (NAPCI) domains as there was a special early focus on the management of acute coronary syndromes.

NICOR identified which hospitals had responded to the calls for data across each domain, so that analysts could undertake sensitivity analyses to ensure that the trends seen in the national datasets were confirmed in those hospitals with the most complete weekly data.

As the weekly data feeds were not subject to all the regular validation processes, reassurances were given that the inputs would not be used to feed a QI programme and that the usual validation cycle would continue for that purpose.

3.2 Working within the necessarily tight legal and information governance controls

Under the Control of Patient Information (COPI) Notice for data sharing issued by the Secretary of State, NICOR worked with NHS Digital, NHS England (including Specialised Commissioning) and the Data Controllers (HQIP and Barts Health NHS Trust) to establish an entirely new Trusted NHS Data Environment for rapid data linkage, analysis and reporting. This collaboration ensured a fast-track process to approve the release of data for immediate analysis.

NICOR also worked with NHS Digital to create a 'cardiovascular data spine', bringing together the national audit data with the Hospital Episode Statistics (HES)/Secondary Uses Service Admitted Patient Care (SUSAPC) Database and Office for National Statistics (ONS) data feeds. As part of this, the Independent Group Advising on the Release of Data (IGARD) process was suspended, bar all work on COVID-19-related data to allow the rapid utilisation of data within NHS Digital. NICOR then worked with NHS Digital to:

- Implement the necessary Trusted Data Repository for NHS coding and audit data
- Put in place honorary contracts to enable the data managers and analytical teams to work together
- Upload weekly data to the NHS Digital data repository to facilitate continuous analysis.

Once these processes began to generate information for use, NICOR, in partnership with NHS Digital, worked with its academic partners (Imperial College London, Keele University, University of Leeds and University of Oxford) to ensure that there was maximal visibility of the analyses once finalised, approved and/or published.

3.3 Data have rapidly been turned into information that can inform policy

As the flow of current data was established, NICOR facilitated the establishment of a Cardiovascular Specialist Strategic Group (CSSG) to determine how best to feed this through to SAGE (chaired by the Chief Scientific Advisor) and to NHS England (through the National Clinical Director for Heart Disease). The CSSG brings together academic collaborators with analysts from NICOR, NHS England, NHS Digital and ONS to prioritise clinical questions, help analyse the information, and to respond rapidly to requests for data.

4. Rapid data on CVD inform immediate policy to improve care and save lives

4.1 There has been a reduction of about one third in the number of heart attack admissions

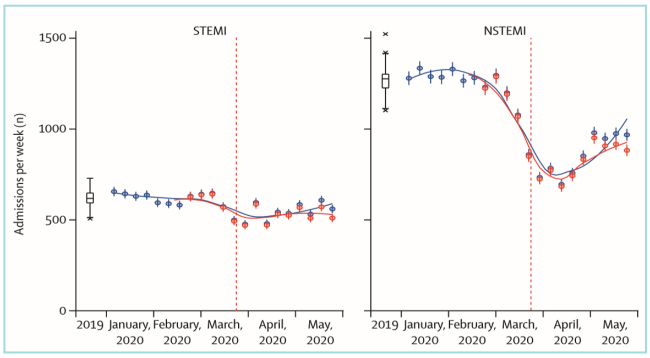
Early in the pandemic a group of scientists from Oxford began working independently to explore the effect of COVID-19 on admissions for acute coronary syndromes using the Secondary Uses Service Admitted Patient Care (SUSAPC) database. In order to ensure that analyses were not duplicated, and to take advantage of the infrastructure that had been established to expedite analyses of NHS data, they collaborated with NHS Digital and the CSSG. In particular, they aimed to assess the impact of the pandemic on background CVD presentation, care delivery and outcomes.

The results of analyses of SUSAPC data showed that there was a 35% decline in patients presenting at hospital for heart attacks by the end of March 2020 (Figure 1). The nadir of this fall was seen at the beginning of April, and by the end of May the numbers had partially recovered. Early results from this research were presented to SAGE/NHS England on 17th April 2020 and were published in the Lancet on 14th July.[1]

The fall in admissions, especially amongst those with non-ST-elevation myocardial infarction (NSTEMI), actually began prior to the start of lockdown. While changes in patterns of behaviour during lockdown might have cut the incidence of myocardial infarction, this is unlikely to explain the dramatic fall in those presenting at hospital. More likely is that patients stayed away either to avoid putting pressure on Intensive Therapy Units (ITUs), for fear of catching the virus or because of the 'Stay at Home' message.

The SUSAPC data, whilst timely, included limited details about the process of care once patients are admitted to hospital. The greater detail captured in the national audit databases allowed a deeper exploration of these findings. Prof Chris Gale's team at the University of Leeds used NICOR data to evaluate further the causes of this dramatic decline in hospital admissions (Figure 2).[2] This confirmed how the fall off in presentation for acute myocardial infarction (AMI) started well before the UK lockdown as news reports grew in the media, especially about the effects of the virus in Italy.

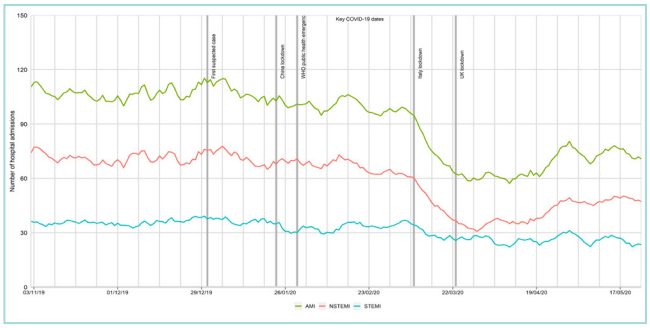
Figure 1: *Weekly admissions in England of patients with an acute coronary syndrome (ACS), by type [Source: SUSAPC data, graph reproduced with permission from The Lancet[1]]. The vertical dotted red line represents the date of lockdown.*



STEMI = ST-elevation myocardial infarction / NSTEMI = non-ST-elevation myocardial infarction.

Red lines = unadjusted data / Blue lines = data adjusted for incomplete coding

Figure 2: *Times series of daily hospitalisations in England of AMI between 1st January 2019 and 24th April 2020, by STEMI and NSTEMI [Source: MINAP data. From: Wu J et al. Patient response, treatments and mortality for acute myocardial infarction during the COVID-19 pandemic. Eur Heart J: Qual Care Clin Outcomes. 2020 Jul30;qcaa062. https://doi.org/10.1093/ehjqcco/qcaa062. Reprinted by permission from Oxford University Press on behalf of the European Society of Cardiology.[2]]*



STEMI = ST-elevation myocardial infarction / NSTEMI = non-ST-elevation myocardial infarction /

AMI = Acute Myocardial Infarction

Overall, there was a 42% reduction in AMI cases reported to NICOR at the nadir in April, with a subsequent recovery phase. As with the previous analysis, the fall was greater for NSTEMI cases (49%) than with STEMI cases (29%).

The need to understand the pattern of presentation and care

underlines the importance of timely data submission during this rapidly evolving clinical period. The analyses of SUSAPC data will continue during the post-lockdown period and the results of this can be accessed online.

The University of Leeds plans to update summaries of the hospital admission data later in the year at http://cardiovascularcovid.leeds.ac.uk

4.2 Fewer patients with STEMI self-presented but proportionately more received primary PCI

The characteristics of the STEMI patients presenting were similar to the pre-COVID period but fewer patients self-presented and proportionately more received primary PCI,[2] suggesting that fewer patients who did not normally receive reperfusion may have been admitted. Call-to-door times were maintained although there was a slight increase in median door-to-reperfusion times (by 4 minutes) (door-to-balloon times were longer in an analysis of the NAPCI data). Secondary preventive strategies were maintained at high levels. Crude 30-day mortality rates fell from 10.2% pre-COVID to 7.7% in the COVID-19 period. The median length of stay fell from 3 days to 2 days. In the recovery phase, the proportion of self-presenters began to increase, proportionately fewer received primary PCI and the crude mortality rose to 8.3%.

4.3 Fewer elderly and female patients and those with comorbidities were admitted with NSTEMI but this subset had a higher mortality than usual

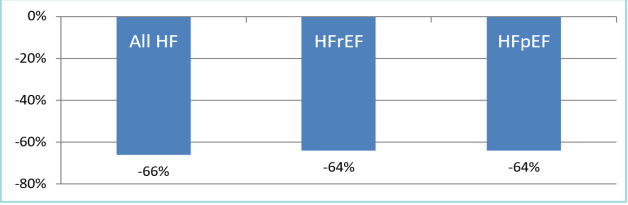
The story for the NSTEMI population was slightly different. During the COVID-19 period, patients were younger, there were fewer female patients and fewer had diabetes or a past history of cerebrovascular disease. Again, there was a fall in those who self-presented rather than calling the ambulance services. This suggested that older patients with comorbidities may not have attended hospital during this period. Fewer patients underwent inter-hospital transfer for treatment. For those undergoing an invasive strategy, the median times to angiography fell dramatically from 64 hrs to 26 hrs. Secondary preventive treatment was maintained at high levels although fewer received in-house echocardiography. The median length of stay fell from 5 to just 2 days. However, crude 30-day mortality increased from 5.4% to 7.5%. These changes began to return to normal patterns during the recovery phase and 30-day mortality fell to 5%.

The study highlighted the need for appropriate public messaging during a pandemic to encourage patients to call for help when acutely ill, especially older and more vulnerable patients.

4.4 The fall-off in the number of patients presenting to hospital with heart failure was even more dramatic than for heart attacks

In April 2020, there was a 66% drop in reported admissions to hospital for heart failure compared to expected numbers (Figure 3). This fall was for both heart failure with reduced ejection fraction and heart failure with preserved ejection fraction. Unlike those with AMI, there has not yet been an upturn in admissions and the latest information from May suggests an even greater fall.

Figure 3: *Percentage fall in admissions to hospital and interventional therapies for patients with heart failure, comparing April 2020 with the average for January/April 2019 [Source: NICOR data from the National Heart Failure Audit]*



Learning for the Future

The public, and especially the most vulnerable patients, have to be reassured that it is better to seek admission to hospital for treatment of a heart attack or heart failure than to stay at home for fear of infection or to avoid putting pressure on NHS resources.

4.5 There has been an across the board reduction in elective cardiac procedures performed on patients

Additional analyses by a group led by Prof Mamas Mamas (Keele University), using the whole of the national PCI dataset along with additional analysis across the other NICOR domains, revealed a substantial decrease in the number of all types of interventional procedures for CVD.[3,4] The drop in elective activity was greatest as urgent and emergency work was prioritised. A subsequent analysis of the NICOR data showed reductions in reported procedure rates ranging from a 50% fall for TAVI up to 92% for ablation (Figure 4).

The low point for this reduction was seen in April with a slight upturn in the volume of TAVI, pacemaker, ICD, CRT, and ablations procedures in May. This means that, since the onset of the COVID-19 crisis and by the end of April, more than 15,000 first-choice procedures that might have been expected were not performed, with no current evidence of patients being offered alternative treatments (for example, TAVI in place of sAVR or PCI in place of CABG). Obviously, the longer the period when the volume of treatments is lower than normal, the greater will be the 'catch-up' pressures on waiting lists once the pandemic has passed. Further analysis of this fall in procedures compared with those expected is on-going.

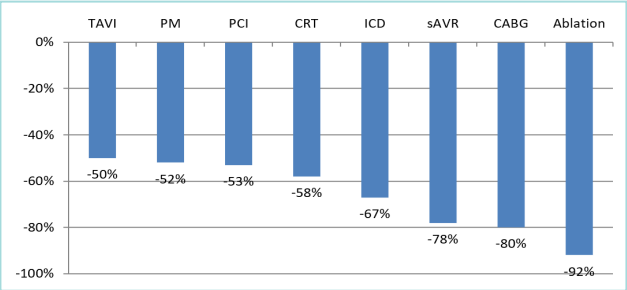
Learning for the Future

In planning for a pandemic, the design of CVD services should be organised to maintain elective capacity as close as possible to normal levels to avoid a significant build-up in waiting lists. This may involve the need to ring-fence some cardiac critical care unit beds.

4.6 For those heart attack patients who were admitted, levels of clinical care have largely been maintained

The analyses of NICOR data by the teams led by Prof Chris Gale (University of Leeds) and Prof Mamas Mamas (Keele University) both showed there was no shift away from the guideline-driven 'best' treatment with primary PCI (PPCI) for patients admitted with STEMI to less effective thrombolytic drug therapy but far fewer patients were treated with primary PCI compared to the historical comparison periods and there were fewer inter-hospital transfers for this indication.[2,3,4] There were some delays in times to treatment for patients with STEMI, especially for those requiring inter-hospital transfer, who had the highest rates of major adverse cardiovascular events and in-hospital mortality. Secondary prevention treatments were maintained and length of stay in hospital was reduced.

Figure 4: *Average reduction in total interventional procedures (emergency and elective) for patients with CVD in April 2020 compared to the average for January/April 2019 [Source: NICOR data]*



PCI = percutaneous coronary intervention / CABG = coronary artery bypass grafting / sAVR = surgical aortic valve replacement / TAVI = transcatheter aortic valve replacement / PM = pacemaker / ICD = implantable cardioverter-defibrillator / CRT = cardiac resynchronization therapy device

Fewer patients with NSTEMI were admitted and fewer were treated with an invasive approach. Those undergoing angiography and PCI were less likely to be from a BAME origin, and they were younger, with fewer females and fewer with comorbidities. Those undergoing an invasive strategy had their angiograms significantly earlier after admission (reduced from 64 to 26hrs). In probability, this was because of greater capacity being available to treat these urgent cases following the major reduction in elective work for catheter laboratories and the overall reduction in urgent and emergency cases across the board. This also allowed patients to experience shorter stays in hospital. Secondary prevention treatments were maintained but fewer patients underwent in-house echocardiography.

4.7 There has been an increase in patients presenting with out-of-hospital cardiac arrest

Subsequent analysis of both the MINAP and BCIS datasets has shown an increase in the number of CVD patients presenting to hospital with an out-of-hospital cardiac arrest (OOHA) during the pandemic.[5] This does not reflect the total number of patients with OOHA, as it does not record patients who suffered OOHA but died prior to admission, or patients who had OOHA associated with other causes.

CVD patients presenting with OOHA were more likely to be older, female, of Black, Asian and Minority Ethnicities (BAME) origin and with a background of diabetes or hypertension. Proportionately more presented with STEMI but that probably reflected the more dramatic fall off in admissions with NSTEMI.

Fewer of these patients underwent angiography or PCI and, although the outcomes of those who underwent procedures were consistent with previous years, overall mortality was higher than in 2019. This probably results from a different case mix but could also involve a selection bias during the pandemic related to changing thresholds for intervention, with concerns about inflicting risk on catheter laboratory teams or the availability of sufficient personal protection equipment (PPE).

Learning for the Future

An increase in the number of out-of-hospital cardiac arrest patients will remain a risk in any future pandemic and policies and services should ensure that the care of these individuals is not compromised.

4.8 Black, Asian and Minority Ethnicity patients with acute coronary syndromes have been more affected by the pandemic than white patients

In a further analysis around ethnicity led by Professor Mamas' group, fewer older females from Black, Asian and Minority Ethnicities were admitted with NSTEMI than seen in the historical comparison period.[6] The BAME group was proportionately more likely to present with STEMI, but the call for help for this cohort was longer than for white patients (the differences were much greater than those usually seen). There was a rise in the proportion of white patients presenting with NSTEMI who were investigated with angiography but this rise was not seen in the BAME group. In addition, although both cohorts had reduced waits for angiography compared with the pre-COVID period, BAME patients had longer delays. Overall in-hospital mortality for the BAME group was higher in the COVID-19 period than in previous times and adjusted mortality higher than seen for white patients. The reasons for these differences are not fully explained by the observed differences in the presentations and comorbidities between the different ethnic groups.

4.9 Excess mortality in England and Wales during the COVID Pandemic

It is now known that there has been an excess in all-cause mortality in the first wave of the pandemic with some regional differences both in terms of absolute numbers and rates per 100,000 population.[7,8,9] Although much of the excess cause of mortality has resulted from COVID-19, there has been an additional excess of deaths due to non-COVID related causes, including cardiovascular deaths.

Analyses led by Professor Mamas using ONS data from 144,279 adult deaths recorded during the study period, with 36,438 confirmed COVID cases, showed that the age standardized mortality rates of COVID-19 was higher than all other common primary causes of death, across age groups and sexes, except for cancers in women between the ages of 30-79 years.[10] Males suffered more COVID-related deaths but women suffered more non-COVID-related deaths. The most prevalent reported conditions in patients who died from COVID-19 were hypertension, dementia, chronic lung disease and diabetes, whilst the rates of pre-existing ischemic heart disease were similar in COVID (11.4%) and non-COVID (12%) deaths. Although absolute numbers increased with age, pulmonary embolism in those with COVID-19-associated deaths was proportionately more common in the <60 and 60-69 age groups, more so in men than women. Further analysis of the causes of the excess deaths and where they happened is on-going.[11,12,13]

4.10 10% of 30-day deaths occurring after PCI during the pandemic have been due to COVID-19: will this affect risk scores used to predict outcomes?

Professor Mamas's group also investigated the causes of death after PCI, especially after the changes imposed by the COVID-19 pandemic. It was found that 40% of 30-day mortality related to non-cardiac causes, and after March 1st, 10% of deaths were due to COVID-19. These results raise questions about the application of standard risk scores for PCI outcomes analysis during the pandemic period.[14]

5. An integrated analysis of national data may be able to inform the COVID-19 risk profiles for those returning to work

The substantial contribution of age, male sex, ethnicity and significant comorbidity on adverse outcome from acute COVID-19 is well known and underpins the national shielding policy. In terms of preventing illness and saving lives, a crucial further insight might be gained by establishing how different CVD risk profiles affect the acute consequences an individual is likely to experience from a COVID-19 infection.

To further inform policy as the country returns to work after lockdown, NICOR is planning research focused on individuals in the 'at work' age group who have a lower background risk profile. This builds on early analysis into this question by the OpenSAFELY Collaborative, which highlighted the increased risk of those with Asian or Black ethnicity, deprivation and a range of clinical factors[15] and will explore the possibility of linking the substantial NHS Health Checks dataset of 40 – 74 year-olds with COVID-19 outcome. To do so, a collaboration between NHS Digital and Public Health England teams (led by Prof John Deanfield's group) has been established.

6. High quality research is needed to understand the longer-term impacts of COVID-19

The long-term consequences of the COVID-19 pandemic on CVD service provision and outcomes will be widespread and complex to identify and evaluate. We anticipate an increase in late morbidity and mortality from several sources, including delayed or non-presentation, direct cardiac effects of COVID-19 and late health consequences of inflammation. Any such latent excess mortality and morbidity related to heart attack or heart failure will have implications for health services, the response to which should be supported by evidenced-based recommendations.

Such future work will be able to use the detailed UK datasets which NICOR collects to examine the long-term impact of COVID-19 on cardiovascular care and outcomes. As part of this, continuous data from 2020 can be compared with comparable records over the last three years to help track future trends.

With a view to ensuring that comprehensive national data is available to all who will be able to assist with the necessary research into this, NICOR has joined a collaborative with the UK Health Data Research Alliance, NHS Digital, SAIL Databank, HSC Public Health Agency, Public Health Scotland, The British Heart Foundation Data Science Centre and Health Data Research UK to ease the process of data access for academic groups across the country. We are also planning to support projects proposed by the wider academic community and other stakeholders

7. Lessons from the COVID-19 experience should shape the way for rapid nationwide data reporting

The COVID-19 crisis has taught us the importance of the contemporaneous collection, analysis and reporting of data on a nationwide basis to inform timely decision-making in healthcare. This, in turn, underscores the need for a national longitudinal and integrated dataset that can be used not only in responding to an immediate public emergency but to help every-day decision-making in the NHS.

The value of this has been hugely amplified over the last few weeks by the creation of a unified national data collaborative and the transformation of analytical processes and information governance, all of which has gone to inform decision-making through the rapid availability of contemporary data. This collaborative process – transparent, inclusive and using data collected daily at the 'coalface' – has enabled us to look in detail across a broad range of CVD conditions and clinical interventions to minimise the harm from COVID-19.

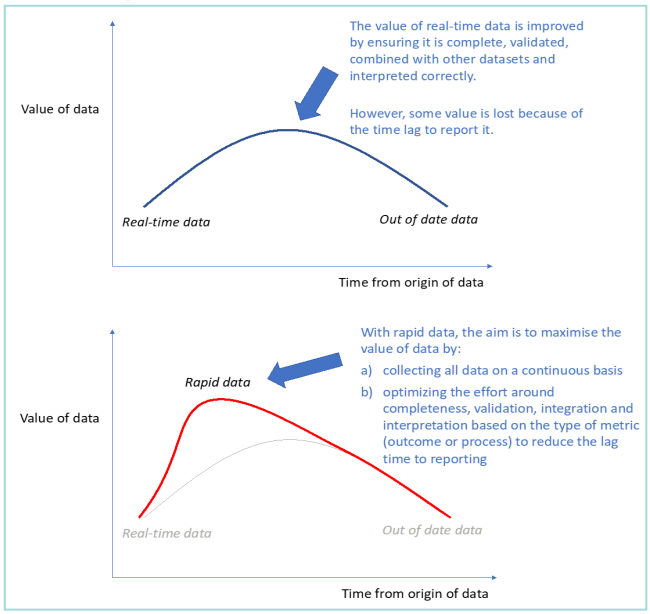
These gains from the COVID-19 response should not be lost and should now be embedded in the future ways of working for CVD audit and QI. This drive for information involves different ways of collecting data, new analytical and reporting tools and an ability to turn data not only into policy responses in a moment of crisis but also to accelerate the improvement of long-term care and outcomes from patients affected by CVD.

Of course, there are trade-offs to be made between the speed at which data can be made available and the value of data to building understanding, shaping policy and QI and taking decisions. Standing back from the experience from COVID-19 to synthesise some broader learning from the work with national data collection, it is clear that the value of contemporary data is improved by ensuring it is complete, validated, combined with other datasets and interpreted correctly. However, some value is lost because of the time lag to report it.

'Rapid data', as we would term it, maximises the overall value by using continuous data collection and optimising the effort around completeness, validation, integration and interpretation based on the type of metric.

So, for certain key outputs of the national audit programme, in particular outcome measures, it is essential to have professional engagement in a validation process that ensures both data completeness and accuracy and, where appropriate, provides enough time to make case mix adjustments. The longer the process for validation, however, the greater the risk that the information produced will be of less value as it becomes increasingly out-of-date. In this respect, for many data metrics, such as the type of treatment a patient received or its indication, a time-consuming validation process adds little value.

Figure 5: *Using continuous national data collection to deliver 'rapid data' of maximum value*



Consequently, NICOR's aim is to allow hospitals the ability to track continuously their own performance on these process metrics and to see how they perform against accepted standards, national averages and benchmark centres. This function can only work if data are entered and submitted to NICOR rapidly, using contemporaneous direct data entry, or with data uploads ideally on a weekly basis.

8. In quickly redesigning services to deal with COVID-19, local systems show how they need to be the future focus for QI

As we move into the recovery phase from COVID-19 and begin tackling the backlog of CVD treatments, there will be pressures on the NHS at national, regional and local levels to determine a way forward and put in place the capacity needed. The National Cardiac Audit Programme will have an integral role to play in informing these decisions and reassuring the public that these changes will support the highest possible standards of care.

At the same time, it is vital not to lose sight of the potential for continued QI based on the insights gained through the audit measures across the six NCAP domains. For many of these measures there have been significant and sustained improvements over the years, as a result of more consistent clinical care and the adoption of new evidence-based treatments. For others, though, there are stubborn inconsistencies in practice or performance which have proved hard to shift. These lead to wide variations in the care provided around the country and, inevitably, have an impact on the outcomes that individual patients experience.

The evidence is mounting that future QI for CVD should increasingly be organised and implemented at a local system level as the necessary changes can only come from actions that span across organisations. Encouragingly, the collective response to COVID-19 has demonstrated the potential for just such rapid redesign. The experience of this close working has given many local systems an insight into how they need to carry on the necessary transformation to improve care and outcomes for the continuing big health challenges of our time – conditions such as cancer, diabetes, dementia and, of course, CVD.

Such local system planning and QI is at the heart of the Long Term Plan and is reflected in the move from the establishment of Sustainability and Transformation Partnerships (STPs) which are now steadily making the move to become Integrated Care Systems (ICSs).[16] This might be in the form of a hospital provider and an ambulance trust working together to reduce call-to-balloon times for PCI or from hospitals reorganising patient flows to reduce times to urgent first-time CABG, or from demand for CRM services being aggregated in a smaller number of operators to meet minimum volume standards.

To assist with this, NICOR's 2020 NCAP report to be published later this year will provide QI recommendations for local system leaders to improve CVD outcomes. This will complement our collaboration with NHS England and the devolved nations, the Professional Societies, NHS Digital and individual hospitals to put in place the digital platforms and commitment to continuous data entry and validation that will ensure rapid data are available to all who need them, now and in the future.

What these analyses cannot tell us

We cannot be certain about the number of patients who have suffered a heart attack or an acute episode of heart failure who have NOT attended hospital during the COVID-19 pandemic, but we have looked at the observed versus expected admissions and commented on the observations.

We cannot be certain about the number of patients who were due to have a cardiovascular procedure but have had this postponed, but we have looked at the observed versus expected admissions and have commented on the observations.

Our analyses look at the demographic features of specific cohorts of patients during the pandemic but we cannot fully explain why we have seen differences in the characteristics of patients who have been admitted versus those who have historically been admitted. For example, we are not able to determine which patients might have a genetic susceptibility to a severe reaction to the SARS-Cov-2 virus. Where possible however we have added commentary to our observations.

Further research is ongoing to try and estimate the excess numbers of patients who have died at home from a cardiovascular cause during the pandemic.

Other groups around the country are looking into many other aspects of the impact of COVID-19 on cardiovascular outcomes. This report does not attempt to summarise all of their findings.

It should be noted that our findings are based on NICOR data as well as the hospital coding data sent to NHS Digital. We are aware that not all Trusts were able to provide timely data during this period. We have analysed overall trends but primarily investigated the data from hospitals whose data download frequency allowed us to conclude that the activity data were real and not just due to a failure to send data. Our conclusions are reinforced by the very similar findings from both coding and national audit data.

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This report is available online at (link to be added)

National Institute for Cardiovascular Outcomes Research (NICOR)

NICOR is a partnership of clinicians, IT experts, statisticians, academics and managers who, together, are responsible for six Cardiovascular Clinical Audits (the National Cardiac Audit Programme – NCAP) and a number of new health technology registries, including the UK TAVI registry. Hosted by Barts Health NHS Trust, NICOR collects, analyses and interprets vital cardiovascular data into relevant and meaningful information to promote sustainable improvements in patient well-being, safety and outcomes. It is commissioned by the Healthcare Quality Improvement Partnership (HQIP) with funding from NHS England and GIG Cymru/NHS Wales, and additional support from NHS Scotland. Funding is being sought to aid the participation of hospitals in Northern Ireland, the Republic of Ireland and the private sector.
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Barts Health NHS Trust

With a turnover of £1.5 billion and a workforce of around 17,000, Barts Health is a leading healthcare provider in Britain and one of the largest NHS trusts in the country. The Trust's five hospitals – St Bartholomew's Hospital in the City, which is home to the Barts Heart Centre, The Royal London Hospital in Whitechapel, Newham Hospital in Plaistow, Whipps Cross Hospital in Leytonstone and Mile End Hospital – each deliver high quality compassionate care to the 2.5 million people of east London and beyond. During the Covid-19 pandemic, the Trust also hosted the temporary NHS Nightingale Hospital London.

The Healthcare Quality Improvement Partnership (HQIP)

HQIP is led by a consortium of the Academy of Medical Royal Colleges, the Royal College of Nursing and National Voices. Its aim is to promote quality improvement in patient outcomes, and in particular, to increase the impact that Clinical Audit, outcome review programmes and registries have on healthcare quality in England and Wales. HQIP holds the contract to commission, manage and develop the National Clinical Audit and Patient Outcomes Programme (NCAPOP), comprising around 40 projects covering care provided to people with a wide range of medical, surgical and mental health conditions. The programme is funded by NHS England, the Welsh Government and, with some individual projects, other devolved administrations and crown dependencies.
www.hqip.org.uk/national-programmes

NHS Digital

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https://digital.nhs.uk/

Office for National Statistics

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https://www.ons.gov.uk/