NATIONAL CARDIAC AUDIT PROGRAMME

MYOCARDIAL ISCHAEMIA NATIONAL AUDIT PROJECT (MINAP)

2021 Summary Report

NICOR

British Cardiovascular Society

The 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.
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British Cardiovascular Society

The British Cardiovascular Society is the voice for those working in cardiovascular health, science and disease management in the UK; we aim to promote and support both the healthcare professionals who work in cardiology and the patients for whom we want to encourage the best possible treatment. Our members are healthcare professionals, working in the field of cardiovascular health.
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Barts Health NHS Trust

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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

This report was published on 14 October 2021

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MINAP AT A GLANCE

Data from the period April 2019 to March 2020

Of 86,547 confirmed cases of myocardial infarction (MI) there were 900 fewer STEMIs and 400 more NSTEMIs in 2019/20 compared to 2018/19

83.2% of STEMI cases receive reperfusion therapy, almost all by Primary Percutaneous Coronary Intervention (PPCI) (up from 74.3% in 2010/11)

Call-To-Balloon time (CTB): the global response of the health service from the time the patient calls for help until the PCI. This is itself made up of

a) Call-To-Door time (CTD): during which the ambulance service must respond to the call, make a pre-hospital assessment, provide appropriate treatments and convey the patient to hospital. This is a measure of ambulance service response.

b) Door-To-Balloon time (DTB): during which hospital staff must confirm the diagnosis, assess the patient's suitability for PCI, prepare for and begin to perform the PCI. This is a measure of the hospital response.

Call-To-Balloon times for STEMI are lengthening (up from 110 minutes in 2010/11 to 126 minutes in 2019/20)

Call-To-Door times for STEMI are lengthening (up from 58 minutes in 2010/11 to 80 minutes in 2019/20)

Place of care and specialist care: Admission to a cardiac ward allows optimum cardiac monitoring and access to highly trained cardiac nursing staff. Specialist care has been associated with more positive outcomes and patients seen by specialists are more likely to be referred for recommended interventions.

61% of patients with NSTEMI are admitted to a cardiac ward (no change for three years)

76.3% of STEMI cases undergo in-house echocardiography (up from 57.5% in 2010/11)

96.4% of NSTEMI cases are seen by a member of a cardiology specialist team

Of those NSTEMI cases seen by a specialist 83.5% of NSTEMI cases eligible for angiography undergo this procedure in-house – but only 54.9% within the 72 hours recommended by national guidelines

Ongoing management of heart attack patients

>90% of MI patients are discharged on standard secondary prevention therapies but only 68% of those with LV systolic dysfunction leave hospital on a mineralocorticoid receptor antagonist (MRA) (no change over three years).

These medicines have been shown to reduce the likelihood of subsequent coronary events in those who have suffered heart attack.

81% of heart attack patients are referred for cardiac rehabilitation

Exercise-based cardiac rehabilitation programmes are associated with fewer cardiac deaths in patients with coronary artery disease.

Executive summary

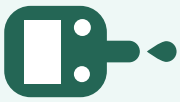
The 2019/20 Myocardial Ischaemia National Audit Project (MINAP) report records approximately 86,500 cases of heart attack - either ST-segment elevation myocardial infarction (STEMI) or non-ST-segment elevation myocardial infarction (NSTEMI) - admitted to hospitals in England, Wales and Northern Ireland.

Importantly, the report covers a period (April 2019 until March 2020) that was largely unaffected by the substantial changes in hospital practice and activity caused by the COVID-19 pandemic[1]. While the number of patients admitted to hospital with heart attack had begun to fall in the fortnight before the national 'lockdown' on 23 March 2020, the nadir for hospitalisations with heart attack was 19 April 2020.[2]

This report therefore represents 'pre-pandemic' activity and performance of hospitals and will form a baseline against which post-pandemic recovery plans and initiatives may be compared.

The quality of care provided to patients is expressed through a variety of quality improvement metrics derived from national and/or international guidelines. The metrics are presented both in terms of the trend (how that aspect of care has changed over the last ten years) and also the variance in performance between hospitals during this year.

KEY MESSAGES

	FOCUS OF ATTENTION	AUDIT FINDING
	**Number of heart attacks**	Fewer STEMI cases for the second consecutive year; **900** fewer this year
	**Patient characteristics**	Increasing proportion of patients have a BMI >30 (**31.4%**) or diabetes (**22.7%**)
	**Ethnicity**	About **10%** of cases occur in patients from ethnic minorities, mainly Asian and Black ethnicity patients. These patients tend to be younger, to be receiving treatment for high blood pressure and elevated cholesterol, and almost half (**44%**) have diabetes
	**Reperfusion in STEMI**	Increasing proportion receive reperfusion (**83%**), nearly all delivered as primary PCI (PPCI)
	**Timely PPCI in STEMI**	Progressive lengthening of median Call-To-Balloon time (no change in Door-To-Balloon time) with the lowest proportion of patients receiving PPCI within the recommended time for the last 10 years
	**Pre-discharge echocardiogram**	Progressive improvement in proportion (**76.3%**) with STEMI undergoing an echocardiogram

	**Admission of patients with NSTEMI to a cardiac ward**	No significant change over the last three years in proportion (**61%**) admitted to a cardiac ward and much variation between hospitals
	**NSTEMI patients cared for by a cardiologist**	Consistently high performance with **96.4%** of patients seen by cardiologists during their admission
	**Angiography for NSTEMI**	Consistently high performance with most eligible patients (**83.5%**) undergoing angiography during admission
	**Timely angiography for NSTEMI**	Slight worsening in proportion receiving angiogram within target time (**55%**). There is considerable variation between hospitals
	**Secondary prevention drug treatment after a heart attack**	Consistently high performance with respect to individual drug classes. Most patients (**91%**) are discharged on all the drug classes for which they are eligible
	**Referral for cardiac rehabilitation after a heart attack**	Continued improvement in performance; **81%** to **84%** of eligible patients referred

1 Introduction

The Myocardial Ischaemia National Audit Project (MINAP) reports on the care provided by hospitals and Ambulance Trusts to patients who are hospitalised with an acute coronary syndrome (including heart attack). Performance is compared with 'optimal care' derived from national standards, guidelines and expert opinion.

Clinicians can use the MINAP data to compare their practice with others and identify where quality improvement (QI) initiatives will have the greatest benefit. In this way, MINAP can be both the prompt for, and a measure of the effects of, QI activity.

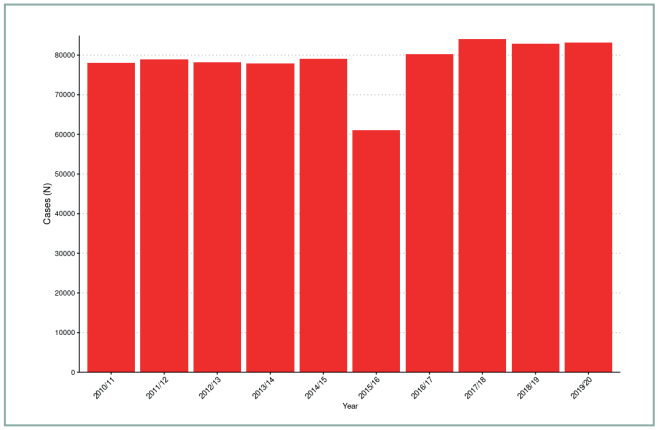
MINAP works closely with the British Cardiovascular Society – the body that represents and supports professionals who practise cardiology in the UK, and that maintains close links with patients and carers of patients with cardiac disease, and with cardiac nurses and physiologists.

Further information about MINAP, including contact details for the NICOR project team and details of the MINAP dataset, can be found on the NICOR web site.

1.1 The overall number of cases continues to fall

Between 1st April 2019 and 31st March 2020, 97,547 records were submitted of which 86,547 were confirmed cases of heart attack [Figure 1.1].

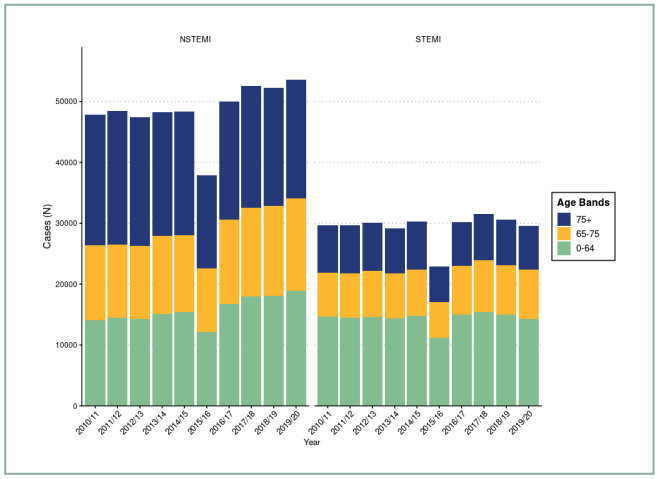
Figure 1.1: Trend in absolute number of submissions to MINAP, 2010/11 - 2019/2020



In this and subsequent analyses of trends over time values for 2015/16 are for 9 months only.

The majority (56,110 - 65%) of these were non-ST-segment elevation myocardial infarction (NSTEMI), the remaining 30,437 (35%) being ST-segment elevation myocardial infarction (STEMI). This represents a reduction in the number of STEMI cases (by approximately 900) and a modest increase in NSTEMI (by approximately 400) compared with the previous year, and continues a trend for a reduction in overall numbers of heart attacks following a decade-long peak of 89,226 in 2017/18 [Figure 1.1 and Figure 1.2]. This reduction is not accounted for by the small reduction in numbers related to an absence of data from an interventional centre in Northern Ireland. The reduction in numbers of STEMI patients might be influenced by the impact of preventive measures. We await further annual trends to understand whether there is a real change in NSTEMI cases.

Figure 1.2: Trend in absolute number of submissions to MINAP expressed by age and type of heart attack, 2010/11 - 2019/2020



1.1.1 Male patients, those from ethnic minorities, and those with STEMI tend to be younger

Patients with STEMI tend to be younger than those with NSTEMI (median age 65 years vs 71 years). In other words, half of those with STEMI are 65 years old or younger while half of those with NSTEMI are 71 years old or older.

There were approximately two male patients for every female patient. The male preponderance is greater in STEMI than NSTEMI (72% vs 66%). Male patients tend to be younger than females (median age 66 years for male vs 74 years for female), and this is so for STEMI

and NSTEMI [Table 1]. The difference in median ages between male and female patients was 9 years for STEMI (63 years vs 72 years) and 6 years for NSTEMI (69 years vs 75 years).

Table 1: Median age (in years) at time of heart attack, 2019/20

Group	Median Age
STEMI	
All	65
Male	63
Female	72
White patients	66
Black & Asian patients	58
NSTEMI	
All	71
Male	69
Female	75
White patients	71
Black & Asian patients	65

For the 67,283 cases in which ethnicity was recorded, 6,500 (9.7%) were from ethnic minorities - most of which (6,321) being from Black and Asian ethnic groups.

These patients were significantly younger (overall median age 63 years vs 70 years) than the White patients. The difference in median ages between Black and Asian patients and White patients was 8 years for STEMI (58 years vs 66 years) and 6 years for NSTEMI (65 years vs 71 years).

[Note: The MINAP data field for Ethnicity has limited options and has not kept pace with contemporary governmental and societal guidance on recording and writing about this aspect of self-reported identity. So here, Black refers to a person who identifies as Black, African or of Caribbean background or Black British; Asian includes people who would identify as Indian, Pakistani, Bangladeshi, Chinese and other Asian backgrounds, or Asian British]

1.1.2 Rising numbers with diabetes, particularly among ethnic minorities

There continues to be a year-on-year increase in the prevalence of diabetes mellitus among patients in MINAP [Figure 1.3]. This mirrors an increase in the proportion of patients who are overweight [Figure 1.4].

Figure 1.3: Percentage of patients with no previous history of coronary artery disease who had been diagnosed with diabetes mellitus prior to their heart attack, 2010/11 - 2019/20

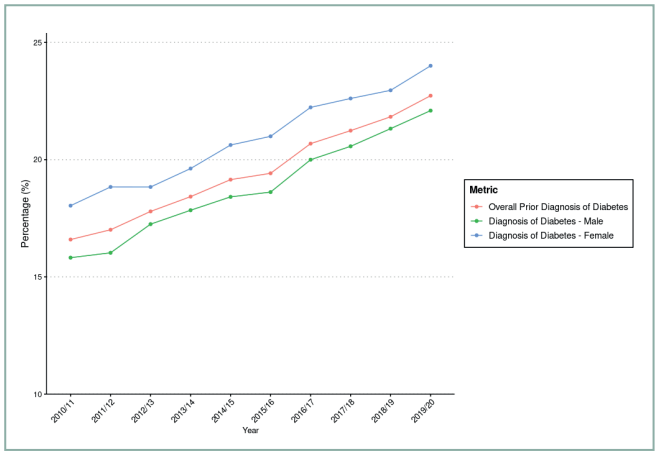
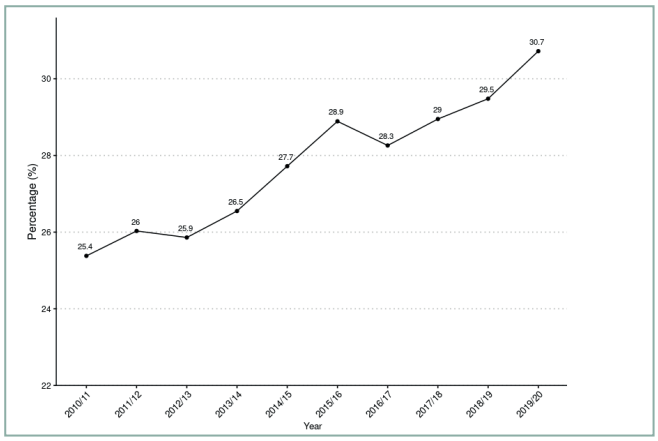


Figure 1.4: Proportion of patients who had a body mass index of 30 or greater at time of first heart attack, 2010/11 - 2019/20



A previous diagnosis of Diabetes was more common in females than in males and much more common among the grouped ethnic minorities compared with the White patients.

Restricting analysis to those 62,169 cases without prior evidence of coronary artery disease in whom diabetic status was recorded, 22.7% were known to have diabetes - 22.1% among males, 24% among females, 20.4% among White patients, 44% among the aggregated Black and Asian ethnic groups.

Other risk factors for developing cardiovascular diseases also were seen more often among aggregated Black and Asian ethnic groups - hypertension in 56% vs 48%; hyperlipidaemia in 39.5% vs 29% - though cigarette smoking was less common (see below).

[Note: A recently published study of NSTEMI using 2010-2017 MINAP data confirms these findings with respect to risk factors profiles, and also considers differences in the provision of care between white and other ethnic groups. Reassuringly using statistical matching for different patient characteristics there are similar outcomes with respect to survival and major adverse cardiac events.[3]]

1.1.3 Smokers are younger when they have heart attacks

Smoking status was known in 70,195 cases. Of these, 29% regularly smoked tobacco in the weeks before their heart attack, 36% were 'ex-smokers' and 35% had never regularly smoked.

There was a greater proportion of current smokers among cases of STEMI than NSTEMI (38% vs 24%), among males compared with females (30% vs 25%) and among White patients compared with aggregated Black and Asian ethnic groups (29% vs 26%). The proportion of cases who had 'never smoked' was much greater among aggregated Black and Asian patients (53% vs 33.5%).

There is an association between smoking and age, with current smokers being a little more than 10 years younger than ex-smokers and never-smoked [Table 2]. This association is unaffected by sex, ethnicity and type of heart attack.

The proportion of current smokers was 28.5% in England, 34% in Wales and 31% in Northern Ireland.

Table 2: Mean age (in years) by smoking status, 2019/20

Group	Current smokers	Ex-smokers	Never smoked
All	59.1	70.9	70.3
Male	58	70.0	67.4
Female	62.1	73.4	75
STEMI	58.0	68.9	68.2
NSTEMI	59.9	71.6	71.3
White patients	59.7	71.2	71.3
Aggregated Black & Asian patients	54.1	65.1	65.2

1.2 Measuring what happens in MINAP

1.2.1 Individual patients are unique, but mechanisms of disease are common. So, for a given clinical condition particular investigations and treatments should be offered to everyone.

These treatments, or 'processes of care', are those that can reverse or reduce the ill effects of the condition and so are associated with better 'outcomes of care'. Frequently, such processes of care are 'evidence-based' and are recommended by clinical guidelines. While not the only determinants of outcome - patient factors, such as age, are also influential - whether and how well evidence-based treatments are provided is the responsibility of clinical teams and health services. This is the rationale for expressing quality of care in terms of process measures, rather than just reporting outcomes.

For MINAP, the condition in question is 'heart attack' - myocardial or heart muscle injury. Often the cause is an abrupt reduction in blood flow within a coronary artery, though injury can also occur in the presence of excessive heart work, or as a response to severe generalised disorders such as overwhelming infection. The focus of MINAP is the management of the former - injury following a primary coronary artery event - so-called Type 1 myocardial infarction.

Metrics in this report [Section 2] reflect care provided early after onset of symptoms to reduce heart muscle damage, and so limit the 'size' of heart attack, and later care to improve recovery and reduce the likelihood of subsequent heart attacks.

Complementary data are also available in the NAPCI report.

MINAP does not capture all elements of good quality care. Important but less tangible aspects of care, for example those small acts that demonstrate healthcare professionals' and workers' thoughtfulness, sensitivity and kindness, that influence the experiences of individual patients and those close to them during their hospitalisations, are not collected.

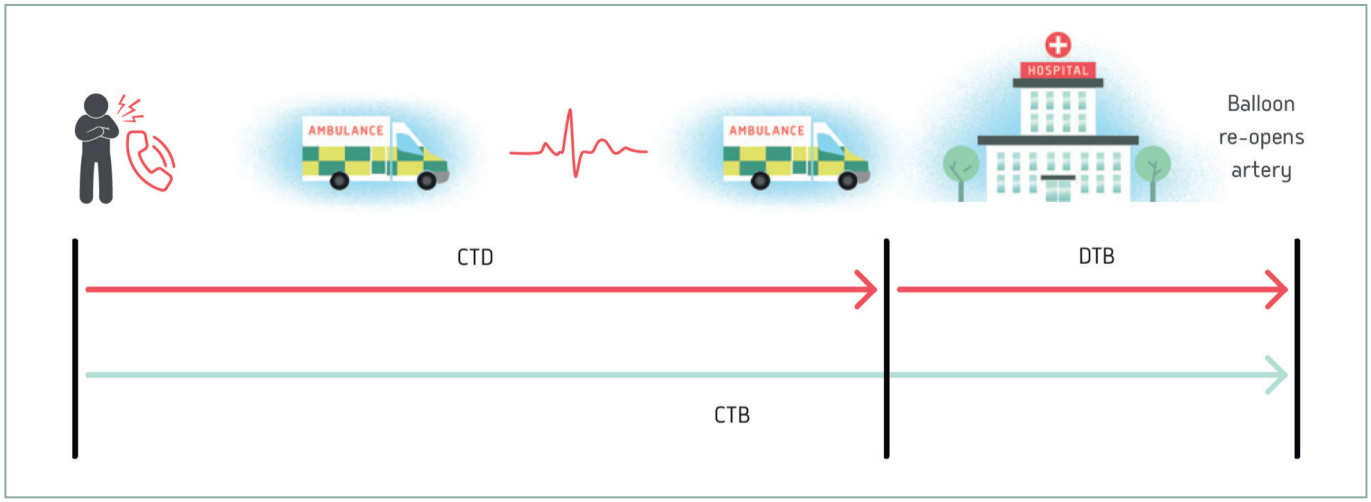
2 | Quality improvement metrics

2.1 Call-To-Balloon times are lengthening; fewer patients are receiving timely primary PCI

2.1.1 Overview of the QI metric

QI Metric Description/Name	Call-To-Balloon time for STEMI
Why is this important?	Shorter Call-To-Balloon times (CTB) are associated with better outcomes
QI theme	Effectiveness/timeliness
What is the standard to be met?	a) CTB <120 minutes b) CTB <150 minutes
Key references to support the metric	NICE quality standard (QS 68[4]) 'Adults with acute ST-segment-elevation myocardial infarction (STEMI) who present within 12 hours of onset of symptoms have primary percutaneous coronary intervention (PCI), as the preferred coronary reperfusion strategy, as soon as possible but within 120 minutes of the time when fibrinolysis could have been given.' [Given that pre-hospital fibrinolytic therapy may take 30 minutes to start – this leads to a standard of 'within 150 minutes']. See Figure 2.1 for overview of times to treatment for patients undergoing PPCI for STEMI.
Numerator	a) All with STEMI who underwent primary PCI within 120 minutes of call for help b) All with STEMI who underwent primary PCI within 150 minutes of call for help
Denominator	All with STEMI who underwent primary PCI for whom a CTB can be calculated
Trend	Progressive lengthening of CTB over last 6 years. Smaller proportion of patients receiving timely primary PCI – 40% within 120 minutes, 67% within 150 minutes [Figure 2.2 and Figure 2.3]
Variance	All but one hospital achieved CTB 150 minutes for at least half the patients treated. Only 10 hospitals achieved CTB 120 minutes for at least half the patients treated. The best performing hospital achieved CTB 120 minutes in 69.7% and CTB 150 minutes in 87.4% [Figure 2.4]

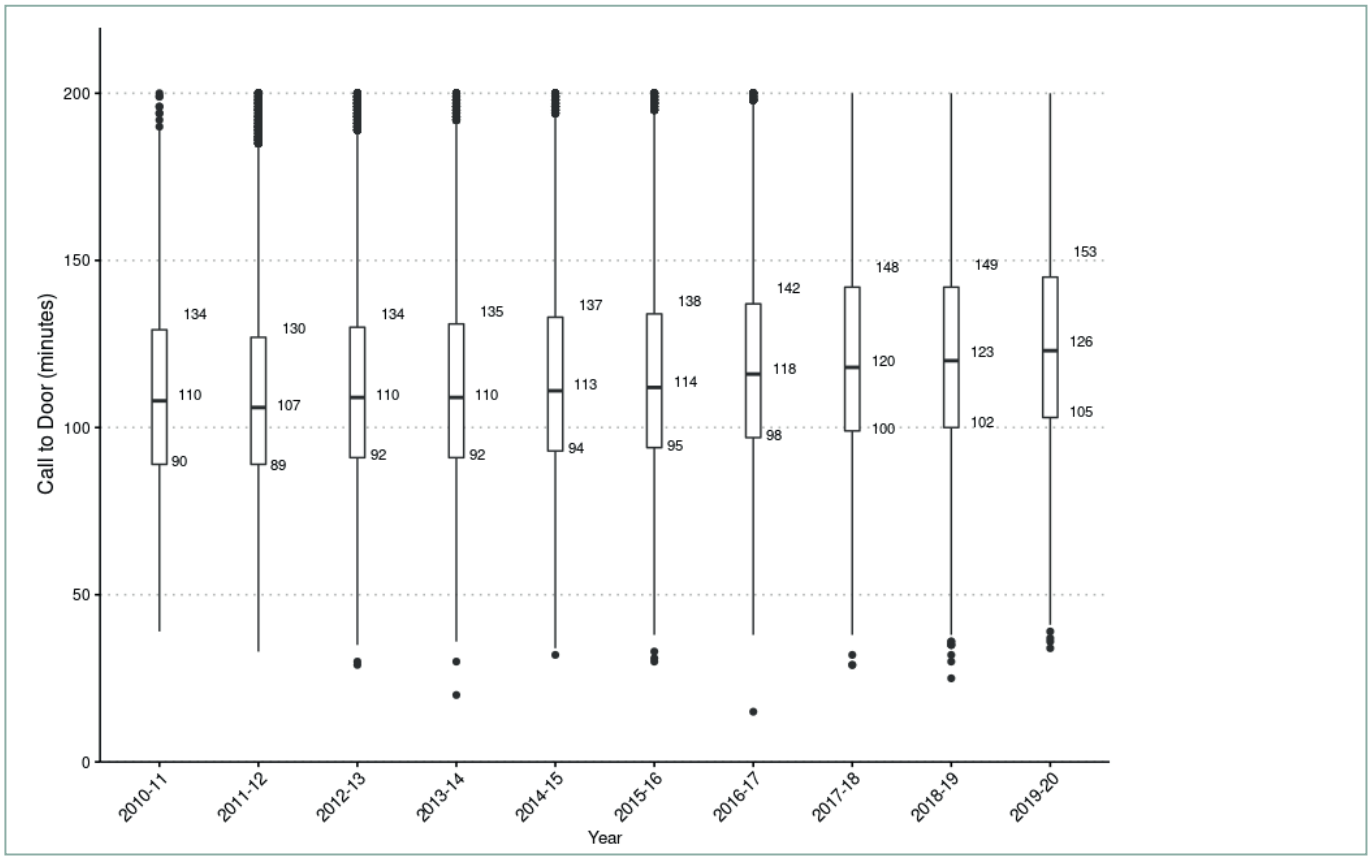
Figure 2.1: Time intervals relevant to reperfusion treatment for those receiving primary PCI



Call-To-Balloon time (CTB): the global response of the health service from the time the patient calls for help until the PCI. This is itself made up of a) Call-To-Door time (CTD): during which the ambulance service must respond to the call, make a pre-hospital assessment, provide appropriate treatments and convey the patient to hospital. This is a measure of ambulance service response; b) Door-To-Balloon time (DTB): during which hospital staff must confirm the diagnosis, assess the patient's suitability for PCI, prepare for and begin to perform the PCI. This is a measure of the hospital response.

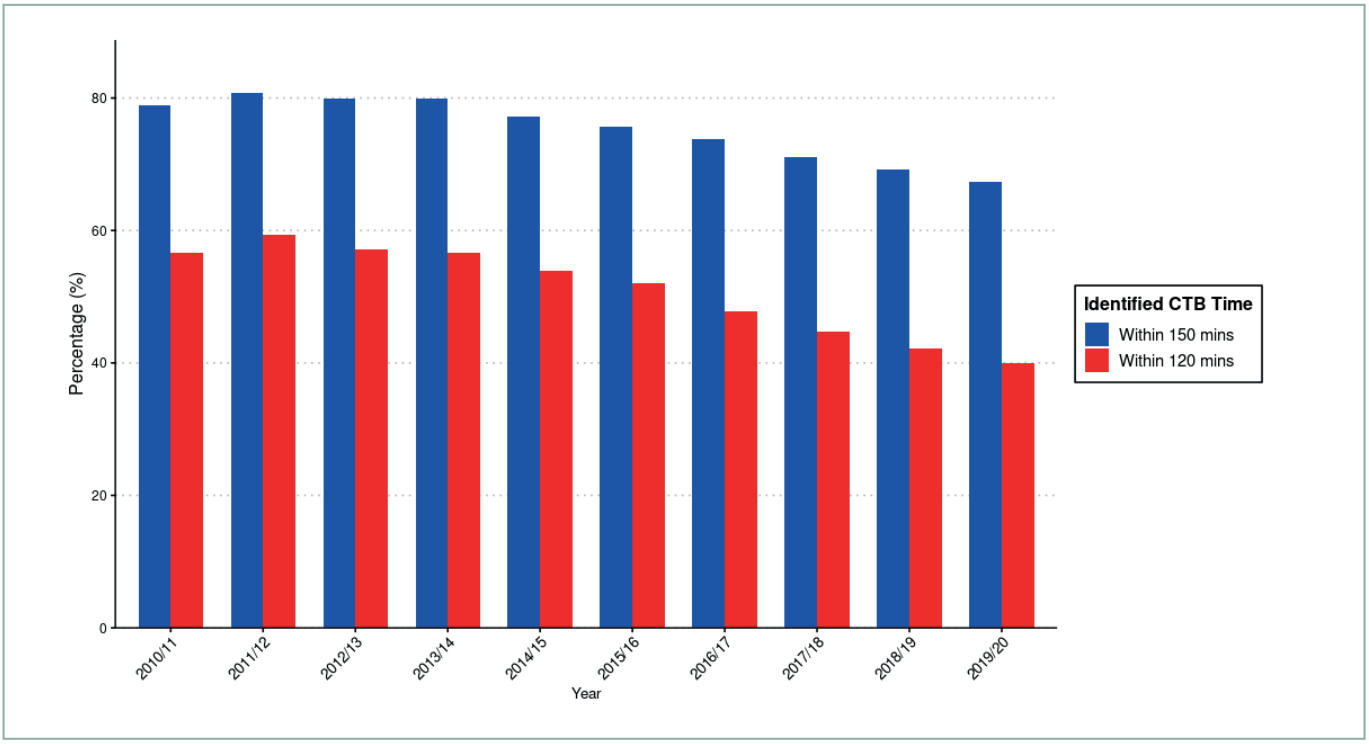
2.1.2 Audit results

Figure 2.2: Trend in Call-to-Balloon times (CTB) - median and interquartile ranges, 2010/11 - 2019/20



Each box encompasses the middle 50% of patients. The number adjacent to the lower border of each box is the CTB achieved in up to 25%, that adjacent to the upper border is the CTB achieved in at least 75%. The bold line within each box is the CTB achieved in 50% (i.e. the median value).

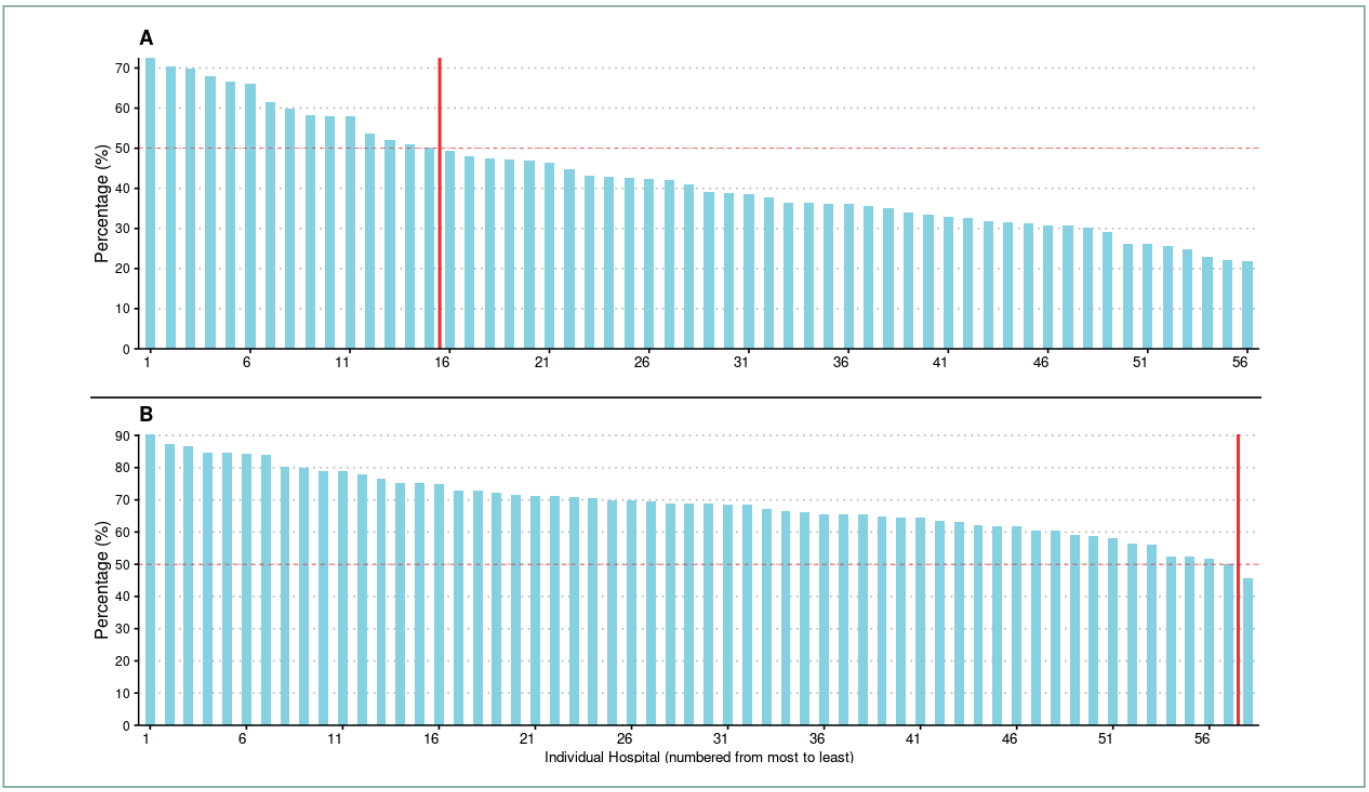
Figure 2.3: Trend in the proportion of patients with STEMI who underwent primary PCI within CTB 120 minutes and CTB 150 minutes, 2010/11 - 2019/20



Legend: mins = minutes

As the median CTB has lengthened, the proportion of patients with STEMI who undergo primary PCI within 150 minutes, and within 120 minutes, has fallen to the lowest level during the last decade.

Figure 2.4: Distribution of hospitals with respect to the proportion (%) of patients with STEMI who undergo primary PCI within A: CTB 120 minutes and B: CTB 150 minutes, 2019/20



These analyses are for hospitals providing primary PCI services for STEMI and exclude hospitals recording 20 or fewer patients within the relevant CTB metric. Those hospitals to the right of the red line did not provide primary PCI to at least 50% of patients for the relevant CTB metric.

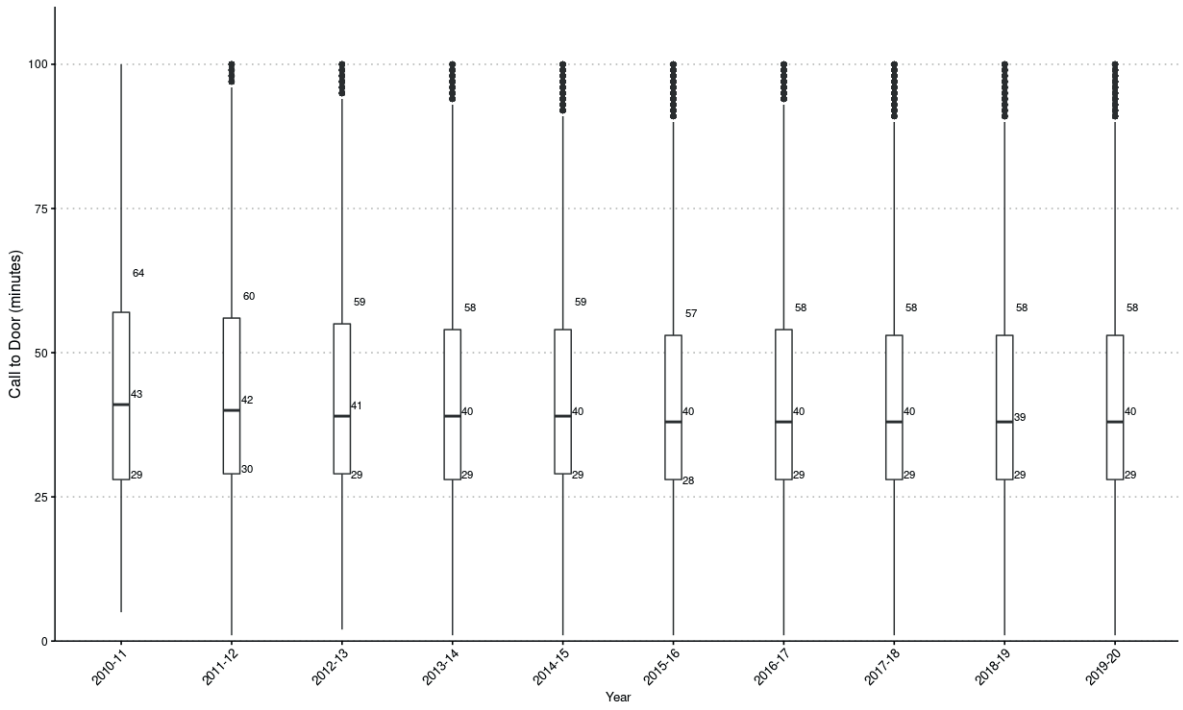
2.2 Door-To-Balloon times are unchanged

2.2.1 Overview of QI metric

QI Metric Description/Name	Door-To-Balloon time for STEMI
Why is this important?	Shorter Door-To-Balloon times (DTB) should be associated with better outcomes following STEMI
QI theme	Effectiveness/timeliness
What is the standard to be met?	a) DTB <60 minutes b) DTB <90 minutes
Key references to support the metric	European Society of Cardiology guidelines for STEMI: 'important time targets' – 'Maximum time from STEMI diagnosis to wire crossing the lesion in patients presenting at primary PCI hospital ≤60 minutes' [5]
Numerator	a) All with STEMI who underwent primary PCI within 60 minutes of arrival at PPCI centre b) All with STEMI who underwent primary PCI within 90 minutes of arrival at PPCI centre
Denominator	All with STEMI who underwent primary PCI for whom a DTB can be calculated
Trend	Median DTB has varied very little over last 10 years and is presently 40 minutes [Figure 2.5]
Variance	• 35 of 60 hospitals achieved DTB 60 minutes in at least 70% of patients treated; in 8 hospitals DTB 60 minutes was achieved in fewer than 60% patients • 17 of 62 hospitals achieved DTB 90 minutes in at least 90% of patients treated; in 8 hospitals DTB 90 minutes was achieved in fewer than 75% patients • the best performing hospital achieved DTB 60 minutes in 94.2% and DTB 90 minutes in 97.5% [Figure 2.6]

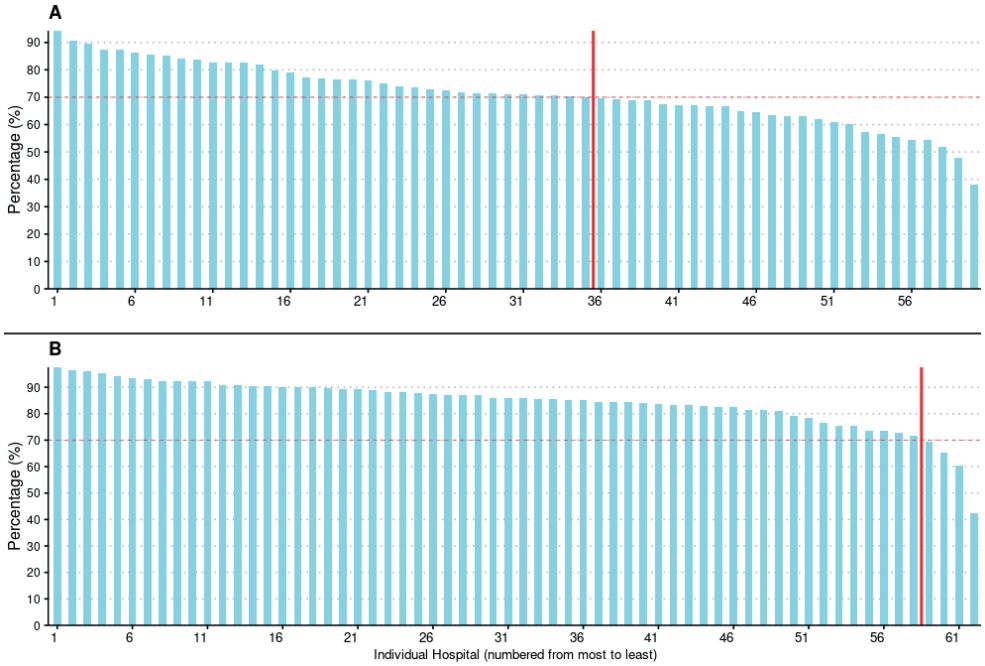
2.2.2 Audit results

Figure 2.5: Trend in Door-to-Balloon times (DTB) - median and interquartile ranges, 2010/11 - 2019/20



Each box encompasses the middle 50% of patients. The number adjacent to the lower border of each box is the DTB achieved in up to 25%, that adjacent to the upper border is the DTB achieved in at least 75%. The bold line within each box is the DTB achieved in 50% (i.e. the median value).

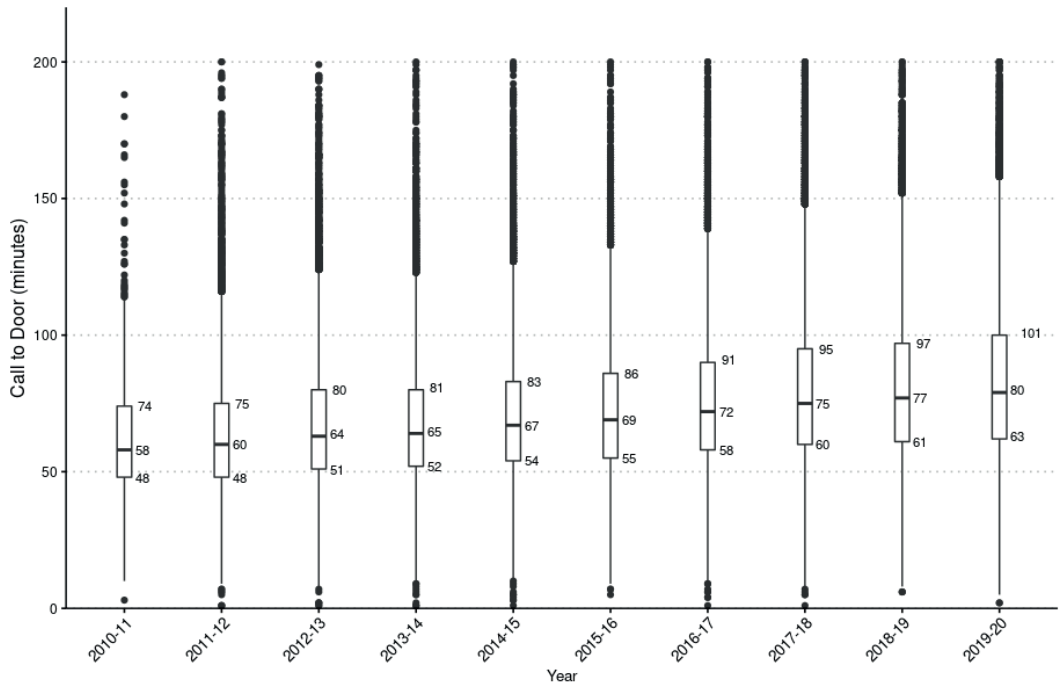
Figure 2.6: Distribution of hospitals with respect to the proportion of patients with STEMI who undergo primary PCI A: within 60 minutes and B: within 90 minutes, 2019/20



These analyses are for hospitals providing primary PCI services for STEMI and exclude hospitals recording 20 or fewer patients within the relevant DTB metric. Those hospitals to the right of the red line did not provide primary PCI to at least 50% of patients for the relevant DTB metric.

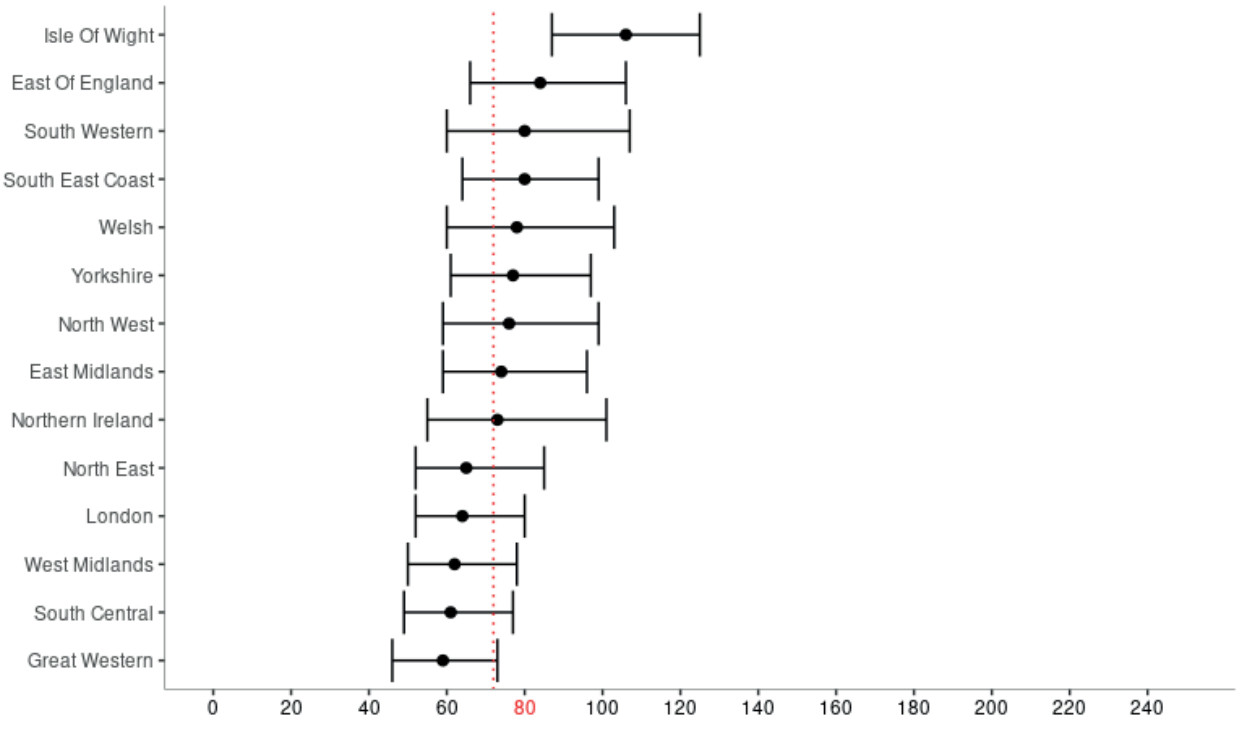
Given that the DTB has remained stable, the lengthening CTB is associated with a lengthening in the pre-hospital CTD time [Figure 2.7].

Figure 2.7: Trend in Call-To-Door times (CTD) - median and interquartile ranges, 2010/11 - 2019/20



The number adjacent to the lower border of each box is the CTD achieved in up to 25%, that adjacent to the upper border is the CTD achieved in at least 75%. The bold line within each box is the CTD achieved in 50% (i.e. the median value).

Figure 2.8: Median Call-to-Door intervals (CTD) for both direct admissions and inter-hospital transfers, in minutes, by Ambulance Trust, 2019/20



2.2.3 Recommendations for those not achieving the standard

In the management of STEMI, staff in hospitals where Call-To-Balloon time standards are not being met should work with partner Ambulance Trusts, emergency departments, neighbouring non-interventional hospitals and cardiologists to better understand delays in provision of primary PCI. This may include making improvements to the hospital response to the arrival of a patient but may also focus on ways to improve pre-hospital Call-To-Door times.

A good starting place would be a consideration of the safety recommendations and observations contained within the Healthcare Safety Investigation Branch report - Emergency response to heart attack.[6]

2.3 Greater proportion of STEMI treated with reperfusion therapy

2.3.1 Overview of QI metric

QI Metric Description/Name	No reperfusion for STEMI
Why is this important?	Reperfusion of a completely or partially occluded coronary artery is associated with reduced myocardial damage
QI theme	Effectiveness
What is the standard to be met?	All patients with ST elevation within 12 hours of onset of symptoms should be considered for reperfusion. No specific target rate for 'no reperfusion'
Key references to support the metric	ESC guideline for management of STEMI recommends 'Reperfusion therapy is indicated in all patients with symptoms of ischaemia of ≤ 12 hour duration and persistent ST segment elevation'[5] ESC Quality Indicator – Proportion of STEMI patients arriving in the first 12 hours receiving reperfusion therapy[7]
Numerator	Those patient with ST elevation myocardial infarction who do not receive reperfusion therapy
Denominator	All patients with STEMI for whom reperfusion is not judged to be 'too late' by the admitting team
Trend	Substantial reduction in the proportion of patients with STEMI who do not receive reperfusion therapy over 10 years, from 26% to 17% [Figure 2.9]
Variance	Not reported for individual hospitals

2.3.2 Audit results

Figure 2.10 shows the trend in management of STEMI with respect to the type of reperfusion treatment offered. In particular, there has been a fall in the number of cases in which intravenous thrombolytic treatment is given instead of PCI. In 2019/20 only 99 patients with STEMI were given thrombolytic therapy.

There are a number of reasons why reperfusion therapy is not given [Table 3]. In at least half of such cases the attending clinicians determine that a PCI would not be beneficial to the particular patient, often because the patient arrived at hospital too late in the course of the heart attack to gain benefit [Figure 2.11].

Figure 2.9: Proportion (%) of patients with STEMI who do not receive reperfusion therapy (neither primary PCI nor thrombolysis), 2010/11 - 2019/20

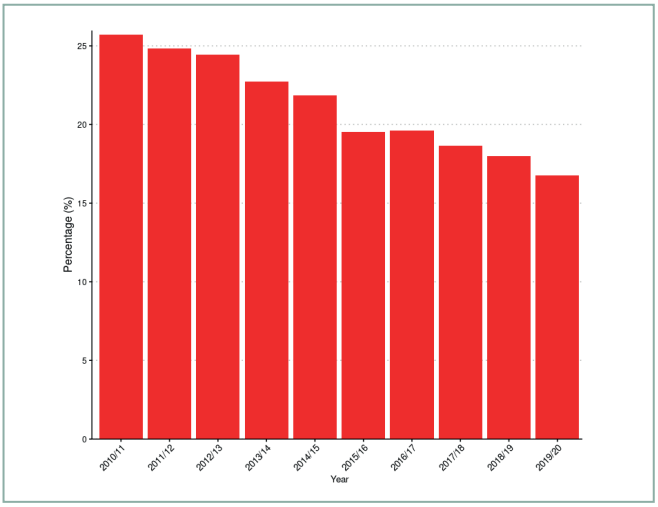


Figure 2.10: Trend in proportion (%) of patients with STEMI receiving primary PCI, intravenous thrombolytic therapy or no reperfusion therapy (neither primary PCI nor thrombolysis), 2010/11 - 2019/20

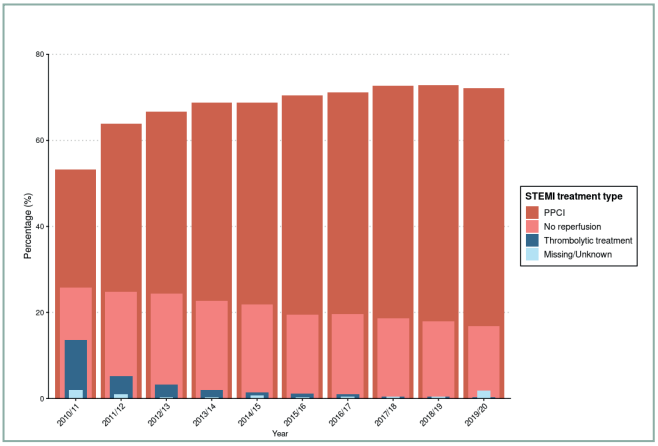
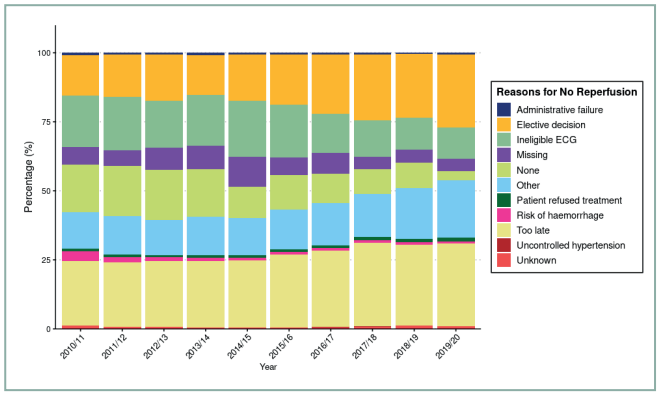


Table 3: Reasons for no reperfusion therapy in STEMI, 2019/20

	Number	Percent
Too late	1,507	29.5
Elective Decision	1,362	26.7
Ineligible ECG	585	11.5
Other	1,053	20.6
No reason	166	3.2
Missing a reason	231	4.5
Patient refused	69	1.4
Risk of haemorrhage	36	0.7
Unknown	52	1.0
Administrative failure	38	0.7
Uncontrolled hypertension	2	0.04
Total	5,101	100

Figure 2.11: Trend in reasons for no reperfusion therapy in STEMI, 2010/11 - 2019/20



2.4 More patients with STEMI undergo pre-discharge echocardiogram

2.4.1 Overview of QI metric

QI Metric Description/Name	Echocardiography after STEMI
Why is this important?	Performance of echocardiography allows assessment of left ventricular (LV) function and targeted treatments of heart failure – it also identifies patients who might benefit from 'device therapy'
QI theme	Safety/other
What is the standard to be met?	No national standard has been published, but aim for 90% achievement
Key references to support the metric	ESC guideline for management of STEMI recommends 'routine echocardiography to assess resting LV and RV function, detect early post-MI mechanical complications, and exclude LV thrombus… in all patients'[5]
Numerator	Patients undergoing echocardiographic assessment during the index admission
Denominator	Patients with STEMI who survived to discharge home (i.e. did not die during the index admission, and were not transferred to another hospital) in whom echocardiography was not identified as 'not indicated'
Trend	Increase in proportion undergoing echocardiogram prior to discharge, continuing trend for 'year-on-year' improvement - now 76% [Figure 2.12]
Variance	• 74 hospitals managing STEMI arranged echocardiography in at least 90% of patients treated; • In 12 hospitals fewer than 25% of patients with STEMI underwent an echocardiogram before discharge • The highest performing hospitals reported arranging an echocardiogram in every patient with either STEMI or NSTEMI [Figure 2.13 and Figure 2.14]

2.4.2 Audit results

Figure 2.12: Proportion (%) of patients who undergo echocardiogram following STEMI, 2010/11 – 2019/20

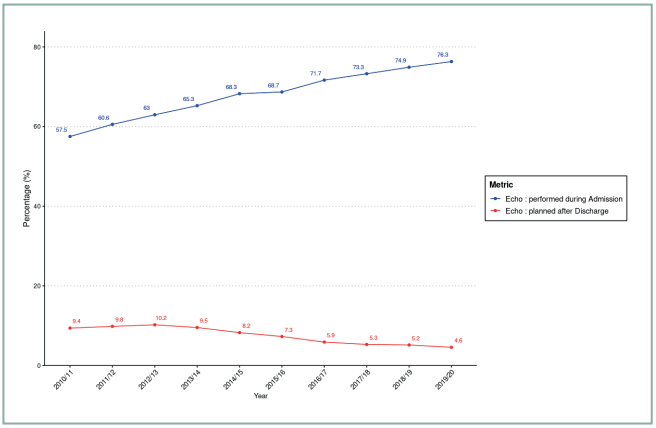
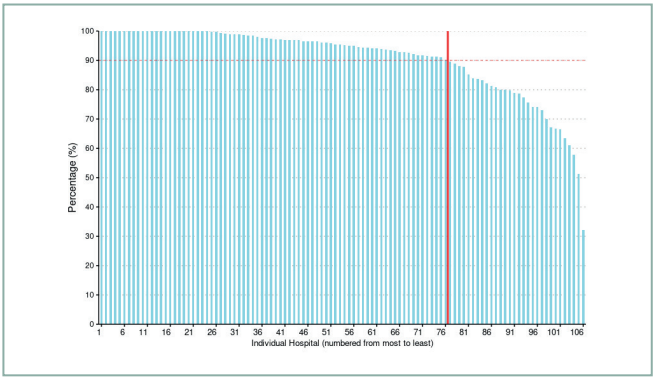
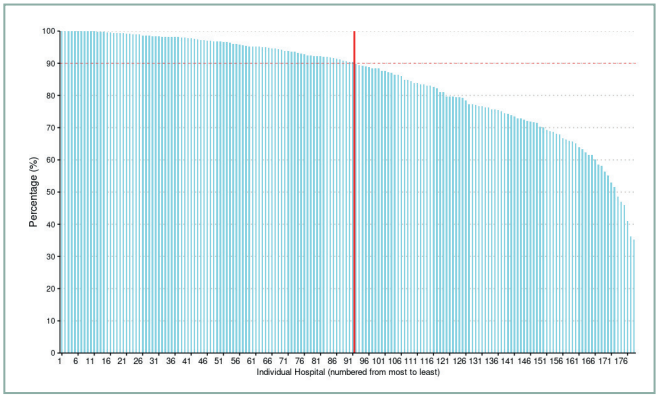


Figure 2.13: Distribution of hospitals with respect to the proportion (%) of patients with STEMI who undergo an echocardiogram during admission, 2019/20



Hospitals to the right of the red line have not achieved ≥ 90% of patients undergoing echocardiography as an in-patient. Data from 107 hospitals; hospitals reporting fewer than 20 cases excluded.

Figure 2.14: Distribution of hospitals with respect to the proportion (%) of patients with STEMI and NSTEMI who undergo an echocardiogram during admission, 2019/20



Hospitals to the right of the red line have not achieved ≥ 90% of patients undergoing echocardiography as an in-patient. Hospitals reporting fewer than 20 cases excluded.

2.4.3 Recommendations for those not achieving the standard

In the management of both STEMI and NSTEMI, staff in hospitals with lower rates of provision of an echocardiogram should undertake a review of data collection processes - to ensure that the reported rate accurately reflects practice - and then review the patient pathway to identify opportunities for echocardiography during the index admission.

Consideration should be given to performing a limited 'bedside' echocardiogram if there are difficulties obtaining timely detailed 'departmental' studies.

Where patients are discharged early to another hospital before an echocardiogram can be performed there must be a clear request to perform the test at the receiving hospital.

2.5 A third of NSTEMI cases are not admitted to cardiac wards

2.5.1 Overview of QI metric

QI Metric Description/Name	Admitted to cardiac ward after NSTEMI
Why is this important?	Admission to a cardiac ward allows optimum cardiac monitoring and access to highly trained cardiac nursing staff
QI theme	Safety
What is the standard to be met?	No national standard has been published, but aim for 80% achievement
Key references to support the metric	Admission to a non-cardiac ward is associated with a lower rate of angiography following admission with NSTEMI[8]. European Society of Cardiology Guidelines advise that patients with NSTEMI should be admitted to a monitored unit – coronary care, intensive care or intermediate care depending on risk – and managed by personnel adequately trained to manage life-threatening arrhythmias[9]
Numerator	All patients with a final diagnosis of NSTEMI who were admitted to a cardiac care unit or cardiac ward or intensive care unit
Denominator	All patients with a final diagnosis of NSTEMI who did not die in the Emergency Department before admission to a hospital ward
Trend	Increases in the proportion of patients with NSTEMI who are admitted to a cardiac ward have 'levelled off' over the last 3 years - now 61.3% [Figure 2.15]
Variance	In 60 of 180 hospitals at least 80% of patients with NSTEMI were admitted to a cardiac ward [Figure 2.16] In 26 hospitals fewer than 30% of patients with NSTEMI were admitted to a cardiac ward

It may be that the organisation of some hospitals, with competing priorities for bed usage, will not allow a meaningful increase in cardiac care beds. An expansion in cardiac bed numbers may further be hampered by the need to manage the extra needs secondary to the pandemic and its aftermath. There may be an opportunity to use dedicated multi-specialty 'high care' beds.

Figure 2.15: Proportion (%) of patients with NSTEMI who are admitted to a cardiac ward and who are seen by a cardiologist during their admission, 2010/11 to 2019/20

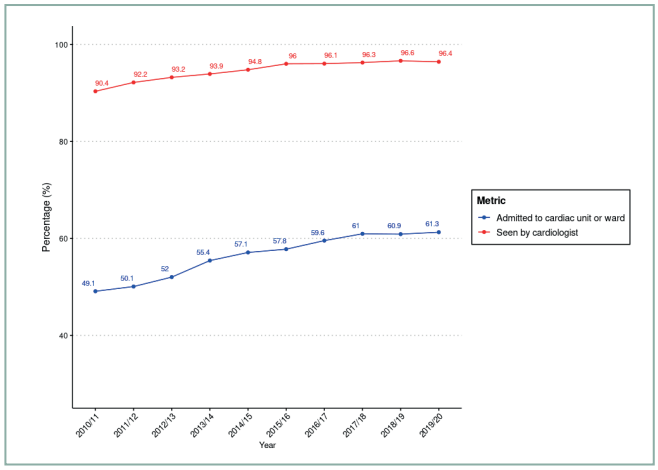
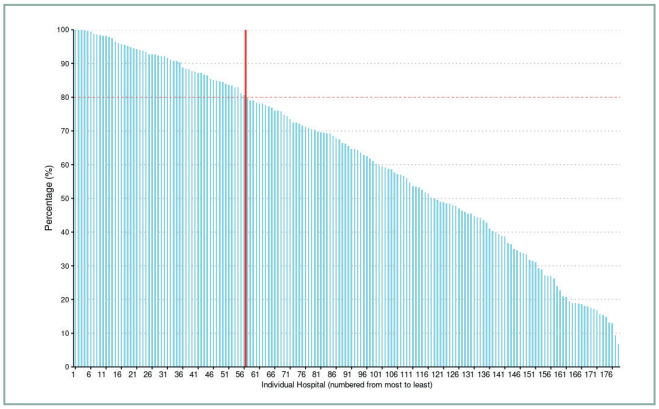


Figure 2.16: Distribution of hospitals with respect to the proportion (%) of patients with NSTEMI who are admitted to a cardiac ward, 2019/20



Hospitals to the right of the red line have not achieved ≥ 80% of patients admitted to a cardiac ward. Hospitals reporting fewer than 20 cases excluded

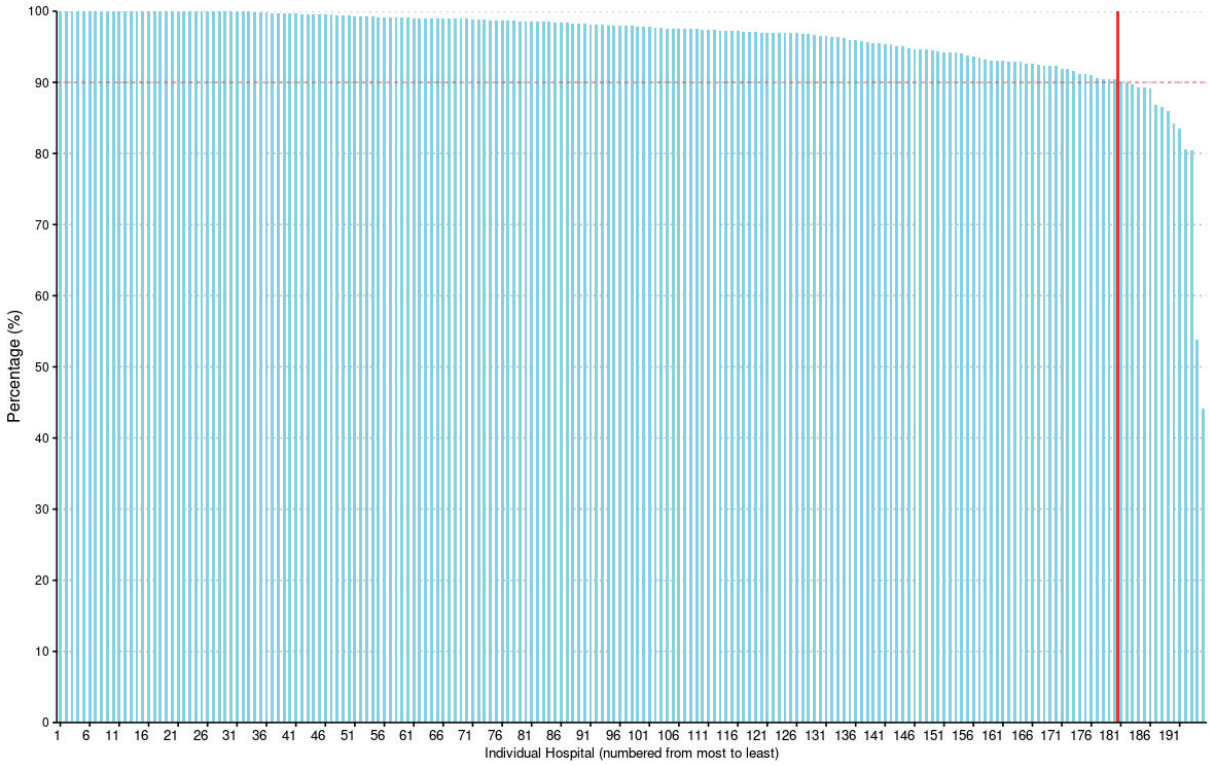
2.6 Cardiologists are involved in care of most patients with NSTEMI

2.6.1 Overview of QI metric

QI Metric Description/Name	Seen by cardiologist following NSTEMI
Why is this important?	Specialist involvement should ensure increased and more timely access to recommended interventions
QI theme	Effectiveness
What is the standard to be met?	All patients with NSTEMI felt to be caused by an acute coronary event should be reviewed by a cardiologist during the index admission
Key references to support the metric	Early involvement of a cardiologist is associated with increased use of guideline-recommended management[10]
Numerator	Patients with NSTEMI who were seen by a cardiologist (or a member of the clinical team working under the supervision of a consultant cardiologist) during admission.
Denominator	All patients with final diagnosis of NSTEMI who are admitted to hospital
Trend	Proportion of patients with NSTEMI who are seen by cardiologists during admission remains high - now 96.4% [Figure 2.15]
Variance	Little variation - 183 of 201 hospitals reported at least 90% of patients with NSTEMI seen by a cardiologist during admission [Figure 2.17]

2.6.2 Audit results

Figure 2.17: Distribution of hospitals with respect to the proportion (%) of NSTEMI seen by a member of a specialist cardiology team during their admission, 2019/20



Hospitals to the right of the red line have not achieved ≥ 90% of patients being seen by a member of the specialist team. Hospitals reporting fewer than 20 cases excluded.

2.6.3 Recommendations for those not achieving the standard

Those hospitals with low rates of cardiology involvement in the care of patients with heart attack should undertake a review of their data collection processes - to ensure that the submitted data reflects practice. If it does, there should be consideration of improved provision of cardiac care during admissions.

This might require increased staffing or more flexible use of members of the cardiology team - for example Nurse Specialists and Physician Associates.

2.7 Improvements in provision of coronary angiography maintained

2.7.1 Overview of QI metric

QI Metric Description/Name	Coronary angiogram during admission with NSTEMI
Why is this important?	Angiography allows confirmation of the diagnosis and is a precursor for coronary interventions such as PCI and CABG
QI theme	Effectiveness
What is the standard to be met?	No national standard has been published, but aim for 100% given that the denominator excludes those judged to be ineligible for angiography
Key references to support the metric	NICE quality standard (QS 68): 'Coronary angiography is important to define the extent and severity of coronary disease'[11] European Society of Cardiology Guidelines: '[Coronary angiography] allows confirmation of the diagnosis, identification of the culprit lesion in a coronary artery, establishment of suitability for PCI or CABG, and stratification of short term and long term risk'[9]
Numerator	All those for whom a coronary angiogram was performed during index admission (either in the admitting hospital or in another hospital)
Denominator	All patients with a final diagnosis of NSTEMI, excluding those who refused an angiogram and those for whom an angiogram was judged to be 'not applicable'
Trend	Improvements in rate of angiography seen in the previous five years have 'levelled-off' over the last five years, remaining high - now 83.5% [Figure 2.18]
Variance	• At least 90% of eligible patients with NSTEMI underwent an angiogram in 109 hospitals [Figure 2.19] • In 8 hospitals fewer than 50% of patients with NSTEMI underwent an angiogram

2.7.2 Audit results

Figure 2.18: Proportion (%) of eligible patients with NSTEMI who undergo angiography during admission, and proportion (%) in which the angiogram is performed within 72 hours of admission, 2010/11 - 2019/20

Legend: hrs = hours

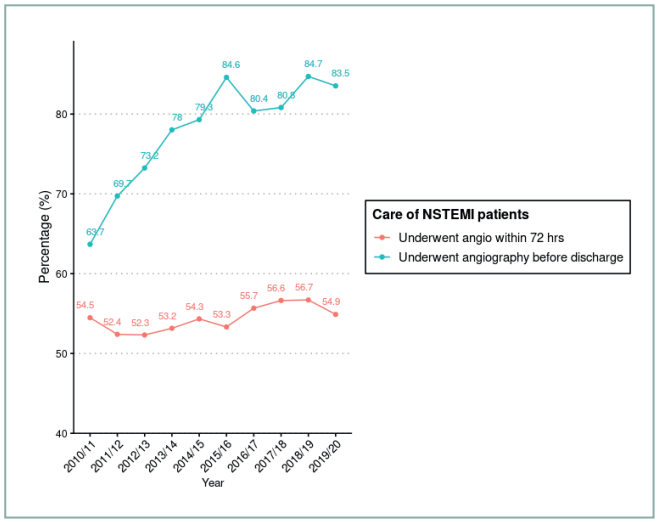
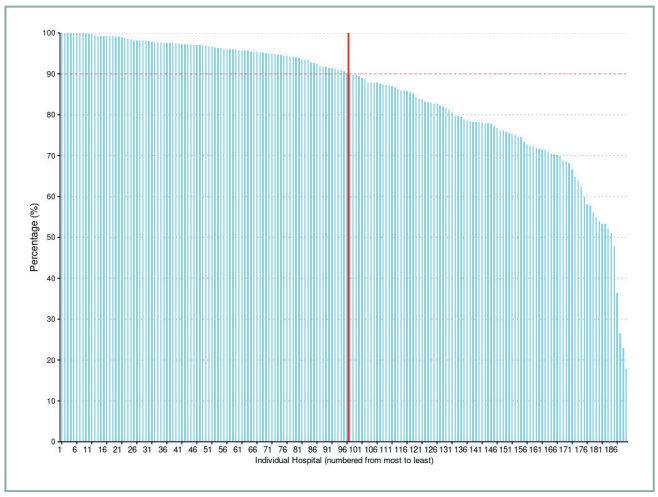


Figure 2.19: Distribution of hospitals with respect to the proportion (%) of eligible patients with NSTEMI who undergo an angiogram during their admission, 2019/20



2.7.3 Recommendations for those not achieving the standard

In the management of NSTEMI staff in those hospitals with low rates of angiography in eligible patients should perform a review of their systems of data collection and submission, and their systems for managing ACS

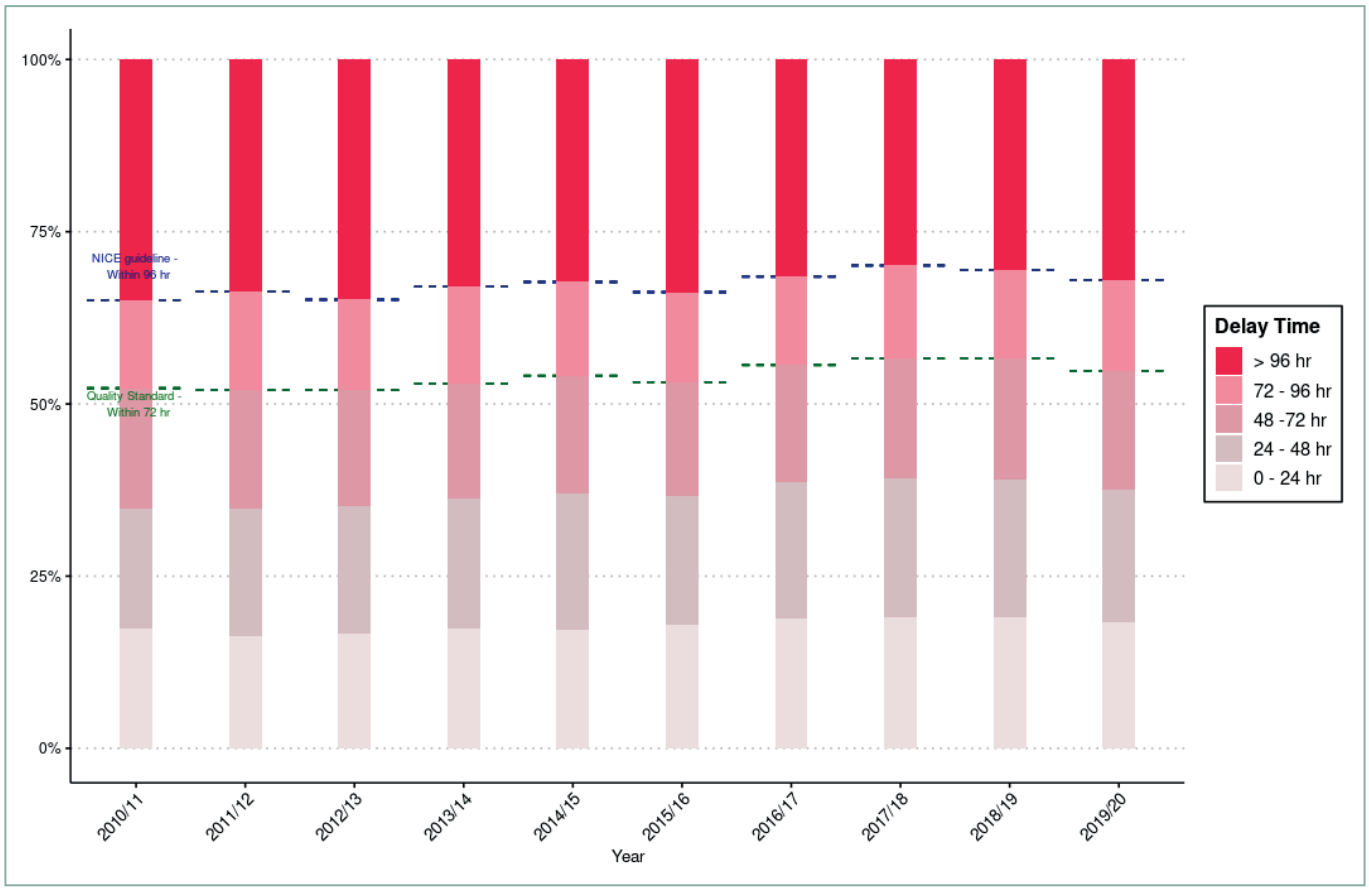
2.8 No improvement in delays to coronary angiography

2.8.1 Overview of QI metric

QI Metric Description/Name	Proportion of patients undergoing angiography within 72 hours of admission to hospital with NSTEMI
Why is this important?	Early angiography leads to early revascularisation with better outcomes in high risk patients and shorter hospital stays
QI theme	Effectiveness/timeliness
What is the standard to be met?	Angiography within 72 hours of admission to hospital in all cases unless angiography is deemed inappropriate
Key references to support the metric	NICE quality standard (QS 68): 'Adults with non-ST-segment elevation myocardial infarction (NSTEMI) or unstable angina who have an intermediate or higher risk of future adverse cardiovascular events are offered coronary angiography (with follow-on percutaneous coronary intervention [PCI] if indicated) within 72 hours of first admission to hospital.'[11]
Numerator	Those patients in whom the time to angiography – Interval from admission to angiography - is shorter than 72 hours
Denominator	All patients with final diagnosis of NSTEMI who undergo angiography during admission and for whom the interval from admission to angiography can be calculated
Trend	Virtually no change over the last ten years in the proportion of patients with NSTEMI who receive angiography within 72 hours of admission - now 55% [Figure 2.20 and Table 4]
Variance	• In 45 hospitals at least 60% of patients with NSTEMI underwent an angiogram within 72 hours of admission • In 9 hospitals fewer than 25% of patients with NSTEMI underwent an angiogram within 72 hours of admission • In the highest performing hospital 90.3% of patients received an angiogram within 72 hours of admission [Figure 2.21]

2.8.2 Audit results

Figure 2.20: Distribution of delays from admission to angiography in patients with NSTEMI, 2010/11 to 2019/20

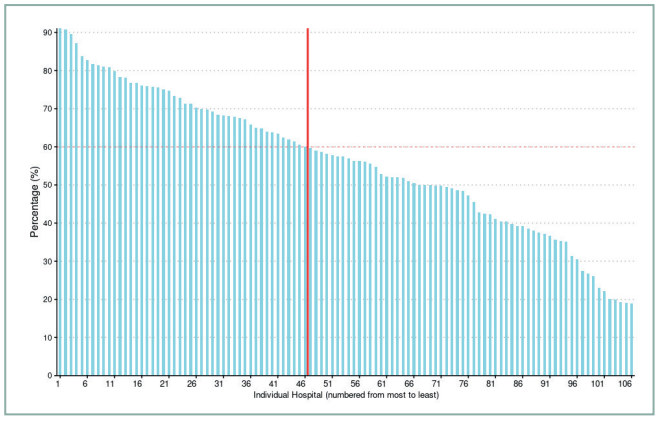


Legend: hr = hours

Table 4: Delay to angiography (angio) following admission with NSTEMI, by nation, expressed as proportion receiving angiogram within 72 hours of admission and median delay with interquartile ranges (IQR) 2019/20

	Angio within 72 hours (%)	Median (IQR) interval from admission to angio – no transfer required (hours)
England	55	66 (30-114)
Northern Ireland	51	72 (32-122)
Wales	55	65 (36-106)

Figure 2.21: Distribution of hospitals with respect to the proportion (%) of patients who undergo an angiogram within 72 hours, 2019/20



2.8.3 Case study – Improving the NSTEMI pathway

Dr Richard Jones
Consultant Cardiologist Queen Alexandra Hospital, Portsmouth.

The UK has one of the world's best systems for treating STEMI. The systems for treating acute coronary syndromes are rather more mixed. The latest MINAP data demonstrate a significant variation in access times for acute coronary syndromes. The best systems will achieve the NICE guideline of 72 hours from admission to cath lab. Most do not. Over the last few years I have worked with systems throughout England seeking to improve their performance. Taking time to stand back and analyse the pathway is time well spent. Everyone who 'touches' the pathway should be involved. During visits to many departments I have found the following approach helpful.

1. **Review available data** – how are we currently performing? This step should create a sense of urgency that change is needed. The so-called 'burning platform'.
2. **Gather together the people who influence the pathway.** Typically this will include the medical assessment and cardiology ward team, Cath lab manager, radiographer, physiologist and interventional lead, cardiac rehabilitation and admin team and senior nurse. Ideally involve the clinical director, divisional lead nurse and manager. The ambulance service should be involved if inter-hospital transfer is required. It is vital to secure the services of a transformation manager to keep the project on track. They must be free of the inevitable distractions of frontline operational pressures. This person will run the action plan when everyone else returns to the busy clinical coal face.
3. **Create the vision** as to what the pathway should look like for 80% of patients. It is recognised that some patients will be more complicated and need a bespoke approach, but if you succeed in creating an efficient pathway for the 80% then that will free up time to deal with the more complicated patients.
4. **Communicate the vision** widely and repeatedly so no-one is in doubt as to the importance of this work, and stress the benefits for patients.
5. **Remove obstacles** – a workshop is now required involving all of those listed above to identify all of the problems in the pathway. These might include delays in initial case identification, cath lab scheduling, demand/capacity assessment, and discharge planning. At the end of the workshop you should have created an action plan with timelines and responsibilities - allow a minimum of a half day for the workshop.
6. **Create quick wins** – e.g. fast-tracking the initial referral process can often save a day or two.
7. **Build on the change** – The core members of the improvement group must meet regularly to review progress and seek further support from senior management as required e.g prioritising flow out of the ED/AMU for NSTEMI.
8. **Don't let up!** All too often initial improvements slip backwards, and it is important that the changes are embedded and regularly reviewed in a formal setting.

Conclusion: Adopting a proven improvement methodology is important – most attempts to change things for the better fail. The chances of success are greatly improved by using an effective 'change' model.

2.8.4 Recommendations for those not achieving the standard

In those hospitals where the 72 hour quality standard for angiography following admission with NSTEMI is not met commissioning groups, managerial and clinical leaders should engage in a process of system review, economic appraisal and quality improvement. This may require changes within hospitals, across referral networks and/or in the overall commissioning of services.

There should be an emphasis on early reliable identification of suitable patients, streamlined referrals, and adequate capacity for transferring patients into (and out of) interventional hospitals; this may involve weekend angiography lists for such patients.

2.9 Most patients leave hospital on all eligible prevention medication

2.9.1 Overview of QI metric

QI Metric Description/Name	Percentage of patients discharged on all secondary prevention drugs for which they are eligible following either STEMI or NSTEMI
Why is this important?	These medicines have been shown to reduce the likelihood of subsequent coronary events in those who have suffered heart attack.
QI theme	Effectiveness
What is the standard to be met?	No specified standard – so suggest 90% of relevant patients should receive all secondary prevention drugs for which they are eligible at time of discharge from hospital following STEMI and NSTEMI.
Key references to support the metric	NICE Guideline (CG 172): Offer all people who have had an acute MI treatment with the following drugs: ACE (angiotensin converting enzyme) inhibitor; dual antiplatelet therapy (aspirin plus a second antiplatelet agent); beta-blocker; statin[12]
Numerator	Patients discharged on all secondary prevention drugs for which they were judged to be eligible
Denominator	All patients with a final diagnosis of either STEMI or NSTEMI who were discharged home (i.e. not transferred to another hospital or who died during admission), excluding patients who were ineligible/ unsuitable or declined to receive each one of the following drugs or drug classes: aspirin, beta blocker, statin, either ACE inhibitor or angiotensin receptor antagonist, and either thienopyridine or ticagrelor.
Trend	Consistently high performance over past ten years - now 90.9% of patients are discharged on all secondary prevention drug classes for which they are eligible [Figure 2.22]
Variance	• More than 90% of patients were discharged on all secondary prevention medication for which they were eligible in 123 hospitals • In 9 hospitals fewer than 50% of patients were discharged on all eligible medication [Figure 2.23]

2.9.2 Audit results

Figure 2.22: Proportion (%) of patients discharged on all secondary prevention medication for which they are eligible, 2010/11 - 2019/20

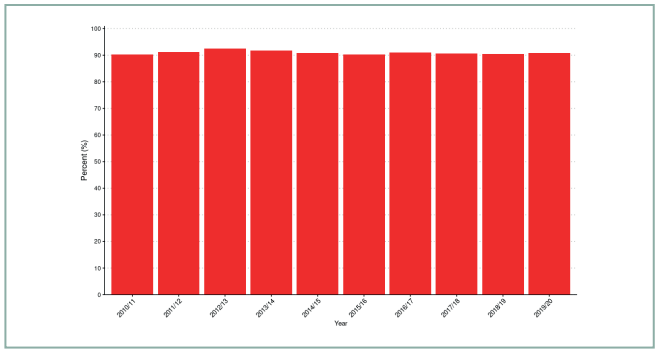
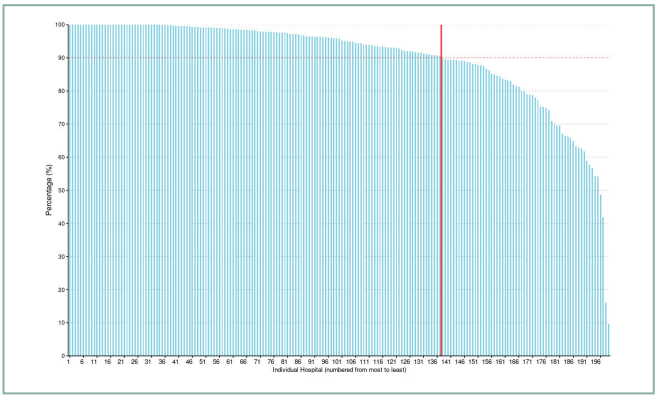


Figure 2.23: Distribution of hospitals with respect to the proportion (%) of patients with STEMI and NSTEMI who are discharged home on all secondary prevention drugs for which they are eligible, 2019/20



Hospitals to the right of the red line have not achieved ≥ 90% of patients being discharged on all secondary prevention drugs for which they were eligible. Hospitals reporting fewer than 20 cases excluded.

Considering prescription of individual secondary prevention drugs at the time of discharge: 94.8% who were eligible received either an Angiotensin Converting Enzyme inhibitor or angiotensin receptor antagonists; 98.1% received aspirin; 97.9% received another antiplatelet agent (thienopyridine inhibitor or ticagrelor); 96.7% received a beta blocker; 97.8% received a statin.

Continuing treatment following discharge from hospital maximises the benefit of these preventive therapies. Encouragement to continue treatment is one of the roles of clinicians providing cardiac rehabilitation. Primary care clinicians also play a role, and the Quality and Outcomes Framework[13] includes indicators that incentivise General Practitioners to include in a register those patients with previous myocardial infarction and to promote the secondary prevention of coronary heart disease.

2.9.3 Recommendations for those not achieving the standard

In the management of both STEMI and NSTEMI, staff in hospitals not meeting the standard for prescription of all secondary prevention medication prior to discharge should first explore data completeness and ensure that their data are a valid representation of practice. If suboptimal performance is confirmed quality improvement programmes should be implemented.

These might include the use of discharge pro-forma or checklists, direct involvement of specialist cardiac pharmacists or 'ACS nurse specialists'.

2.10 Two-thirds of eligible patients receive aldosterone antagonists

2.10.1 Overview of QI metric

QI Metric Description/Name	Aldosterone antagonists (also known as mineralocorticoid receptor antagonists – MRA) following STEMI
Why is this important?	Evidence for improved outcomes when aldosterone antagonists are given to patients with impaired LV systolic function soon after STEMI
QI theme	Effectiveness
What is the standard to be met?	No specified standard – so suggest 85% of eligible patients should receive MRA at time of discharge from hospital following STEMI
Key references to support the metric	European Society of Cardiology Guideline: 'MRAs are recommended in patients with a LVEF (Left Ventricular Ejection Fraction) ≤40% and heart failure or diabetes, who are already receiving an ACE inhibitor and a beta-blocker, provided there is no renal failure or hyperkalaemia[5]
Numerator	All patients who are prescribed an aldosterone antagonist at the time of discharge from hospital to home
Denominator	Patients with a final diagnosis of STEMI, who are discharged home (i.e.do not die during index admission and are not transferred to another hospital), who undergo an echocardiogram during admission, which reveals LVEF is 'poor' (presently defined as LVEF <30% in MINAP)
Trend	Improvements in proportion receiving MRA have 'levelled-off' over last three years - now 68% [Figure 2.24]
Variance	14 hospitals provided MRA to at least 90% of eligible patients; 3 hospitals provided MRA to fewer than 70% [Figure 2.25]

2.10.2 Audit results

Figure 2.24: Trend in use of aldosterone antagonists in those with STEMI and significant left ventricular systolic impairment, 2010/11 - 2019/20

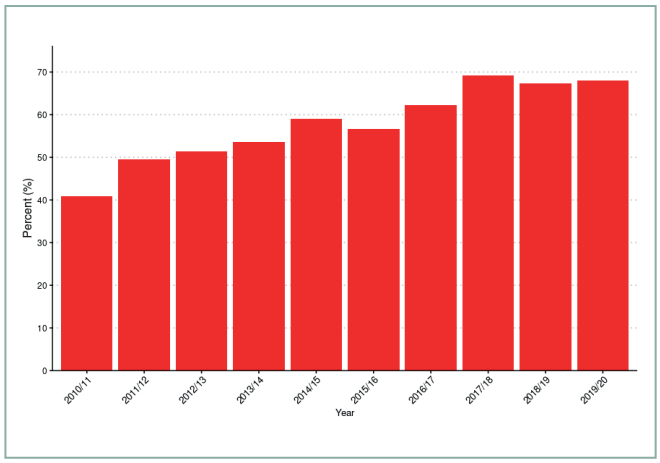
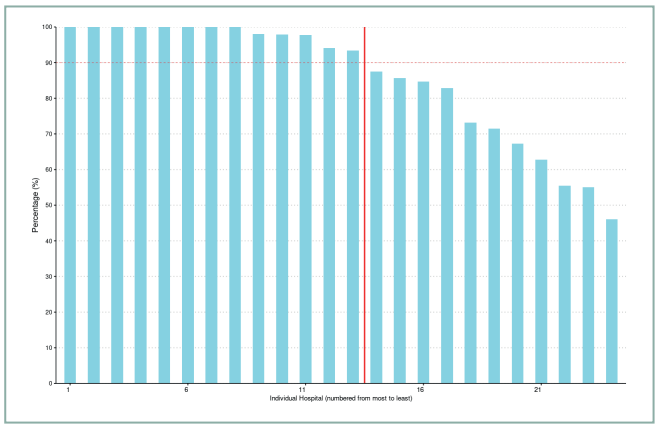


Figure 2.25: Distribution of hospitals with respect to the proportion (%) of patients with STEMI and significantly impaired left ventricular systolic function discharged home on aldosterone antagonists



Hospitals to the right of the red line have not achieved ≥ 90% of patients being discharged on aldosterone antagonist despite being eligible by virtue of significant left ventricular impairment. Data from 25 hospitals; hospitals reporting fewer than 20 cases excluded.

2.10.3 Recommendations for those not achieving the standard

Staff in those hospitals with lower rates of prescription of aldosterone antagonists should ensure that patients with impaired LV function are identified by echocardiography (or some other reliable assessment method) and that such patients are considered for appropriate treatment.

This might require the use of discharge pro-forma or checklists and the direct involvement of specialist cardiac pharmacists, 'ACS nurse specialists' and specialist sonographers.

2.11 Further improvements in referral to cardiac rehabilitation

2.11.1 Overview of QI metric

QI Metric Description/Name	Referral to cardiac rehabilitation
Why is this important?	Exercise-based cardiac rehabilitation programmes are associated with fewer cardiac deaths in patients with coronary artery disease.
QI theme	Effectiveness
What is the standard to be met?	NHS Long Term Plan aspires to '85% of those eligible accessing cardiac rehabilitation'
Key references to support the metric	European Society of Cardiology recommends all patients participate in cardiac rehabilitation programmes (ESC quality indicator: 'Proportion of patients without a contraindication enrolled in a secondary prevention/cardiac rehabilitation programme at discharge')[5] NICE quality standard (QS 99) 'Adults admitted to hospital with a myocardial infarction are referred for cardiac rehabilitation before discharge.'[14]
Numerator	All patients who are referred to cardiac rehabilitation programme at the time of discharge from hospital to home
Denominator	All STEMI and NSTEMI patients who survived to discharge home (i.e. did not die during index admission, and were not transferred to another hospital) who neither refused referral nor had reasons that would make cardiac rehabilitation 'not indicated'
Trend	Continuing improvement over last three years - now 84% [Figure 2.26]
Variance	121 hospitals referred at least 85% of patients to cardiac rehabilitation; 13 hospitals referred fewer than 50% [Figure 2.27]

2.11.2 Audit results

Figure 2.26: Proportion (%) of patients (STEMI and NSTEMI combined) referred for cardiac rehabilitation programmes, 2010/11 to 2019/20

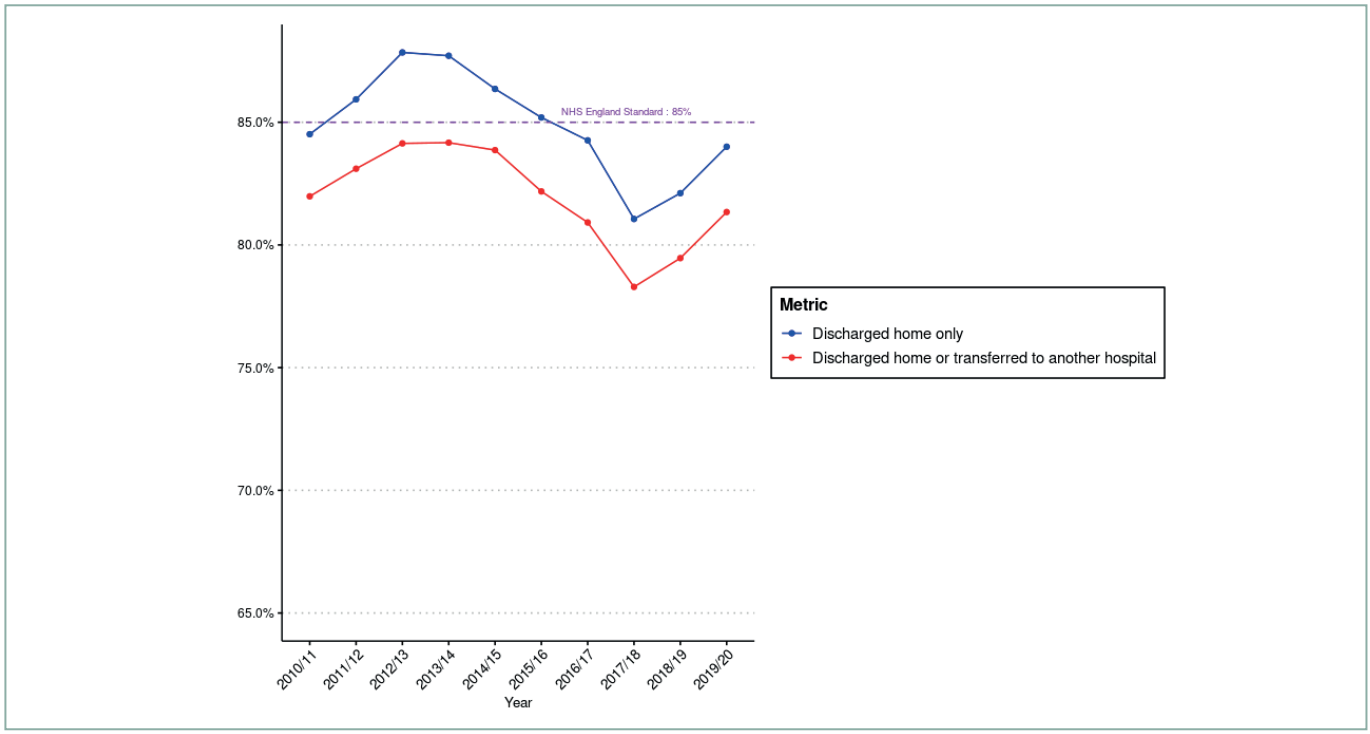
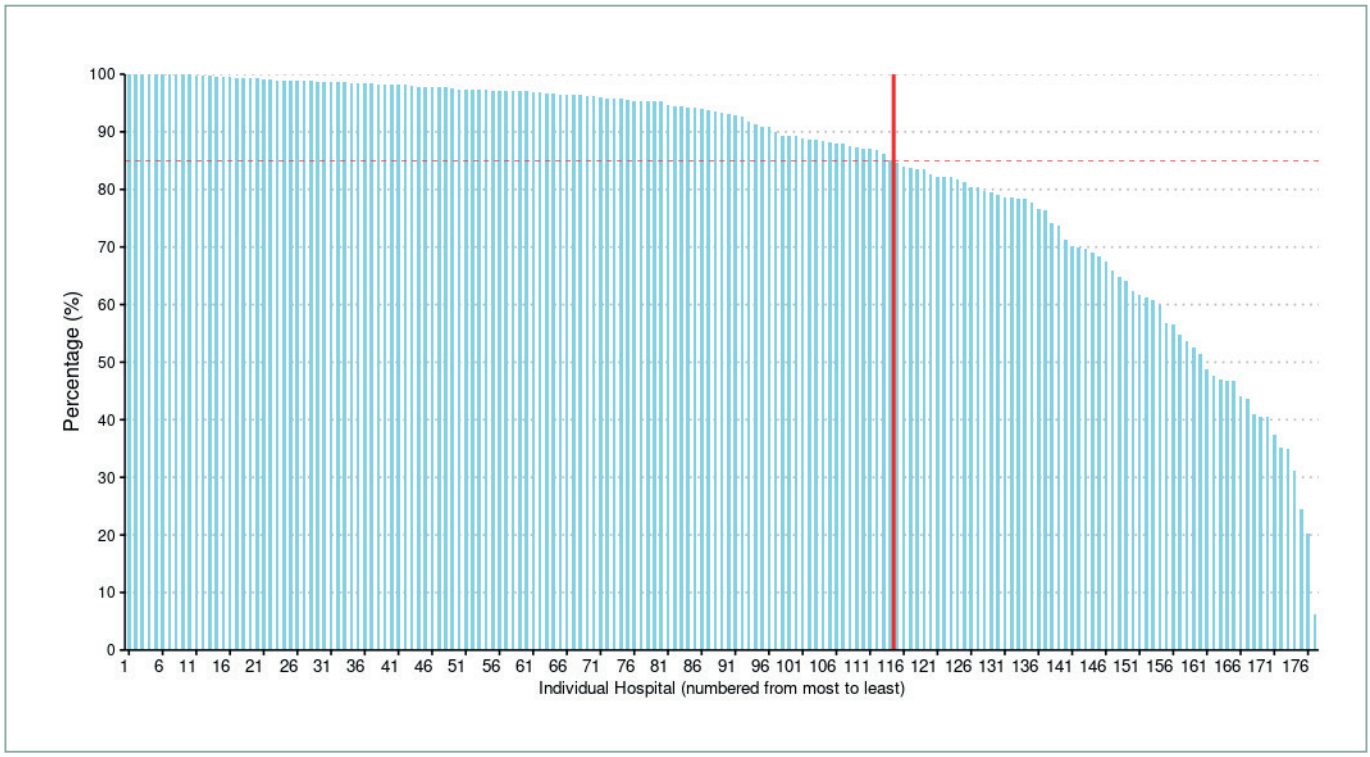


Figure 2.27: Distribution of hospitals with respect to the proportion (%) of patients with STEMI and NSTEMI who are referred for cardiac rehabilitation at the time of discharge home or transfer to another hospital, 2019/20



Hospitals to the right of the red line have not achieved ≥ 85% of patients being referred for cardiac rehabilitation. Hospitals reporting fewer than 20 cases excluded.

2.11.3 Recommendations for those not achieving the standard

Staff in hospitals not meeting the standards for referral of patients to cardiac rehabilitation following either STEMI or NSTEMI should review the provision of services and the early identification of patients who might benefit.

They might consider the routine distribution of cardiac rehabilitation information/invitation leaflets to all patients admitted to cardiac facilities, and the inclusion of such information in discharge checklists.

2.12 Case Ascertainment

MINAP aims to collect complete information about the care of every patient admitted to hospital with a heart attack. This will lead to greater confidence in the reliability of subsequent analyses and in the validity of comparisons between participating hospitals. Measures of data quality include data completeness – the proportion of possible information that is collected for each individual patient who appears in the dataset – and case ascertainment – the proportion of those cases eligible for entry into MINAP that actually appear in the dataset.

Case ascertainment is expressed as the ratio of the number of cases coded as myocardial infarction (in Hospital Episode Statistics (HES) data provided by NHS Digital in England and in the Patient Episode Database for Wales (PEDW) from Digital Health and Care Wales/Iechyd a Gofal Digidol Cymru) to the number of cases submitted to MINAP.

In order to identify patients with heart attack within HES and PEDW, NICOR uses two sets of International Classification of Diseases (ICD) 10 Codes.

The first set of codes is more restrictive, namely:

STEMI: all patients discharged with final diagnosis of STEMI – identified by the presence of the following ICD 10 codes in ANY position:

I21.0	ST elevation myocardial infarction of anterior wall;
I21.1	ST elevation (STEMI) myocardial infarction of inferior wall;
I21.2	ST elevation (STEMI) myocardial infarction of other sites;
I21.3	ST elevation (STEMI) myocardial infarction of unspecified site

NSTEMI: all patients discharged with final diagnosis of NSTEMI – identified by the presence of the following code in the FIRST position:

I21.4	Acute subendocardial myocardial infarction

Using these codes, the case ascertainment rate for England was 93.8% (78,966 cases submitted to MINAP and 84,210 cases coded in HES). The case ascertainment rate for Wales was 87.7% (4,783 cases submitted to MINAP and 5,452 cases coded in PEDW).

The second set of codes is less restrictive, namely:

STEMI: all patients discharged with final diagnosis of STEMI – identified by the presence of the following ICD 10 codes in ANY position:

I21.0	Acute transmural myocardial infarction of anterior wall;
I21.1	Acute transmural myocardial infarction of inferior wall;
I21.2	Acute transmural myocardial infarction of other sites;
I21.3	Acute transmural myocardial infarction of unspecified site
I21.9	Acute myocardial infarction (unspecified)
I22.0	Subsequent myocardial infarction of anterior wall;
I22.1	Subsequent myocardial infarction of inferior wall;
I22.8	Subsequent myocardial infarction of other sites;

NSTEMI: all patients discharged with final diagnosis of NSTEMI – identified by the presence of the following code in the FIRST position:

I21.4	Acute subendocardial myocardial infarction;
I22.9	Subsequent myocardial infarction of unspecified site;

Using these codes, the case ascertainment rate for England was 89.7% (78,966 cases submitted to MINAP and 88,012 cases coded in HES). The case ascertainment rate for Wales was 68.3% (4,783 cases submitted to MINAP and 6,995 cases coded in PEDW).

3 Future directions

As outlined in the Introduction to this report, the period of study (trends within the decade up to March 2020; hospital activity during the year of April 2019 until March 2020) was largely unaffected by the substantial changes in demand for care and in hospital practice that characterised the COVID-19 pandemic.[2]

The report therefore represents 'The Way We Were', a description of the management of heart attack in the immediate 'pre-pandemic' era. While the precise figures presented within it are, by definition, 'historic', the metrics that define the quality of care remain valid. So the report can serve as a useful resource against which post-pandemic systems of care may be compared.

In the future we intend to:

- Express more of the existing metrics with respect to geographic (and managerial) regions and networks;
- Express survival/mortality rates following admission to hospital using a risk adjustment model derived from existing validated models and developed at University College London;
- Work with other domains within NCAP to produce linked metrics - for example the rate of implantation of complex cardiac devices following heart attack;
- Develop, implement and promote the use of 'user tools' that enable participating hospitals to analyse their performance 'in real time' and at a 'case-by-case' level.
- Revise the MINAP dataset to more closely reflect contemporary options for investigations and treatments, harmonising where possible with other national audits and international clinical disease registries.
- Explore the utility of existing routinely collected datasets and electronic health records in performing some or all of the present audit functions.

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5 | Thanks and acknowledgements

We appreciate the continuing support of colleagues within the National Institute for Cardiovascular Outcomes Research (NICOR), the clinical leads of the other domains within the National Cardiac Audit Programme (NCAP), members of the NCAP Operational & Methodology Group, chaired by Prof Mark de Belder, the NCAP Delivery Group, chaired by Mr James Chal, and colleagues from UCL Partners. We also acknowledge the encouragement of Ross Pow, of Power of Numbers Ltd, who facilitated workshops to guide the interpretation and presentation of various aspects of NCAP.

We acknowledge the contribution of all hospitals and Ambulance Trusts and of individual cardiologists, nurses, ambulance teams, data managers and clinical audit teams who contributed to this audit. Without their engagement patients would not have benefited from improved care over the last ten years.

We thank the patient representatives on the NCAP Operational and Methodology Group and the NICOR Patient Advisory Group and Panel for their contribution to the programme and their help in determining the content of this report.

This report was prepared by Clive Weston (Clinical Lead for MINAP), Samuel Perwaiz (Project Manager), Robin Philip (NICOR Analyst), Gabriel Burcea (NICOR Analyst) with support from colleagues within the MINAP Domain Expert Group : Mark de Belder, Peter Ludman, Chris Gale, John Riddell, Andrew Wragg, Miles Curtis, Ali Dana, Alan Keys, Tom Quinn, Simon Ray, Gethin Ellis and the NCAP team.

The NCAP is funded by the Healthcare Quality Improvement Partnership (HQIP) as part of the National Clinical Audit and Patient Outcomes Programme (NCAPOP). Please go to www.hqip.org.uk for more information.

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This report is available online here