MYOCARDIAL ISCHAEMIA NATIONAL AUDIT PROJECT (MINAP)

2020 SUMMARY REPORT (2018/19 DATA)

NICOR

British Cardiovascular Society

CONTENTS

EXECUTIVE SUMMARY

The 2018/19 Myocardial Ischaemia National Audit Project (MINAP) report records approximately 87,000 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. There has been a 2.4% fall from numbers recorded in 2017/18.

The care provided is expressed through 11 'quality improvement metrics', each of which is supported by national and/or international guidelines. The metrics are described with respect to the overall trend – how this aspect of care has changed over the previous 9 years – and the variance – how much variation there is between the performances of participating hospitals during this year (2018/19).

Notwithstanding variation between hospitals, positive highlights of the report include:

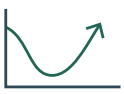
- The proportion of patients with STEMI who receive immediate reperfusion treatment has increased to the highest recorded level, and primary percutaneous coronary intervention (PPCI) is the default reperfusion treatment throughout the participating nations - rates of PPCI in Wales are now as high as in England and Northern Ireland

- Performance of an echocardiogram following STEMI is at its highest recorded level

- There is a high level of involvement of cardiologists in the management of patients with NSTEMI

- The proportion of eligible patients undergoing a coronary angiogram following NSTEMI has increased to its highest ever level

- There is consistently good performance in the prescription of drugs to prevent subsequent heart attacks (secondary prevention) at the time of discharge from hospital



- A previously reported deterioration in rates of referral to cardiac rehabilitation programmes following heart attack has reversed

In these and other areas, overall care would improve further were the performances of the 'top ten' hospitals to be matched by those of the rest.

The following two areas remain of particular concern and in need of quality improvement activity, as outlined in relevant Recommendations within the report:

- There is a continuing trend towards less timely PPCI in STEMI, with the lowest recorded proportion of patients treated within the standard 'call to balloon' interval (CTB); this appears to relate to increasing pre-hospital delays

- There has been little improvement in the proportion of patients with NSTEMI undergoing coronary angiography within the NICE Quality Standard of 72 hours after admission to hospital

These various aspects of care can be further summarised below:

Focus of attention	Audit Finding
Characteristics of patients	Increasing proportion of patients with heart attack have diabetes (26.5%) and BMI >30 (30%)
Reperfusion in STEMI	Increasing proportion with STEMI receive reperfusion (82%); nearly all PPCI
Timely PPCI in STEMI	Progressive lengthening of median Call-To-Balloon time, despite no overall change in Door-To-Balloon time, leading to fewer patients receiving PPCI within recommended time (69%)
Pre-discharge echocardiogram	Progressive increase in proportion with STEMI (75%) undergoing echocardiogram; much variation between hospitals, particularly with respect to echo in NSTEMI
Admission to a cardiac ward with NSTEMI	Overall increase in proportion admitted to cardiac ward (61%); much variation between hospitals
Cared for by cardiologists	Consistently high performance with 96.6% seen by cardiologists during admission
Angiography for NSTEMI	Substantial increased proportion (84.7%) of eligible patients undergoing angiography during admission
Timely angiography for NSTEMI	Very little improvement in proportion receiving angiogram within target time (56.7%); much variation in hospital performance
Secondary prevention drug treatment after heart attack	Consistently high performance; a better understanding is required of the use of aldosterone antagonists in the subset of patients with poor ventricular function following heart attack
Referral for cardiac rehabilitation after heart attack	Reversal of a trend towards worsening referral rates with 79% to 82% of eligible patients referred; much variation between hospitals
Case ascertainment	Overall case ascertainment is good (96.1% for England and 85.3% for Wales), but varies substantially between hospitals and depends on the ICD codes chosen to perform the analysis
In hospital mortality	Unadjusted in hospital mortality has fallen for NSTEMI (to 2.8%) but risen for STEMI (to 5% for those receiving reperfusion)

1. INTRODUCTION

The Myocardial Ischaemia National Audit Project (MINAP) is a domain within the National Cardiac Audit Programme (NCAP) that contains information about the care provided to patients who are admitted to hospitals in England, Wales, Northern Ireland, and the Isle of Man with acute coronary syndrome (heart attack). Data in MINAP relate to the 'patient journey' - from a call to the emergency services or self-presentation at an Emergency Department, through diagnosis and treatment in hospital, to the prescription of preventive medications on discharge.

Clinicians can use the data to 'benchmark' the quality of care they provide against that provided at similar hospitals and against national standards and clinical guidelines. They can determine where local quality improvement (QI) initiatives are likely to have the greatest benefit, using MINAP as both the stimulus and the system of measuring the effect of such initiatives.

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

Further information about MINAP, including contact details for the NICOR project team can be found on the NICOR web site. The first aggregate report of the National Cardiac Audit Programme (NCAP), published in 2018, contained (in Appendix A) a useful description of the mechanisms by which heart attacks occur and a summary of recommended treatments.

Details of the MINAP dataset, including definitions of the variables and guidance on applying the various options, are also available on the NICOR web site.

1.1 FOCUS OF THIS REPORT

This report focuses on patients admitted between 1st April 2018 and 31st March 2019. Hospital and Ambulance Trust performance is presented graphically. Tables on the NICOR website allow identification of the performances of particular hospitals with respect to quality indicators. The report also includes analyses of trends over time.

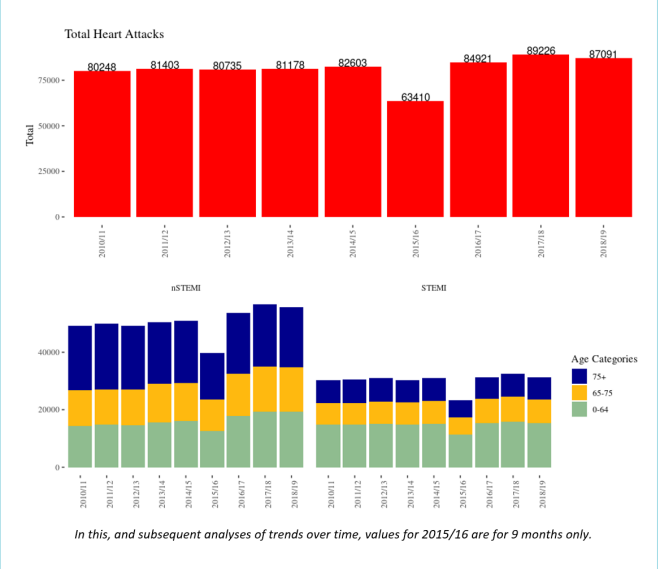
1.2 CASE NUMBERS: THERE ARE FEWER HEART ATTACKS

Overall, 98,220 records were submitted of which 87,091 were confirmed cases of heart attack. The majority (55,727 – 64%) of these were non-ST-segment elevation myocardial infarctions (NSTEMI). The remaining 31,364 (36%) were ST-segment elevation myocardial infarctions (STEMI). This ratio of NSTEMI to STEMI (approximately 2:1) has remained relatively constant over the last five years.

There was a decrease of 2.4% in cases of heart attack compared with the previous year. It is too early to determine whether this reduction is the beginning of a longer-lasting trend towards fewer heart attacks. The number submitted in 2018/19 remains the second highest over the last nine years [Figure 1].

The overall case ascertainment rate (see Section 6 below) was 96% in England and 85% in Wales.

Figure 1: *Trend in absolute number of submissions to MINAP, by year, age and type of heart attack, 2010/11 to 2018/19*



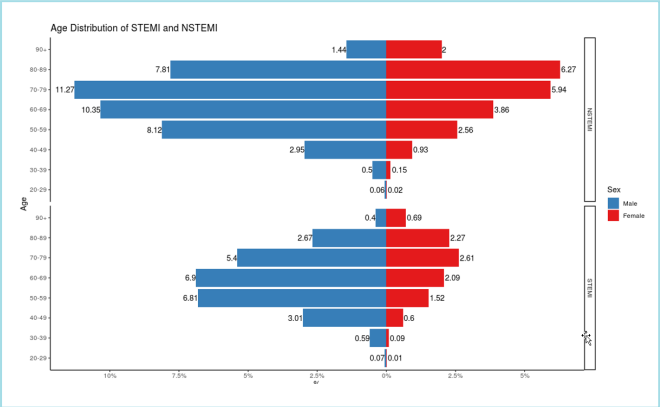
1.3 AGE AND SEX

NSTEMI tends to occur in older people [Figure 2]. Half of those with STEMI are 65 years old or younger while a little over half of those with NSTEMI are older than 70 years. The median age for STEMI and for NSTEMI is the same as reported last year (65 years and 71 years respectively).

In males, STEMI is more prevalent than NSTEMI up to age band 40-49yr, after which NSTEMI becomes more common. NSTEMI is more often seen than STEMI in all age bands in females. Overall, the ratio of NSTEMI to STEMI increases from about 2:1 at age 70-79 years to more than 3:1 in the very elderly.

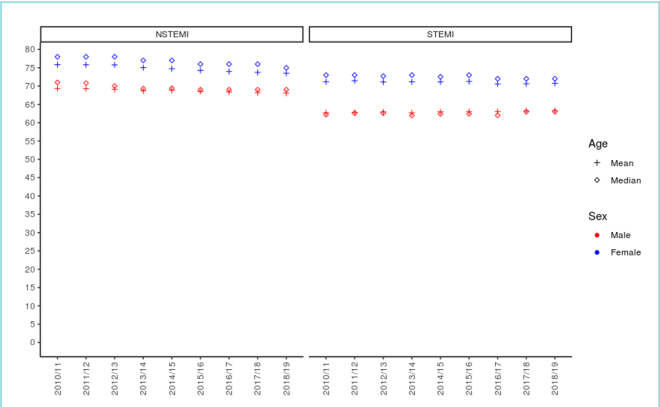
There are more males (68%) than females (32%) - this was more evident for STEMI (males 72% vs female 28%) than NSTEMI (males 66% vs females 34%). Males tend to experience heart attack at a younger age than females – a difference in median age of 8 years for all heart attacks (66 years vs 74 years); 9 years for STEMI (63 years vs 72 years); 6 years for NSTEMI (69 years vs 75 years) in 2018/19.

Figure 2: *Distribution of ages of male and female patients, categorised by type of heart attack, 2018/19*



The number adjacent to each row is the percentage of all heart attacks that fall within that particular age and sex band (e.g. approximately 6.8% of all heart attacks present as STEMI in male patients between the ages 50 and 59 years).

Figure 3: *Mean and median ages of patients categorised by sex and type of heart attack, 2010/11 to 2018/19*



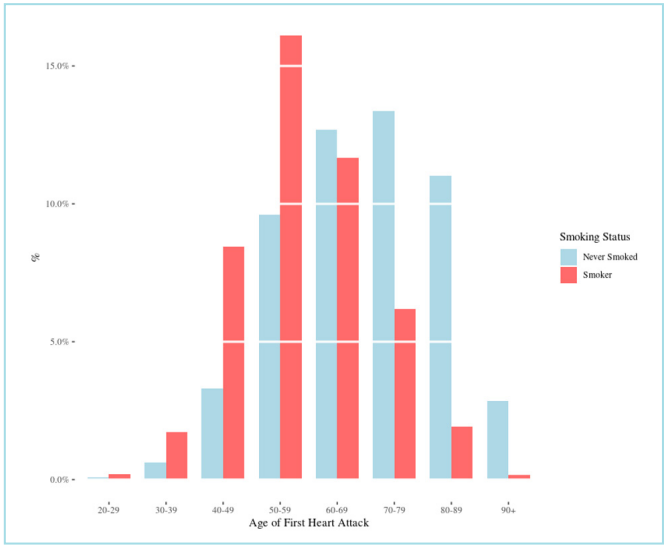
The difference between male and female sex, and between NSTEMI and STEMI, with respect to mean and median age, is a consistent finding, though the size of the difference has changed [Figure 3]. While the median age of male patients with STEMI has increased by 1 year since 2010/11, the median age for male NSTEMI has fallen by 2 years. The median age for females with STEMI and NSTEMI has also fallen, the latter by 3 years.

1.4 SMOKERS HAVE HEART ATTACKS AT AN EARLIER AGE

Smoking status was known for 70,435 patients. Of these, 28.9% were regularly smoking tobacco in the weeks leading up to their heart attacks, 36% were described as 'ex-smokers' and 35.1% had never regularly smoked. Smoking habits varied between the three nations, with current smokers accounting for 35% of heart attacks in Northern Ireland, 32.6% in Wales, and 28.1% in England.

Smoking status is associated with type of heart attack. Just under 1 in 4 patients with NSTEMI were current smokers compared with slightly more than 1 in 3 patients with STEMI. Smoking was also linked to age, with current smokers being, on average, more than 10 years younger than either ex-smokers or 'never' smokers at the time of their heart attacks [Figure 4].

Figure 4: *Distribution of ages of patients who had never smoked tobacco and those who were regular smokers at the time of their heart attacks, 2018/19*

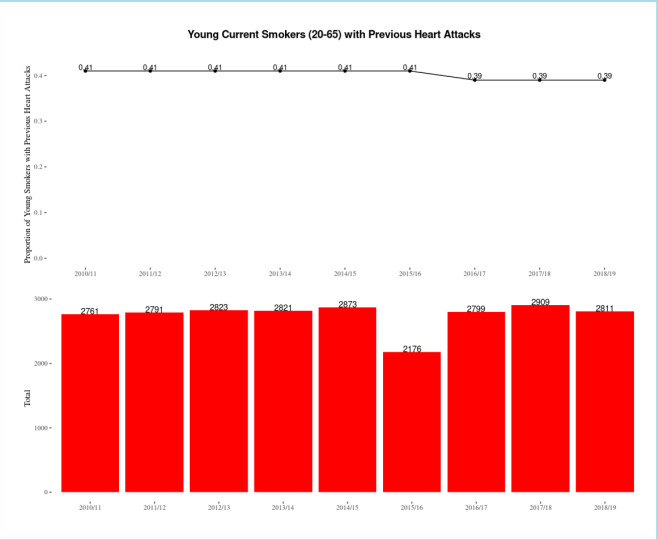


This was so for STEMI – mean age for smokers 58 years compared with 68.2 years for those who had never smoked – and for NSTEMI – mean age for smokers 60.1 years compared with 71.5 years for those who had never smoked.

For those 26,093 patients who were already known to have coronary artery disease – a prior diagnosis of angina or myocardial infarction, or previous coronary artery bypass graft operation or percutaneous coronary intervention (PCI) – before their heart attacks, and therefore who may have had

opportunities to discuss smoking cessation as a way of reducing the likelihood of future vascular events, 17.9% were still regularly smoking. This was highest in younger patients [Figure 5]. This varied between the nations in a similar pattern to that seen overall, with the greatest proportion of those with previously diagnosed coronary disease who continued to smoke up to the point of their heart attack being 21.3% in Northern Ireland, 19.1% in Wales and 17.7% in England.

Figure 5: *Absolute number of cases (histograms) and proportion of all cases (graph) in which a patient aged up to 65 years, who was a smoker at the time of their heart attack, was already known to have coronary artery disease, 2010/11-2018/19*



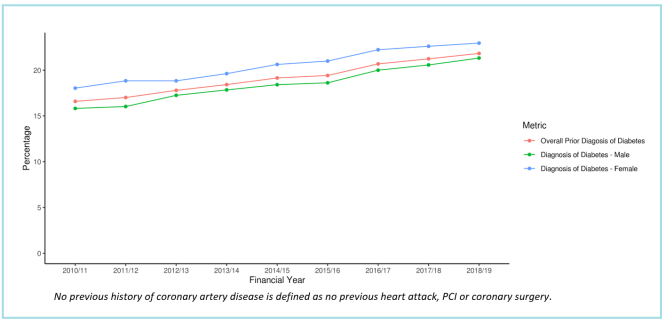
Figures for 2015/16 are for 9 months only. 'Known to have coronary artery disease' is defined as a self-reported history of previous angina myocardial infarction, percutaneous coronary intervention or coronary artery bypass grafting.

1.5 RISING NUMBERS OF PATIENTS WITH DIABETES MELLITUS

For those 64,974 patients who, before their heart attack, had no prior evidence of coronary artery disease (i.e. no previous heart attack, PCI or coronary surgery), the presence or absence of diagnosed diabetes was recorded in 62,400. Overall 21.8% had a prior diagnosis of diabetes – 21.3% of males and 22.9% of females.

There continues to be a year-on-year rise in prevalence of diabetes in the MINAP database [Figure 6]. When the same analysis is performed on the whole dataset, including those with previous evidence of coronary artery disease, the proportion of those with prior diabetes was even greater, rising from 21.2% in 2010/11 to 26.5% in 2018/19.

Figure 6: *Percentage of patients with no previous history of coronary artery disease who had been diagnosed with diabetes mellitus prior to presentation with heart attack, 2010/11-2018/19*



No previous history of coronary artery disease is defined as no previous heart attack, PCI or coronary surgery.

The increase in cases of diabetes within MINAP mirrors an increasing prevalence of diabetes in the general population, and is associated with a higher proportion of patients in 'overweight' and 'obese' categories [Figure 7].

1.6 BODY MASS INDEX: HEAVIER PATIENTS HAVE HEART ATTACKS AT A YOUNGER AGE

There is an association between Body Mass Index (BMI) and age at onset of heart attack in both men and women. A higher BMI is associated with younger age at the time of first heart attack. So, for example, females presenting with a BMI of 40 are approximately 10 years younger than those with a BMI of 25; males with a BMI of 40 are approximately 5 years younger than those with a BMI of 25 [Figure 8].

While caution is needed in interpreting this association, the findings with respect to tobacco smoking, continued smoking despite a previous diagnosis of coronary disease, diabetes and BMI point to targets for prevention strategies.

Figure 7: *Proportion of patients who had a body mass index of 30 or greater at time of a first heart attack, 2010/11 to 2018/9*

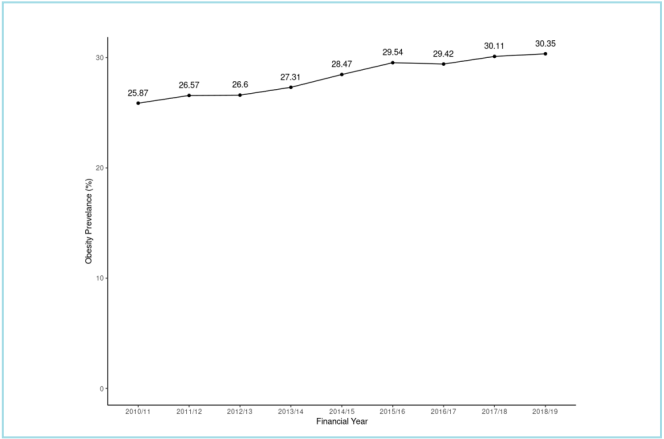
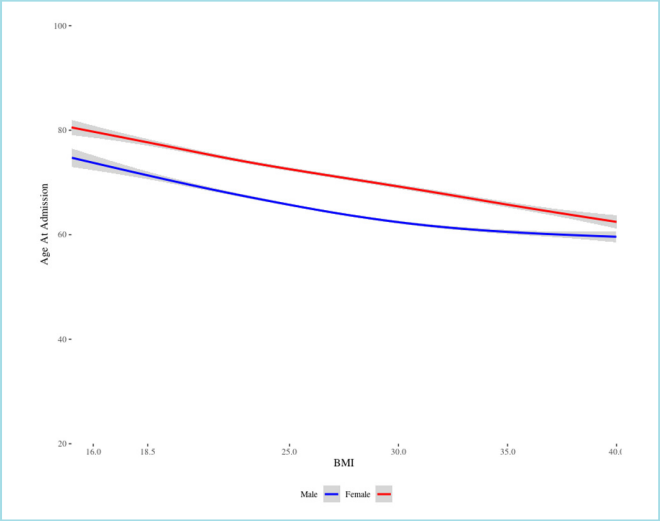


Figure 8: *Correlation between age at time of first heart attack and body mass index (BMI) in men and women, 2018/19*



1.7 PRIMARY PCI IS THE STANDARD TREATMENT FOR STEMI THROUGHOUT THE UK

Management of STEMI requires immediate specialised treatment. A PCI is the preferred reperfusion procedure. Intravenous fibrinolytic drug treatment (thrombolysis) is a reasonable alternative when the delay between diagnosis of STEMI and PCI is likely to be more than 120 minutes. The use of thrombolysis is therefore seen when there is limited access to advanced interventional cardiac care, and has dwindled over the years [Figure 9].

Only 118 patients received thrombolysis in 2018/19 compared with 142 in the previous year and 301 in the year before that. Whereas 143 patients in Wales received thrombolysis in 2016/17, this fell to 16 patients in 2017/18 and 10 patients in 2018/19. This change largely represents the establishment of a primary PCI (PPCI) pathway in North Wales – a major quality improvement initiative that sees the provision of reperfusion therapy to the Welsh population now matching that in England [see section 3.3 below]. Thrombolytic treatment was given to a single patient in Northern Ireland.

Primary PCI is now provided for all in Wales. The advent of primary PCI as the preferred reperfusion therapy for patients with STEMI resulted in a re-design of hospital services characterised by the identification of a relatively small number of 'Primary PCI centres' – larger hospitals capable of providing PCI at any time – each serving a large population (circa 1 million) and staffed by a team of highly trained clinicians and technicians.

Because of the rural nature of much of Wales, and the effect this has on transport and health service provision within the Principality, it proved difficult to implement a nationwide primary PCI service, though patients in the South East and South West did have access through the cardiac centres of Cardiff and Swansea.

With respect to the proportion of those patients receiving reperfusion therapy who were treated with primary PCI, Wales 'lagged behind' England. This difference was mitigated by the use of pre-hospital thrombolysis delivered by ambulance paramedics.

The establishment of a North Wales primary PCI service at Ysbyty Glan Clwyd has been a significant quality improvement initiative, and the rates of primary PCI in Wales are now as high as in England [Figure 10], albeit achieving short CTB times still proves challenging in sparsely populated rural areas - the median CTB in Wales being 140 minutes compared with 122 minutes in England.

CTB for the three Welsh hospitals providing the primary PCI service ranges from 26% to 35% patients treated within 120 minutes, and from 53% to 60% treated within 150 minutes.

Figure 9: *Proportion of patients receiving intravenous thrombolytic therapy, primary PCI, or no-reperfusion treatment, for STEMI, 2010/11 to 2018/19*

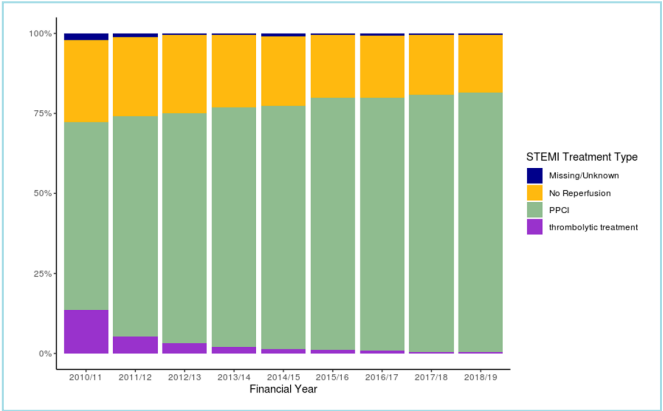
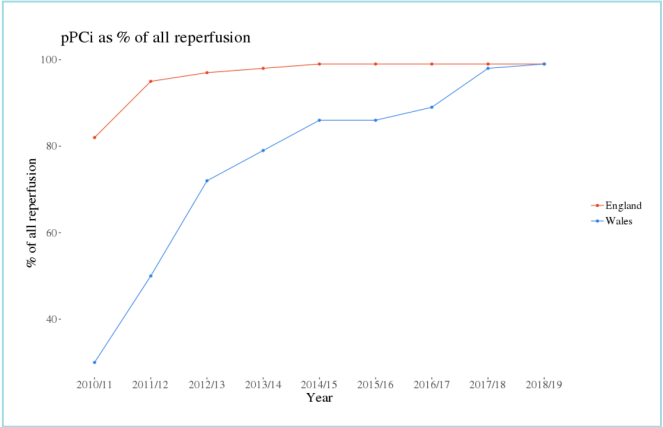


Figure 10: *Proportion of patients who received reperfusion therapy for STEMI using primary PCI, in England and in Wales*



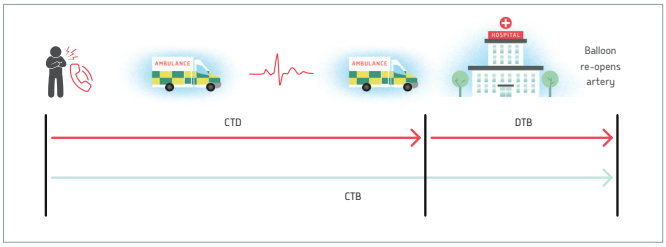
2. QUALITY IMPROVEMENT METRICS

2.1 CALL-TO-BALLOON AND CALL-TO-DOOR TIMES ARE WORSENING FOR STEMI

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	Shorter Door-To-Balloon times (DTB) should be associated with better outcomes following STEMI
QI theme	Effectiveness/timeliness	Effectiveness/Timeliness
What is the standard to be met?	• a) CTB <120 min • b) CTB <150 min	• a) DTB <60 min • b) DTB <90 min
Key references to support the metric	NICE quality standard (QS 68) [1] "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 30mins to start – this leads to a standard of 'within 150 mins'].	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 mins"[2]
Numerator	a) All with STEMI who underwent primary PCI within 120 min of call for help b) All with STEMI who underwent primary PCI within 150 min of call for help	a) All with STEMI who underwent primary PCI within 60 min of arrival at PPCI centre b) All with STEMI who underwent primary PCI within 90 min of arrival at PPCI centre
Denominator	All with STEMI who underwent primary PCI for whom a CTB can be calculated	All with STEMI who underwent primary PCI for whom a DTB can be calculated
Trend	Consistent lengthening of median CTB over last 5 years, leading to fewer patients receiving primary PCI within recommended standard time	No substantial change in DTB over last 5 years
Variance	In the best performing hospital 70% of patients achieve a CTB within 120 minutes; 50% of patients achieve such a CTB in 18 hospitals. Yet in 5 hospitals fewer than 30% of patients have CTB <120 minutes.	80% of patients achieve DTB <60 min in 17 hospitals. 80% of patients achieve DTB <90 min in 49 hospitals. Yet in 7 hospitals fewer than 60% of patients have DTB <60 minutes.

Once STEMI has been recognised, the sooner primary PCI is performed the more likely is significant heart muscle damage prevented. The timeliness of primary PCI has become a measure of quality of care. The various time intervals, or delays, reported in MINAP are represented in Figure 11.

Figure 11: *Time periods relevant to reperfusion treatment for those receiving primary PCI*



CTB = Call-to-Balloon time; DTB = Door-to-Balloon time; CTD = Call-to-Door time

Mapped against the most frequently used 'patient pathway' – in which 78% of those receiving primary PCI first alert the ambulance services and are then taken directly to a hospital that can provide PCI – these include:

- 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:
- 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.
- 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.

Overall, hospitals provide primary PCI to most patients presenting with STEMI within the recommended time frames:

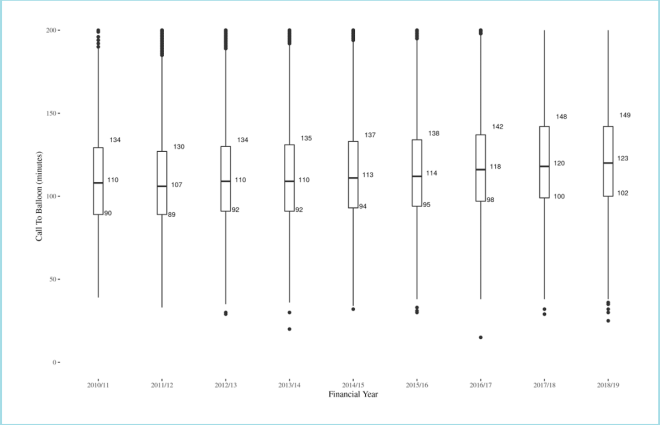
- 69% within 150 minutes and 42% within 120 minutes of the

call for help (CTB)

- 87% within 90 minutes and 73% within 60 minutes of arrival at hospital (DTB).

There has been a lengthening of median CTB over the past five years [Figure 12]. This lengthening of CTB has been seen in all participating countries. In England the median CTB increased from 117 minutes in 2015/16 to 122 minutes in 2017/18 and 125 minutes in 2018/19; in Wales from 127 to 138 and now to 140 minutes over the same period; in Northern Ireland from 107 to 114 and now 116 minutes.

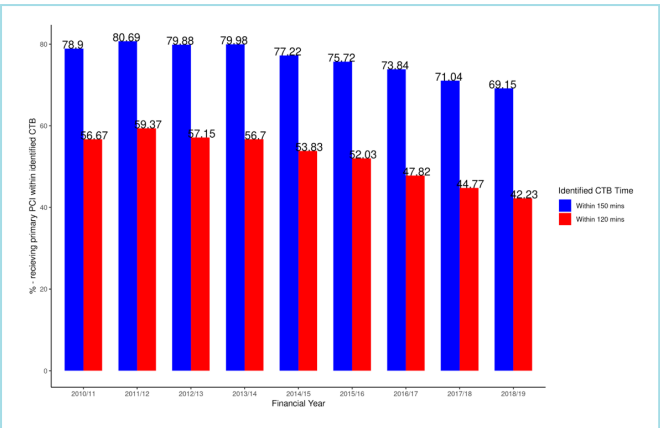
Figure 12: *Trend in Call-To-Balloon times (CTB) – median and interquartile ranges, 2010/11 to 2018/19.*



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

The overall effect is that a smaller proportion of patients are receiving PCI within the optimum time [Figure 13].

Figure 13: *Changes in Call-To-Balloon (CTB) time - percentage of those receiving primary PCI within the identified CTB target, 2010/11 to 2018/19*



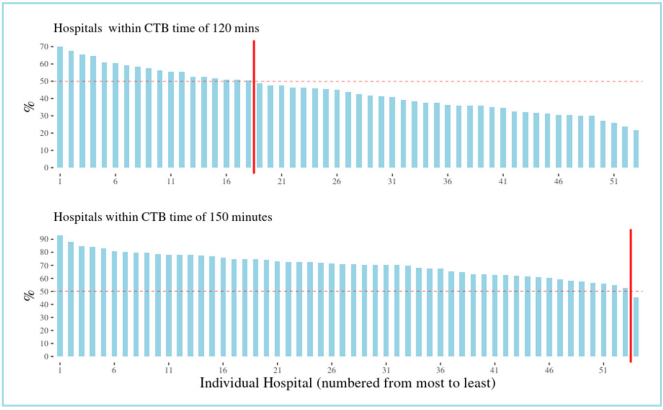
A potential explanation for the lengthening CTB time might be the inclusion of increasing numbers of patients who are not taken directly from the community to a primary PCI centre, but rather to a hospital that does not offer a primary PCI service – the subsequent transfer between hospitals significantly prolonging the interval between the original call for help and subsequent PCI.

In fact, while there is indeed a longer CTB time associated with inter-hospital transfer – 47.6% achieving the CTB target of 150 minutes compared with 73.6% for direct admissions – there has been no increase in the proportion of patients requiring inter-hospital transfer.

There is significant variation in performance between hospitals [Figure 14]. So, in the best performing hospital 70% of patients achieve a CTB within 120 minutes and 50% of patients achieve such a CTB in 18 hospitals. Yet in 5 hospitals fewer than 30% of patients have CTB <120 minutes.

For CTB <150 minutes the best hospital provides this for 93% of patients, and 17 hospitals provide this to at least 75% of patients. Yet in 8 hospitals fewer than 60% of patients achieve such a CTB time.

Figure 14: *Distribution of hospitals with respect to the proportion of patients with STEMI who undergo primary PCI within CTB 120 minutes and CTB 150 minutes, 2018/19*

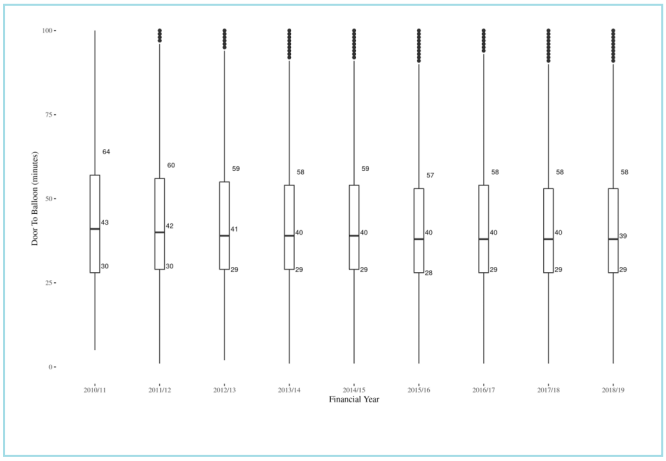


(These analyses are for hospitals providing primary PCI services for STEMI and exclude hospitals recording 20 or fewer patients within the relevant CTB metric. Those hospitals to the right of the red line did not provide primary PCI to at least 50% of patients for the relevant CTB metric.)

There has been little change in hospital performance - if anything a small improvement in median DTB [Figure 15]. 87.3% of patients received PCI within 90 minutes of arrival at hospital in 2018/19 compared with 88% in 2017/18 and 89% in 2016/17 – 73.1% within 60 minutes of arrival in 2018/19 compared with 72.6% the previous year.

The median DTB time was 40 minutes in England this year compared with 41 minutes last year; it has improved to 38 minutes from 42 minutes in Wales and extended to 31 minutes from 30 minutes in Northern Ireland. Given these results, the documented increase in CTB time points to increasing delays to treatment being incurred prior to the patient arriving at the PCI centre.

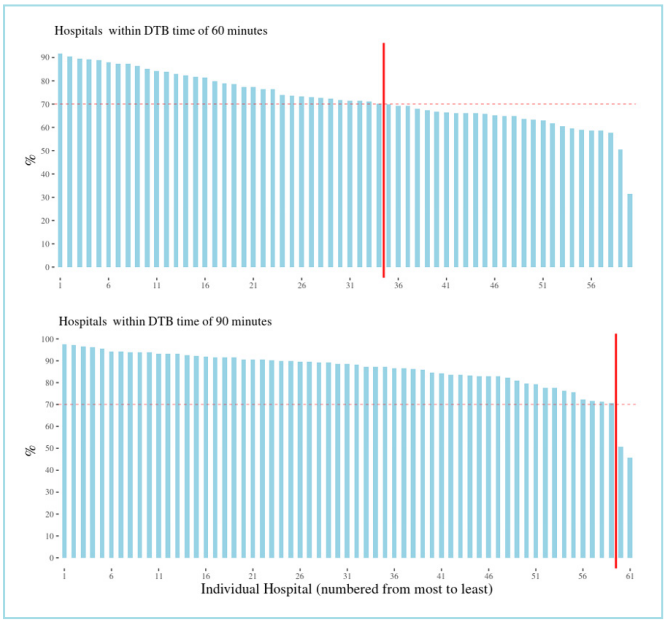
Figure 15: *Trend in Door-To-Balloon times (DTB) over nine years (2010/11 – 2018/19), by median and interquartile ranges*



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

There is variation in performance between hospitals [Figure 16]. In the best performing hospital 92% of patients achieve a DTB within 60 minutes and 97.5% within 90 minutes; 80% of patients achieve a DTB within 60 minutes in 17 hospitals, and 80% within 90 minutes in 49 hospitals. Yet in 7 hospitals fewer than 60% of patients have a DTB <60 minutes.

Figure 16: *Distribution of hospitals with respect to the proportion of patients with STEMI who undergo primary PCI within DTB 60 minutes and DTB 90 minutes, 2018/19*

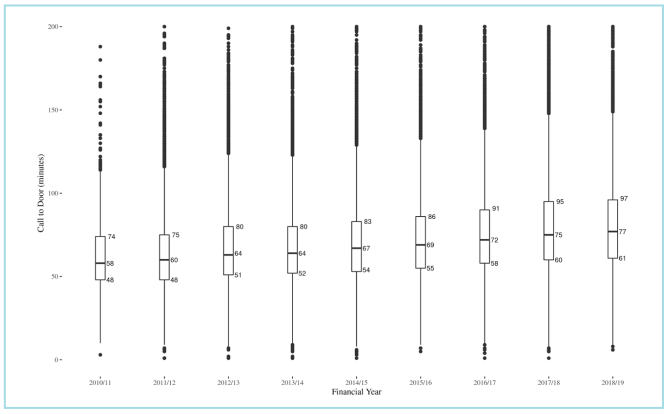


These analyses are for hospitals providing primary PCI services for STEMI and exclude hospitals recording 20 or fewer patients within the relevant DTB metric. Those hospitals to the right of the red line did not provide primary PCI to at least 70% of patients for the relevant DTB metric.

The 'Call-To-Door' (CTD) interval represents the involvement of ambulance services in the pre-hospital care of STEMI patients. This includes receipt of a call for help, dispatch of appropriate personnel, provision of early management on-scene (including resuscitation if necessary, accurate diagnosis, continuous monitoring and administration of appropriate drugs), and transfer to the most suitable hospital (where following arrival there is handover of clinical details to the receiving hospital clinicians).

There is no 'maximum acceptable' CTD time – though CTD affects the CTB. There is likely to be a 'trade-off' between the benefit of meticulous pre-hospital assessment and care and the potential detriment of consequent delays to hospital admission. The CTD interval is lengthening, continuing a trend seen over the last 8 years [Figure 17].

Figure 17: *Trend in Call-To-Door (CTD) over nine years (2010/11 – 2018/19), by median and interquartile ranges, excluding inter-hospital transfers*



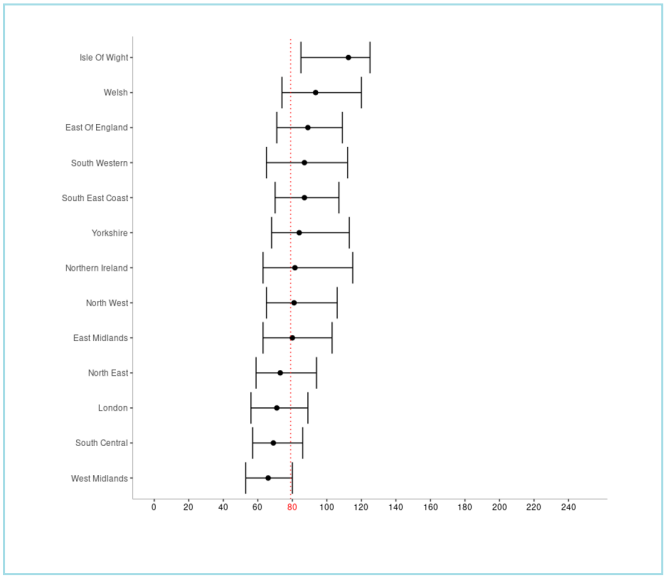
Each box encompasses the middle 50% of patients. The number adjacent to the lower border of each box is the CTD achieved by up to 25%, that adjacent to the upper border is the CTD achieved by at least 75%. The bold line within each box is the CTD achieved by 50% (i.e. the median value).

In 2018/19, excluding inter-hospital transfers, 25% of patients transported to hospital with STEMI had arrived within 61 minutes of calling for help, 50% within 77 minutes (compared with 75 minutes the previous year) and 75% within 97 minutes. The proportion of patients with CTD of 60 minutes or shorter has fallen from 33.5% to 26.9% over the last three years.

There may be a number of factors contributing to this worrying trend. One of these may be a lengthening in the response to a call for help by the ambulance service. A case of delayed response has triggered an investigation looking at the emergency response to heart attack (in England) by the Healthcare Safety Investigation Branch - which is in progress at the time of writing.[3]

There is variation between Ambulance Trusts in median CTD [Figure 18]. This likely reflects differences in the geographic nature of the areas served by each Trust, in patient characteristics and in Trust policies.

Figure 18: *Median Call-To-Door intervals for both direct admissions and inter-hospital transfers, in minutes, by Ambulance Trust*



The issue of ambulance response to, and management of, STEMI is addressed within existing NHS Ambulance Quality Indicators. CTB (rather than CTD) times are sent by MINAP to NHS England, while other aspects of care, described as a 'STEMI care bundle', are supplied by Ambulance Trusts.[4]

Recommendations for those not achieving the standards

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 to provision of primary PCI. Individual case reviews may a play a part in quality improvement. Ambulance Trusts should review their local trends and consider methods to improve Call-To-Door times.

2.2 PROPORTIONATELY MORE PATIENTS RECEIVE REPERFUSION THERAPY

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"[2] ESC Quality Indicator – Proportion of STEMI patients arriving in the first 12 h receiving reperfusion therapy[5]
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 over the last 9 years

Of the 31,364 cases of STEMI, 5640 (18%) did not receive reperfusion therapy – neither PCI nor thrombolysis. There has been a consistent improvement in this aspect of care over the last nine years - the rate of 'non-reperfusion' being a little greater than 25% in 2010/11 [Figure 19].

There is variation between the participating countries, with the 'no reperfusion' rate being lowest in Northern Ireland (7.5%) and highest in England (18.5%); in Wales the rate is 16.5%.

The commonest reason that reperfusion is not provided is that the patient attends too late after the onset of symptoms to benefit from PCI. In other cases an elective decision is made not to perform PCI based upon patient characteristics (such as frailty), or, following urgent angiography, the recognition that PCI is not the best option. In 16% of cases the reason is unclear – no reason being given or data missing from the dataset [Table 1].

Figure 19: *Proportion of patients receiving neither intravenous thrombolytic therapy, nor primary PCI for STEMI, 2010/11 to 2018/19*

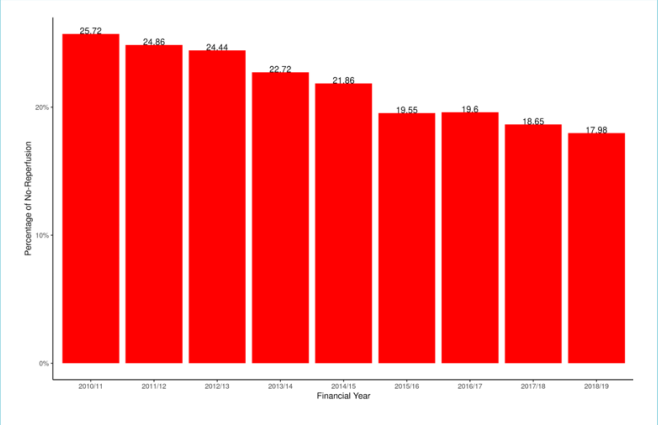


Table 1: *Reasons for no reperfusion in STEMI, 2018/19*

	Number	Percent
Too late	1635	29.0%
Elective Decision	1308	23.2%
Ineligible ECG	624	11.1%
Other	1020	18.1%
No reason	554	9.8%
Missing a reason	278	4.9%
Patient refused	70	1.2%
Risk of haemorrhage	49	0.9%
Unknown	72	1.3%
Administrative failure	25	0.4%
Uncontrolled hypertension	5	0.1%
Total	5640	100%

2.3 MORE STEMI PATIENTS ARE UNDERGOING PRE-DISCHARGE ECHOCARDIOGRAPHY

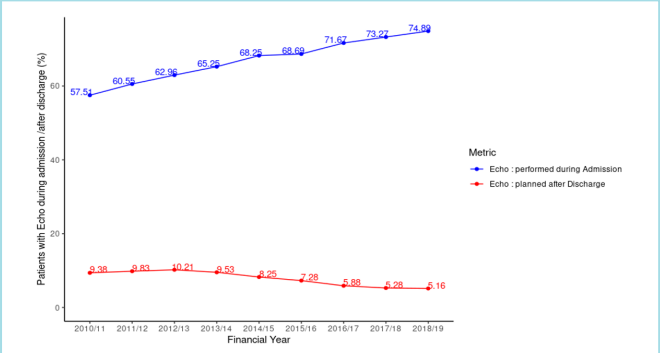
QI Metric Description/Name	Echocardiography after STEMI
Why is this important?	Performance of echocardiography allows assessment of left ventricular (LV) function and targeted treatments of heart failure – it also identifies patients who might benefit from 'device therapy'
QI theme	Safety/Other
What 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"[2]
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	Progressive increase in rate of echocardiography performed before discharge from hospital
Variance	For STEMI, 69 participating hospitals reported performing an echocardiogram in at least 90% of cases while 6 recorded lower than 50%

Following STEMI poor ventricular function is an indication for treatment with particular drugs (e.g. a mineralocorticoid receptor antagonist) and/or implantation of advanced cardiac devices such as a defibrillator. Evaluation of ventricular function is most often achieved by echocardiography.

The requirement for in-patient echocardiogram is implicit in DVLA guidance on driving after a heart attack – if the LV ejection fraction is at least 40% before hospital discharge, and there are no other disqualifying reasons, patients can resume driving cars or motorcycles a week after a heart attack, rather than after 4 weeks.[6]

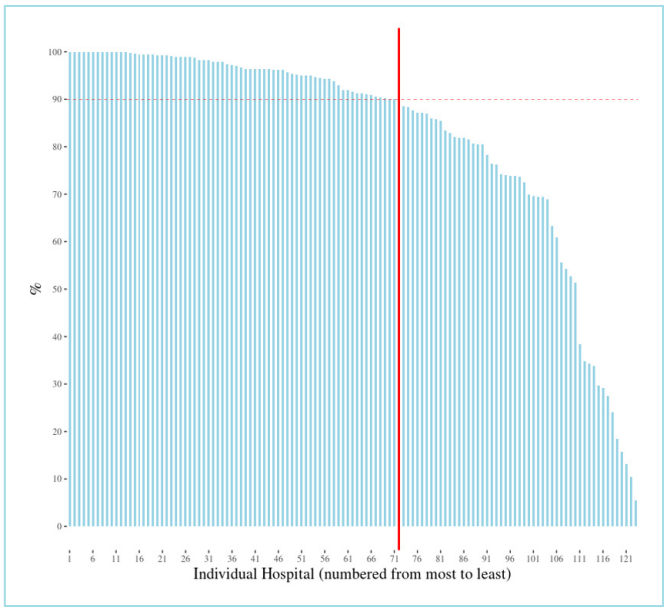
In 2018/19, of 30,619 patients discharged home following STEMI 22,932 (75%) were reported to have undergone an echocardiogram during the admission. This is an improvement compared with 2017/18 when 73% underwent an echocardiogram during the admission [Figure 20]. In both 2018/19 and 2017/18, 5% were discharged with a plan for a subsequent echocardiogram in the outpatient setting.

Figure 20: *Proportion of patients undergoing echocardiography following STEMI*



There is significant variation in practice. Of the 123 hospitals that recorded at least 20 cases of STEMI, 71 reported performing an echocardiogram in at least 90% of cases and 6 recorded that fewer than 50% of patients underwent echocardiography prior to discharge [Figure 21]. In 5 of these latter hospitals data completeness was poor, with no information being submitted in more than 50% of eligible cases.

Figure 21: *Distribution of hospitals with respect to the proportion of patients with STEMI who undergo an echocardiogram during admission, 2018/19*

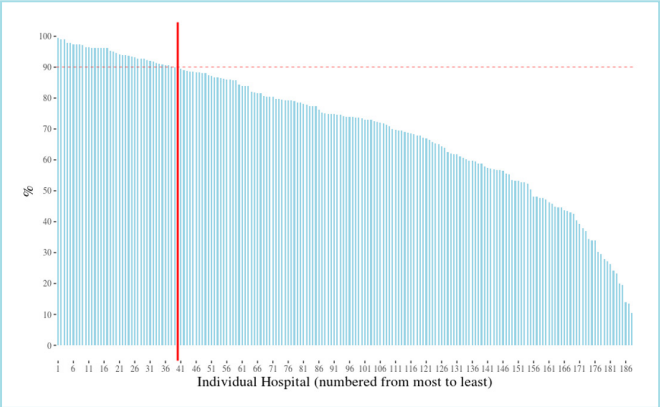


Hospitals to the right of the red line have NOT achieved ≥90% of patients undergoing echocardiography as an in-patient. Data from 123 hospitals; hospitals reporting <20 cases excluded.

Variation in practice was more marked with respect to the provision of echocardiography to all heart attacks, i.e. either STEMI or NSTEMI. While at least 90% of patients underwent an echocardiogram during the index admission in 40 hospitals, fewer than 50% of patients underwent echocardiography prior to discharge in 33 hospitals [Figure 22]. In 42 hospitals data

completeness was poor, with no information being submitted in more than 50% of eligible cases.

Figure 22: *Distribution of hospitals with respect to the proportion of patients with either STEMI or NSTEMI who undergo an echocardiogram during admission, 2018/19*



Hospitals to the right of the red line have NOT achieved ≥90% of patients undergoing echocardiography as an in-patient. Data from 189 hospitals; hospitals reporting <20 cases excluded.

In considering this metric it should be remembered that there are other methods of assessing ventricular function that could negate the need for echocardiography. Further, there may be patients whose ventricular function is already known to be poor at the time of admission to hospital and in whom further echocardiography is unlikely to change their management.

In some regions patients with STEMI are taken to 'high-volume' primary PCI centres and then repatriated to a hospital that is closer to their home, where an echocardiogram can be performed; the first hospital that creates the MINAP record may not be able to confirm with certainty that an echocardiogram has been performed before eventual discharge.

For these reasons it is unrealistic to expect achievement of 100% for this metric. However it is clear that many hospitals can provide an echocardiographic assessment in at least 90% of cases. Those hospitals with lower rates should undertake a review of their data collection processes - to ensure that the apparent low 'echo rate' reflects practice - and if it does, should review the patient pathway to identify opportunities for echocardiography during the index admission.

Recommendation for those not achieving the standard

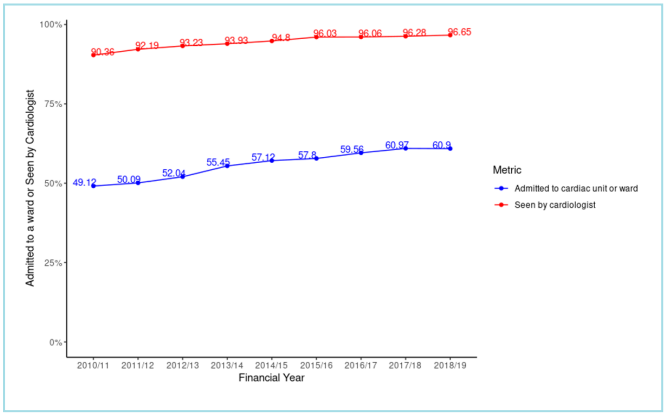
In the management of heart attack (both STEMI and NSTEMI), concerning the performance of pre-discharge echocardiography, staff in those hospitals with lower rates of provision should undertake a review of data collection processes - to ensure that the reported rate accurately reflects practice - and then review the patient pathway to identify opportunities for echocardiography during the index admission; where patients are discharged early to another hospital, there must be a clear request to provide this service at the receiving hospital.

2.4 MORE NSTEMI PATIENTS SHOULD BE ADMITTED TO A CARDIAC WARD

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[7] 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[8]
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	A gradual increase in the proportion of patients being admitted to a cardiac ward over the last 9 years
Variance	In 58 hospitals at least 80% of patients were admitted to a cardiac ward, while in 17 hospitals fewer than 20% of patients were admitted to such a ward

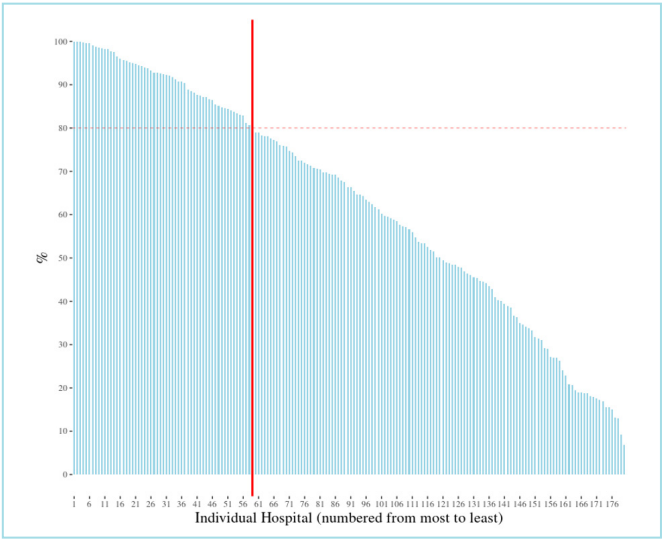
Ideally, patients with NSTEMI should be managed in a cardiac ward and assessed by a cardiologist. In 2018/19, 60.9% were admitted to a cardiac ward/unit. This is almost identical to the previous year, however there has been a gradual improvement over the last 9 years [Figure 23].

Figure 23: *Trend in proportion of patients with NSTEMI who are admitted to a cardiac unit or ward and seen by a cardiologist during admission*



There is much variation between hospitals with respect to this metric [Figure 24]. In 17 hospitals fewer than 20% of patients were admitted to a cardiac ward, while in 58 hospitals at least 80% of patients were admitted to such a ward.

Figure 24: *Distribution of hospitals with respect to the proportion of patients with NSTEMI who are admitted to a cardiac ward*



Hospitals to the right of the red line have NOT achieved ≥80% of patients admitted to a cardiac ward. Data from 180 hospitals; hospitals reporting <20 cases excluded.

Recommendation for those not achieving the standard

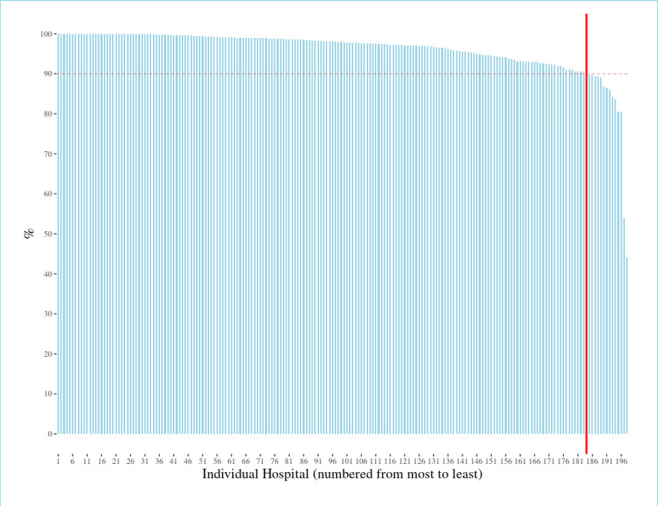
Concerning admission to a cardiac ward, where possible, patients with a heart attack (both STEMI and NSTEMI) should be treated on a cardiac ward, but outreach services should be provided for those nursed elsewhere. Those hospitals not reaching recommended levels should review their systems and bed allocations to allow patients the benefits of access to cardiac care.

2.5 MORE PATIENTS ARE BEING SEEN BY A CARDIOLOGY TEAM DURING THE ADMISSION

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[a]
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	Consistently high performance over years
Variance	The majority of participating hospitals report high rates. However, 15 hospitals record cardiologists being involved in the care of fewer than 90% of NSTEMI patients

The proportion being seen by a cardiologist remains very high – 96.6% – though this value should be interpreted with a little caution because of suggestions that in some centres it is only after having NSTEMI confirmed by a cardiologist that a patient's case is submitted to MINAP. As it is, 15 hospitals record cardiologists being involved in the care of fewer than 90% of NSTEMI patients [Figure 25].

Figure 25: *Distribution of hospitals with respect to the proportion of patients with NSTEMI who are seen by a member of a specialist cardiology team*



Hospitals to the right of the red line have NOT achieved ≥90% of patients being seen by a member of the specialist team. Data from 198 hospitals; hospitals reporting <20 cases excluded.

Recommendation for those not achieving the standard

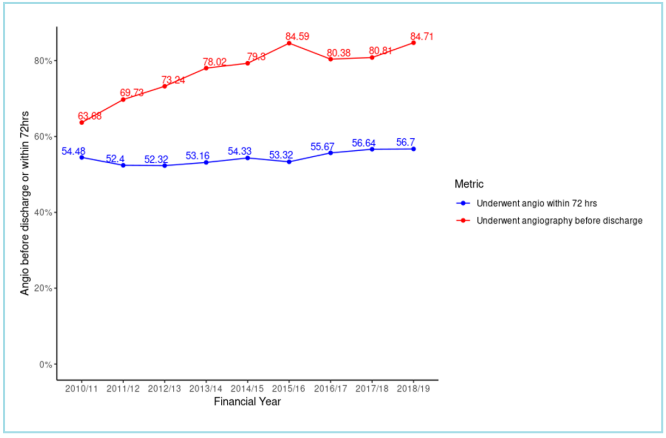
Those hospitals with low rates of cardiology involvement for patients with a heart attack should undertake a review of their data collection processes - to ensure that the data submitted reflects practice. If it does, then there should be consideration of improved provision of cardiac care during admissions. This might require increased staffing or more flexible use of members of the cardiology team - for example Nurse Specialists and Physician Associates.

2.6 INCREASING USE OF CORONARY ANGIOGRAPHY BUT STILL LONG DELAYS FOR MANY PATIENTS

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"[10] 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[8]
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	Increase in proportion undergoing angiogram during index admission over last 9 years
Variance	Angiography was performed in at least 95% of eligible patients in 83 hospitals, but in fewer than 50% of eligible patients in 2 hospitals

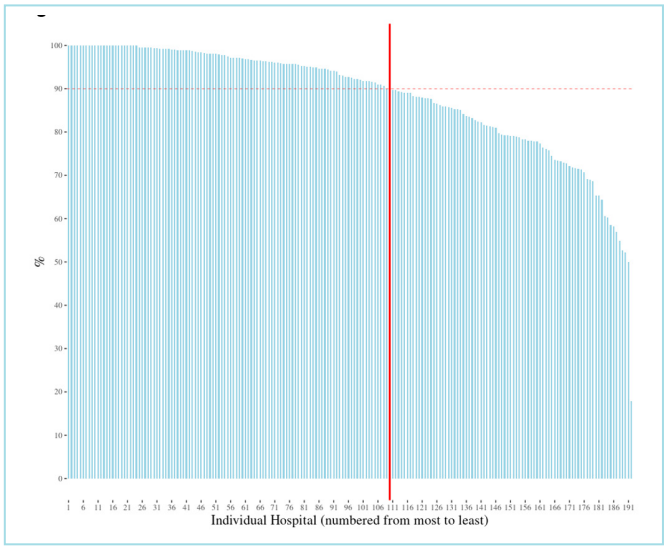
Of 55,727 cases of NSTEMI, 47,323 (84.9%) were judged to be eligible for an angiogram to investigate their coronary arteries, of which 40,088 (84.7% of those eligible) underwent the procedure before discharge home. This is a similar proportion as during the previous three years [Figure 26]. In Northern Ireland 96.7% of eligible patients underwent angiography before discharge, compared with 84.3% in England and 85.1% in Wales.

Figure 26: *Trends for proportion of eligible patients with NSTEMI undergoing angiography (red line) and the proportion of these undergoing angiography within 72hr of arrival at hospital (blue line)*



Angiography was performed in at least 95% of eligible patients in 83 hospitals, but in fewer than 50% of eligible patients in 2 hospitals [Figure 27]. Those hospitals with low rates of angiography should review their systems of managing NSTEMI.

Figure 27: *Proportion of NSTEMI patients eligible for angiography who undergo an angiogram during the index admission*



Hospitals to the right of the red line have NOT achieved ≥90% of eligible patients undergoing angiography during hospital admission. Data from 192 hospitals; hospitals reporting ≤20 cases excluded.

2.7 TOO FEW PATIENTS RECEIVE ANGIOGRAPHY WITHIN 72 HOURS OF ADMISSION

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 Metric Description/Name	Proportion of patients undergoing angiography within 72 hours of admission to hospital with NSTEMI
QI theme	Effectiveness
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."[10]
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	While angiography is offered to a greater percent of those who are eligible for the investigation, there has been only a slight increase in the proportion undergoing angiography within 72 hours of arrival over the last 9 years.
Variance	In 21 hospitals 75% of patients undergo angiography within 72 hours; In 7 hospitals 25% or fewer patients receive angiography within 72 hours.

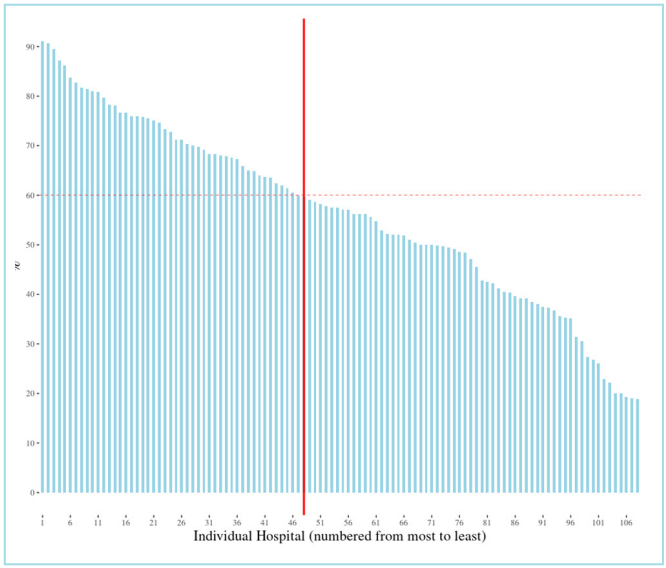
NICE guidelines suggest a benefit for diagnostic coronary angiography, with subsequent PCI if judged to be necessary, when the angiogram is performed up to 96 hours after admission to hospital with symptoms of NSTEMI, in those patients estimated to be at moderate to high risk – nearly all those patients recorded in MINAP. NICE also proposes that performance of angiography within 72 hours is a marker of good quality care.

In 2018/19, 19.1% of patients who underwent angiography did so within 24 hours of admission, 39% within 48 hours and 56.7% within the recommended 72 hours. This compares with 56.6% in 2017/18, 56.1% in 2016/17 and 53% in 2015/16. However, 30.5% did not undergo an angiogram within 96 hours [Figure 28].

Figure 28: *Delay from admission to angiography in NSTEMI*

The median delay to angiography was 69.2 hours in 2010/11 and had fallen to 64.5 hours in 2018/19. There is wide variation in performance of individual hospitals with regard to this metric [Figure 29].

Figure 29: *Proportion of NSTEMI cases undergoing angiography within 72 hours*



Hospitals to the right of the red line are NOT achieving the 60% Best Practice Tariff target. Data from 108 hospitals; hospitals reporting <20 cases or incomplete data excluded.

In only 21 hospitals is angiography within 72 hours of admission provided to more than 75% of patients – though this is an increase from 13 hospitals in 2017/18. In 7 hospitals 25% or fewer patients receive angiography within 72 hours of admission – an increase from 5 hospitals in 2017/18.

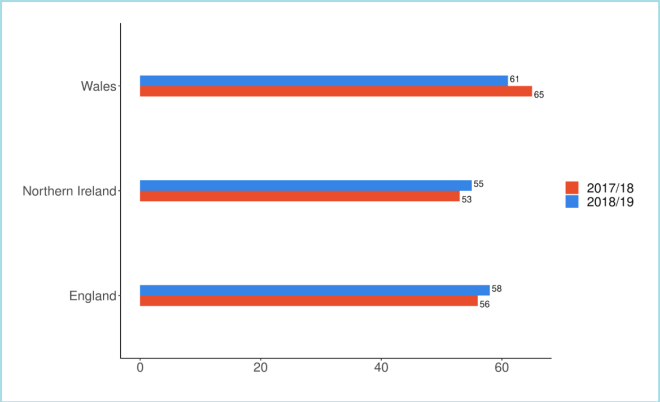
Closer examination reveals that those patients with NSTEMI who are initially admitted, quite appropriately, to a hospital that does not provide angiography services, and who therefore need transfer to another hospital to undergo angiography, are less likely to be offered timely angiography. In 2018/19, the median interval from admission to angiography was 57 hours (interquartile range 27-101 hours) for those admitted directly to a hospital with angiography/PCI facilities compared with 80 hours (Interquartile range 46-130 hours) for those requiring inter-hospital transfer. This means that fewer than half of those patients who require transfer between hospitals in order to undergo angiography receive the investigation within the 72-hour 'quality standard' time.

There are also differences within and between the home nations with respect to this metric, as shown in the accompanying Table 2.

Table 2: *Delay to angiography (angio) following admission with NSTEMI, by nation, expressed as proportion receiving angiography within 72 hours of admission and median delay with interquartile ranges (IQR) 2018/19 and 2017/18*

	Angio within 72 hr of admission (18/19)	Median (IQR) interval from admission to angio – no transfer required (hr) (18/19)	Angio within 72 hrs of admission (17/18)	Median (IQR) interval from admission tob angio – no transfer required (hr)(17/18)
England	57%	57 (27-101)	57%	56 (27-99)
Northern Ireland	61%	55 (26-109)	63%	53 (28-102)
Wales	55%	61 (29-99)	50%	65 (38-108)

Figure 30: *Change in delay to angiography after admission with NSTEMI by nation*



The median delay has improved in Wales by 4 hours (61 hours in 2018/19 compared with 65 hours in 2017/18), but lengthened in both England (57 hours compared with 56 hours) and Northern Ireland (55 hours compared with 53 hours) [Figure 30].

There is clearly room for improvement with respect to this aspect of care, though progress is slow. This aspect of the management of patients with NSTEMI has been included in NHS England's 2017/18 and 2018/19 National Tariff Payment System with the intention of incentivising timely angiography. This system includes a 'base payment' for each angiogram, with an additional 'conditional' payment being made to those hospitals in which 60% of NSTEMI patients receive coronary angiography with 72 hours of admission.

Recommendation for those not achieving the standard

In the management of NSTEMI, concerning performance of a coronary angiogram, staff in those hospitals with low rates of angiography in eligible patients should review their systems of managing NSTEMI.

Commissioning Groups in those areas where hospitals do not meet the standards for the use of pre-discharge angiography within 72hours of admission to hospital should set up a process review and quality improvement programme involving all stakeholders to change performance. There should be tight performance management of the entire process, with consideration of streamlining the identification of appropriate patients and their referral for angiography and possible intervention. Commissioning Groups should consider all options to improve performance including that of decommissioning services in centres with consistently poor performance and redirecting patients to more responsive centres.

2.8 GOOD ADHERENCE TO SECONDARY PREVENTION MEDICATION GUIDELINES BUT ROOM FOR IMPROVEMENT

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.

QI Metric Description/Name	Percentage of patients discharged on all secondary prevention drugs for which they are eligible following either STEMI or NSTEMI
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[11]
Numerator	Patients discharged on all secondary prevention drugs for which they were judged to be eligible.
Denominator	All patients with 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 - between 90.3% and 92.5% over the last 9 years.
Variance	37 hospitals reached the target for patients being prescribed all drugs for which they were eligible; fewer than 50% of patients were discharged on all eligible drugs in 9 hospitals.

Certain drugs have been shown to reduce the likelihood of subsequent heart attacks in survivors of both STEMI and NSTEMI. Originally the performance of individual hospitals was reported with respect to each of these 'secondary prevention' medications that were prescribed at the time of discharge from hospital, excluding patients who were ineligible/unsuitable to receive the medication or who declined to do so.

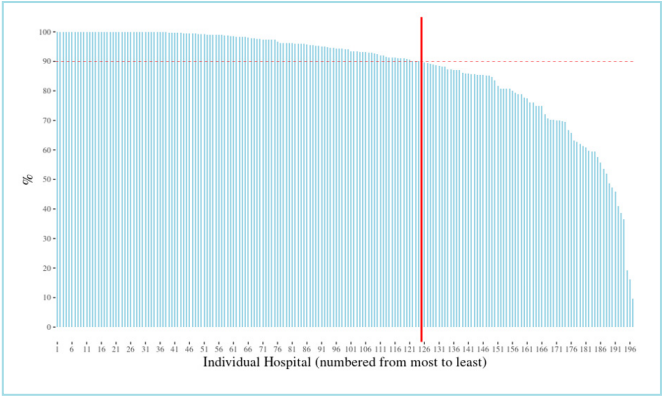
The proportion of patients discharged on each drug class, other than aldosterone antagonists (mineralocorticoid receptor antagonists – MRA) (see 5.1.2 below), has been over 90% for some years. This year rates were: ACE inhibitor/Angiotensin receptor antagonist, 94.4%; Aspirin, 98.2%; Beta blocker, 96.4%; Statin, 97.6%; Clopidogrel, Prasugrel or Ticagrelor, 97.4%.

Given the excellent and consistent results with respect to individual drug classes, the measure of performance with respect to secondary prevention drugs is now expressed as a composite – the proportion of patients discharged on all the secondary prevention drugs for which they were eligible, based upon their particular situation.

For this more taxing performance measure, 59,319 of 65.607 (90.4%) patients were discharged home with all drugs for which they were eligible. Over the last nine years the figure has varied little - between 90.3% and 92.5%. There is significant variation between hospitals [Figure 31]. The majority of hospitals perform well in this metric.

9 hospitals report discharging fewer than 50% of patients on all the drugs for which they were eligible, while 37 hospitals provided appropriate drugs for every patient discharged.

Figure 31: *Distribution of hospitals with respect to the proportion of patients with heart attack who are discharged home on all secondary prevention drugs for which they are eligible*



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. Data from 197 hospitals; hospitals reporting <20 cases excluded.

Recommendation for those not achieving the standard

In the management of heart attack (both STEMI and NSTEMI), staff in hospitals not meeting the standard for the prescription of all secondary prevention medications prior to discharge should first explore data completeness and ensure that their data is a valid representation of practice. If the reported performance is confirmed they should design and implement a quality improvement programme. This might include the introduction of a discharge pro forma or checklist, the involvement of a specialist hospital pharmacist or 'ACS Nurse Specialists'. Regions, networks and commissioning groups should facilitate peer-support activities through a local collaborative whereby highly-performing hospitals or Trusts support those hospitals consistently returning poor performance in this metric

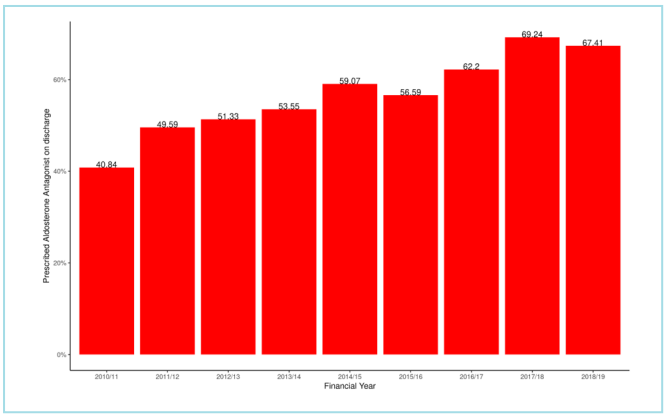
2.9 ALDOSTERONE ANTAGONISTS SHOULD BE CONSIDERED FOR ALL PATIENTS WITH IMPAIRED LV FUNCTION

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"[2]
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	Progressive rise in use of aldosterone antagonists over past nine years.
Variance	In 13 hospitals, at least 90% of patients with poor LV systolic function following STEMI received MRA; in 3 hospitals fewer than 60% of such patients received MRA.

Aldosterone antagonists are recommended following a heart attack if there is also evidence of heart failure – judged by physical or radiological signs, and using echocardiography. Such drugs were prescribed to 27.8% of all patients who were discharged home following either STEMI or NSTEMI, an increase from 26.5% the previous year.

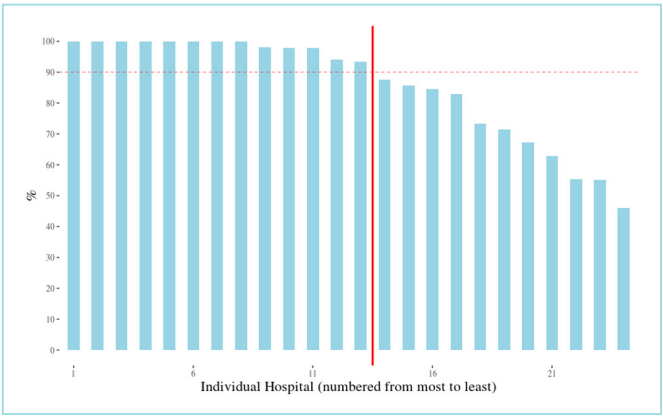
When the analysis is restricted to patients with STEMI who also undergo an echocardiogram that reveals significant impairment of ventricular function [Figure 32], the rate of prescription of aldosterone antagonist medication is 67.4% (1818 of 2697 patients). For the three home nations the rate of use is 66.4% in England, 74.8% in Wales and 98% in Northern Ireland (albeit in Northern Ireland this represents only 49 of 50 eligible patients).

Figure 32: *Trend in use of aldosterone antagonists in those with STEMI and significant left ventricular impairment*



This new analysis suggests that 'guideline-recommended' use of aldosterone antagonists lags behind that of other secondary prevention medication, and could be the target for quality improvement initiatives. That being said, 13 of 24 hospitals reported prescribing aldosterone antagonists at the time of discharge in at least 90% of this, admittedly small, sub-group of patients [Figure 33]. Relatively few hospitals appear in this particular analysis because of the requirement that there be at least 20 patients who, having undergone an echocardiogram that revealed poor LV function following STEMI, received aldosterone antagonists. This necessarily restricts the analysis to larger primary PCI centres.

Figure 33: *Distribution of hospitals with respect to the proportion of patients with STEMI and significantly impaired ventricular 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 significant left ventricular impairment. Data from 24 hospitals; hospitals reporting <20 cases excluded.

Recommendation for those not achieving the target

As part of the review of prescription of secondary prevention medications prior to discharge, specific attention should be made to the prescription of aldosterone antagonists for patients with impaired LV function.

2.10 REFERRAL TO CARDIAC REHABILITATION – HAVE WE TURNED THE CORNER?

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")[2] NICE quality standard (QS 99) "Adults admitted to hospital with a myocardial infarction are referred for cardiac rehabilitation before discharge."[12]
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	There has been a reversal of a trend towards worsening performance.
Variance	10 hospitals report referring all eligible patients; 17 hospitals refer less than one half of eligible patients

Cardiac rehabilitation is a structured programme of care that can be offered to patients with a variety of manifestations of heart disease so as to improve their physical, mental and social well-being. Most programmes include an exercise component, and cover educational and relaxation/emotional issues.

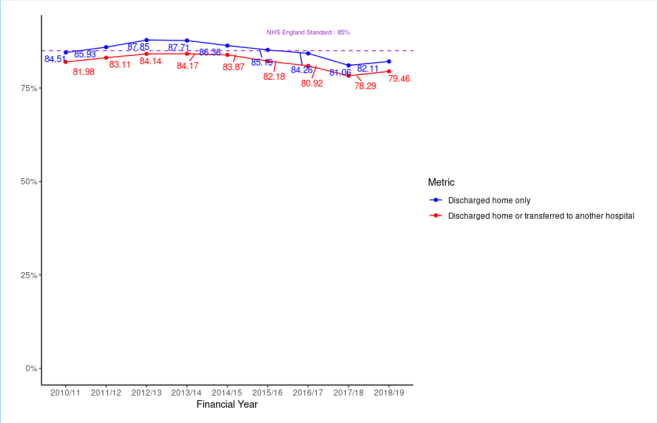
Meta-analysis of exercise-based cardiac rehabilitation programmes reports 22% reduction in cardiac mortality in patients with coronary disease.[13]

NHS England's 'Long Term Plan' confirms the importance of cardiac rehabilitation and proposes that by 2028 the proportion of patients accessing cardiac rehabilitation "will be amongst the best in Europe, with up to 85% of those eligible accessing care".

The National Audit of Cardiac Rehabilitation (NACR) 2019 NACR report shows that about half of all eligible patients take up a place in a cardiac rehabilitation programme. The estimated rate of those starting rehabilitation was highest for those recovering from cardiac surgery (75%) and was 60% for those who underwent PCI for the management of heart attack and only 28% for those with MI not treated with PCI. The rate of referral to cardiac rehabilitation for this last group – post heart attack not managed by PCI – is falling and is described in the NACR report as a "worrying trend".

In the previous MINAP report, referral for cardiac rehabilitation was reported only for those patients who were discharged from hospital directly to their homes. This excluded patients who were transferred from the participating hospital to another hospital for further treatment. The rationale for this was that referral for rehabilitation was most likely to happen at the end of an entire episode of hospital care. In 2018/19, 82% of patients with either STEMI or NSTEMI, who were discharged home from hospital, were referred for cardiac rehabilitation, an increase of 1% from the previous year. This is a reversal of a worrying trend over the previous 5 years [Figure 34].

Figure 34: *Rates of referral for cardiac rehabilitation programmes following either STEMI or NSTEMI*

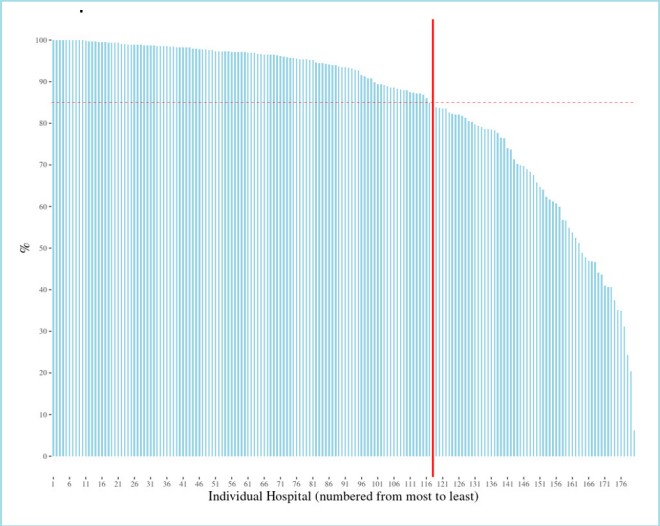


However, in many cases of NSTEMI a conversation about cardiac rehabilitation, and indeed an invitation to attend a cardiac rehabilitation course, occurs in a non-interventional hospital prior to transfer to an interventional hospital for coronary angiography. Such activity is not represented in the analysis described above.

So a second analysis is presented this year, namely the rate of referral to rehabilitation, either STEMI or NSTEMI, for those discharged home and those transferred to another hospital. In 2018/19, 79.5% of such patients were referred to cardiac rehabilitation programmes.

How many of the patients referred to cardiac rehabilitation actually started the programme, and completed it, is unknown. There may be opportunities to link MINAP, and indeed other domains of NCAP, with the NACR, to further validate the data and to facilitate quality improvement initiatives.

Figure 35: *Distribution of hospitals with respect to the proportion of patients with heart attack who are referred for cardiac rehabilitation at the time of discharge home or transfer to another hospital*



Hospitals to the right of the red line are NOT achieving ≥85% of patients referred for cardiac rehabilitation. Data from the 180 hospitals; hospitals with 20 patients <excluded.

There is substantial variation between hospitals with respect to the proportion of patients referred to cardiac rehabilitation [Figure 35]. Ten hospitals report referral of all eligible patients and 117 hospitals achieve the NHS 'Long Term Plan' aspiration of 85%. However, 17 hospitals refer less than one half of eligible patients.

Recommendation for those not achieving the target

Staff in hospitals not meeting the standards for referral of patients to cardiac rehabilitation following a heart attack (both STEMI and NSTEMI) should review the provision of services (including structural/staffing issues) and the effective and early identification of patients who might benefit.

3. FUTURE DEVELOPMENTS

3.1 IMPROVING CASE ASCERTAINMENT

Case ascertainment (the proportion of those patients eligible for entry into MINAP that actually appear in the dataset) is a marker of data quality. Other descriptors of data quality include the timeliness of data submission (how soon after the heart attack is data submitted), and data completeness (the proportion of possible information that is collected for each individual patient who appears in the dataset).

Determination of case ascertainment involves a comparison between the number of cases coded by staff within a hospital coding department as myocardial infarction (either in Hospital Episode Statistics (HES) data provided by NHS Digital in England or in the Patient Episode Database for Wales (PEDW) from NHS Wales Informatics Service - GIG Cymru Gwasanaeth Gwybodeg) with the number of cases submitted to MINAP by clinicians and audit clerks.

A lower than expected number of cases in MINAP (case ascertainment <100%) may reflect sub-optimal data quality. However, it may also reflect a degree of double-counting in HES/PEDW - for example a patient being transferred from a referring hospital to a receiving hospital will generate a separate coded admission in both hospitals. If they return to the initial hospital before discharge home a second coded admission in that hospital also will be generated.

A greater than expected number of cases in MINAP (case ascertainment >100%) can also be reported and is likely to represent hospital coding clerks using more than the limited number of International Classification of Diseases (ICD) 10 codes that we had extracted to record cases of acute myocardial infarction.

This year case ascertainment rates are presented at NHS Trust level for England and at Hospital level for Wales using, first, the inclusion criteria with respect to ICD 10 Codes used last year [see Table 6.1], and second, a wider range of such codes [Table 6.2].

Table 6.1: *Original criteria for comparison with MINAP records*

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 (STEMI) 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 the original 'more restrictive' criteria the overall case ascertainment rate for England was 96.1%. (79,763 MINAP records submitted and 82,990 HES cases recorded) - ranging from 13.4% to 199% for hospitals. For hospitals in Wales, using the original 'more restrictive' criteria, the overall case ascertainment rate was 85.3% - ranging from 60.1% to 113.7%.

Table 6.2: *Revised criteria for comparison with MINAP records*

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 (STEMI) 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;
I21.9 Acute myocardial infarction (unspecified)
I22.0 Subsequent ST elevation (STEMI) myocardial infarction of anterior wall;
I22.1 Subsequent ST elevation (STEMI) myocardial infarction of inferior wall;
I22.8 Subsequent ST elevation (STEMI) myocardial infarction of other sites;
I22.9 Subsequent 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;
I22.2 Subsequent non-ST elevation myocardial infarction.

Using the revised 'more permissive' criteria the overall case ascertainment rate for England was 91.9%. (79,763 MINAP records submitted and 86,765 HES cases recorded) - ranging from 12.3% to 192% for hospitals. For hospitals in Wales, using the revised 'more permissive' criteria, the overall case ascertainment rate was 68.6% - ranging from 50.6% to 93.1%.

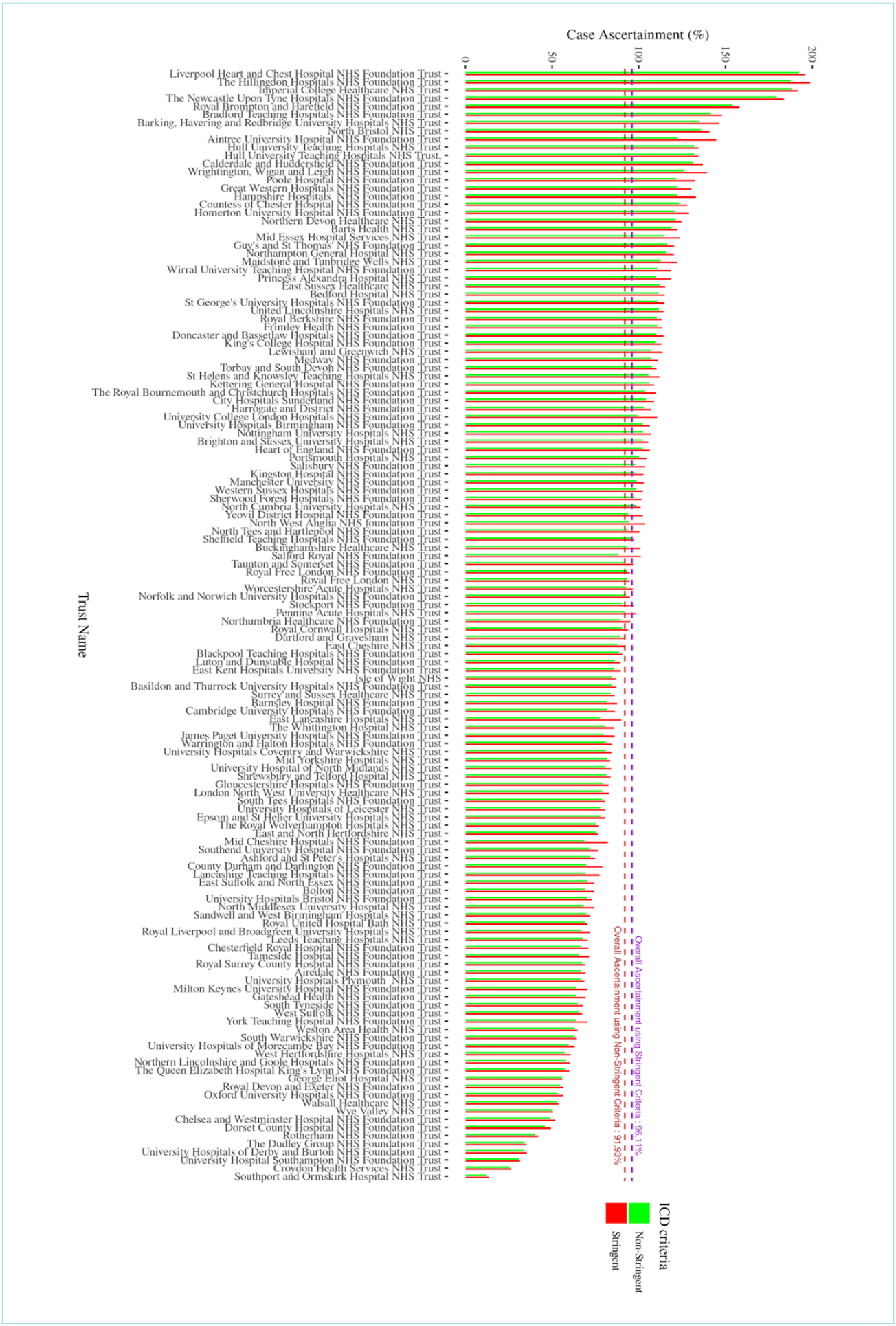


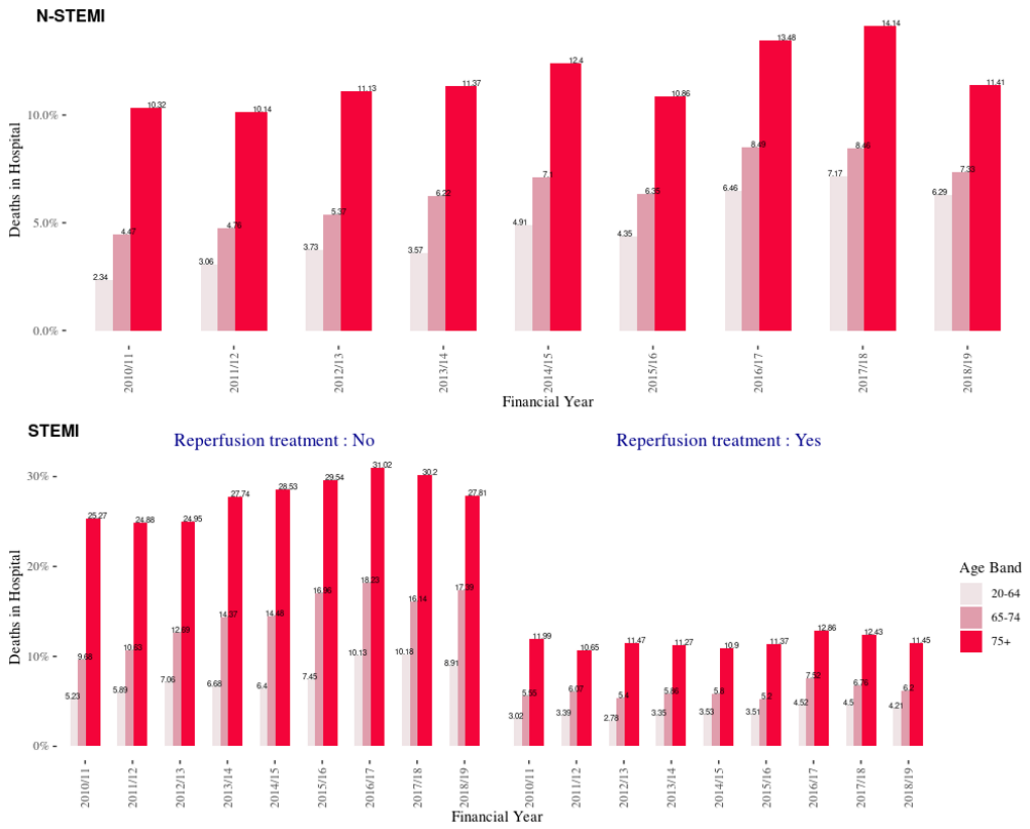
Figure 36: *Case Ascertainment by Trust in England*

We will continue to work with participating hospitals to better understand local coding practices, advising those with the lowest case ascertainment rates to implement systems whereby MINAP data collection is informed by review of coding records. For those hospitals with high (>100%) ascertainment rates we recommend that hospital clinicians and managers research the disparity to ensure that coding systems are used accurately.

3.2 CAPTURING MORE DATA ON MORTALITY

Heart attack remains a dangerous event, sometimes associated with sudden death in the community. MINAP only records information on the management of those admitted to hospital. Most patients admitted to hospital are later discharged home, alive.

Figure 37: *In-hospital mortality rates for NSTEMI and STEMI with and without reperfusion treatment) in three age bands, 2010/11 to 2018/19*



Trends for in-hospital death rates in three age bands for NSTEMI and for STEMI (whether or not reperfusion treatment was provided) are shown in Figure 37. This is further expressed for England, Wales and Northern Ireland in Figure 38 (for STEMI) and Figure 39 (for NSTEMI).

Figure 38: *In-hospital mortality rates for NSTEMI and STEMI with and without reperfusion treatment) in three age bands, 2010/11 to 2018/19*

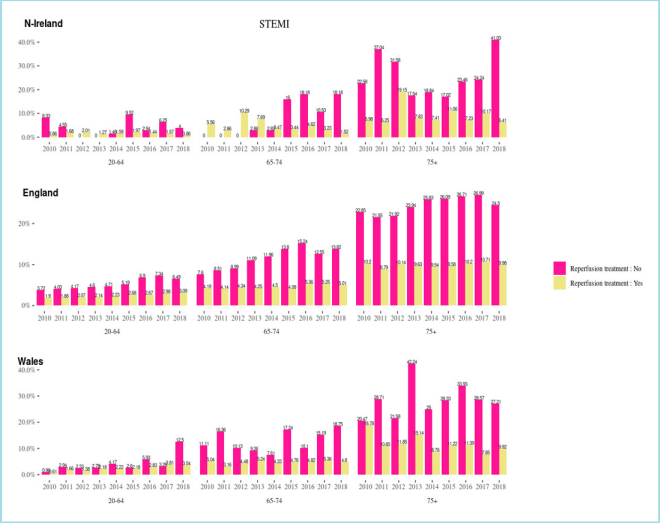
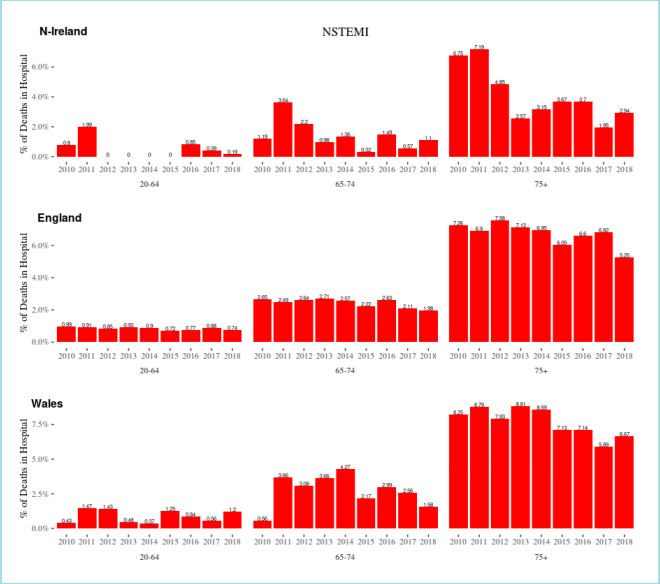


Figure 39: *In-hospital mortality rates (percent) for NSTEMI by nation, in three age bands, 2010 to 2019*



Without splitting into age bands, overall in-hospital mortality following NSTEMI has fallen from 4.3% in 2010/11 to 2.8% in 2018/19. However in-hospital mortality has risen for STEMI both in those who do not receive reperfusion treatment (from 12.5% in 2010/11 to 16.8% in 2018/19) and in those who receive reperfusion treatment (from 4.4% in 2010/11 to 5% in 2018/19).

In considering these observations regarding deaths in hospitals it should be remembered that no adjustments have been made for any of the known pre-treatment predictors of outcomes. Statistical Scientists at University College London have recently developed a mathematical model, based upon the existing GRACE scoring system, that can adjust for a number of patient-specific (treatment-independent) characteristics. This will be implemented next year on the 2019/20 data, and on three-year data (e.g. 2017/20). This should allow a better understanding of the trends presented here as well as meaningful comparisons of mortality rates between nations and between hospitals.

In the meantime, a review of the present unadjusted data demonstrates a number of interesting associations.

- Patients in the older age band are more likely than younger patients to die in hospital following both NSTEMI and STEMI, whether or not reperfusion treatment is provided in cases of STEMI.
- In every age band, in-hospital mortality is greater for those with STEMI than with NSTEMI.
- Those patients with STEMI who do not receive reperfusion treatment (for reasons discussed in 3.3 above) have higher mortality rates - at least twice as great in every age band - than those who do.
- For NSTEMI, in the two older age bands (that include the majority of patients) in-hospital mortality was lower in 2018/19 than during the previous eight years.
- The in-hospital mortality rate for the youngest age group following STEMI, which contains approximately half of all cases of STEMI, has progressively risen over the last nine years, reaching 3% for those receiving reperfusion treatment (nearly always primary PCI) in 2018/19.

3.3 IMPROVING REPORTING BACK OF HOSPITAL-LEVEL DATA

The NCAP has recently launched new data tools for hospitals to help with the NAPCI and NACSA. These tools will next be applied to MINAP data. The tools include:

- a data completion tool: hospitals can drill down to the data for individual patients and identify missing or incorrect data, which itself will enhance the validation process
- a QI metric tool: hospitals can see how they perform in the selected national QI metric panel, not only against the national average but against the top performing centres
- a local query tool: hospitals can set up a separate query and see how they compare against the national average.

These tools mean that hospitals can constantly see how they are faring with the current data in the database. The functionality is significantly improved if all centres download data frequently and regularly, preferably on a weekly basis. The information that can be provided back then becomes far more useful.

REFERENCES

1. National Institute for Health and Care Excellence. Acute coronary syndromes in adults. Quality Standard [QS 68] Quality Statement 6: Primary PCI for acute STEMI. 2014. Available at: https://www.nice.org.uk/guidance/qs68/chapter/Quality-statement-6-Primary-PCI-for-acute-STEMI
2. The Task Force for the management of acute myocardial infarction in patients presenting with ST-segment elevation of the European Society of Cardiology (ESC). 2017 ESC Guidelines for the management of acute myocardial infarction in patients presenting with ST-segment elevation. Eur Heart J 2018;39:119-177.
3. https://www.hsib.org.uk/investigations-cases/emergency-response-heart-attack/ accessed on 14 July 2020.
4. NHS England. Ambulance Quality Indicators. Current Data Specifications. at https://www.england.nhs.uk/statistics/wp-content/uploads/sites/2/2019/12/20191213-AmbCO-specification.pdf accessed on 14 July 2020.
5. Schiele F, et al. Editor's Choice - Quality indicators for acute myocardial infarction: A position paper of the Acute Cardiovascular Care Association. Eur Heart J Acute Cardiovasc Care 2017;6:34-59.
6. Driver & Vehicle Licensing Agency. Assessing fitness to drive - a guide for medical professionals. February 2020. at https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/866655/assessing-fitness-to-drive-a-guide-for-medical-professionals.pdf
7. Birkhead J, et al. Determinants and outcomes of coronary angiography after non-ST-segment elevation myocardial infarction. A cohort study of the Myocardial Ischaemia National Audit Project (MINAP). Heart 2009;95:1593-99.
8. The Task Force for the management of acute myocardial infarction in patients presenting without persisting ST-segment elevation of the European Society of Cardiology (ESC). 2015 ESC Guidelines for the management of acute coronary syndrome in patients presenting without persistent ST-segment elevation. Eur Heart J 2016;37:267-315.
9. Birkhead J, et al. Impact of specialty of admitting physician and type of hospital on care and outcome for myocardial infarction in England and Wales during 2004-5: observational study. BMJ 2006;332:1306-8.
10. National Institute for Health and Care Excellence. Acute coronary syndromes in adults. Quality Standard [QS 68] Quality Statement 3: Coronary angiography and PCI within 72 hours for NSTEMI or unstable angina. 2014 Available at: https://www.nice.org.uk/guidance/qs68/chapter/Quality-statement-3-Coronary-angiography-and-PCI-within-72-hours-for-NSTEMI-or-unstable-angina
11. National Institute for Health and Care Excellence. Myocardial Infarction: cardiac rehabilitation and prevention of further cardiovascular disease. Clinical Guideline [CG 172]. 2013 Available at: https://www.nice.org.uk/guidance/CG172/chapter/1-Recommendations#drug-therapy-2
12. National Institute for Health and Care Excellence. Acute coronary syndromes in adults. Quality Standard [QS 99] Quality Statement 2: Referral for cardiac rehabilitation. 2015 Available at: https://www.nice.org.uk/guidance/qs99/chapter/Quality-statement-2-Referral-for-cardiac-rehabilitation
13. Anderson L, et al. Exercise-based cardiac rehabilitation for coronary heart disease: Cochrane systematic review and meta-analysis. J Am Coll Cardiol 2016;67:1-12.

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The NCAP is commissioned 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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