MYOCARDIAL ISCHAEMIA NATIONAL AUDIT PROJECT

2019 SUMMARY REPORT (2017/18 DATA)

NICOR

British Cardiovascular Society

CONTENTS

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 hospital with an acute coronary syndrome (heart attack). Staff in participating centres submit data that relate to each 'patient journey'; from a call to the emergency services or self-presentation at an Emergency Department, through diagnosis and treatment at hospital, to the prescription of preventive medications on discharge. Analyses of these data illustrate the provision of care at each participating hospital, and, where relevant, care provided in the community by Ambulance Trusts.

Clinicians can use the data to 'benchmark' the quality of care they provide against that provided at similar hospitals and, where such exist, against national standards and guidelines that describe optimum care. They can also determine where local quality improvement (QI) initiatives are likely to have the greatest benefit. In this way, MINAP can be both the prompt for, and the system for measuring the effect of, QI initiatives.

MINAP works closely with the British Cardiovascular Society – the body that represents and supports those 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 can be found on the NICOR website. The first aggregate report of the National Cardiac Audit Programme (NCAP) contained (in Appendix A) a useful description of the mechanisms by which heart attacks occur and a basic 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 website.

2. ANALYSIS

The current analysis is for patients with heart attacks who were admitted to hospital during the 12 months between April 2017 and March 2018. Hospital and Ambulance Trust performance, with respect to a number of aspects of care and data quality, are presented in tabular form. Additionally some key findings derived from the overall dataset are described below. Various analyses of the dataset also appear in the NCAP aggregate report – 'Improving cardiovascular outcomes: timely, specialist, evidence-based care'.

Importantly, this period coincided with a change in the system of electronic data collection. Some hospitals continued entering patients to the previous 'application' after the date of change over to the new 'application'. A very few cases have therefore been excluded from this analysis.

3. CASE NUMBERS

Between April 2017 and March 2018, 102,056 records were submitted of which 92,233 were confirmed cases of heart attack – an increase of approximately 5% (from 87,557) compared with the previous year. The overall case ascertainment rate (see relevant section below) was 101.7%. As before, the majority (56,493 – 61%) of these were non-ST elevation myocardial infarction (NSTEMI) – referred to as 'lower risk heart attacks' in the NCAP aggregate report. The remaining 35,740 (39%) were ST elevation myocardial infarction (STEMI) – referred to as "high risk heart attacks" in the NCAP aggregate report. This ratio of NSTEMI to STEMI cases has remained constant for the last five years.

4. PATIENT CHARACTERISTICS

4.1 AGE & GENDER

NSTEMI tends to occur in older people [Figure 1]. Up to age 50 years STEMI is the predominant form of heart attack. Thereafter the ratio of NSTEMI to STEMI increases, to more than 3:1 in the very elderly. 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 (median age for NSTEMI is 71 years).

There are more males than females in the MINAP database – 68% male in 2017/18. 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 compared with 74 years); of 9 years for STEMI (63 years vs 72 years); and of 7 years for NSTEMI (69 years vs 76 years).

Figure 1: *Distribution of ages of male and female patients, categorised by type of heart attack, 2017/18*

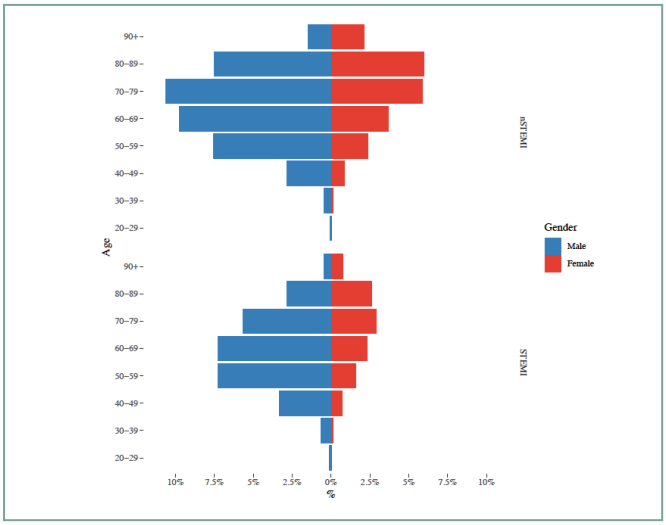


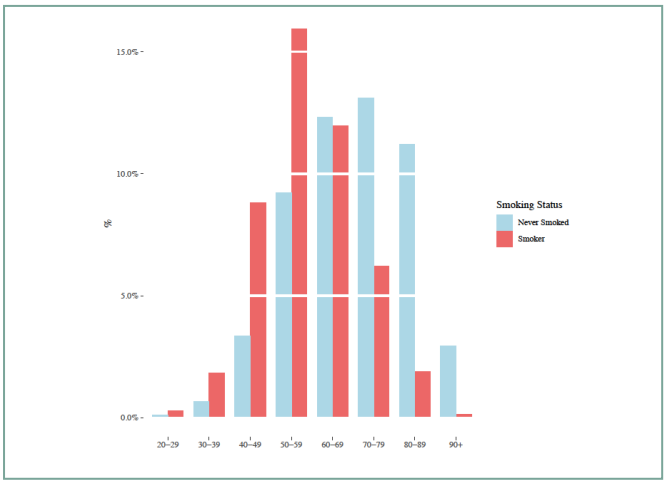
Table 1: *Mean and median age of patients (in years) categorised by sex and type of heart attack, 2017/18*

	Mean Age	Median Age
Female - NSTEMI	73.8	76.0
Female - STEMI	70.7	72.0
Male - NSTEMI	68.3	69.0
Male - STEMI	63.1	63.0

4.2 SMOKING

Smoking status was known for 75,592 patients. Of these, 28.7% were regularly smoking tobacco in the weeks leading up to their heart attacks, 37.1% were described as 'ex-smokers' and 34.1% had never been in the habit of smoking. Smoking habits varied between the Home Countries, with current smokers accounting for 40.1% of heart attacks in Northern Ireland, 31.4% in Wales, and 28.4% in England – albeit there is likely to be substantial regional variation within each country.

Figure 2: *Distribution of ages of patients who had never smoked tobacco and those who were regular smokers at the time of their heart attacks, 2017/18*



Smoking status was linked to age at onset of heart attack, with current smokers being, on average, more than 10 years younger than either ex-smokers or 'never' smokers [Figure 2]. This was so in cases of STEMI – mean age for smokers 57.7 years compared with 68.2 years for those who had never smoked – and in cases of NSTEMI – mean age for smokers 60.3 years compared with 71.9 years for those who had never smoked.

4.3 DIABETES MELLITUS

For those 68,561 patients who, before their heart attack, had no prior evidence of coronary artery disease (i.e. no previous heart attack, percutaneous coronary intervention (PCI) or coronary surgery), the presence or absence of diagnosed diabetes was recorded in 65,718. Of these, 21.1% had a prior diagnosis of diabetes – 20.5% of males and 22.4% of females. This represents a steady rise in prevalence of diabetes in the MINAP database. For example, the prevalence of diabetes was approximately 19% in women and 17% in men in 2011/12 and 15% in women and 13% in men in 2003/04.

Table 2: *Proportion of patients who had been diagnosed with diabetes mellitus prior to presentation with a first heart attack, 2017/18 compared with earlier years*

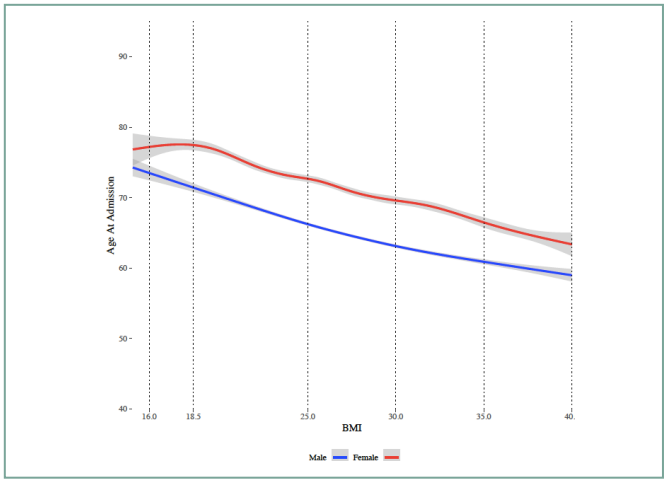
	Male	Female
2003 - 2004	13%	15%
2011 - 2012	17%	19%
2017 - 2018	20.5%	22.4%

The increase in cases of diabetes within MINAP is consistent with the known link between diabetes and cardiovascular diseases and the increased prevalence of diabetes in the general population, secondary to increased rates of patients in 'overweight' and 'obese' categories.

Recording of weight and height is inconsistent in the database, but preliminary analysis shows an association between Body Mass Index (BMI) and age at onset of first heart attack in both men and women, with higher BMI being associated with younger age at the time of first heart attack. Females with BMI 40 are approximately 10 years younger than those with BMI 25; males with BMI 40 are approximately 8 years younger than those with BMI 25 [Figure 3].

Caution is needed in interpreting this association. However, taken together, the findings with respect to tobacco smoking, diabetes and BMI point to targets for prevention strategies.

Figure 3: *Correlation between age at time of first heart attack and body mass index (BMI) in men and women, 2017/18*



5. STEMI

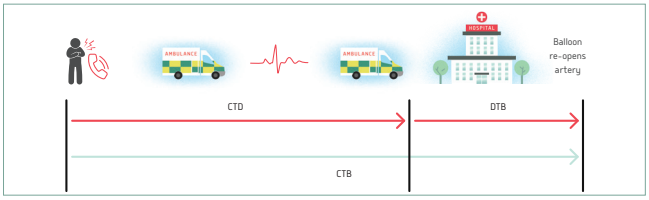
Management of STEMI requires immediate specialised treatment. A PCI is the preferred reperfusion procedure. Intravenous fibrinolytic drug treatment (thrombolysis) is a reasonable alternative when the likely delay between diagnosis of STEMI and PCI is predicted to be more than 120 minutes. The use of thrombolysis is therefore seen when there is limited access to advanced interventional cardiac care. Overall, only 142 patients received thrombolysis in 2017/18 compared with 301 the previous year. Whereas 143 patients in Wales received thrombolysis in 2016/17 this fell to 16 patients in 2017/18, representing increased accessibility to primary PCI services in the Principality.

5.1 TIMELINESS OF PRIMARY PCI

Once STEMI has been recognised, the sooner that primary PCI is performed the more likely it is that significant heart muscle damage will be prevented. The timeliness of primary PCI has become a measure of the quality of care. The various time intervals, or delays, reported in MINAP are represented in the accompanying figure. Mapped against the most frequently used 'patient pathway' – whereby 79% 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.

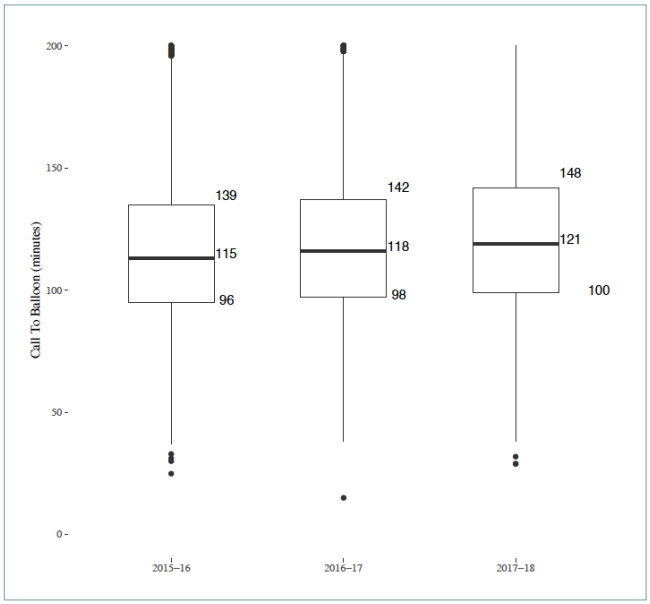
Figure 4: *Time periods relevant to reperfusion treatment for those receiving primary PCI*



Hospitals provide primary PCI to most patients presenting with STEMI within the recommended timeframes – 70.5% within 150 minutes (and 44% within 120 minutes) of the call for help (CTB). 88% receive within 90 minutes and 73% within 60 minutes of arrival at hospital (DTB).

However, the figure of 70.5% receiving treatment with a CTB time within 150 minutes represents a slight worsening of performance; the corresponding proportion being 72% of cases in 2016/17 and 75% of cases in 2015/16. A lengthening of the median CTB time has been observed in all of the Home Countries [Figure 5]. In England, the median CTB time increased by 5 minutes from 117 minutes in 2015/16 to 122 minutes in 2017/18; in Wales, median CTB time increased by 11 minutes from 127 to 138 minutes; in Northern Ireland the median CTB time increased by 7 minutes, from 107 to 114 minutes. This trend has also been reported by the National Audit of Percutaneous Coronary Interventions (NAPCI).

Figure 5: *Trend in Call-to-Balloon times (CTB) over three years – median and interquartile ranges.*



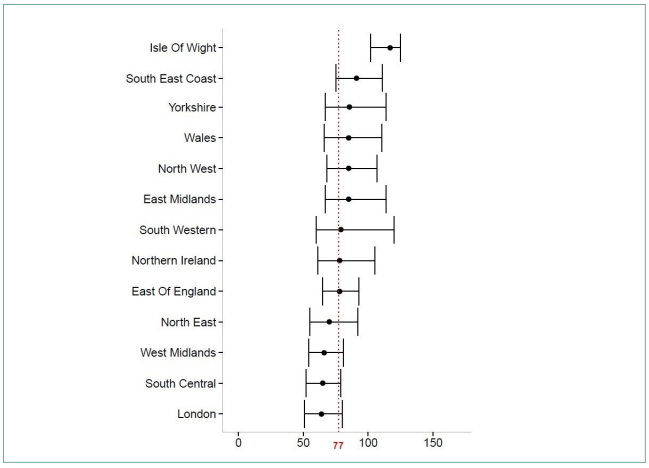
(Each box encompasses the middle 50% of patients. The number adjacent to the lower border of each box is the CTB achieved by up to 25%, that adjacent the upper border is the CTB achieved by at least 75%. The bold line within each box is the CTB achieved by 50%, i.e. the median value)

There has been minimal change in hospital performance (DTB times). 88% of patients received PCI within 90 minutes of arrival at hospital in 2017/18 compared with 89% in 2016/17. The median DTB time increased by 1 minute in 2017/18 (overall, and in England) compared with the previous year (from 40 minutes in 2016/17 to 41 minutes in 2017/18). It remained 42 minutes in Wales for both years and increased by 1 minute in Northern Ireland

(from 30 minutes to 31 minutes). Given these results, the documented increase in measures of CTB time suggest that increasing delays to treatment are being incurred prior to the patient arriving at the PCI centre. The overall median CTD time was 73 minutes in 2015/16, 75 minutes in 2016/17 and 77 minutes in 2017/18. The proportion of patients with a CTD time of 60 minutes or fewer has fallen from 33.5% to 26.9% over three years.

There is variation between Ambulance Trusts in the median CTD times (Figure 6). It is unclear how much these differences reflect the geographic nature (and transport connections) of the areas served by each Trust, differences in patient characteristics and differences in dispatch policies. Certainly, it is unsurprising to observe the relatively long CTD times experienced by patients attended by the ambulance service of Isle of Wight NHS Trust, who have to be transported, often by road and helicopter, to a primary PCI centre on the mainland, in Portsmouth.

Figure 6: *Median Call-to-door intervals, in minutes, by Ambulance Trust*



[Note: This figure is an analysis of all cases – those (the majority) transferred directly from the community to a primary PCI centre and those first presenting to a non-PCI centre and requiring inter-hospital transfer.]

There is no 'minimum or maximum' acceptable CTD time – other than CTD affects the CTB – though there is likely to be a 'trade-off' between the benefit of meticulous, but time-consuming, pre-hospital assessment and care and the potential detriment of consequent delays to hospital admission. The reporting of CTD will at least allow Ambulance Trusts to 'benchmark' their performance and to explore aspects of data quality to ensure that this metric is a valid representation of the care they provide.

MINAP is working with ambulance services to further validate these important quality metrics, and encourages all participating stakeholders to strive to improve timeliness of care.

Although there is little change in the median DTB times, there is clearly room for improvement. The PPCI centres with the worse times should review their processes to achieve the times of the best hospitals.

Notwithstanding discussions about pre-hospital delays, a key recommendation of the NCAP aggregate report remains the need to call an ambulance if symptoms suggestive of a heart attack are experienced, rather than presenting oneself to hospital.

5.2 POTENTIAL CHANGES TO DESCRIPTORS OF TIMELINESS

In 2017 an expert Task Force of the European Society of Cardiology produced new guidelines for the management of acute myocardial infarction in patients presenting with ST-segment elevation. These guidelines strongly support the recording and reporting of treatment delays, describing them as "the most easily audited index of quality of care in STEMI". However, the suggested time intervals and targets differ from those that have been used for many years in UK practice.

Instead of CTB and DTB metrics, the Task force proposes expressing the treatment delay as the interval from diagnosis, whether that diagnosis is made in the community by ambulance personnel or in the Emergency Department in the case of patients who make their own way to hospital, and the time that the relevant equipment used during PCI first passes through the coronary artery blockage.

While not stipulating an acceptable response time within which ambulance services should attend a patient following a call for help, the guidelines do state that the diagnosis, involving ECG interpretation, should occur within 10 minutes of the first medical contact (FMC). 90 minutes is felt to be the maximum acceptable delay from diagnosis to PCI; 60 minutes for those who present directly to a primary PCI centre.

There is continuing debate as to whether and when such performance measures of timeliness can be incorporated into the NCAP, and what changes might be necessary with respect to datasets and data collection. It is unlikely that there will be significant change in reported metrics until 2020.

5.3 NO REPERFUSION

Of the 35,740 cases of STEMI, 8393 (23.5%) did not receive reperfusion therapy – neither PCI nor thrombolysis. This is an improvement: in 2015/16, the proportion was 24.4%, and in 2014/15 it was 27%.

The reasons that reperfusion is not provided are variable; the commonest, in about a quarter, being that the patient has presented to hospital too late 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 those who do not receive PCI the reason is unclear – no reason being given or data being missing from the dataset.

Table 3: *Reasons for no reperfusion STEMI, 2017/18*

	Number	Percent
Too late	1991	23.7%
Elective Decision	1702	20.3%
Ineligible ECG	1612	19.2%
Other	1538	18.3%
No reason	752	9.0%
Missing a reason	522	6.2%
Patient refused	84	1.0%
Risk of haemorrhage	74	0.9%
Unknown	69	0.8%
Administrative failure	47	0.6%
Uncontrolled hypertension	2	0.02%
Total	**8393**	**100%**

5.4 ECHOCARDIOGRAPHY

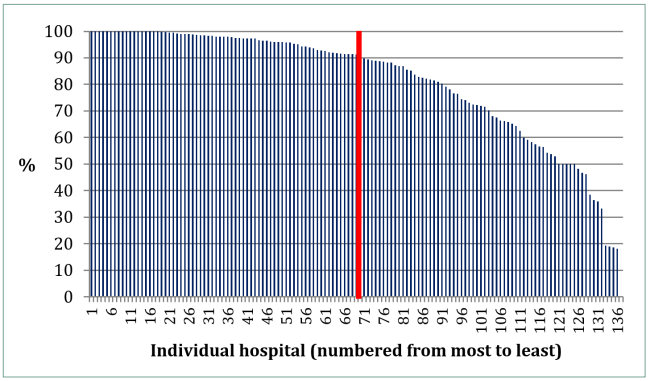
Following STEMI, patients should undergo evaluation of left ventricular (LV) function, because those with poor ventricular function may benefit from particular treatments, including certain drugs and implantation of pacemakers and defibrillators. This evaluation is most often achieved by echocardiography, a non-invasive ultrasound technique that should be available in all hospitals that admit such patients. This requirement, for in-patient echocardiogram, is implicit within the NICE guideline for management of heart attacks, which suggests that those with reduced ejection fraction should receive a mineralocorticoid receptor antagonist. It is also 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.

Performance of an echocardiogram is a relatively new metric and its reporting comes with a number of caveats. First, there are other less-commonly-used methods of assessing ventricular function that, if used during the index admission, could negate the need for echocardiography. Second, 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 care needs. Third, in some regions patients with STEMI are taken to 'high-volume' primary PCI centres and then, after prompt reperfusion, 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. Lastly, in many cases, when an echocardiogram has not been performed during the index admission, plans are made to perform the test soon after discharge.

In 2017/18, of 34,771 patients with STEMI 73% were reported as having undergone an echocardiogram during the admission and 5% were discharged with a plan for subsequent echocardiogram in the outpatient setting.

There is significant variation in practice [Figure 7]. Of the 147 hospitals that recorded at least 20 cases of STEMI, 57 reported performing an echocardiogram in at least 90% of cases and 25 reported that fewer than 50% of patients underwent echocardiography prior to discharge. In some of these latter hospitals poor data completeness contributed to this apparent sub-optimal performance. One hospital was excluded because more than 50% of cases were left blank or labelled as 'unknown'.

Figure 7: *Distribution of hospitals with respect to the proportion of patients with STEMI who undergo an echocardiogram during admission, 2017/18*



[Hospitals to the right of the red line have **failed** *to reach the target of ≥90% of patients undergoing echocardiography as an in-patient. Data from 138 hospitals; hospitals with incomplete data or reporting <20 cases excluded.]*

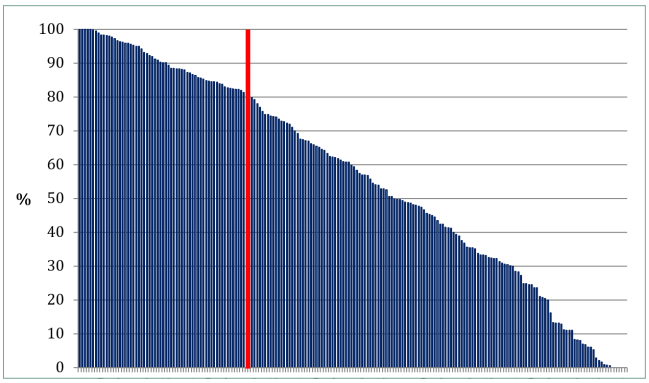
Eighteen hospitals reported arranging post-discharge echocardiography in at least 20% of all patients they managed for STEMI.

6. NSTEMI

Ideally, patients with NSTEMI should be managed in a cardiac ward and assessed by a cardiologist. In 2017/18, 61.1% were admitted to a cardiac ward/unit. This is a continuation of a trend to improved care, increasing from 59.6% and 57.5% in 2016/17 and 2015/16 respectively.

There was much variation between hospitals with respect to this metric [Figure 8].

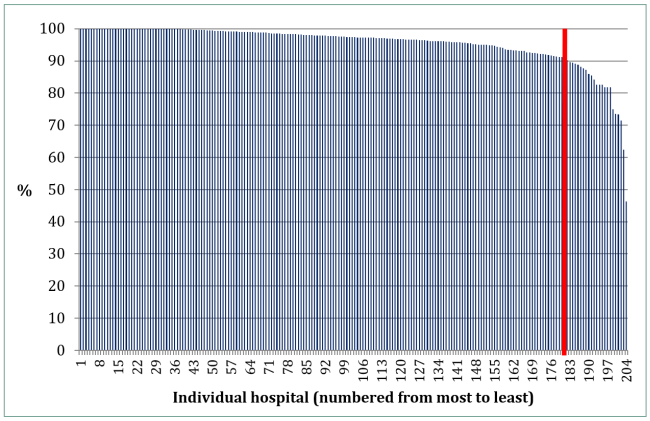
Figure 8: *Distribution of hospitals with respect to the proportion of patients with NSTEMI who are admitted to a cardiac ward*



[Hospitals to the right of the red line have **failed** *to reach the target of ≥80% of patients admitted to a cardiac ward. Data from 204 hospitals; hospitals reporting <20 cases excluded.]*

The proportion being seen by a cardiologist remains very high – 96.3% – though this figure 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. This point emphasises the importance of reporting of case ascertainment (see below). As it is, 22 hospitals record cardiologists being involved in the care of fewer than 90% of NSTEMI patients.

Figure 9: *Distribution of hospitals with respect to the proportion of patients with NSTEMI who are seen by a member of a specialist cardiology team*



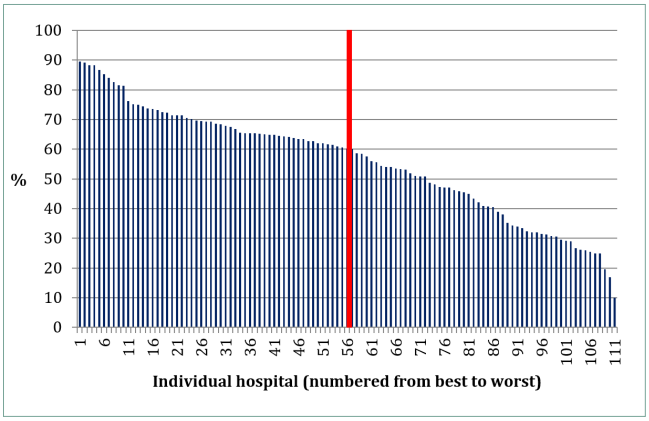
[Hospitals to the right of the red line have **failed** *to reach the target of ≥90% of patients being seen by a member of the specialist team. Data from 204 hospitals; hospitals reporting <20 cases excluded.]*

Of 56,493 cases of NSTEMI, 47,803 (84.6%) were judged to be eligible for an angiogram to investigate their coronary arteries, of which 40,882 (85.5% of those eligible) underwent the procedure before discharge home. This is the same proportion as the previous two years. Angiography was performed in at least 95% of eligible patients in 66 hospitals, but in fewer than 50% of eligible patients in 11 hospitals.

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 2017/18, 19.1% patients who underwent angiography did so within 24 hours of admission and 20% in the following 24 hours. However, 43% patients who underwent angiography did not do so within 72 hours of admission; 30% did not undergo an angiogram within 96 hours. Therefore, the proportion of patients who underwent angiography within the recommended 72 hours was 56.6% in 2017/18, compared with 56.1% in 2016/17 and 53.0% in 2015/16. There is wide variation in performance of individual hospitals with regard to this metric. In only 13 hospitals is angiography within 72 hours of admission provided to more than 75% of patients. In 5 hospitals 25% or fewer patients receive angiography within 72 hours of admission (Figure 10).

Figure 10: *Proportion of NSTEMI cases undergoing angiography within 72 hours*



[Note: Hospitals to the right of the red line are NOT achieving the 60% Best Practice Tariff target. Data from 111 hospitals; 95 hospitals reporting <20 cases or incomplete data excluded.]

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 2017/18, the median interval from admission to angiography was 57 hours (interquartile range 27-99 hours) for those admitted directly to a hospital with angiography/PCI facilities compared with 76 hours (Interquartile range 45-122 hours) for those requiring inter-hospital transfer.

Table 4: *Delay to angiography (angio) following admission with NSTEMI, by nation, expressed as proportion receiving an angiogram within 72 hours of admission and median delay with interquartile ranges (IQR) 2017/18*

	Angio within 72 hr of admission	Median (IQR) interval from admission to angio – no transfer required (hr)
England	57%	56 (27-99) hr
Northern Ireland	63%	53 (28-102) hr
Wales	50%	65 (38-108) hr

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

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.

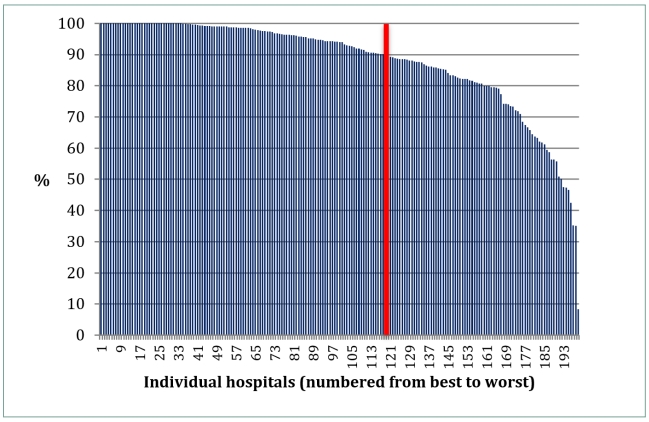
7. SECONDARY PREVENTION

7.1 MEDICATION

Certain drugs have been shown to reduce the likelihood of subsequent heart attacks in heart attack survivors – both STEMI and NSTEMI. Originally the performance of individual hospitals was reported with respect to each of the various 'secondary prevention' medications 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 – MRAs), which are reserved for those with specific post-heart attack characteristics, has been over 90% for some years. Use of each drug class in the entire dataset is: ACE inhibitor/Angiotensin receptor antagonist, 94.1%; Aspirin, 98.3%; Beta blocker, 96.4%; Statin, 97.7%; Clopidogrel, Prasugrel or Ticagrelor, 97.5%.

Because of these excellent 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.

Figure 11: *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 **failed** *to reach the target of ≥90% of patients being discharged on all secondary prevention drugs for which they were eligible. Data from 199 hospitals; hospitals reporting <20 cases excluded.]*

For this more taxing performance measure, 62,550 of 69,190 (90.4%) patients were discharged home with all drugs for which they were eligible. There is significant variation between hospitals [Figure 11]. Seven hospitals report discharging fewer than 50% of patients on all the drugs for which they were eligible, while 34 hospitals provided appropriate drugs for every patient discharged.

A further drug class, aldosterone antagonists, is recommended following heart attack if there is also evidence of heart failure – judged by physical signs, radiological and echocardiography. Such drugs were prescribed to 26.5% of patients who were discharged home following either STEMI or NSTEMI.

7.2 CARDIAC REHABILITATION

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 wellbeing. Most programmes include an exercise component, and cover educational and relaxation/emotional issues.

NICE recommends that all patients admitted to hospital with heart attack, regardless of age, should be given advice about and offered enrolment on a cardiac rehabilitation programme with an exercise component. If they are referred to such a programme before they are discharged from hospital there is a suggestion (by NICE) that patients are more likely to take up the offer. The NHS England 'Long Term Plan' confirms the importance of cardiac rehabilitation and proposes a milestone – 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".

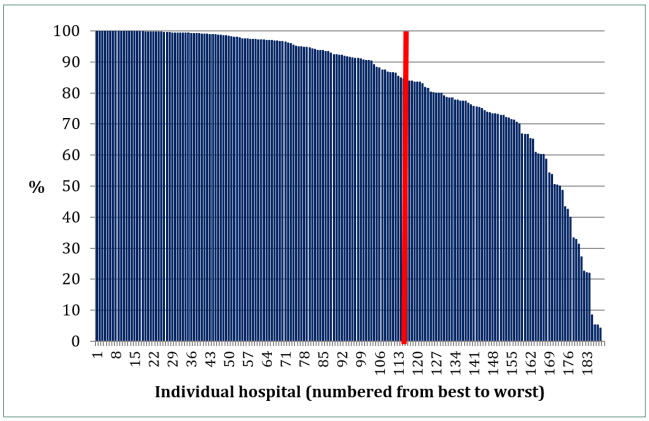
The British Heart Foundation funds a National Audit of Cardiac Rehabilitation (NACR), hosted by the University of York. The 2018 NACR report shows that in 2016/17 42,441 patients started a rehabilitation programme. This was slightly fewer than 50% of those thought to be eligible – based upon records of the number of patients discharged from hospital following heart attack, PCI or coronary surgery. The estimated rate of those starting rehabilitation was highest for those recovering from cardiac surgery (71%) and was 57% for those who underwent PCI for the management of heart attack and only 33% for those with MI not treated with PCI.

In MINAP, in 2017/18, 81% of 64,362 patients with either STEMI or NSTEMI, who were discharged home from hospital, were referred for cardiac rehabilitation. This analysis excludes those patients who were transferred from the participating hospital to another hospital for further treatment. This proportion, of approximately 4 in every 5 patients being referred, is the same

whether or not there is a prior diagnosis of coronary artery disease – previous heart attack PCI and/or coronary artery bypass grafting.

There is substantial variation between hospitals with respect to the proportion of patients referred to cardiac rehabilitation [Figure 12]. Some hospitals report referring all eligible patients while others refer only the minority. Additionally, 15 hospitals were excluded from the analysis because of insufficient data quality – more than 50% of cases being left blank or labelled as 'unknown'.

Figure 12: *Distribution of hospitals with respect to the proportion of patients with heart attack who are referred for cardiac rehabilitation at the time of discharge*



[Note: Hospitals to the right of the red line have **failed** *to reach the target of ≥85% of patients referred for cardiac rehabilitation. Data from 189 hospitals; 17 excluded as inadequate data.]*

How many of these patients actually started a rehabilitation 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 identify areas ripe for quality improvement initiatives.

8. CASE ASCERTAINMENT

In any one hospital the care experiences, and outcomes, of individual patients will vary. If only a small proportion of cases from that hospital are submitted to MINAP the care provided to those particular cases may give a skewed or 'unrepresentative' view of the care provided to the majority. MINAP aspires to include complete information about the care of every patient admitted to hospital with heart attack. By so doing there can be greater confidence in the reliability of subsequent analyses and in the validity of comparisons between participating hospitals.

Increasingly, measures of data quality are looked upon as proxy indicators of the culture of a participating centre with respect to the prevailing approach to providing care and to seeking quality improvement. 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 patients eligible for entry into MINAP that actually appear in the dataset.

Case ascertainment rates are presented at NHS Trust level for England and at Hospital level for Wales. It 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 NHS Wales Informatics Service) to the number of cases submitted to MINAP.

Both HES and PEDW are secure 'data warehouses' containing details of all inpatient and day case activity at NHS hospitals, in England and Wales respectively. The databases can be used to ensure that NHS Trusts receive the correct funds for the treatments that they deliver, but may also be used for monitoring of clinical activity and for academic and service improvement purposes.

The expression of case ascertainment is in its infancy, having been included in the MINAP public report for the first time last year. As then, the analysis reveals wide variation in case ascertainment. Some hospitals submit significantly fewer cases to MINAP than would be expected based upon the corresponding HES/PEDW codes; others submit many more cases to MINAP than appear in HES/PEDW. This latter point – a greater than expected number of cases submitted to MINAP – appears counterintuitive. It is likely to represent differences in hospital coding practices.

In order to identify patients with heart attack within HES and PEDW, NICOR use the following, recommended, inclusion criteria with respect to International Classification of Diseases (ICD) 10 Codes:

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.

Only these data are incorporated into assessments of case ascertainment. If hospitals, or even individual coders within hospitals, take a different approach, for example using a more generic code for heart attack, patients will not be included in the information provided by HES/PEDW to NICOR, and so will not appear in the MINAP analysis of case ascertainment.

It is likely that this accounts for case ascertainment rates significantly greater than 100% in a number of hospitals and Trusts. So, for example, while the median case ascertainment rate for English Trusts is 99%, there are 11 Trusts that have rates above 150% (implying substantially greater MINAP submissions than coded discharges) and 11 Trusts that have rates below 50% (implying inadequate case finding).

The case ascertainment rate in England was 102.2%, with a median Trust rate, for the 137 participating English NHS Trusts, of 98.5%. The case ascertainment rate in Wales was 94.3%, with a median Health Board rate, for the 6 participating Welsh Health Boards, of 97.3%. The overall case ascertainment rate for all of England and Wales was 101.7%.

Given the documented variation, MINAP will work with participating centres to better understand existing coding practice. This is likely to lead to inclusion of additional ICD codes in HES/PEDW returns in future iterations.

9. MORTALITY

Heart attack remains a dangerous condition. However, most patients who survive to be admitted to hospital are later discharged home.

In this report we present hospital-specific, all-cause, '30-day mortality following STEMI' – in other words, the proportion of patients who have died within 30 days of admission to hospital with STEMI, whether or not the death occurred in hospital or following discharge, and whether or not the cause of death was as a direct consequence of the heart attack. A 'cut point' of 30 days from admission is chosen because this interval more closely reflects the effect of early care provided in ambulances and hospitals, which is the focus of MINAP. At later time points, for example 1 year, the effects of early ambulance and hospital care becomes 'diluted' by community factors.

The 'vital status' of each patient – whether they are alive or dead – is obtained using information recorded by the Office of National Statistics (ONS), an arrangement that is regulated by appropriate governance. Linkage to vital status is not available for patients in Northern Ireland, nor for visitors to the UK, who do not possess an NHS number.

As with other NCAP domains, in order to smooth out temporal variations, we have presented this analysis for three-years – 2015/16-2017/18 – rather than just the most recent single year. Only those hospitals that submitted at least 150 patients during these three years are included in the analysis. Those few patients younger than 20 years are excluded, as are patients who were already hospitalised for unrelated medical causes at the time of their heart attack. In the case of patients transferred between hospitals during the management of STEMI, death is 'assigned' to a single hospital – the hospital to which they were first admitted.

In presenting mortality rates, hospitals have been grouped depending on whether or not they form part of a 'community service for primary PCI' – hospitals to which patients with STEMI will be transported by ambulance services – and, within each category, also by nation. When comparing outcomes it should be recognised that patients taken to non-interventional centres may differ significantly from those taken directly to primary PCI centres. The categorisation of hospitals has been informed by an annual survey performed by the NAPCI.

Importantly, the mortality rates for all hospitals are 'unadjusted'. That is, they have not been mathematically adjusted to take into account those patient characteristics that might be expected to influence survival yet are not under the control of the assigned hospital. For this reason caution should be exercised when comparing hospitals. For example, a hospital serving an area with a generally older population might be expected to have a higher mortality despite similar levels of quality of care.

However, in order to enable future risk adjustment the mortality table includes, for each hospital, a measure of data completeness for a combination of three key data items that consistently have been shown to influence survival – age, systolic blood pressure and heart rate on admission. Of the hospitals included in the mortality table, 9 had data completeness below 90%; data completeness had improved in 65 hospitals, and had worsened in 34, compared to the previous year.

Over the 3 years, the 30-day mortality rate for STEMI in those hospitals included in the analysis (as described above) is 9.07% – 8,405 deaths following 92,711 admissions. Although not a direct comparison, it is interesting to note that in 2017 another national registry – SWEDEHEART – reported that historic improvements in 30-day mortality rate for STEMI in Sweden had 'plateaued' at approximately 9% .

Consistent with the concept that patients admitted to non-interventional hospitals differ in important prognostic characteristics to those taken to PPCI centres, the 30-day mortality for the 77,604 patients admitted to PPCI centres in England was 9.35% compared with 15.14% for the 9,084 patients admitted to non-interventional hospitals. In Wales the corresponding rates were 8.68% of 4,184 patients compared with 13.72% of 1,176 patients.

As mentioned above, we do not present mortality outcomes for hospitals in Northern Ireland in this MINAP report, because of issues relating to assessing vital status using NHS numbers. However, a recent publication in a peer-reviewed scientific journal described the development of a national primary PCI service based on centres in Belfast and Altnagelvin. Reassuringly, the 30-day mortality rate achieved in 2015/16 by this service was just over 6%.

10. CASE STUDIES

A. Timely angiography in NSTEMI

We asked **Tracey Realey** – Projects Nurse for Acute Medicine at **Royal Berkshire Hospital, Reading** – to describe those aspects of care that she believes account for her hospital being among the best performers with respect to timely angiography in patients with NSTEMI; 88% of patients with NSTEMI receive angiography within 72 hours of admission. She identified the following four factors:

- "The use of an electronic referral system by which patients who require a cardiology review are referred to the 'Cardiologist of the Week'
- The early identification of patients who require either a bed on the Cardiac Care Unit, or onto the Cardiology ward
- The provision of a daily in-patient/ward angiography list after the day-case/ outpatient angiography list
- The provision of an in-patient angiography service on Sundays."

B. Developing a regional 'Treat & Repatriate' approach across a rural network

We asked **Dr Adrian Raybould** – Consultant Cardiologist – and **Dr Zia Ul Haq** – Cardiology Specialist Registrar – to describe a Quality Improvement initiative that they had implemented in response to prolonged delays in the transfer of patients with NSTEMI between general hospitals in **Hywel Dda University Health Board**, west Wales and the regional Cardiac Centre in **Morriston Hospital, Swansea**:

- "The area is predominantly rural, and so faces significant geographical challenges. The regional cardiac centre provides a primary PCI service for patients with STEMI, while those with NSTEMI are initially admitted to one of four non-interventional general hospitals. These hospitals experienced significant delays in transferring patients for angiography and would each, individually, liaise with the centre with respect to their patients.
- A common, single, referral pathway to the regional centre was put in place across the area.
- A 'treat-and-repatriate' service was initiated, using just 2 day-case beds at the cardiac centre and a dedicated ambulance service to provide coordinated transport to-and-from the various hospitals.
- During the first 7 weeks of the initiative, there was a significant reduction in the time from referral to angiography – from 10 days to 3.5 days.
- The number of patients waiting for transfer in the four non-interventional hospitals fell from 30 to 4.
- 82 patients made use of the 2 day-case beds, with only 4 patients needing to remain in the centre overnight."

C. How do professional and service boundaries affect care for patients with NSTEMI?

We asked **Helen Cramer** – Senior Research Fellow, **University of Bristol** – to explain, on behalf of the academic group of which she is a member, some interesting qualitative research into the management of NSTEMI:

"Researchers at the University of Bristol conducted a study evaluating processes of care for patients with NSTEMI. Data from MINAP were used to select 10 hospitals with different characteristics (e.g. size, type), and different levels of performance on MINAP indicators. The focus was on patients with NSTEMI, given the greater complexity and uncertainty in providing care for these patients compared to those with STEMI. Observation and interviews with staff and patients were the methods used to identify good practices in the care of patients with NSTEMI.

We observed that things did not always flow smoothly for patients with NSTEMI; there were patterns in the types of obstacles and challenges faced by staff. One of our main conclusions was that caring for NSTEMI patients in a timely and effective manner required increased attention at key 'boundary points' in a patient's journey. We drew on conceptual ideas about 'boundary work' from other studies of organisations. For example, boundary work included negotiations between teams when patients needed to be transferred into another department as their caring needs changed e.g. a greater level of monitoring was needed, diagnostic tests or treatment. Hospitals are intensely hierarchical organisations and we observed that some negotiations were hampered as staff with different roles, levels of seniority and levels of influence tried to align responsibilities for patients as they were moved between departments and beds. In one hospital there was a dual-condition ward (cardiac and respiratory), where the physical space of the ward, its bays and beds, were dispersed between two different clinical specialties and medical teams. This arrangement caused uncertainty for the staff about the boundaries of their patient caseload, lines of responsibility and accountability. Nursing staff reported that making this dual-condition ward system work was taxing:

> *We've got obviously a cardiac patient in a respiratory bed so the respiratory consultant's done his ward round today but he won't see her because she's a cardiology patient...[And the cardiology team] It's not their referral... [ ] we're constantly chasing the doctors asking who does this patient belong to? And who's going to see her? (S6, nurse, Hospital 4, interview)*

This sort of boundary uncertainty had consequences for patient care and several of the patients observed in this ward experienced treatment delays and omissions:

> *An 82-year-old woman was waiting for a specialist review by the cardiologists attending this ward. However, after eleven days as an in-patient in the ward she was discharged without having had the angiogram planned for her. A ward nurse confirmed that this patient had been missed by doctors on some ward rounds because there had been a disagreement over who had responsibility for the patient within this dual condition ward. The patient was interviewed three weeks after discharge and she reported that she had no contact with the rehabilitation team and was missing two of the medications she was supposed to have on discharge (P2, Hospital 4, Field notes, observation and medical notes).*

However, we also observed some excellent examples of boundary work and highly effective negotiations spanning physical/spatial, hierarchical, professional and specialist boundaries. These examples often came from staff in enhanced, specialist cardiac roles – roles which could be further emulated. For example, one specialist cardiac nurse described how he identified NSTEMI patients and helped to negotiate their pathway through the hospital:

> *I try and catch people down in A&E [ ] before they go to the wards... [ ] I go through the diagnosis and look to see if there's anybody with chest pain ... [emergency staff] they'll catch me and say ...[ ] I've got this patient on 5b I'd like you to have a look for me... [ ] mopping up any loose ends as well because often they're seen by junior doctors ...[ ] I have a very good relationship with the cardiology consultants ... I'm always diplomatic... [ ]I like to, sort of, make the doctors think it's their idea... [ ] and getting [ ] what I want for the patient... [ ] And if tests are needed then I will expedite those tests. .... It's all about being proactive. ... [ ] I can get things moving (S13, nurse, Hospital 3, I:AR).*

Modern health care is fragmented into specialisms according to parts of the body that need attention (cardiology, renal, respiratory), the age of the patient (gerontology, paediatrics), the urgency of treatment (acute, chronic) and the professional training and roles (nurse, doctor) required to respond. To address this specialisation and fragmentation there is a great need for interdisciplinary and cross-sectional work, which brings the issue of boundaries into particular focus. The lens of boundary

work could inform reviews of current organisational practice around patient groups, such as NSTEMI patients, that pose interdisciplinary, diagnostic and management challenges."

For more details please refer to the open access paper: Cramer, H., Hughes, J., Johnson, R., Evans, M., Deaton, M., Timmis, A., Hemingway, H., Feder, G. and Featherstone, K. (2018). '"Who does this patient belong to?" Boundary work and the re/making of (NSTEMI) heart attack patients', Sociology of Health and Illness, vol 40(8)1404-1429. There is also a short 3 minute video and a paper focused on nursing aspects of the findings: Deaton, C., Johnson, R., Evans, M., Timmis, A., Zaman, M.J., Hemingway, H., Hughes, J., Feder, G. and Cramer, H. (2016) 'Aligning the planets: The role of nurses in the care of patients with non - ST elevation myocardial infarction', Nursing Open, 4, 1, 49-56. This study presents independent research funded by the National Institute for Health Research (NIHR) under its Research for Patient Benefit (RfPB) Programme (Grant Reference Number PB-PG-0909-20262). The views expressed are those of the author(s) and not necessarily those of the NIHR or the Department of Health and Social Care.

D. Maximising referrals to cardiac rehabilitation

We asked **Anne Degruchy** – MINAP – Data Collection Officer – and her colleagues, **Emma Edgar** – Lead Cardiac Nurse – and **Carol Bagshaw** – Cardiac Rehabilitation Nurse to explain how **Harrogate District Foundation Trust, Harrogate** achieves one of the best outcomes with respect to referring patients to cardiac rehabilitation. They identified the following characteristics of their service:

- "We have three very experienced cardiac rehabilitation nurses who are passionate about their role.
- We proactively identify patients with acute coronary events by
  - Checking secure email where we receive Acute Coronary Syndrome (ACS) referrals from other hospitals, this includes post-surgical patients
  - Each morning printing a list of the previous 24 hr laboratory troponin blood results, reviewing any abnormal results and excluding the non-coronary causes
  - Attending a cardiology meeting each morning to discuss current inpatients
  - Daily attendance at the Medical Admissions Unit, Medical Short Stay and Cardiac care Unit.
- Referrals are also received directly from ward nurses, and, for patients in the community, from General Practitioners.
- We consult with patients during their admission and contact them within a week of discharge.
- The cardiac nurse team provides tailored, individualised, cardiac rehabilitation for all ACS patients. We offer home visits, clinic appointments, telephone consultations and exercise groups.
- We have built a well-known and established team who work both in the hospital and community setting. We are accessible to patients via NHS secure email, providing nurses' individual email addresses and contact numbers.
- Every patient is given a named nurse, for continuity of care.
- We provide a telephone support line within office hours for patients to use after discharge.
- Patients are given a patient satisfaction questionnaire in order to audit the cardiac rehabilitation service, enabling us to continuously improve."

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This report is available online at:
https://www.nicor.org.uk/national-cardiac-audit-programme/myocardial-ischaemia-minap-heart-attack-audit/

2019 Healthcare Quality Improvement Programme (HQIP)

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

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