Heart attack care in Ireland 2014

Report of the national clinical programme for Acute Coronary Syndrome (ACS) on standardising treatment of patients with STEMI in 2014

December 2015
Foreword

In 2009, the Health Service Executive (HSE) undertook to introduce a greater degree of clinical leadership into the health service by initiating a number of clinical programmes. The national clinical programme for Acute Coronary Syndrome (ACS) was one such programme, initiated in 2010, as a joint venture between the Irish Cardiac Society (under the auspices of the Royal College of Physicians of Ireland, RCPI) and the Health Service Executive. Its defined role was to standardise national delivery of treatment of patients with acute coronary syndromes.

A programme for ACS working group, supported by a consultant cardiology advisory group, formulated an Optimal Reperfusion Service (ORS) protocol which was implemented nationally between October 2012 and January 2013. The Optimal Reperfusion Service protocol was the result of extensive consultation nationally with ambulance service, hospitals and other stakeholders involved in the delivery of ACS care, as well as discussion with international principals of successful programme for ACS in diverse places such as Paris, Vienna, London, Glasgow and across Denmark.

This report outlines the state of the programme at the end of the second year of implementation with particular reference to management of ST elevation acute myocardial infarction (STEMI). The very significant change in the number of STEMIs getting PPCI (angioplasty) is a tribute to the cooperation between the dedicated hospital teams and the ambulance service. Furthermore it should be noted that the volume of work in PPCI centres is greater than outlined when false positives and inappropriate referrals not outlined here are considered. The report also outlines issues that have arisen both in terms of delivery of the protocol and data collection that will need to be addressed as the programme goes forward.

As well as acknowledging the hard work of our colleagues in providing this service we would like to thank all members of the working group and in particular Brendan Cavanagh, programme manager, who has managed all facets of this programme expertly from the beginning, Dr Martin Quinn who chaired the Data Governance subgroup achieving consensus in a difficult area and Aisling Sheridan who facilitated the analysis of the new database. Finally, we pay tribute to our colleague, Dr Geoff King, who as CEO of the Pre-hospital Emergency Care Council (PHECC), made a major contribution to the Optimal Reperfusion Service protocol. Ar deis De go raibh a anam dílis.

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Executive Summary

Background

In 2009, the Health Service Executive (HSE) initiated clinical leadership through a number of clinical programmes. The National Clinical Programme for Acute Coronary Syndrome (ACS) was one such programme, initiated in 2010, as a joint venture between the Irish Cardiac Society (under the auspices of the Royal College of Physicians of Ireland (RCPI)) and the Health Service Executive. This programme addressed the care of patients with acute coronary syndromes which includes both ST elevation myocardial infarction (STEMI - major heart attack) and non ST elevation myocardial infarction (NSTEMI) (Glossary).

The evidence

International evidence has shown that primary percutaneous coronary intervention (PPCI) is the most effective treatment for STEMI if the PPCI centre can be reached within 90 minutes of diagnosis. Furthermore a protocol for managing NSTEMI, including early angiography, is now evidence based practice and implemented in most developed countries.

The ACS Clinical Programme

The aim of the national clinical programme for ACS was to save lives by standardising the care of ACS patients across the country. The initial focus of the programme was to develop a national Optimal Reperfusion Service (ORS) protocol for care of patients with STEMI, designate primary PCI centres for Ireland and standardise pre-hospital and in-hospital response following review of the international literature and service provision across Ireland in 2010.

Measuring performance

In order to ensure that the national clinical programme for ACS delivered on its aim of standardising heart attack care a mechanism for monitoring performance, in line with other clinical programmes, was set up. This included establishing a suite of indicators of performance underpinned by a dataset with data definitions, a new electronic data collection system allied to the main activity monitoring mechanism, the Hospital Inpatient Enquiry system (HIPE) which became known as HeartBeat Portal as well as a structure for analysis and reporting. Furthermore a Data Governance committee was set up to oversee this monitoring mechanism.

Monitoring of treatment of all STEMI patients was recorded by the PPCI centres whether brought directly or referred from surrounding general hospitals. Hence performance at the PPCI centres reflects the hinterland served, the response of the National Ambulance service as well as the functioning of the Centre.

Results

Type of treatment In 2014 data on 1,247 patients with STEMI were recorded from eight out of the nine PCI centres. A major change in the way patients with STEMI are treated has occurred in Ireland with a shift from both thrombolysis and PPCI used in equal measure in 2011 compared with a rate of 92% PPCI in 2013 and 2014 in reperfusion treated patients. This major achievement has been realised to a high degree in all PPCI centres reflecting change equally across the country. Furthermore this high level of PPCI compares favourably with other countries such as England 97% and Wales 72%.
Timeliness

Timeliness of treatment (first medical contact to balloon insertion) of 68% is below the initial target for the programme for ACS (75% for 2013, 80% for 2014). This is a very challenging area but efforts now must be directed at this area for improvement. Furthermore variation in this figure was found across the country which may reflect all of the following:- characteristics of population served, pre-hospital access issues or service provision.

Discharge bundle of care

The suite of measures on discharge which are evidence based and shown to reduce mortality as well as increase quality of life are the group of medications, smoking cessation counselling and initiation of cardiac rehabilitation without contraindications. Discharge medication shows good concordance with guidelines with some exceptions which may reflect data collection issues. Three quarters of documented smokers receive smoking cessation counselling which needs to be improved upon. Data on cardiac rehabilitation (CR) is evolving and difficult to interpret at this stage. Further work is required to collect data on CR provided in other hospitals.

Outcome

The crude in-hospital mortality rate was 5.9% which compares favourably with international reports.

Areas for further attention

The ORS is now in place nationally and a new Donegal / Derry service is anticipated to commence in 2016 in Altnagelvin Hospital, in Derry, Northern Ireland, which will accept STEMI patients from Donegal. Consequently, the next important areas to address are

a) improving quality of care with a particular emphasis on the challenging area of improving timeliness,

b) ensuring sustainability of the programme with emphasis on adequate staffing and robust data management,

c) raising public awareness about how best to access heart attack care in this new era, d) implementing the NSTEMI ACS protocol (glossary), and e) adequate staffing of delivery teams in PPCI centres.
Chapter 1 Overview of types of heart attacks

Introduction
The purpose of this chapter is to explain, in simple terms, what a heart attack is, the types of heart attack and relevant treatment.

1.1 What is a heart attack?
A heart attack is a serious medical emergency in which the supply of blood to the heart is suddenly blocked, usually by a blood clot. The lack of blood to the heart can seriously damage the heart muscles. If left untreated, the muscles will begin to die.

1.2 What types of heart attack are there?
Acute coronary syndrome (ACS) refers to a group of conditions due to decreased blood flow in the coronary arteries: ST elevation myocardial infarction (STEMI, usually total blockage), non ST elevation myocardial infarction (NSTEMI, partial blockage), or unstable angina (UA) with the latter two often grouped together as NSTEMI ACS.

1.3 What treatments are there for heart attack?
ST elevation myocardial infarction (STEMI) heart attacks is diagnosed using 12 - lead ECG machine and is treated urgently by either insertion of a wire into the artery to open it using a balloon to allow the blood to flow to the heart muscle again (PPCI) or by using a clotbursting drug (thrombolysis).

Non ST elevation myocardial infarction (NSTEMI) heart attacks and unstable angina (taken together as NSTEMI ACS) are initially treated medically and in the majority of cases are sent for an early investigation of the arteries to the heart (called a cardiac catheter procedure or angiogram) with/without percutaneous coronary intervention (PCI) both of which are undertaken in a hospital equipped with a catheter laboratory.

1.4 Why is there an emphasis on treatment of heart attack now?
Recent international evidence has shown that primary PCI is the most effective treatment of STEMI (major heart attack) and most countries in the developed world have implemented Primary PCI programmes. Also these programmes include the occasional use of clot busting drugs (thrombolysis) in areas where the distance/time to a primary PCI centre is too great followed by urgent transfer of thrombolysed STEMI patients as soon as possible to a primary PCI centre to ensure that angiography can be performed in a timely manner. International best practise aims at PPCI in over 80% of STEMIs, the dominant feature of which is that all STEMIs within a 90 min drive time from first diagnostic ECG to a PPCI centre would have PPCI.

The programme for ACS was set with the aim of saving lives by standardising the care of ACS patients across the country, with the primary goal that all STEMIs within a 90 minute drive time to a PPCI centre from first diagnostic ECG, would have PPCI.
Chapter 2 Overview of the Acute Coronary Syndrome Programme

Introduction
The purpose of this chapter is to set out the aim, background features and key elements of the national clinical programme for Acute Coronary Syndrome (ACS) programme.

2.1 Aim and background to the programme for ACS
The national clinical programme for ACS was set up in Ireland in 2010 with the aim of saving lives by standardising the care of ACS patients across the country. The initial focus of the programme for ACS was to develop a national Optimal Reperfusion Service (ORS) protocol for care of patients with STEMI.

Prior to the initiation of the national clinical programme for ACS in 2010 there were

- **Hospitals**: 36 hospitals taking patients with acute cardiac conditions (with Emergency Departments and coronary care units) with the majority providing thrombolysis as the mainstay of treatment for patients with STEMI.

- **Catheter labs**: 9 hospitals in Ireland had at least one Cardiac Catheter lab. 5 of these hospitals had 2 Cath labs each and reported the provision of PPCI on a 24/7 service though varying levels of staff and agreements were in place regarding out of hours rosters.

  Three hospitals had a visiting mobile lab (one day per week) with the cardiologist, or physician with interest in cardiology, undertaking angiography for the local population – Tullamore, Letterkenny and Sligo. A further 7 Private hospitals provided interventional cardiology across the country though acute treatment was limited (West 1, South 2, Greater Dublin area 4).

- **Pre-hospital service**: A recently formed National Ambulance Service with no national agreements in place to mandate pre-hospital diagnosis, treatment initiation and transport of patients directly to the Cath lab bypassing local hospitals. A number of remote parts of the country had a pre-hospital service delivered by GPs, hospital outreach or advanced paramedics.

- **Performance**: 1466 STEMs were recorded on HIPE in 2010. Information on reperfusion therapy in 14 hospitals in 2010 showed that while 83% of STEMI patients received reperfusion therapy only 46% were treated with PPCI and that timeliness (to international standards) was 60% (Heartbeat Bulletin, 2010).

2.2 Developing the Optimal Reperfusion Service (ORS) protocol
The national clinical programme for ACS undertook the following reviews and assessments:

- **International evidence base**: for PPCI over thrombolysis, the models of care in place and how the transition to PPCI was undertaken in various countries and populations including site visits and conferences.

- **Needs assessment**: including study of the demography and population projections for Ireland as well as a mapping exercise showing that 81% of the population aged 55 years and over lived within a 90 minute drive time of Dublin, Cork and Galway (Map 2.1).

- **Strengths and weaknesses of provision of PPCI in 2010-2011**: across the country including the hospital arrangements and the ambulance protocols in place.

Based on a 2010 review of practice in 30 European countries it was proposed that there be a provision of one centre per 500,000 to 1 million population. Consequently 4-8 centres are possible in Ireland depending on distribution across the population, existing resources in cardiology centres, required developments and cost.
2.3 Key features of the Optimal Reperfusion Service protocol

The programme for ACS, in conjunction with stakeholders in pre-hospital, hospital settings and the RCPI Advisory group (Appendix A), developed the ORS service with the following key features:

- **ORS protocol (Box 1)** which was initiated in the West and South in October 2012 and implemented nationally in January 2013.

- **Standardised pre-hospital response**
  - triage, treatment and transport of patients (including by-pass of local hospitals, equipping vehicles with 12-lead ECGs and training paramedics in ECG use and interpretation).
  - establishing a ‘Code STEMI’ freephone line to facilitate direct conversation ambulance crew with the patients and cardiology staff at the PPCI centre as well as direct NAS ambulance access to PPCI centre Cath labs without going through ED.
  - enabling helicopter transfer for STEMI patients to PPCI centre in certain areas (expanded further in 2013)

- **Designated primary PCI Centres** Seven centres (6 full time and 1 providing 9-5 service) were designated in 2013. Two other hospitals with Cath labs (PCI centres) provided a service to ‘walk-in’ patients during daytime service.

The PPCI centres were designated based on population and on current staff and facilities using international best practice principles (Box 2) with the following recommended characteristics:

- A minimum of 2 labs are recommended at PPCI centre to ensure access at all times
- A minimum roster of 1:5 roster Interventional Cardiologists is recommended
- 24/7 provision is the preferred option to avoid confusion.
- The aim in this national PPCI programme is for at least 80% PPCI initially with 90% achieved after 5 years.
- National protocol with local adaptation if necessary
- Standardised data collection as set out in chapter 3.

In November 2015 SVUH Dublin ceased to be a 24/7 centre leaving 2 PPCI centres (MMUH and SJH) covering Dublin and its catchment area, This development reflects the difficulty in maintaining 24/7 on-call teams. This change in provision does not affect the 2014 data reported here.

- **Standardised hospital response in a primary PCI Centre (and in referring hospitals)** as well as immediate transport of STEMI patients to a primary PCI centre, the programme for ACS recommends the urgent transfer of the small number of patients who have received thrombolysis as soon as possible to a primary PCI centre to ensure that angiography can be performed in a timely manner.

A model of care document was developed to capture the rationale, the protocol and other details ([http://www.hse.ie/eng/about/Who/clinical/natclinprog/acsprogramme/modelofcare/](http://www.hse.ie/eng/about/Who/clinical/natclinprog/acsprogramme/modelofcare/))
2.4 Current situation

After considerable preparation and consultation the ORS protocol started in University College Hospital Galway (UCHG), Cork University Hospital (CUH) and University Hospital Limerick (UHL) in October 2012 with national roll out in January 2013. While this protocol has involved change for all sectors the biggest change to practice has been within the ambulance service. In the main, the protocol has worked well with widespread satisfaction expressed.

A number of issues still need to be addressed such as reducing inappropriate referrals, national ECG transmission, the appropriate use of thrombolysis and reducing delay to treatment.

Box 1: ORS protocol – implemented nationally January 2013

Box 2: The designated PPCI centres in 2013 and 2014

| University College Hospital, Galway (24/7) | St James’s Hospital, Dublin (24/7) |
| Limerick University Hospital (24/7) | Mater Misericordiae University hospital, Dublin (24/7) |
| Cork University Hospital (24/7) | St Vincent’s University Hospital, Dublin (24/7) |
| University Hospital Waterford (9-5, Mon-Fri) | |

Note: As PCI centres, AMNCH (Tallaght) and Beaumont hospitals do PPCI on self presenting STEMI patients
Map 2.1: Drive times from PPCI centres in Dublin, Cork and Galway
Chapter 3 How the programme for ACS is monitored

3.1 Introduction
In order to ensure that the national clinical programme for ACS delivered on its aim of standardising heart attack care a mechanism for monitoring performance, in line with other clinical programmes, was set up. The purpose of this chapter is to briefly outline the performance mechanism and the underpinning data collection and analysis.

An ACS Data Governance Committee (Appendix B) was set up in August 2013 to review and advise on the existing Heartbeat monitoring system.

3.2 Background
Historically registry data on AMI care has been collected in a number of sites in Ireland. However the only ACS registry currently in existence is the CHAIR registry collecting data on all ACS patients in the acute hospitals in Cork and Kerry since 2002 (population base of 660,000). From 2006 to 2011 an AMI Improvement Programme (Heartbeat) was initiated and developed which involved setting up a mechanism of data collection for STEMI patients to populate key indicators used internationally and accompanied by feedback to participating hospitals (n=21). This initiative contributed considerably to the mechanism set up for monitoring the programme for ACS.

3.3 Indicators for the national clinical programme for ACS
Internationally there is consistency on indicators for the assessment of treatment of STEMI heart attack (Appendix C). The programme for ACS built upon the work of the AMI Improvement Programme (set out above), modifying the set of indicators to reflect the shift to primary PCI as the mainstay of treatment and to adhere to the thrust of the other Clinical programmes in establishing and monitoring key performance indicators (KPIs). These indicators reflect key evidenced based elements of treatment on admission and on discharge which promote best outcomes in terms of mortality and morbidity.

Currently there are a total of 10 KPIs agreed with three KPIs in the National Service Plan and reported on a quarterly basis. (Appendix D)

3.4 Establishing the data collection mechanism
The data set and data definitions were finalised following review of those on Heartbeat (paper), as well as updating our understanding of international work from ESC, UK (MINAP), USA (IHI, AHA/ACC), Canada (SHN), Denmark and Australia/New Zealand. (see Appendix A).

The current dataset consists of 63 data variables in 5 sections:

a) patient risk factors;
b) arrival information;
c) reperfusion and intervention information;
d) discharge information; and
e) follow up information as well as demographic data which is already collected on the main administrative database (HIPE).

In 2014 data was collected on Heartbeat Portal in six PPCLI centres and the two PCI centres. Emphasis is placed on the need to ensure completeness of data on all STEMI patients especially on the critical recording of date and time of a) first positive ECG along with b) date and time of reperfusion therapy as well as other mandatory fields. The dataset has undergone one revision (April 2014) since Oct 2012 and will be due for revision in 2016.
3.5 Electronic data collection
In 2010 a development in HIPE, by the ESRI, resulted in a clinical ‘add on screen’ to the national administrative dataset. This development in clinical data collection was utilised by a number of Clinical Programmes including the national clinical programme for ACS and became known as Heartbeat Portal. PPCI/PCI centres are responsible for collecting and reporting on the data on all STEMI patients including those who get thrombolysis or no treatment as they will be sent to a PPCI/PCI centre for investigation and treatment. This differs from the previous paper based Heartbeat. Data collection started in October 2012. By June 2014, six of the nine PCI centres were actively contributing data on a regular basis, two centres were assisted with an external resource to retrospectively enter their 2013 data and one hospital forwarded data captured on another system which was not analysable.

3.6 Important definitions
The treatment window from first medical contact (FMC) to treatment of 120 minutes as set out in the ESC 2010 STEMI guidelines was used in this initiative. FMC is defined as the time of first positive ECG taken as establishing the diagnosis of STEMI. Treatment time was taken as the start time for using a device. For thrombolysis the accepted definition of door of hospital to initiation of treatment (needle) was used. A manual was developed for use by clinical staff which included key data items and patient inclusion/exclusion criteria (details on request).

A mapping exercise, undertaken in conjunction with the Health Intelligence Unit (Dr H Johnson), established that 80% of the population 55 years and over lived within a drive time of 90 minutes to the major cities of Dublin, Cork and Galway. Consequently it was agreed that within the 120 minute FMC to treatment window the optimum pre-hospital drive time would be 90 minutes allowing an in-hospital preparation time of 30 minutes. These times are used in the analysis.

3.7 Methods and analysis
The data provided for this report was taken from the July 2015 download of the year January - December 2014 Heartbeat Portal. Data from 8 centres was included in this analysis. JMP statistical software, version 12 was used for analysis which was undertaken at national level. Chi-square tests were used to compare differences across groups, with significance presumed at p<0.05. Relative risk calculations were used to compare timely PPCIs among those who travelled directly to the PCI centres and those who travelled indirectly.

3.8 Ensuring quality of data
To ensure quality of data the following steps were undertaken:
1. The development of a manual to set out the data items and their definitions along with inclusion and exclusion criteria
2. The identification of mandatory fields, hide/skip functions, messages where inconsistencies occur, internal database ranges and other consistency checks were incorporated to minimise error at data collection.
3. The visits to hospitals by CHAIR officers (ACS registry in HSE South) to promote consistency.
4. The analytic stage checks to clean data, check for errors as well as range and consistency checks.
5. The comparison of Heartbeat portal data and HIPE coded data for STEMI and in-hospital death.

While a number of data checks have been incorporated to minimise errors, formal validations of data via a manual audit has not yet occurred. A comprehensive plan for validation of the data is being considered in conjunction with the ACS Data Governance Committee. This would address validation of diagnosis, completeness of records, accuracy of records and completeness of the capture of STEMI patients.
A study of the concordance between Heartbeat and the administrative system, HIPE, is also to be undertaken in the context of improving data quality.

3.9 Completeness

The number of hospital discharges (emergency) with a principle diagnosis of STEMI on the HIPE system was 1,268. The number of STEMIs on Heartbeat Portal for 2013 was 1246. This suggests a coverage of 98.3% on the new data collection system. However a concordance study is an important next step.

For mandatory fields (n=18) on Heartbeat Portal completeness was at least 99% with one exception - angiography (87%) in patients who did not receive PPCI (table 3.1).

However, we are aware that not all records have been entered for analysis – the database currently misses some data from two PPCI centres as well as circa 100 records from the ninth PPCI centre. Consequently we estimate that 1247 accounts for 82% of STEMI records.

3.10 Feedback

Currently, all hospitals have the facility to manipulate their own data using the Heartbeat Portal standard analysis tool. A plan to establish a formal feedback mechanism showing performance for a PPCI centre compared to the national average is currently being developed with the Health Intelligence Unit, HSE similar to the feedback available to the Surgery programme known as NQAIS.

Table 3.1 Completeness of data for mandatory fields, 2014

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Chapter 4 Results of monitoring of the ORS protocol, 2014

4.1 Introduction
In 2014, data was received on 1,528 patients entered onto Heartbeat Portal of which 1,247 patients had confirmed STEMI in eight (out of nine) PPCI/PCI centres. The remaining 281 cases reflect Cath Lab activation and had other diagnoses (Box 4.1). The number of patients with STEMI on Heartbeat portal in 2013 was 1,246.

Box 4.1 Diagnosis of Heartbeat Portal entries in 2014

Details of treatment regimen for all STEMI patients were recorded on Heartbeat Portal by the PPCI/PCI centres whether brought directly or referred from surrounding general hospitals. Hence performance at the PPCI centres reflects the hinterland served, the response of the National Ambulance service as well as the functioning of the Centre.

4.2 Patient profile
The mean age of patients with STEMI (figure 4.1) was 62.4 years with a six year difference between males (61.4 years) and females (67.5 years). Furthermore the mean age differed across PPCI centres (and therefore across regions) with patients in UHL being older patients (figure 4.1). Three quarters of STEMI patients were male (78%) with significant variation across PPCI centres ranging from 70% to 84% (figure 4.1)

For most patients in 2014 (86.3%) the current presentation was their first myocardial infarction. With documentation of smoking status in 84% of records the rate of current smoking among these patients was found to be 44%.

With symptom onset to door of hospital available for 88% of patients the median time from symptom to first hospital was 150 min (2 hours 30 mins). Furthermore 50% of these patients arrived at first hospital within 3 hours of symptom onset.

4.3 First assessment and presentation
Overall, the location of the first positive ECG was either the Emergency Department (47.9%) or the Ambulance (41.8%) with 6.1% in General Practice and 4.1% in another location. Notably, in the catchment of University College Hospital Galway the proportion of patients with ECGs by the GP was almost double (11.7%), reflecting the remote areas in this units catchment area.

Almost half (48.9%) of presentations to PPCI centres were between the hours of 9am to 5pm each day, with the remainder presenting outside of office hours during the week and at weekends.

Almost 60% of patients presented to the PPCI centre by ambulance either from home, community, GP surgery or self-presented to the PPCI centre ED, while one-third were transferred from another hospital (a non PPCI centre).
4.4 Type and timeliness of reperfusion therapy

a. Type of treatment: Overall, of the 1,247 confirmed STEMI patients 968 (77.6%) received PPCI, 85 (6.8%) received thrombolyis with 148 (11.9%) contraindicated and 45 (3.6%) receiving no acute reperfusion therapy (table 4.1) similar to 2013 data. While there was no difference between genders in receipt of therapy, the mean age of those who received RT (PPCI or TL) was significantly younger than those who received no acute reperfusion therapy (62.2 yrs v 66.9 yrs), p<0.05.

b. Among reperfusion treated patients (n= 1,053): 968 (91.9%) received PPCI and 85 (8.1%) received TL. All PPCI centres with the exception of UCHG had rates of PPCI above the 2014 national target of 80% (Figure 4.2). These data are similar to those found in 2013.

c. Timeliness of PPCI (n= 968): Timeliness of PPCI (First Medical Contact to balloon within 120 minutes) was achieved in 661 (68.3%) patients. In the Western and Southern parts of the country (CUH, UHL and UCHG) serving widely dispersed populations timeliness ranged from 51% to 87%. In the Eastern areas with greater population densities timeliness within the three Dublin PPCI centres (MMUH, SJH and SVUH) ranged from 58% to 82% (Figure 4.3). These data are broadly similar to that in 2013.

d. Timeliness of thrombolysis (n=85): Timeliness of thrombolysis (door to needle within 30 minutes) was low at 35. % (n=30) in 2014. This figure in 2013 was 29%. This may reflect unnecessary time spent deciding between administering thrombolysis and transferring for PPCI. Strict adherence to the ORS protocol will greatly improve this figure.

4.5 Further analysis of timeliness of PPCI

Some 296 patients with STEMI had PPCI outside the target of FMC to balloon treatment of 120 minutes.

a. Route to PPCI centre Delay was studied by analysing the route to the PPCI Centre (Box 4.2). Three quarters (74%) of patients with STEMI arrived at the PPCI centre by the direct route in 2014. Excluding 12 (1.2%) cases with missing values 77% of those who presented directly to a PPCI centre (table 4.2) have a timely PPCI compared to 47% of those who present indirectly (Relative Risk (RR)=1.64, (1.42<RR<1.88), p<0.00001). Consequently those who present directly have 64% greater chance of having a timely PPCI compared to those who present indirectly.

b. Delayed PPCI Of those whose PPCI therapy was outside the recommended time window 111 (11.5%) patients had PPCI after the target timeframe of 120 minutes but within the following 30 minutes. A further 57 (6%) patients had treatment between 150 – 180 minutes after diagnosis (FMC). Finally 128 (13.3%) patients had PPCI three hours or longer from FMC.

c. Pre-hospital or in-hospital delay Delay was studied by analysing the pre-hospital and in-hospital target time frames set out in the programme for ACS (Box 4.2). Overall delay in timely PPCI occurred in each of the following situations: pre-hospital environment (33%), in-hospital setting (35%) and in both environments (32%) to a similar degree (table 4.3).

When the route was direct to the PPCI Centre then much of the delay is at the hospital level (59%), whereas when the indirect route is used the delay is more likely to be within pre-hospital setting (such as non-PPCI hospital or NAS) (table 4.3, figure 4.4).

d. Door to balloon In 2014 ‘door to balloon’ within 60 minutes, the new international indicator, was 71.0% with two hospitals achieving over 80%. Median door to balloon time was 36 minutes with no difference between centres and similar to 2013 (35 minutes). In 2014, door to balloon within 90 minutes was 82.0% (85% in 2013). Variation across Centres is set out in figure 4.5.

e. Arrival by helicopter In the nine months (April – Dec 2014) 74 people with STEMI were conveyed by helicopter to a PPCI centre. This group were older (mean age 63.5 years, more likely to be male (89%) and be transported into UCHG (68%). 45 (66%) patients had PPCI with 23 (51%) receiving it within the time window (FMC to balloon = 120 minutes). The median time to treatment (FMC to balloon) was 120 minutes compared with 92 minutes for the PPCI patient group overall. The pre-hospital window (FMC to door) was longer – median of 81 minutes compared to 54 minutes. However the hospital window (door to balloon) was shorter – median of 31 minutes compared with 36 minutes.
Box 4.2 Definitions of Direct and Indirect route to PPCI centre

**Definitions**

**Direct route** is defined as the route undertaken when the patient went directly to the PPCI Centre i.e. date/time arrival at 1st Hospital = date/time arrival at PPCI centre.

**Indirect route** then is when the patient did not go directly to the PPCI Centre, for example, via another hospital. i.e. date/time arrival at 1st Hospital ≠ date/time arrival at PPCI centre.

**Pre-hospital (stage 1):** Interval between positive ECG and Arrival at PPCI Centre

**In hospital (stage 2):** Interval between arrival at PPCI centre and RT time

- **In Hospital Delay:** (stage 1<=90 and stage 2>30)
- **Pre-Hospital Delay:** (stage 1>90 and stage 2<=30)
- **Both delays:** (stage 1>90 and stage 2>30)

### 4.6 Discharge bundle of care for secondary prevention

In 2014, medication on discharge from the PPCI centre for eligible patients (i.e. those not contraindicated) ranged overall between 70.6% for ACEI/ARBs and 86.0% for aspirin compared to the target of 90% (table 4.4). There was considerable variation within medication categories across hospitals. A number of factors could account for the variation including the fact that a proportion of patients would receive these medications later at the referral hospital as well as some missing data.

Smoking cessation counselling was achieved in 72% of documented smokers. Data on cardiac rehabilitation (CR) is challenging to interpret not least because it is incomplete as CR may be offered at the local hospital and not always captured at the Centres. 607 (52%) patients were invited to CR and a further 93 (7.9%) were contraindicated. 120 patients declined but the variation across centres is very large. Lastly, data was missing on 353 patients.

### 4.7 Outcome

**In-hospital mortality:** During 2014, seventy four patients with STEMI died in this cohort from eight PPCI/PCI centres – a crude in-hospital mortality rate of 5.9% (6.6% in 2013) with no significant difference between those who received PPCI (5.2%) and thrombolysis (5.9%). However in-hospital mortality among those who were contraindicated (11.5%) was higher as expected. Lastly, there was no difference in in-hospital mortality between patients who came to hospital via the direct or the indirect route to PPCI.

### 4.8 Length of stay

The average length of stay (LOS) for this group of STEMI patients was 5.1 days with variation across Centres. Of note is the fact that this reflects LOS at a PPCI centre and does not include the LOS in a referral hospital, a feature which will vary across the country. The policy of the Centre in relation to repatriation / discharge may vary from immediately post PPCI, the following morning or several days later after mobilisation.
Figure 4.1 Profile of STEMI patients, 2014

Table 4.1 Treatment modalities within the region of the PCI centre, 2014

<table>
<thead>
<tr>
<th>PCI Centre Hospital</th>
<th>PPCI (n)</th>
<th>Thrombolysis</th>
<th>Contraindicated</th>
<th>No acute Reperfusion therapy¹</th>
<th>Missing</th>
<th>Total²</th>
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<tbody>
<tr>
<td>UCHG</td>
<td>179</td>
<td>54</td>
<td>17</td>
<td>13</td>
<td>1</td>
<td>264</td>
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<tr>
<td>UHL</td>
<td>176</td>
<td>0</td>
<td>4</td>
<td>1</td>
<td>0</td>
<td>181</td>
</tr>
<tr>
<td>CUH</td>
<td>144</td>
<td>25</td>
<td>56</td>
<td>1</td>
<td>0</td>
<td>226</td>
</tr>
<tr>
<td>MMUH³</td>
<td>143</td>
<td>0</td>
<td>30</td>
<td>7</td>
<td>0</td>
<td>180</td>
</tr>
<tr>
<td>SVUH</td>
<td>95</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>109</td>
</tr>
<tr>
<td>SJH³</td>
<td>196</td>
<td>4</td>
<td>30</td>
<td>5</td>
<td>0</td>
<td>235</td>
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<tr>
<td>AMNCH⁴</td>
<td>18</td>
<td>0</td>
<td>9</td>
<td>3</td>
<td>0</td>
<td>30</td>
</tr>
<tr>
<td>BH⁴</td>
<td>17</td>
<td>1</td>
<td>0</td>
<td>4</td>
<td>0</td>
<td>22</td>
</tr>
<tr>
<td>TOTAL</td>
<td>968</td>
<td>85</td>
<td>148</td>
<td>45</td>
<td>1</td>
<td>1247</td>
</tr>
</tbody>
</table>

Notes:
¹ Reasons given for no acute reperfusion therapy - patients had co-morbidities, referred for CABG, etc
² Heartbeat for 2014 was closed for data entry in July 2015 as per HIPE regulations
³ MMUH and SJH were both assisted with retrospective data entry. In both hospitals a number of records were unavailable when Heartbeat for 2014 was closed and therefore were not included in the analysis. These figures therefore significantly underestimate the numbers dealt with in these two hospitals.
⁴ AMNCH & BH are PCI centres treating ‘walk-in’ patients

Key to Hospital acronyms

| UCHG - University College Hospital Galway | SVUH - St Vincent’s University Hospital, Dublin |
| UHL - University Hospital Limerick | SJH - St James’ Hospital, Dublin |
| CUH - Cork University Hospital | AMNCH – Tallaght Hospital, Dublin |
| MMUH - Mater Misericordiae University Hospital, Dublin | BH – Beaumont Hospital, Dublin |
Figure 4.2 Type of reperfusion therapy among reperfusion treated patients, 2014

Note 1 AMNCH & BH are PCI centres treating ‘walk-in’ patients
Note 2 Missing n= 12

Table 4.2 Timeliness of PPCI and route taken to PPCI centre, 2014

<table>
<thead>
<tr>
<th>Route to PPCI Centre</th>
<th>Timely PPCI</th>
<th>Non-timely PPCI</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>%</td>
<td>n</td>
</tr>
<tr>
<td>Direct route</td>
<td>544</td>
<td>76.8%</td>
<td>164</td>
</tr>
<tr>
<td>Indirect route</td>
<td>116</td>
<td>46.8%</td>
<td>132</td>
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</table>
Table 4.3 Delay to PPCI by setting (pre-hospital and in-hospital), 2014

<table>
<thead>
<tr>
<th>Route to Centre</th>
<th>Pre-Hospital Delay</th>
<th>In-Hospital Delay</th>
<th>Both</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct to PPCI Centre</td>
<td>27 (16.5%)</td>
<td>96 (58.5%)</td>
<td>41 (25%)</td>
<td>164</td>
</tr>
<tr>
<td>Indirectly to PPCI Centre</td>
<td>71 (53.8%)</td>
<td>8 (6.1%)</td>
<td>53 (40.2%)</td>
<td>132</td>
</tr>
<tr>
<td>TOTAL</td>
<td>98 (33.1%)</td>
<td>104 (35.1%)</td>
<td>94 (31.8%)</td>
<td>296</td>
</tr>
</tbody>
</table>

Figure 4.4 Delay to PPCI by setting (pre-hospital and in-hospital), 2014

Fig 4.5 Door to Balloon times by PPCI/PCI centre (60 mins and 90 mins), 2014

Note: ‘Door’ time is arrival at PPCI/PCI centre time
### Table 4.4 Medications on discharge from PPCI centre, 2014 (% received among patients eligible for each medication)

<table>
<thead>
<tr>
<th>Hospital Code</th>
<th>Dual anti-platelet therapy</th>
<th>Beta Blocker</th>
<th>ACEI or ARB</th>
<th>Statin</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No of eligible patients</td>
<td>No given Dual anti-platelet</td>
<td>% of eligible patients</td>
<td>No of eligible patients</td>
</tr>
<tr>
<td>UCHG</td>
<td>247</td>
<td>229</td>
<td>92.7%</td>
<td>240</td>
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<tr>
<td>UHL</td>
<td>168</td>
<td>166</td>
<td>98.8%</td>
<td>167</td>
</tr>
<tr>
<td>CUH</td>
<td>184</td>
<td>182</td>
<td>98.9%</td>
<td>202</td>
</tr>
<tr>
<td>MMUH</td>
<td>175</td>
<td>147</td>
<td>84%</td>
<td>169</td>
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<tr>
<td>SVUH</td>
<td>103</td>
<td>8</td>
<td>7.8%</td>
<td>102</td>
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<tr>
<td>SJH</td>
<td>207</td>
<td>200</td>
<td>96.6%</td>
<td>213</td>
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<tr>
<td>AMNCH*</td>
<td>28</td>
<td>24</td>
<td>85.7%</td>
<td>26</td>
</tr>
<tr>
<td>BH*</td>
<td>20</td>
<td>19</td>
<td>95%</td>
<td>21</td>
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<tr>
<td>Total</td>
<td>1132</td>
<td>975</td>
<td>86.1%</td>
<td>1140</td>
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</table>

Note 1: Eligible patients are STEMI patients less those contraindicated. This number may differ for each indicator.
Note 2: SVUH had missing data >90% for all medications.
Note 3: * AMNCH & BH are PCI centres treating ‘walk-in’ patients
Chapter 5 What has been achieved and what are the next steps?

Introduction
The optimal reperfusion protocol (ORS) for patients with STEMI (heart attack) has been successfully implemented across the country for two years now (2013 and 2014). Furthermore a monitoring programme with data collection and performance indicators has been initiated. This has happened at a time of austerity and major reduction in the health service budget. The purpose of this chapter is to reflect on the key changes as well as areas for further attention after two years of the ORS protocol around the country.

5.1 Shift in type of treatment
There has been a key change in the way patients with STEMI are treated. Since early 2013 the dominant mode of treatment for STEMI is PPCI - with 92% of STEMI patients who received reperfusion treatment received PPCI. This is a major accomplishment and has been achieved to a high degree in all PPCI centres reflecting change in all regions across the country. Furthermore this high level of PPCI compares favourably with other countries such as England 97% and Wales 72%.

While not directly comparable data in 2011 from 21 hospitals (Heartbeat Bulletin) showed that just over half of patients (55%) received PPCI (Figure 5.1).

Notably a high proportion of patients receive reperfusion therapy. A small minority in 2014 (16 %) receive no therapy largely due to contraindication. By comparison in England this percentage was 26% in 2012-2013.

Figure 5.1 Type of reperfusion therapy among patients who received reperfusion therapy – 2011 (21/36 hospitals) and 2014 (8/9 PPCI/PCI centres)

5.2 Timeliness of treatment
As ‘time is muscle’ the timeliness of PPCI is essential. The finding of timeliness to treatment (FMC to balloon) of 68% in both 2013 and 2014 falls below the interim target (80%) for the programme for ACS and points to an area for attention and improvement. Furthermore variation is found across the country which may reflect factors such as the hinterland served, pre-hospital access or hospital response. Patients contraindicated for thrombolysis and then transferred to PPCI centre will result in unavoidable decrease in timeliness.
In reviewing delay to treatment opportunities appear to exist in a number of areas for improvement. With only two thirds of patients arriving directly to PPCI centre and so 36% of patients arriving to treatment via another hospital there is a role for raising awareness among the public about the new method of treatment for Heart Attack. Consequently people with symptoms (or their relatives and friends) should call the Emergency Services so as to arrive directly at a PPCI centre by ambulance. Another area which may be improved upon is that of rapid turn around in a referring centre in conjunction with the ambulance service – the so called door-in, door-out timeframe.

With 11% of patients receiving PPCI just 30 minutes outside the treatment window small efficiencies and quality improvements in the pre-hospital and the hospital environment may bring about change for patients. With 13% of patients receiving PPCI three hours or longer from FMC the issue of whether patients, at a distance from PPCI centres, are appropriately assessed for thrombolysis (TL) must be further pursued along with the emphasis on timeliness of giving TL in relevant situations.

### 5.3 Discharge bundle of care

As well as the benefit of PPCI, emphasis in guidelines is now placed on an evidence based discharge bundle of care comprising medication and lifestyle behaviour change interventions such as smoking cessation counselling and exercise based rehabilitation programmes. Discharge medication in eligible patients, especially for ACE inhibitors/ARBs, shows some variability. Centres with poor results may reflect data collection issues or performance. Only three quarters of smokers received smoking cessation counselling which requires improvement. Data on cardiac rehabilitation is evolving and difficult to interpret at this stage.

### 5.4 Outcome

Crude in-hospital mortality rate of 5.9% is similar to reports in the international literature. It is important to point out that this statistic reflects the mortality rate at discharge from the PPCI centre. Some patients may spend time at the local hospital before discharge home which is not captured by this statistic. Consequently comparison with international literature is not wise. Further work to gather and analyse 30 data mortality is advisable.

### 5.5 Heartbeat Portal

Heartbeat Portal is a new method of collecting clinical data with high coverage of most STEMI patients in eight of the nine Centres. However, data was incomplete in two Centres due to retrospective collection with an estimated loss of 150 records (10%). Furthermore data for one Centre was not available for analysis. On the other hand the high rate of data completeness for mandatory fields is most reassuring. An important next step is to set up specific validation of this data system. Other area for consideration is a study of concordance with HIPE.

### 5.6 Patient profile

This cohort of patients appear to be younger (mean age 62 years) and with a greater proportion of males (78%) than a previous Irish AMI study.2 This may reflect issues such as clinical ascertainment, data capture or may point to a changing condition within a country in recession.

It should be noted that the numbers reported here do not fully reflect the volume of work being carried by the cardiology teams providing this service as between 15% and 20% of cases will be false positives or inappropriate referrals and are not contained in this analyses.
5.7 Areas for further attention

Now that the ORS is in place nationally it is important for the programme for ACS to address the next set of areas covering a) quality of care improvement including data management, b) raising public awareness about how to access this new service and c) implementing an NSTE ACS protocol.

Continuous improvement in patient care will require attention to methods of change management both in pre-hospital and in-hospital settings to improve timeliness of reperfusion therapy both for PPCI and for the minority of patients for whom thrombolysis remains essential treatment to a target of 90%. Furthermore similar methodologies will be helpful in achieving high uptake of the discharge bundle of care including referral to cardiac rehabilitation. A range of methodologies with a proven track record are employed by the Institute of Healthcare Improvement, ‘Get with the Guidelines’ and other organisations.

Underpinning these exercises is the need for sustained high quality data collection and analysis. This area requires close attention and some investment in ensuring resources to sustain and develop what has been achieved with good will in the first year. All PPCI and PCI centres require a dedicated training / data collection officer. Areas in particular are: improve coverage to ensure that 95% patients in all centres are included, undertake data quality audits and a verification process, establish regular formal feedback to hospitals in conjunction with NQAIS – a mechanism already used by surgeons – and finally initiate a national audit process in conjunction with the National Office for Clinical Audit (NOCA).

Maintaining 24/7 on-call teams to treat patients with STEMI is a major ongoing challenge. Adequate staffing is essential. Proposals for additional nursing / technical staff for all PPCI centres are in place.

While the ORS has been implemented organisationally, little attention has been given to educating the public about the change to treatment for heart attack from local thrombolysis to PPCI at designated centres. A campaign of awareness raising among the public is now needed so that those with symptoms and their relatives call the emergency services in order to get swift and appropriate treatment.

Achieving implementation of the ORS in the North West of the country has proven more difficult. However from quarter one, 2016 arrangements should be in place for patients from Donegal to be served by the new PPCI centre in Altnagelvin Hospital in Derry, Northern Ireland.

Lastly, the NSTE ACS protocol, the next element of standardising heart attack care, is at an advanced stage. Monitoring this phase will also be important. KPIs for delivering this service will include angiography defined as urgent, and within 24, 48 or 72 hours. To achieve this will require significant input to cardiology departments including staffing arrangements to open cath. labs. at weekends on a routine basis.
Acknowledgements

- PPCI/PCI centre hospitals
- Hospital group referring hospitals
- HSE National Ambulance Service
- Dublin Fire Brigade Ambulance Service
- Programme for ACS Working Group
- ACS Data Governance Committee (Chair Dr Martin Quinn)
- Data Analysts (Aisling Sheridan, Deirdre Carey)
- HPO/HIPE Office
- Dr Howard Johnson, Health Intelligence Unit, HSE
## Appendix A

**Programme for ACS Group membership**

**Programme for ACS Working Group membership**

<table>
<thead>
<tr>
<th>Prof Kieran Daly, ACS Clinical Lead</th>
<th>Brendan Cavanagh HSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dr Siobhan Jennings HSE</td>
<td>Deirdre Mulligan HSE</td>
</tr>
<tr>
<td>Dr Geoff King, PHECC</td>
<td>Sean Brady (HSE Amb)</td>
</tr>
<tr>
<td>Sue Hennessy HSE</td>
<td>Paudie O’Riordan (HSE Amb)</td>
</tr>
<tr>
<td>Patricia Dunne HSE</td>
<td>Dr Cathal O’Donnell (HSE Amb)</td>
</tr>
<tr>
<td>Martin O’Reilly DFB</td>
<td>Dr Conor Deasy (HSE Amb)</td>
</tr>
<tr>
<td>Dr Martin Quinn St Vincent’s UH</td>
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**RCPI ACS Clinical Advisory Forum membership**

<table>
<thead>
<tr>
<th>Prof Kieran Daly, ACS Clinical Lead</th>
<th>Dr Martin Quinn, St Vincent’s UH</th>
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<tr>
<td>Dr Jim Crowley, UCH Galway</td>
<td>Dr Andrew Maree, St James’s Hospital</td>
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<tr>
<td>Prof David Foley, Beaumont Hospital</td>
<td>Dr David Mulcahy, AMNCH Tallaght</td>
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<tr>
<td>Dr Gavin Blake, Mater MUH</td>
<td>Dr Patrick Owens, UH Waterford</td>
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<tr>
<td>Dr Terry Hennessy, UH Limerick</td>
<td>Dr Siobhan Jennings, Programme for ACS</td>
</tr>
<tr>
<td>Dr Peter Kearney, Cork UH</td>
<td>Brendan Cavanagh, Programme for ACS</td>
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**ACS Data Governance Group**

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<th>Dr Brian MacNeil (UCHG)</th>
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<tr>
<td>Dr Siobhan Jennings, HSE H&amp;W</td>
<td>Dr Bryan Loo (Tallaght H)</td>
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<td>Mary Morrissey, HSE HI</td>
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<td>Dr Peter Kearney (CUH)</td>
<td>Sinead Teehan (St James’s H)</td>
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<td>Philip Dunne HPO/HIPE HSE</td>
</tr>
<tr>
<td>David Hnelly (Amb Service)</td>
<td>Dr Patrick Owens (UHW)</td>
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Appendix B

International performance indicators for STEMI reperfusion therapy

Performance indicators and targets for STEMI care internationally vary both on what is suggested to be reported on and what is considered acceptable though some commonality can be seen with most indicators and targets. Below are some of the main international indicators and/or targets mainly for reperfusion therapy.

1. European Society of Cardiology (ESC) STEMI Guidelines (2012)

Quality targets:
- first medical contact* to first ECG 10 min;
- first medical contact* to reperfusion therapy;
  - for fibrinolysis 30 min;
  - for primary PCI 90 min (60 min if the patient presents within 120 min of symptom onset or directly to a PCI capable hospital).

* first medical contact (FMC), defined as the point at which the patient is either initially assessed by a paramedic or physician or other medical personnel in the pre-hospital setting or the patient arrives at the hospital emergency department— and therefore often in the outpatient setting.

2. UK Myocardial Infarction National Audit Project (MINAP) (2012 Report)

- Call-to-balloon time (CTB) [audit standard up to 150 mins]
- Door-to-balloon time (DTB) [audit standard up to 90 mins]
- Call-to-needle time (CTN) [audit standard up to 60 mins]
- Door-to-needle time (DTN) [audit standard up to 30 mins]

3. Danish National Indicators

- PPCI as a national reperfusion strategy = 100% and accordingly no fibrinolysis
- Pre-hospital diagnosis in 90% of cases
- Field triage in 60% of those diagnosed in a pre-hospital setting
- Door to balloon time of 30 minutes

4. 2013 ACCF/AHA Guideline for the Management of STEMI

- For direct EMS transport - FMC-to-device time system goal of 90 minutes or less
- For non PCI to PPCI centre transport - FMC-to-device time system goal of 120 minutes or less
- When fibrinolytic therapy is indicated or chosen as the primary reperfusion strategy, it should be administered within 30 minutes of hospital arrival
5. IHI (USA) method (2008)
- Thrombolytic agent received within 30 minutes of hospital arrival. Goal 100% of patients; or
- PCI received within 90 minutes of hospital arrival. Goal 100% of patients

6. Safer Healthcare Now (SHN) Canada method
- Thrombolytic agent received within 30 minutes of hospital arrival. Goal 85% of patients; or
- PCI received within 90 minutes of hospital arrival. Goal 90% of patients

- PPCI within 90 minutes of hospital arrival* and within 120 mins of call for help
- Thrombolysis within 30 minutes of hospital arrival*
- ECG within 10 mins of hospital arrival*
  * triage time or registration time - whichever comes first

- PPCI within 60 minutes of presentation if patient presents within 1 hour of symptoms
- PPCI within 90 minutes of presentation if patient presents later than 1 hour of symptoms
- If patient presents to facility without Cath Lab (and symptoms between 3 and 12 hours) it is appropriate to transfer for PPCI if the PPCI can be done within 120 minutes (including transport time).
- Thrombolysis should be considered where there are major delays (> 30 mins) to hospitalisation.
- ECG should where possible be done pre-hospital and transmitted to hospital
- ECG should otherwise be done within 5 mins of hospital arrival
Appendix C

Programme for ACS key performance indicators (KPIs)

1. % of eligible STEMI patients (or LBBB) who get PPCI

2. % STEMI patients (or LBBB) who get timely reperfusion therapy:
   a. First medical contact (FMC) to balloon \( \leq 120 \) mins
      OR
   b. First door to balloon \( \leq 120 \) mins
      OR
   c. Door to needle \( \leq 30 \) mins

3. Mean and Median LOS and bed days for a) STEMI and b) NSTEMI pts

4. Number and % of STEMI patients referred to cardiac rehabilitation Phase 3

5. Number and % of STEMI patients with a start date for CR Phase 3 programme within 4 weeks of discharge

6. The % of eligible (not contraindicated) STEMI patients who receive a) Aspirin and b) dual anti-platelet on discharge

7. The % of eligible (not contraindicated) STEMI patients who receive Beta Blockers on discharge

8. The % of eligible (not contraindicated) STEMI patients who receive Statin therapy on discharge

9. The % of eligible (not contraindicated) STEMI patients who receive ACE/ARBs on discharge

10. The % of eligible (not contraindicated) STEMI patients who receive smoking cessation counselling on discharge
## Glossary of Acronyms

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACC</td>
<td>American College of Cardiology</td>
</tr>
<tr>
<td>ACS</td>
<td>Acute Coronary Syndrome</td>
</tr>
<tr>
<td>AHA</td>
<td>American Heart Association</td>
</tr>
<tr>
<td>CCU</td>
<td>Coronary Care Unit</td>
</tr>
<tr>
<td>CHAIR</td>
<td>Coronary Heart Attack Ireland Register</td>
</tr>
<tr>
<td>CR</td>
<td>Cardiac Rehabilitation</td>
</tr>
<tr>
<td>ED</td>
<td>Emergency Department</td>
</tr>
<tr>
<td>ECG</td>
<td>Electrocardiogram</td>
</tr>
<tr>
<td>ESRI</td>
<td>Economic and Social Research Institute</td>
</tr>
<tr>
<td>FMC</td>
<td>First Medical Contact</td>
</tr>
<tr>
<td>HIPE</td>
<td>Hospital In Patient Enquiry (system)</td>
</tr>
<tr>
<td>HSE</td>
<td>Health Service Executive</td>
</tr>
<tr>
<td>IHI</td>
<td>Institute of Healthcare Improvement (USA)</td>
</tr>
<tr>
<td>KPI</td>
<td>Key Performance Indicator</td>
</tr>
<tr>
<td>LBBB</td>
<td>Left Branch Bundle Block</td>
</tr>
<tr>
<td>LOS</td>
<td>Length of Stay</td>
</tr>
<tr>
<td>MINAP</td>
<td>Myocardial Infarction National Audit Programme (UK)</td>
</tr>
<tr>
<td>NOCA</td>
<td>National Office for Clinical Audit</td>
</tr>
<tr>
<td>NQAIS</td>
<td>National Quality Assurance Information System (Ireland)</td>
</tr>
<tr>
<td>NSTEACS</td>
<td>Non ST Elevation Acute Coronary Syndrome</td>
</tr>
<tr>
<td>NSTEMI</td>
<td>Non STE Elevation Myocardial Infarction</td>
</tr>
<tr>
<td>ORS</td>
<td>Optimal Reperfusion Service</td>
</tr>
<tr>
<td>PCI</td>
<td>Percutaneous Coronary Intervention (aka Angioplasty)</td>
</tr>
<tr>
<td>PPCI</td>
<td>Primary Percutaneous Coronary Intervention</td>
</tr>
<tr>
<td>RCPI</td>
<td>Royal College of Physicians of Ireland</td>
</tr>
<tr>
<td>SHN</td>
<td>Safer Health Care Now (Canada)</td>
</tr>
<tr>
<td>STEMI</td>
<td>ST Elevation Myocardial Infarction</td>
</tr>
<tr>
<td>TL</td>
<td>Thrombolysis (aka Fibrinolysis)</td>
</tr>
</tbody>
</table>