NOCA National Office of Clinical Audit

IHAA Irish Heart Attack Audit

IRISH HEART ATTACK AUDIT

NATIONAL REPORT 2022 AND 2023

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DESIGNED BY SWERVE

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National Report 2022 and 2023

NOCA National Office of Clinical Audit

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5th November 2024

Dear Dr Margey

On behalf of the NOCA Governance Board, I wish to formally acknowledge receipt of the **Irish Heart Attack Audit National Report 2022 and 2023**.

We extend our sincere congratulations to you and the entire team, including Audit Manager Joan McCormack, Governance Committee Chairperson Dr. Sean Fleming, and Patient and Public Interest Representatives Michael Madigan and Pauline O'Shea, for their essential roles in developing this report.

This comprehensive analysis of heart attack care highlights your commitment to enhancing patient outcomes across Ireland.

This letter signifies the NOCA Governance Board's endorsement of the Irish Heart Attack Audit National Report 2022 and 2023. We trust that this report will continue to serve as a pivotal resource for quality improvement and the ongoing enhancement of heart attack care throughout Ireland.

Yours sincerely,

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PREFACE

The advent of the primary percutaneous coronary intervention (PCI) programme in 2012 transformed our management of patients with ST elevation myocardial infarction (STEMI). For the first time there was a national strategy which coordinated the management of myocardial infarction all the way from the community to the hospital. It established designated primary PCI centres that were adequately resourced with cardiac staff and facilities in order to provide an emergency response on a 24-hour basis. It changed the way ambulance staff and emergency departments responded, and provided the framework by which ambulances could bypass local hospitals in order to bring patients to centres with PCI facilities, provided they could do so within the appropriate time frame. It also formalised guidelines for when thrombolysis should be given.

From its inception, the primary PCI programme has prioritised the continuous collection of data from all of the participating centres. This information, collated by a large group of committed cardiac nurses and data managers, has provided the basis for a number of reports, of which the current audit is the latest. The Irish Heart Attack Audit governance committee (led by Dr Ronan Margey) and the National Office of Clinical Audit are to be commended once again for providing important and timely information about the success of our management of this group of patients and for identifying areas for potential improvement.

This national report provides results on 3,102 patients who were treated for a STEMI in 2022 and 2023. This is the largest cohort assessed so far and reflects the increase in the Irish population even though the incidence of STEMI has not changed.

This audit reports on key quality indicators (KQIs) and sets national targets in relation to the timeliness of reperfusion therapy. The results once again emphasise that timely reperfusion leads to reduced mortality and morbidity from heart failure. Substantial progress has been made with regard to a number of KQIs. It is particularly gratifying to see the marked increase in the proportion of patients who are on appropriate secondary prevention therapy (86%) and who were referred for cardiac rehabilitation phase 3 (91%), as these significantly reduce long-term cardiac mortality. Unfortunately, it remains challenging to capture follow-up data on this group of patients and there is limited information on those who attended cardiac rehabilitation phase 3.

The proportion of patients receiving timely primary PCI when transferred from another hospital (45%) remains well below the target. This is a particularly challenging group. The distance from the PCI centre often means that the time frame between a patient's arrival in the emergency department and departure in an ambulance needs to be very short. Reporting the 'door in door out' time, which is done for the first time in this report, will help to highlight delays and identify patients who may be better served with thrombolysis rather than late transfer and delayed primary PCI.

Challenges to the delivery of care are often unique to individual hospitals and regions. There are many moving parts between the time the patient has chest pain and the time they receive reperfusion therapy. Delays may be due to several factors, including patient awareness, ambulance availability, triaging systems in hospitals, and availability of appropriate staff. An important part of this audit report is that it provides specific data to each hospital using the national average as a comparator. This should help hospitals focus on strategies to maximise efficiencies at a local level.

The authors have provided a detailed, valuable report on the current management of STEMI in Ireland today. Based on the data, they have developed a number of recommendations, which I fully endorse. The implementation of these recommendations should continue to improve the delivery of cardiac care across the nation.

Professor Jim Crowley
Regional Director of Cardiology, Saolta University Health Care Group
Medical Director of Croí, the West of Ireland Cardiac Foundation

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GLOSSARY OF TERMS AND DEFINITIONS

ACRONYM	FULL TERM
ACS	acute coronary syndrome
ARB	angiotensin II receptor blocker; an oral medication sometimes used in the treatment of high blood pressure, heart attack, heart failure, and diabetes.
CABG	coronary artery bypass graft
cath lab	catheterisation laboratory
CHD	coronary heart disease
COVID-19	coronavirus disease 2019; the disease caused by severe acute respiratory syndrome coronavirus 2.
CR	cardiac rehabilitation
CSO	Central Statistics Office
denominator	is the total number/cohort that a calculation is made from. It is the bottom number of a fraction that shows the total number of equal parts an object is divided into. For example: 20/100 – 100 is the denominator.
DIDO	door in door out
dL	decilitre
DTB	door to balloon
ECG	electrocardiogram
ED	emergency department
ESC	European Society of Cardiology
FMC	first medical contact
FMCTB	first medical contact to balloon
FMCTD	first medical contact to door
g	gram
GP	general practitioner
GRACE	Global Registry of Acute Coronary Events
Heartbeat	A web-based data collection tool.
h:mm	hour(s):minute(s)
HIPE	Hospital In-Patient Enquiry
HPO	Healthcare Pricing Office
HSE	Health Service Executive
ICD-10-AM	International Classification of Diseases, Tenth Revision, Australian Modification
IHAA	Irish Heart Attack Audit
IQR	interquartile range
KPI	key performance indicator
KQI	key quality indicator

ACRONYM	FULL TERM
LOS	length of stay
MI	myocardial infarction
NAS	National Ambulance Service
NCCA	National Centre for Clinical Audit
NCP-ACS	National Clinical Programme for Acute Coronary Syndrome
NOCA	National Office of Clinical Audit
NSTEMI	non-ST elevation myocardial infarction
numerator	is the number that is derived from the denominator as the subset meeting a specific criterion. Number above the fractional bar. For example: 20/100 – 20 is the numerator.
ORS	optimal reperfusion service
PCI	percutaneous coronary intervention
QI	quality improvement
SMR	standardised mortality ratio
statins	A group of oral medications that work to reduce the level of cholesterol in the blood.
STEMI	ST elevation myocardial infarction
thrombolysis	intravenous medication therapy to treat heart attack by pharmacologically dissolving arterial clots.

EXECUTIVE SUMMARY

This is the third Irish Heart Attack Audit National Report, reporting on data from 3,102 patients with an ST elevation myocardial infarction (STEMI) who received treatment in one of the 10 primary percutaneous coronary intervention (PCI) centres in Ireland, and on data from their referring hospitals, during 2022 and 2023. The data provide detailed information about the care received, the processes of care delivered and the outcomes of patients with a STEMI, enabling each participating hospital to benchmark itself against comparable hospitals in Ireland. The quality of care delivered is measured against national and international key quality indicators (KQIs), and opportunities for quality improvement (QI) are identified. For the first time, we present data on the risk-adjusted in-hospital mortality of patients with a STEMI by PCI centre in 2023, allowing benchmarking of observed hospital mortality against expected mortality.

The incidence of STEMI has remained stable between 2016 (HSE, 2018) and 2022 (402 per 1 million of the population in 2016 compared with 397 per 1 million of the population in 2022). Due to significant population increase, the number of patients with STEMI increased from 1,412 to 1,533 between 2016 and 2022. This increase in the volume of patients has implications for both pre-hospital and PCI centre activity. We look forward to the publication of the National Review of Specialist Cardiac Services, which will address the configuration and resourcing of national adult cardiac services in order to achieve optimal patient outcomes at population level, with a particular emphasis on the safety, quality and sustainability of the services that patients receive.

As in previous Irish Heart Attack Audit reports (National Office of Clinical Audit, 2022a; National Office of Clinical Audit, 2023a), the majority (77%) of patients with a STEMI in 2022 and 2023 were male, with a median age of 62 years. Female patients with a STEMI were older, with a median age of 68 years, and presented with a higher burden of comorbidities. Eighty-six percent of patients with a STEMI in 2022, and 88% in 2023, had at least one modifiable cardiovascular risk factor, and 33% had three or more.

In both reporting years, the proportion of patients brought directly by ambulance to a PCI centre decreased to 55%, and only 47% of those called 112 or 999 within 60 minutes of symptom onset. As clearly described by Michael, who generously shared his heart attack story in our patient perspective narrative, there is a lack of awareness of heart attack symptoms and a reluctance to call 112 or 999. Calling 112 or 999 will ensure prompt pre-hospital electrocardiogram (ECG) diagnosis of a STEMI and allows direct transfer of STEMI cases to PCI centres. It is imperative to fund a public health campaign to increase awareness of heart attack symptoms and the importance of calling 112 or 999.

This report again indicates that the likelihood of achieving national targets in relation to the timeliness of reperfusion therapy is highly dependent on how a patient accesses a primary PCI centre. In 2023, patients who accessed a PCI centre directly (they were brought directly by ambulance, self-presented or were already an inpatient) received timely primary PCI in 79% of cases (78% in 2022), a decrease from 82% in 2021. However, only 45% of those transferred from another hospital to a PCI centre received timely reperfusion in 2023 (38% in 2022). Timely reperfusion was associated with lower proportions of severely reduced left ventricular function (less than 30%) and reduced mortality compared non-timely reperfusion.

Achieving timely reperfusion involves many processes and pathways in all hospitals. When patients initially self-present to non-PCI-capable hospitals, delays are more likely to occur. Monitoring the 'door in door out' (DIDO) times for those patients who present to a non-PCI-capable hospital and who are transferred to a PCI centre for primary PCI is an important metric and one that, if improved, will decrease delays to reperfusion. This is the first report where this metric is reported. In 2023, the median DIDO was 97 minutes (interquartile range (IQR): 62–195 minutes), and only 4% of patients with a STEMI achieved the 30-minute DIDO target.

Monitoring the time to ECG is important for prompt diagnosis and decision-making, and this should be achieved within 10 minutes; this is a KQI/target in the European Society of Cardiology (ESC) acute coronary syndromes treatment guideline, which was published in 2023 (Byrne *et al*., 2023). In 2023, the median time to first positive ECG for patients

diagnosed in the emergency department of a non-PCI-capable hospital was 22 minutes (IQR: 9–65 minutes), and for those who self-presented to a PCI centre (n=144), the median time from arrival at the PCI centre to first positive ECG was 17 minutes (IQR: 7–46 minutes). Capturing the time of the first ECG is a recommended addition to the Heartbeat dataset and we would encourage all hospitals triaging acute chest pain presentations in their emergency departments to audit and report these patients' time to first ECG. In 2023, the National Heart Programme and the National Ambulance Service, in collaboration with the Irish Heart Attack Audit and the Health Service Executive National Quality and Patient Safety Directorate, embarked on the STEMI Care Pathway Quality Improvement Project with the aim of improving the pathways of STEMI care for patients presenting to non-PCI-capable hospitals, and we hope that the QI initiatives will result in improved rates and timeliness of reperfusion for all patients with a STEMI.

The capture of outcome data has improved, and in 2023, a risk-adjusted in-hospital mortality reporting model was developed, facilitating the reporting of in-hospital mortality by PCI centre. In 2023, our risk-adjusted in-hospital mortality modelling indicated that no PCI centre had a mortality rate higher than the expected range. The unadjusted in-hospital mortality rate was 6.4% in 2022 and 6.1% in 2023. In both 2022 and 2023, 8% of patients with a STEMI either had on admission, or developed during their primary PCI procedure, cardiogenic shock. There remains a significant mortality rate associated with cardiogenic shock, at 43% (n=52) in 2022 and 46% (n=61) in 2023. It should be a focus for the acute coronary syndrome/PCI working group within the National Heart Programme to develop a standard treatment pathway for these patients and to improve regional access to mechanical circulatory support in order to help address this excessive mortality rate.

Timely primary PCI was again associated with a reduced mortality rate in 2022 (2.7% versus 7.8% among those who did not receive timely primary PCI), less marked in 2023 (4.1% versus 5.3% among those who did not receive timely primary PCI). Timely primary PCI was also associated with better heart pump function in 2023 (11% with severe left ventricular dysfunction (reduced heart pump function) who received timely primary PCI versus 16% with severe left ventricular dysfunction who received delayed primary PCI).

This report has indicated that some aspects of care and processes of care for patients with a STEMI have improved, some have stayed the same, and some, unfortunately, have worsened; however, the majority of metrics we report are well below agreed national targets.

While statistical testing was carried out, it is important to note that, even for measures where there is no statistically significant[1] improvement, there may be clinical significance, and vice versa. For example, while between 2021 and 2023 there was a statistically significant improvement in KQI 5, the result remains below the agreed target. Monitoring trends for further changes will be a focus of the Irish Heart Attack Audit each year.

The QI projects presented in Chapter 8 and the data quality projects presented in Chapter 9 demonstrate the ongoing commitment of clinical teams and other stakeholders – such as the Healthcare Pricing Office and Hospital In-Patient Enquiry coders, the National Ambulance Service, and the National Heart Programme – to provide high-quality patient care and data for the clinical audit.

[1] Where the observed p-value was less than or equal to 0.05, this was considered to indicate statistical significance.

KEY FINDINGS

IMPROVING		2021	2022	2023	*p*-value
	KEY QUALITY INDICATOR (KQI) 3: The proportion of patients who were transferred to a primary PCI centre from another hospital and received timely primary PCI increased. **TARGET 90%**	41%	39%	45%	*0.349*
	KQI 4: The majority of patients received primary PCI through radial access increased. **TARGET 95%**	93%	92%	94%	*0.277*
	KQI 5: The proportion of patients who had an appropriate secondary prevention medication discharge bundle recorded increased. **TARGET 90%**	74%	75%	86%	*<0.001*
	KQI 6: The proportion of patients who smoke who received smoking cessation advice increased. **TARGET 90%**	85%	80%	91%	*0.002*
	KQI 7: The proportion of eligible patients referred to cardiac rehabilitation phase 3 increased. **TARGET 90%**	66%	57%	91%	*<0.001*
	The proportion of patients with a STEMI who currently smoke has decreased. **TARGET N/A**	39%	35%	35%	*0.057*
	The proportion of cases who called for help within 1 hour of onset of symptoms increased. **TARGET N/A**	44%	45%	49%	*0.04*

ROOM FOR IMPROVEMENT		2021	2022	2023	*p*-value
	KQI 1: The proportion of eligible patients who received reperfusion has decreased. **TARGET 95%**	96%	94%	93%	*0.004*
	KQI 2: The proportion of patients who were brought directly by ambulance to a primary percutaneous coronary (PCI) intervention centre and received timely primary PCI decreased. **TARGET 90%**	82%	78%	79%	*0.07*
	The proportion of patients who received timely thrombolysis decreased. **TARGET 90%**	25%	29%	21%	*0.582*
	The proportion of patients brought directly by ambulance to a PCI centre decreased. **TARGET 95%**	58%	54%	55%	*0.049*
	The proportion of patients with at least one known comorbidity has increased. **TARGET N/A**	27%	29%	33%	*<0.001*

Achieved the target

RECOMMENDATIONS

RECOMMENDATION 1

All percutaneous coronary intervention (PCI) centres, non-PCI-capable hospitals, and ambulance services should participate in the STEMI care pathway quality improvement project.

RECOMMENDATION 2

The Health Service Executive should increase the proportion of patients arriving at a PCI centre directly by ambulance through the delivery of a public awareness campaign aimed at the appropriate use of the ambulance service.

RECOMMENDATION 3

The Irish Heart Attack Audit should complete a survey of PCI networks.

RECOMMENDATION 4

The Irish Heart Attack Audit should report on patients who self-present in all hospitals as a separate cohort and align the timeliness targets with the 2023 European Society of Cardiology guideline.

KEY FINDINGS 2022 AND 2023

3102 confirmed STEMI recorded in 2022 & 2023.

77% Male with median* age **62** years.

23% Female with median age **69** years.

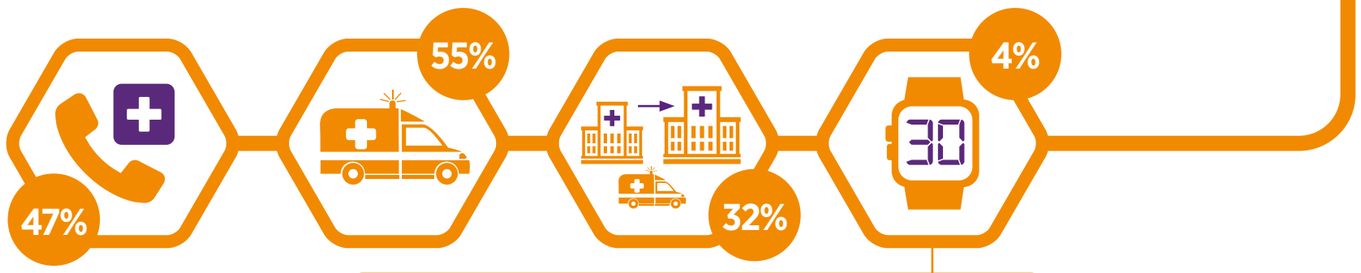
GETTING TO THE SPECIALIST CARDIAC CENTRE

Only **47%** of patients who arrived at a PCI centre directly by ambulance called for help within 60 minutes of onset of symptoms.

55% of patients were brought directly by ambulance to the PCI centre.

32% of patients were transferred from a non-specialist hospital to the PCI centre.

In 2023, only **4%** of patients with a STEMI achieved the 30-minute 'door in door out' (DIDO) target.



DIDO time is the total time a patient with a heart attack spends at the first hospital, from arrival to departure to a PCI centre. The goal is to minimise this time to ensure patients receive life-saving treatment as quickly as possible.

ARE YOU AT RISK OF A HEART ATTACK?

Smoking damages the heart and blood vessels. 35% of patients were smokers at the time of their heart attack, this is almost double the rate of smoking nationally (18%). Current smokers present with heart attack on average 10 years younger than those who have never smoked.

Too much cholesterol in your blood, known as hypercholesterolaemia, increases your risk. 42% of patients had a previous history of hypercholesterolaemia.

High blood pressure, known as hypertension, increases your risk. 46% of patients had a previous history of hypertension.

Diabetes puts you at increased risk of having a heart attack. 21% of patients had a diagnosis of diabetes, an increase from 18% in 2021.

*The median is the middle number in a list of numbers.

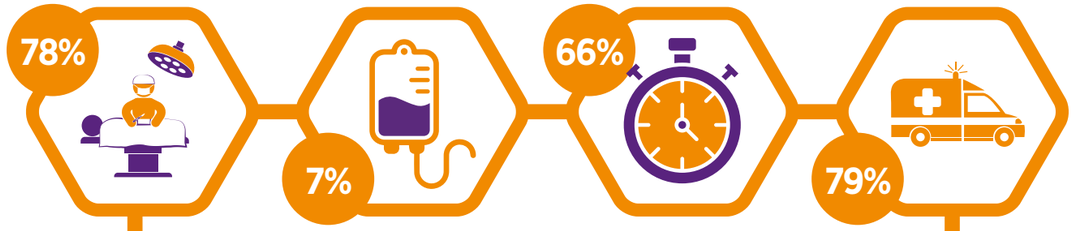
HEART ATTACK TREATMENT

78% of patients with a STEMI received treatment with primary PCI in 2023, an increase from **74%** in 2022.

7% received treatment with thrombolysis, a medication to dissolve clots. This is an increase from **6%** in 2022.

66% of patients received timely treatment to restore blood flow (known as reperfusion) in 2023, well below the target of **90%**.

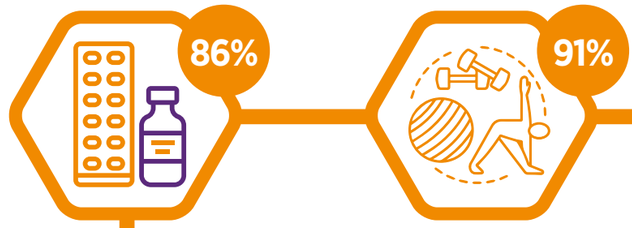
In 2023, timely primary PCI was higher in patients admitted directly by ambulance to a PCI centre (**79%**) compared to those transferred from a non-PCI centre (**45%**).



PREVENTING ANOTHER HEART ATTACK

In 2023, **86%** of patients with a STEMI had appropriate secondary prevention medication prescribed, below the target of **90%**. This is an increase from **75%** in 2022.

In 2023, **91%** of patients were referred to cardiac rehabilitation, which provides an exercise programme and educational classes. This is a notable increase from **57%** in 2022.



OUTCOMES

Timely treatment was associated with reduced mortality – In 2022, patients who received timely primary PCI had a **2.7%** mortality rate compared to **7.8%** for patients who did not receive timely primary PCI (4.1% vs 5.3% in 2023).

THE PATIENT PERSPECTIVE: **MICHAEL'S STORY**

While the data place a focus on areas for facilitating quality improvement and better outcomes for patients who experience a heart attack, they do not capture the individual experience or what matters most to patients during their episode of care. In order to fully understand the needs of patients, it is important to capture the patient's voice. This report includes an account of Michael's experience following his heart attack, taking us from his first symptoms through his emergency treatment and follow-up care.

MICHAEL'S STORY

Michael was 48 years old when he had a heart attack. He had no health problems, was not overweight, did not smoke and was taking steps to improve his fitness by attending a gym three times a week. He is married and has two children, aged 11 and 12 years. At the time of his heart attack he was working in a busy IT department of a company and was involved in local community sports clubs.

THIS CAN'T BE A HEART ATTACK...

On the day of his heart attack in October 2023, Michael was in the gym doing some exercises; they were more rigorous than usual, but nothing too extraordinary. He felt more tired than he usually did and stopped after 45 minutes. He left the gym with his wife and he began to feel some chest pain; it was more discomfort than pain, like a pressure or mild tightness. Then Michael began to feel pins and needles in his hands and feet, which did cause some concern. When he got home, he lay down on the bed and began to feel worse; he felt a little breathless and had a feeling of sickness in his stomach. His wife called the general practitioner (GP), and she and Michael went to the surgery immediately. On the way Michael felt much worse, with increasing breathlessness and nausea. By the time he got to the GP it was clear to the GP that Michael was having a heart attack. The GP performed an electrocardiogram (ECG) and confirmed it was a heart attack (ST elevation myocardial infarction (STEMI)). The GP called 999 and gave Michael aspirin and glyceryl trinitrate (GTN) spray.

"HE HAD NO HEALTH PROBLEMS, WAS NOT OVERWEIGHT, DID NOT SMOKE AND WAS TAKING STEPS TO IMPROVE HIS FITNESS BY ATTENDING A GYM THREE TIMES A WEEK."

MEN: KNOW THE SYMPTOMS OF A HEART ATTACK AND REACT TO THEM.

EVERYTHING HAPPENED SO QUICKLY!

Michael cannot remember the details of the next couple of hours but recalls the speed and urgency of the paramedics. He heard the communications between the paramedics and the cardiac team in University Hospital Galway, and was blue-lighted through Galway city for emergency treatment. He was treated immediately and remembers his surprise that the procedure would be done through the vein in his arm. He was watching the procedure on the screen and all the time not believing that this was happening to him. After the procedure he was cared for in the Coronary Care Unit in University Hospital Galway and was discharged home 4 days later. He cannot remember the names of all those who cared for him but knows they were all brilliant. All his questions were answered, and he received information about all aspects of his care and booklets on medication and on aftercare before he left the hospital.

WHAT HAPPENED NEXT?

The advice Michael was given when he was discharged home was to take it easy and so, for the next few weeks, he rested, took short walks, watched TV and read books. He took more walks and by December he felt good. On one occasion, he recalls that he did too much and began to feel similar feelings of fluttering and discomfort in his

PARAMEDICS' ADVICE: DON'T FEEL STUPID RINGING 999, YOU KNOW YOUR BODY, YOU KNOW IF THERE IS SOMETHING OUT OF THE ORDINARY AND IF THERE IS YOU BETTER GET IT CHECKED OUT.

chest; this was frightening and so this time he called 999 immediately. The paramedics again were very reassuring and supportive. He was told by the paramedics, "Don't feel stupid ringing 999, you know your body, you know if there is something out of the ordinary and if there is you better get it checked out."

His ECG did not show another heart attack, but Michael was brought to hospital for further investigation, which indicated that he was recovering well with very little damage done to his heart. He was now waiting for cardiac rehabilitation and the cardiology team encouraged Michael to keep in contact with the cardiac rehabilitation team in order to access it as soon as possible. Despite this, he did not begin cardiac rehabilitation until mid-February 2024. Cardiac rehabilitation should have been available in a local community hub, but there was no physiotherapist available due to the Health Service Executive recruitment embargo, and so he had to travel to Merlin Park University Hospital to access cardiac rehabilitation there. Michael had 12 sessions of cardiac rehabilitation and found that to be brilliant. He was monitored while doing exercise, which meant that the team could push him to go further each week, which felt very reassuring. The education and support sessions were very informative and Michael often utilised techniques such as relaxation when at home.

CARDIAC REHABILITATION WAS BRILLIANT. IT WAS VERY REASSURING BEING MONITORED WHILE EXERCISING.

Michael is now gaining strength and confidence. He remains involved in the local sports club, does work about the house and spends quality time with his family. His focus on life feels different after this experience and he does sometimes feel anxious about his health. He was offered counselling and does use some techniques to help when he feels anxious. He remains off work but is hoping to return to work on a phased basis and perhaps look at other options in the next few months.

"MICHAEL IS NOW GAINING STRENGTH AND CONFIDENCE. HE REMAINS INVOLVED IN THE LOCAL SPORTS CLUB, DOES WORK ABOUT THE HOUSE AND SPENDS QUALITY TIME WITH HIS FAMILY."

ANY WORDS OF ADVICE?

Michael knew there was something wrong but didn't recognise his symptoms as a heart attack. His symptoms did not match up to his perceived image of someone who would have a heart attack: someone who is older, unhealthy, with severe chest pain, doubled over, sweating and breathless. Michael's symptoms were subtle, but nevertheless, he knew something was wrong. He would like men in particular not to ignore any symptoms, even something minor, but to just get it checked.

WHAT CAN WE LEARN FROM MICHAEL'S STORY?

Michael was not aware of the early and subtle signs of heart attack, and his instinct was to put his symptoms down to other things. He did not know to call 999 for a prompt diagnosis. This is important as we know he is not alone: only one-half of the people whose data are included in this report called an ambulance with their symptoms. Michael's story supports our call for a public awareness campaign to encourage people with heart attack symptoms to call 112 or 999 for emergency help immediately in order to facilitate pre-hospital ECG diagnosis of a STEMI, timely treatment, and reduced heart muscle damage and loss of life.

"MICHAEL WAS NOT AWARE OF THE EARLY AND SUBTLE SIGNS OF HEART ATTACK, AND HIS INSTINCT WAS TO PUT HIS SYMPTOMS DOWN TO OTHER THINGS."

CHAPTER 1
INTRODUCTION

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CHAPTER 1: **INTRODUCTION**

INTRODUCTION

In the European Union, ischaemic heart disease remains the single largest cause of death, responsible for more than 860,000 deaths (19% of all deaths) among men and almost 880,000 deaths (20% of all deaths) among women each year (Wilkins *et al.*, 2017). There are two broad types of heart attack, classified by findings on the electrocardiogram (ECG): ST elevation myocardial infarction (STEMI) and non-ST elevation myocardial infarction (NSTEMI). In Ireland, heart attacks affect an estimated 6,000 people per year (National Office of Clinical Audit, 2022a).

WHAT IS A HEART ATTACK?

A heart attack is a life-threatening medical emergency in which the blood supply to the heart is suddenly cut off, usually by a blood clot (thrombosis) forming at the site of a pre-existing narrowing or blockage, which can be relatively mild. The abrupt lack of blood supply to the heart can seriously damage the heart muscle. If left untreated, the heart muscle downstream from the blockage will begin to die. The extent of the damage is broadly correlated with the amount of muscle supplied by the blocked artery and the length of time the muscle is deprived of blood. After a finite time, this damage is irreversible.

Symptoms of a heart attack include (Figure 1.1):

- new, persistent chest pain: the chest can feel like it is being pressed or squeezed by a heavy object, and the pain can radiate from the chest to the jaw, neck, arms and back
- new, persistent shortness of breath.

In female patients, older patients or patients with diabetes, heart attacks can present with different symptoms, milder symptoms, or vague symptoms such as abdominal pain, confusion or sweatiness. These are sometimes called atypical symptoms and can make it more difficult to diagnose a heart attack (Ibanez *et al.*, 2018).

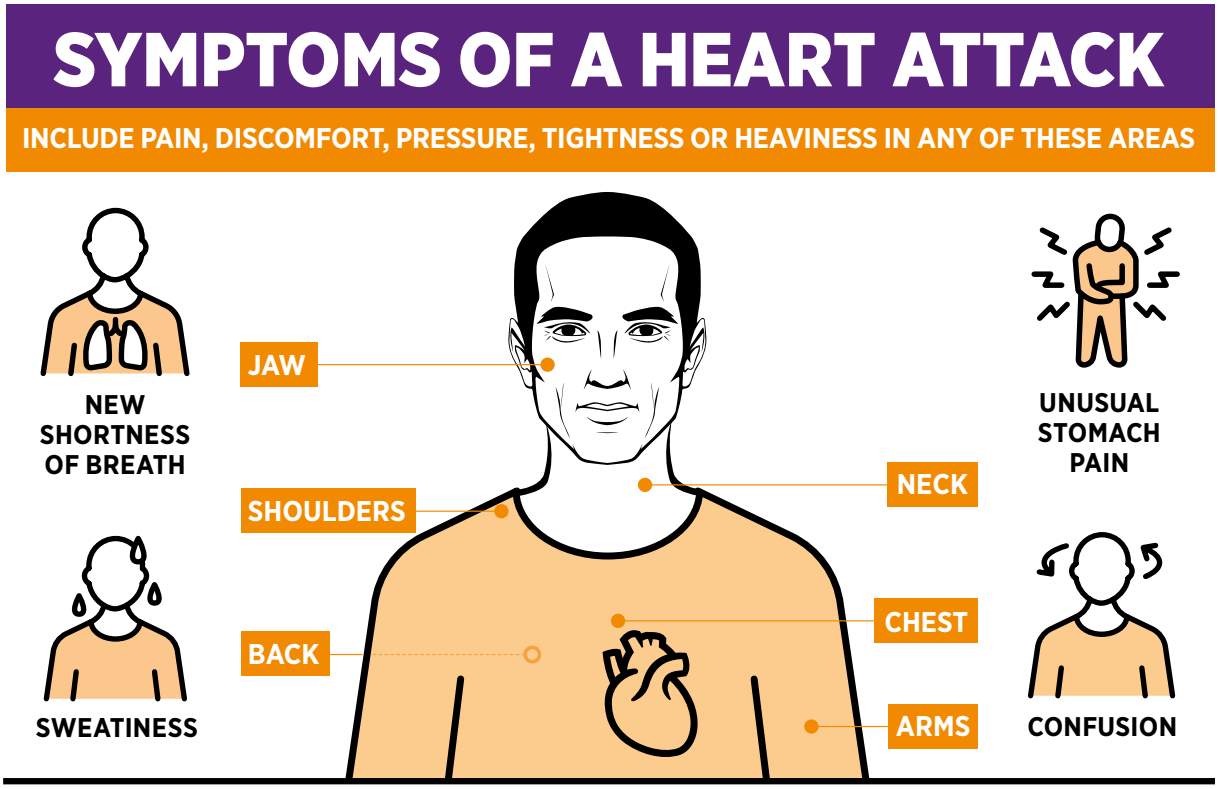
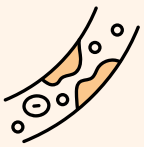


FIGURE 1.1: SYMPTOMS OF A HEART ATTACK

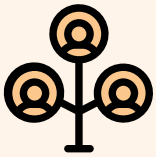
RISK FACTORS FOR CORONARY HEART DISEASE (CHD)

CURRENT OR FORMER SMOKING



ELEVATED CHOLESTEROL LEVELS

DIABETES



FAMILY HISTORY OF PREMATURE CHD

HIGH BLOOD PRESSURE

BEING OVERWEIGHT OR OBESE

Risk factors for coronary heart disease (CHD) include:

- current or former smoking
- elevated cholesterol levels
- diabetes
- family history of premature CHD (a first-degree relative aged under 60 years with a heart attack or coronary disease)
- high blood pressure
- being overweight or obese.

Several additional conditions have more recently been recognised as risk factor equivalents for CHD, including long-term inflammatory disorders such as rheumatoid arthritis and other inflammatory arthritis; inflammatory skin disorders such as psoriasis; and inflammatory bowel disease.

STEMIs are major heart attacks caused by a blockage in the main arteries supplying blood to the heart muscle (think of a blockage on a motorway and how it would affect traffic flow). STEMIs account for about one-quarter of all heart attacks each year in Ireland.

NSTEMIs are different from STEMIs in that blood flow in the coronary artery is only partially interrupted. NSTEMIs may be associated with waxing and waning symptoms occurring on and off over several hours or days. NSTEMIs account for about three-quarters of annual heart attack admissions in Ireland and are initially treated medically. The management of NSTEMIs is currently outside the scope of the Irish Heart Attack Audit (IHAA). The IHAA has stated that it plans to expand its audit to include NSTEMI care. In order to successfully operationalise this, it has begun a pilot collaboration project with the National Heart Programme, the Health Service Executive (HSE), the Coronary Heart Attack Ireland Register and EuroHeart[2] to establish the feasibility of and requirements to expand the IHAA to include NSTEMI care. Further information is provided in Chapter 9.

[2] EuroHeart is a European Society of Cardiology initiative to establish national quality registries on cardiovascular diseases across Europe.

HOW ARE PEOPLE WHO HAVE A STEMI TREATED IN IRELAND?

Early recognition and treatment of heart attack is critical to the outcome. STEMIs are diagnosed using 12-lead ECG machines. They are treated urgently with reperfusion (restoring blood flow), either by use of a clot-dissolving drug (thrombolysis) or by insertion of a wire into the artery in order to open it with a balloon and stent (metal scaffold) and allow blood to flow to the heart muscle again (percutaneous coronary intervention (PCI)). The internationally recognised gold standard treatment for STEMI is to perform emergency reperfusion within 120 minutes of first medical contact (FMC). This is known as primary PCI (sometimes referred to as primary angioplasty) and can only be done in a hospital equipped with an emergency catheterisation laboratory (cath lab). In 2013, the National Clinical Programme for Acute Coronary Syndrome (NCP-ACS) implemented an optimal reperfusion service (ORS) (Figure 1.2) protocol for the care of patients with a STEMI, with the aim of saving lives by standardising care across the country. Further information on the ORS protocol and the indicators underpinning the Heartbeat dataset is provided in the *Irish Heart Attack Audit National Report 2017-2020* (National Office of Clinical Audit, 2022a). Transport timelines in the updated 2023 European Society of Cardiology acute coronary syndromes guideline (Byrne *et al*., 2023) remain unaltered.

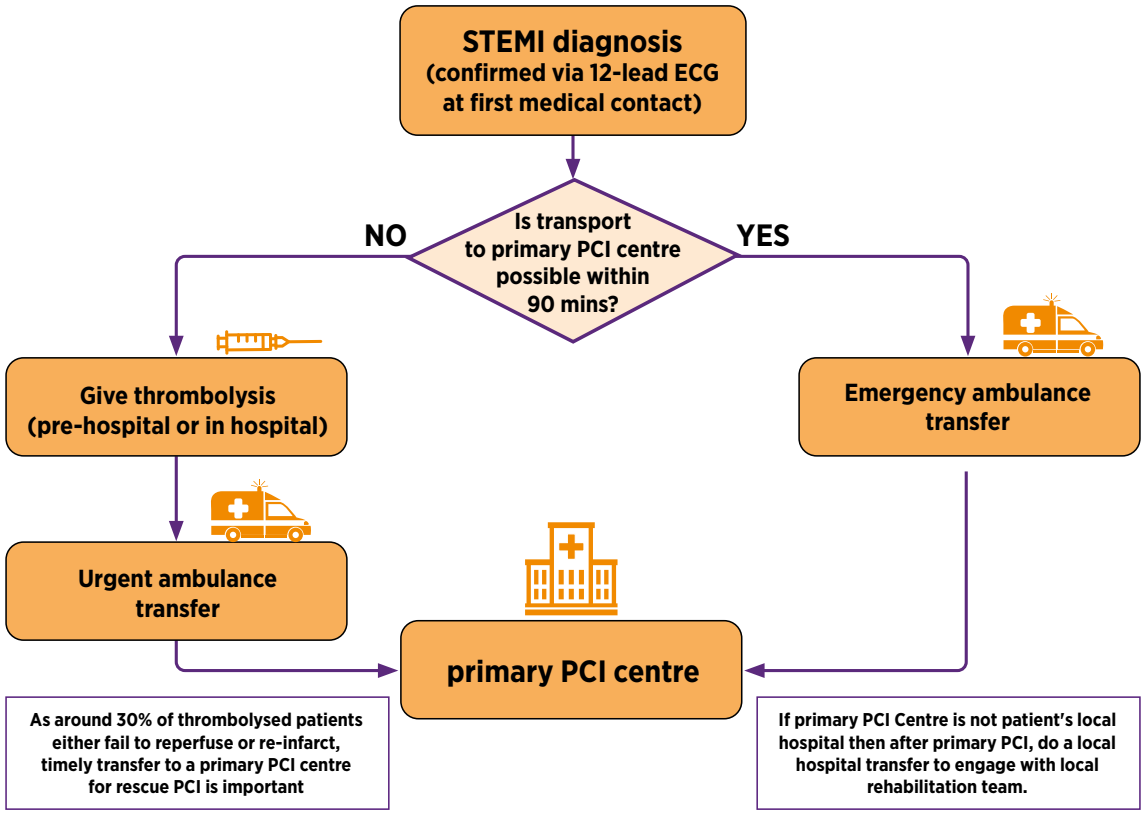


FIGURE 1.2: OPTIMAL REPERFUSION SERVICE PROTOCOL. SOURCE: HSE (2012)

In 2023, the IHAA, in conjunction with the HSE Health Intelligence Unit, undertook a mapping exercise, which indicated that 92% of the population aged 55 years and over lived within a 90-minute drive of one of the six 24/7 primary PCI centres in Ireland; this figure was 95% if University Hospital Waterford was included in the analysis (National Office of Clinical Audit, 2023a).

Currently, seven primary PCI centres are designated to receive patients with a STEMI brought directly by emergency ambulance. Six provide 24/7 access and one provides access from 8.00am to 8.00pm, Monday to Friday. For parts of Donegal, Altnagelvin Area Hospital in Derry provides 24/7 coverage as part of a cross-border care arrangement between the HSE and the United Kingdom's National Health Service. A further three hospital PCI centres provide primary PCI from 9.00am to 5.00pm, Monday to Friday, for patients with a STEMI who self-present to the PCI centre or who are already inpatients (Table 1.1). The term 'PCI centre' is used in this report to refer to both designated primary PCI centres and non-designated, 9.00am to 5.00pm weekday PCI centres.

TABLE 1.1: PERCUTANEOUS CORONARY INTERVENTION CENTRES

Designated primary PCI centres	9.00am–5.00pm weekday PCI centres
Cork University Hospital: 24/7	Beaumont Hospital***
Letterkenny University Hospital (in cooperation with Altnagelvin Area Hospital):* 24/7	St Vincent's University Hospital***
Mater Misericordiae University Hospital: 24/7	Tallaght University Hospital***
St James's Hospital: 24/7	
University Hospital Galway: 24/7	
University Hospital Limerick: 24/7	
University Hospital Waterford: 8.00am–8.00pm, Monday–Friday**	

* Patients in Donegal with a STEMI who receive primary PCI in Altnagelvin Area Hospital are transferred to Letterkenny University Hospital for all further STEMI care.

** University Hospital Waterford expanded the primary PCI service to be provided from 8.00am to 8.00pm, Monday to Friday, in September 2022. Prior to that, University Hospital Waterford provided primary PCI to patients with a STEMI from 8.00am to 5.00pm, Monday to Friday.

***These PCI centres are primarily for patients who self-present or who are inpatients in these hospitals when a STEMI is diagnosed. They provide a PCI service between 9.00am and 5.00pm on weekdays only.

PURPOSE OF THIS REPORT

This report both describes the quality of care provided to patients with a STEMI in 2022 and 2023 from all 10 hospitals providing a primary PCI service using Heartbeat data, and measures the quality of care provided against best practice standards and key quality indicators (KQIs), in order to inform recommendations for improvement.

This report compares hospital-to-hospital performance of processes and outcomes. This report was prepared by a multidisciplinary writing group and overseen by the IHAA Governance Committee.

WHO IS THIS REPORT AIMED AT?

The *Irish Heart Attack Audit National Report 2022 and 2023* is intended for use by a wide range of individuals and organisations, including:

1. patients and carers
2. patient advocacy organisations
3. healthcare professionals involved in heart attack care and primary PCI; clinicians, hospital managers; Hospital Groups
4. policy-makers
5. researchers.

The report has been designed in two parts:

1. The *Irish Heart Attack Audit National Report 2022 and 2023* presents the key findings of the IHAA, case mix, patient pathway, and outcomes.
2. The *Irish Heart Attack Audit National Report, 2022 and 2023: Summary Report* will be of particular interest to patients, patient organisations and the public.

CHAPTER 2
METHODOLOGY

CONTENTS

CHAPTER 2: **METHODOLOGY**

THE IRISH HEART ATTACK AUDIT

The IHAA is a clinically led audit that uses the Heartbeat dataset, which was developed in 2012 by the NCP-ACS in order to monitor the care provided to patients with a STEMI. The origins of the monitoring programme were described in the *Irish Heart Attack Audit National Report 2017-2020* (National Office of Clinical Audit, 2022a). In 2019, governance of Heartbeat was transferred to the National Office of Clinical Audit (NOCA) and the IHAA Governance Committee was established. Appendix 1 outlines the aim and objectives of the IHAA.

The IHAA Governance Committee oversees the IHAA, and its membership comprises clinical experts, Public and Patient Interest representatives, the Healthcare Pricing Office (HPO), senior accountable healthcare management, and research and specialist bodies (Appendix 2).

DATA SOURCES

Heartbeat data are entered into the Hospital In-Patient Enquiry (HIPE) system. The Heartbeat dataset, as defined in the IHAA data dictionary (NOCA, 2024) was collected on all cases admitted to a PCI centre following activation of the ORS protocol (Figure 1.2) and submitted by each hospital to the HIPE system via the Heartbeat portal. HIPE is the principal source of national data on discharges from acute hospitals in Ireland. It collects demographic, clinical and administrative data on discharges from, and deaths in, acute public hospitals nationally.

The reference population for this national report is limited to patients aged 18 years and over. The HIPE data and the Heartbeat data were merged within HIPE to form an anonymised dataset before being sent to NOCA.

DATA COLLECTION

Each PCI centre has a nominated audit coordinator (usually an experienced cardiology nurse who has been formally trained in the Heartbeat dataset and data entry) and a clinical lead who leads on cardiac service governance within the hospital (Figure 2.1). The audit coordinator enters the data into the Heartbeat portal for the PCI centre. If a patient is discharged from a PCI centre to another hospital, follow-up data are sourced, where possible, by the audit coordinator in the PCI centre and entered into the Heartbeat portal. If this information is unavailable, it should be recorded as 'unknown'. Consequently, the PCI centres carry the responsibility for recording the care of patients with a STEMI in conjunction with their referring hospitals. It is likely that a small number of patients who are admitted to a hospital without a cath lab may not transfer to a PCI centre due to specific contraindications and/or comorbidities. They are not recorded in the Heartbeat portal. All data related to cross-border care are submitted by the audit coordinator in Letterkenny University Hospital.

DATA VALIDATION

Several validations are built into the design of the Heartbeat portal in order to display messages when an apparently illogical sequence is encountered. In addition, a number of mandatory fields (mainly admission and reperfusion data) require entry before data can be stored. In 2020, the NOCA data analytics and research team developed a data validation process for the IHAA. This process involves the data analyst producing a report of any missing information within the data and any data anomalies. This report is sent quarterly to the audit coordinators, who amend the record.

DATA ANALYSIS

NOCA received the Heartbeat data from the HPO for the 2022 reporting period on 13 April 2023, and for the 2023 reporting period on 19 April 2024. The NOCA Data Analyst completed the analysis following data checks with the HPO. The analysis was conducted using Statistical Package for the Social Sciences V25. Where appropriate, statistical tests were applied. The chi-squared statistical test was used for binary and categorical data points. Where appropriate, independent sample *t*-tests were used in order to determine the statistical difference in the means of the continuous data points. As a measure of statistical uncertainty, 95% confidence intervals were presented for the means of numerical data points. Where the observed *p*-value was less than or equal to 0.05, this was considered to indicate statistical significance.

In 2022, the NOCA data analytics and research team as well as the IHAA Clinical Lead and Audit Manager commenced a project to develop a risk-adjusted in-hospital mortality model for the IHAA and a management strategy in order to manage statistical outliers. The Global Registry of Acute Coronary Events (GRACE) model was used in order to estimate expected mortality, which then was used to calculate standardised mortality ratios, which were plotted using funnel plots (see Chapter 7). For a detailed description of the project, including the GRACE model and funnel plots, see Chapter 9.

INCLUSION CRITERIA

The analysis in this report is based on records captured on the Heartbeat portal. It includes patients who were:

i discharged between 1 January 2022 and 31 December 2023, inclusive
ii aged 17 years and over.

EXCLUSION CRITERIA

This report excludes patients who:

i were aged 16 years and under
ii died in the emergency department (ED) before treatment could be initiated.

INDICATORS OF CARE

There are internationally validated and widely accepted quality indicators for benchmarking the processes and quality of treatment of patients with a STEMI (see Appendix 3). These indicators reflect key, evidence-based elements of pre-hospital emergency diagnosis, pre-hospital emergency treatment, and hospital treatment on admission and on discharge, which promote best outcomes in terms of mortality and morbidity. Ten key performance indicators (KPIs) were defined in the *Acute Coronary Syndromes Programme Model of Care* (HSE, 2012), and two of these KPIs are reported quarterly to the HSE's Business Intelligence Unit and inform the HSE's annual National Service Plan. In 2021, the following nine KQIs were agreed by the IHAA Governance Committee to be reported quarterly via the NOCA dashboard reporting system:

1. percentage of eligible patients with a STEMI who received reperfusion
2. percentage of patients with a STEMI who were brought directly to a primary PCI centre who had timely primary PCI
3. percentage of patients with a STEMI who were transferred from a non-primary PCI-capable hospital to a primary PCI centre who had timely primary PCI
4. percentage of patients with a STEMI who had radial access for primary PCI
5. percentage of patients with a STEMI who were discharged with an appropriate secondary prevention medication discharge bundle
6. percentage of patients with a STEMI who actively smoke who were offered smoking cessation advice
7. percentage of eligible patients with a STEMI who were referred for cardiac rehabilitation phase 3
8. percentage completeness of the 'survival status at 30 days' data point recorded in Heartbeat
9. percentage of patients who have a cardiac rehabilitation phase 3 date recorded.

The NOCA dashboard is available in each PCI centre and the KQI results for 2022 and 2023 are highlighted throughout this report. The metadata for each KQI are available in Appendix 4, and the result of each KQI for 2022 and 2023 is reported within the findings. Frequency tables for each figure are available in Appendix 5.

EVIDENCE SYNTHESIS AND RECOMMENDATION FORMATION

A writing group – comprising the IHAA Clinical Lead; the IHAA Governance Committee Chairperson; one interventional cardiologist participating in primary PCI; one consultant in public health medicine; one representative from the National Ambulance Service (NAS); one representative from the HPO; the IHAA Audit Manager; the IHAA Assistant Audit Manager; and the NOCA Data Analyst – was established in order to plan and write this report. Following data analysis, the NOCA Data Analyst provided the IHAA writing group with figures and analytical commentary, while the IHAA Audit Manager provided additional clinical commentary, and meetings were held in order to review, edit and interpret the results. The key findings were agreed on by the writing group and recommendations were developed by consensus. In 2024, the HSE National Centre for Clinical Audit (NCCA) introduced a new process related to the development of recommendations. Once the recommendations and owners were agreed by the writing group, these were provided to the HSE NCCA for review. Once recommendations were accepted by the HSE NCCA, NOCA engaged with all recommendation owners in order to ensure their acceptance of the recommendations. The HSE NCCA will track the implementation of recommendations and provide updates to NOCA for the next report.

FIGURE 2.1

HOSPITALS WE WORK WITH

NOTE: Dublin Hospitals have been displayed collectively by hospital group

HSE WEST AND NORTH WEST
University Hospital Galway
Letterkenny University Hospital

**ALTNAGELVIN HOSPITAL*
IHAA uses data from Altnagelvin Hospital, which provides 24/7 primary PCI coverage for parts of Donegal as part of a cross-border care arrangement between the HSE and the NHS.

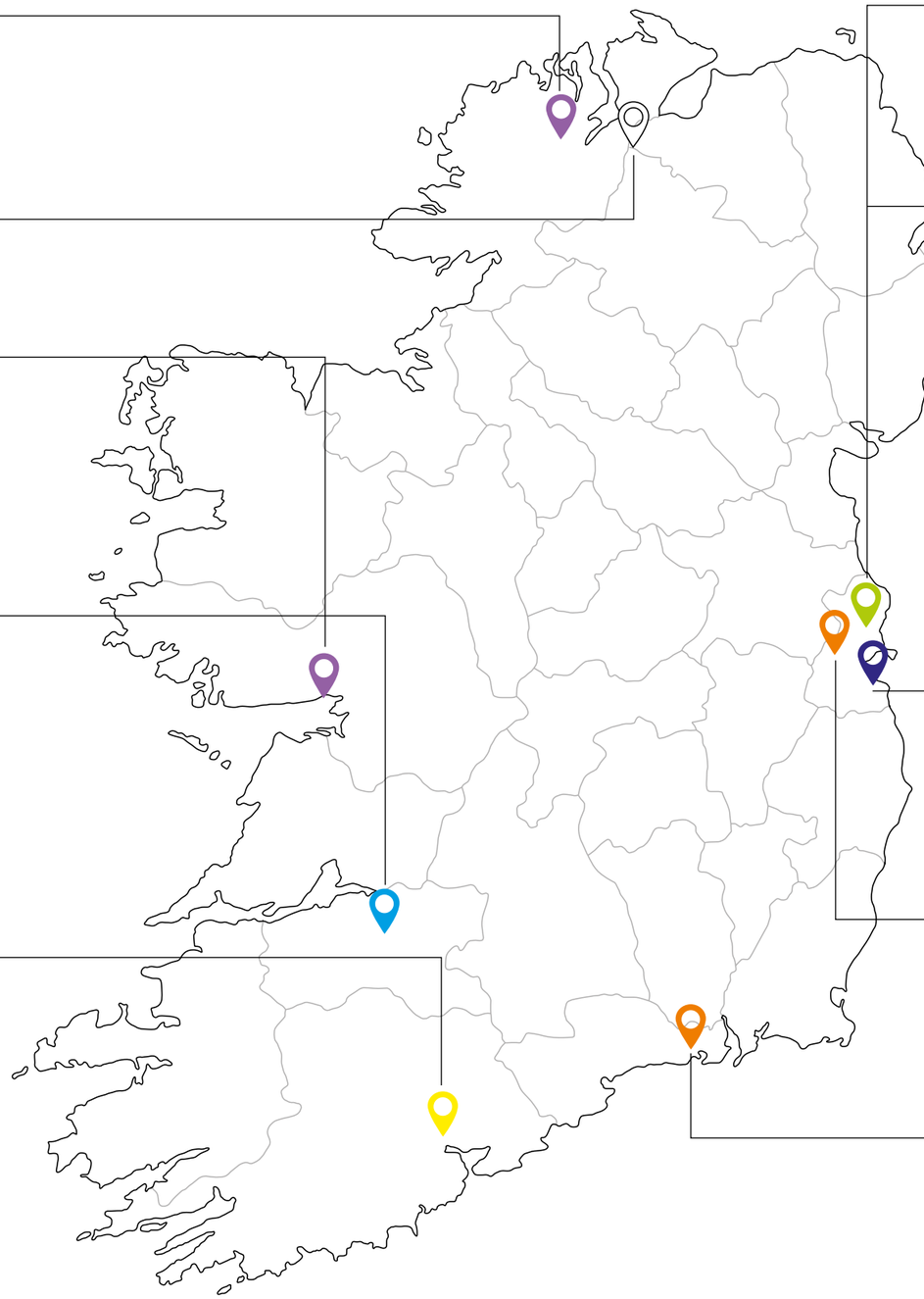
HSE MID WEST
University Hospital Limerick

HSE SOUTH WEST
Cork University Hospital

HSE DUBLIN AND NORTH EAST
Beaumont Hospital
Mater Misericordiae University Hospital

HSE DUBLIN AND MIDLANDS
St James's Hospital
Tallaght University Hospital

HSE DUBLIN SOUTH EAST
St Vincent's University Hospital
University Hospital Waterford



LETTERKENNY UNIVERSITY HOSPITAL
IHAA CLINICAL LEAD: Dr Santosh David
IHAA AUDIT COORDINATOR: Sreeji Kurup

ALTNAGELVIN HOSPITAL*
IHAA CLINICAL LEAD: Dr Godfrey Aleong

UNIVERSITY HOSPITAL GALWAY
IHAA CLINICAL LEAD: Dr James Crowley
IHAA AUDIT COORDINATOR: Mary Hynes

UNIVERSITY HOSPITAL LIMERICK
IHAA CLINICAL LEAD: Dr Samer Arnous
IHAA AUDIT COORDINATOR: Breda McDermott, Catriona Ahern

CORK UNIVERSITY HOSPITAL
IHAA CLINICAL LEAD: Dr Jack Laffan
IHAA AUDIT COORDINATOR: Yvonne McConnon

BEAUMONT HOSPITAL
IHAA CLINICAL LEAD: Dr Mark Kennedy
IHAA AUDIT COORDINATOR: Ciara Power

MATER MISERICORDIAE UNIVERSITY HOSPITAL
IHAA CLINICAL LEAD: Prof. Gavin Blake
IHAA AUDIT COORDINATOR: Elizabeth O'Connor, Jamie Byrne

ST JAMES'S HOSPITAL
IHAA CLINICAL LEAD: Prof. Andrew Maree, Dr Ian Pearson
IHAA AUDIT COORDINATOR: April Villalobos

TALLAGHT UNIVERSITY HOSPITAL
IHAA CLINICAL LEAD: Dr David Moore
IHAA AUDIT COORDINATOR: Catherine Markham

ST VINCENT'S UNIVERSITY HOSPITAL
IHAA CLINICAL LEAD: Dr Charles McCreery
IHAA AUDIT COORDINATOR: Erica Carty

UNIVERSITY HOSPITAL WATERFORD
IHAA CLINICAL LEAD: Dr Patrick O'Callaghan
IHAA AUDIT COORDINATOR: Mairead Hanrick

CHAPTER 3
DATA QUALITY STATEMENT

Coverage of Data Release

Completeness of Data Release

Accuracy of Data Release

CONTENTS

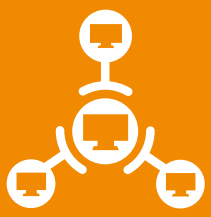
CHAPTER 3: DATA QUALITY STATEMENT FOR THE *IRISH HEART ATTACK NATIONAL REPORT 2022 AND 2023*

This chapter provides an assessment of the quality of the IHAA data in this report using internationally agreed dimensions of data quality (Health Information and Quality Authority, 2018). Table 3.1 describes the context of the data in this report, Table 3.2 outlines the characteristics of the data quality within this report and Table 3.3 provides an overall assessment of the quality of the data in this report.

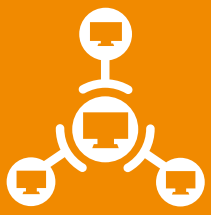
TABLE 3.1: CONTEXT OF DATA IN THIS REPORT

SCOPE	This data quality statement provides an assessment of the Heartbeat data released for this report in 2022 and 2023. This statement solely focuses on the data quality dimension of 'accuracy and reliability', and specifically on the following characteristics: • coverage of data release • completeness of data release • accuracy of data release.
PURPOSE	This will help the reader decide whether the data are fit for the user's specific purpose.
DATA SOURCE	Data for this report have been extracted from the HIPE system, which includes data submitted to the Heartbeat portal within HIPE.
TIMEFRAME OF DATA RELEASE	The data released in this report are based on data reported between 1 January 2022 and 31 December 2023.
TYPE OF DATA	Final

TABLE 3.2: CHARACTERISTICS OF DATA QUALITY

Coverage of data release 	**DEFINITION** Coverage refers to calculating the number of patients with a STEMI who should have their care included in this audit, compared with the number of patients who are recorded in the Heartbeat portal. Data recorded in the Heartbeat portal refer to patients whose condition triggered the activation of the cath lab. Calculating coverage can be approached in two ways: 1. coverage across the country 2. degree of coverage. **1. COVERAGE ACROSS THE COUNTRY** For this report, data are included from all PCI centres (both designated primary PCI and non-designated, 9.00am to 5.00pm weekday PCI centres) (see Table 1.1). **2. DEGREE OF COVERAGE** Another approach to calculating coverage is to study HIPE records. However, there are difficulties with this approach.

Coverage of data release



First, HIPE does not use a unique patient identifier but instead records:

1. all episodes of STEMI, including patients who may not have accessed a PCI centre for reasons such as age and/or major comorbidities
2. patients who are transferred back to their local hospital from a PCI centre following treatment (these cases may each first be counted once as a case at the PCI centre, and then a second time as a case at the non-PCI-capable hospital).

As such, HIPE is likely to have a higher number of episodes of STEMI nationally than the number recorded in the Heartbeat portal.

Second, diagnostic coding for a small proportion of cases may differ between Heartbeat (data collected in real time by cardiac nurses) and the coding on HIPE, which depends on coder interpretation of clinical notes and the application of coding guidelines.

However, quantifying the number of cases with a principal diagnosis of a STEMI (International Classification of Diseases, Tenth Revision, Australian Modification (ICD-10-AM) codes I21.0, I21.1, I21.2 and I21.3) on HIPE in the PCI centres as a proportion of those recorded on Heartbeat does give an indication of coverage for the reporting period.

In 2023, a review was completed of cases coded as having a STEMI diagnosis but with no additional Heartbeat data, and of cases with Heartbeat data and no STEMI diagnosis coded by HIPE (see Chapter 9). This review found that it is not possible to assess coverage of Heartbeat cases accurately by comparing these against HIPE data. Recommendations were made to improve documentation and coding. In the interim, the IHAA will continue to assess coverage using HIPE data as an estimation.

Table 3.4 indicates the annual coverage for each PCI centre. There are two important points to highlight:

1. If a PCI centre had more STEMI cases recorded on Heartbeat than on HIPE, the PCI centre was recorded as having 100% coverage. This may occur due to variance in coding between hospitals.
2. In non-designated, 9.00am to 5.00pm weekday PCI centres, HIPE STEMI cases include those who received a primary PCI in their own hospital and those who received a primary PCI in another PCI centre and were transferred back. In order to estimate Heartbeat coverage in the non-designated PCI centres,[3] the number of cases submitted to Heartbeat (for primary PCIs performed in the hospital), plus the number of cases transferred to the hospital following primary PCI (whose data were recorded on Heartbeat in the PCI centre where the PCI was performed), were reported as the total number used to calculate coverage. This total was then calculated as a proportion of the total number of HIPE cases (see Table 3.4).

The total national coverage was 82% (1533/1879) in 2022 and 80% (1569/1974) in 2023. It is important to note that the total number of HIPE cases includes two episodes of care if a patient is admitted to two PCI centres. Estimating the coverage to account for this duplication is a more accurate calculation of PCI centre coverage. Table 3.4 indicates that eight out of 10 PCI centres had a coverage of more than 80% in 2022. This increased to nine in 2023. Coverage of less than 80% was flagged in each figure when reporting by hospital (see Table 3.4). The absence of an audit coordinator impacted on coverage in two hospitals.

[3] University Hospital Waterford is included in this, as it is providing primary PCI between 8.00am and 8.00pm on weekdays only.

Completeness of data release

The number of data points in the Heartbeat dataset, as defined in the IHAA data dictionary (NOCA, 2024) was revised from 66 in 2021 to 78[4] in 2022 and 2023. Completeness of all data points is presented in Appendix 6. In 2022, there was more than 90% completeness for 65 data points. In 2023, 75 data points had more than 90% completeness.

In 2022, 11 of the 13 new data points had more than 90% completeness and in 2023, all 13 new data points had more than 90% completeness. As in previous IHAA reports (NOCA, 2022a; NOCA, 2023a), follow-up data remain challenging to collect. However, changes and improvements in the capture of follow-up data points between 2020 and 2023 are presented in Figure 3.1.

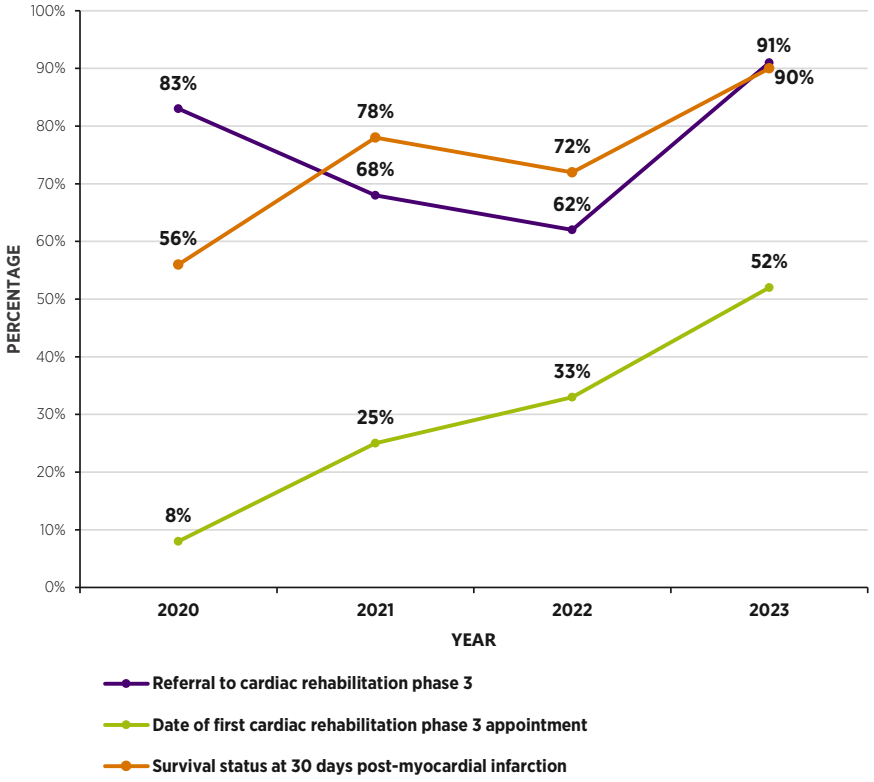


FIGURE 3.1: DATA COMPLETENESS IN FOLLOW-UP DATA, 2020–2023

The capture of follow-up data requires the audit coordinators to gather the data from another hospital. Without adequate resources for data collection and good networks between hospitals to collect the data, follow-up data can be missing. Chapter 8 presents a case study from St James's Hospital where a quality improvement project was implemented that was aimed at improving data quality in follow-up data points, which resulted in increased data completeness in 2023.

Accuracy of data release

All data were reported, including missing or unknown data.

[4] 13 new data points were added and one was removed.

TABLE 3.3: ASSESSMENT OF DATA IN THIS REPORT

Strengths of data in this report	All hospitals eligible to participate in the IHAA are included. All hospitals have access to their own data and can run reports locally through the Heartbeat portal. Data validation reports are provided quarterly to all participating hospitals. Any commonly found inaccuracies were discussed at the bimonthly audit coordinator meetings in order to maximise compliance. A data dictionary and user manual are available and are updated annually in order to support the submission of accurate data. This report is now in a position to provide more outcome results than in previous reports. These additional outcome results include: ✓ 'door in door out' times for patients with a STEMI who are transferred from a non-PCI-capable hospital to the primary PCI centre ✓ door to first positive ECG times for patients with a STEMI who are transferred from a non-PCI-capable hospital to the primary PCI centre ✓ outcomes based on left ventricular function and Killip classification ✓ risk-adjusted mortality.
Limitations of data in this report	Two hospitals had less than 80% data coverage during the reporting period, and this was flagged in all figures where hospital-level results are reported. Data quality related to follow-up data points, while improving, is incomplete, and for some measures only data from 2023 can be presented. The logistic regression model coefficients that are available to be fitted for the GRACE probability of death were estimated in 2014 (Center for Outcomes Research, 2014), and therefore may be outdated and no longer appropriate. The logistic regression model coefficients can be developed using IHAA data; however, at the time of writing this report, there was not a sufficient amount of data for this implementation.

TABLE 3.4: COVERAGE OF HEARTBEAT CASES, BY PERCUTANEOUS CORONARY INTERVENTION CENTRE

Primary PCI centre	Year	Number of cases submitted to Heartbeat	Number of Heartbeat cases with a discharge diagnosis of a STEMI	Number of Heartbeat cases with a discharge diagnosis of a STEMI entered in Heartbeat by another PCI centre where the intervention occurred	Coverage numerator: number of cases used to calculate coverage by PCI centre	Coverage denominator: number of cases with a HIPE principal diagnosis of a STEMI	Coverage
DESIGNATED PRIMARY PCI CENTRES							
Mater Misericordiae University Hospital	2022	461	382	N/A	382	425	90%
	2023	396	340	N/A	340	415	82%
St. James's Hospital, Dublin*	2022	450	410	N/A	410	432	95%
	2023	435	392	N/A	392	443	88%
Cork University Hospital**	2022	243	227	N/A	227	216	100%
	2023	295	261	N/A	261	296	88%
Letterkenny University Hospital	2022	56	42	N/A	42	45	93%
	2023	55	47	N/A	47	47	100%
University Hospital Limerick	2022	228	185	N/A	185	188	98%
	2023	254	194	N/A	194	198	98%
Galway University Hospitals	2022	209	163	N/A	163	209	78%
	2023	213	197	N/A	197	233	85%
St. Vincent's University Hospital	2022	9	8	72	80++	109	73%
	2023	30	21	47	68++	100	68%
University Hospital Waterford+	2022	102	81	10	91++	86	100%
	2023	115	85	14	99++	89	100%
Beaumont Hospital, Dublin**	2022	28	20	81	101++	101	100%
	2023	14	9	65	74++	87	85%
Tallaght University Hospital	2022	17	15	53	68++	62	100%
	2023	29	23	53	76++	66	100%

* The sequencing of HIPE diagnoses in St James's Hospital has been updated since 2021 (NOCA, 2023a) and is now aligned with another PCI centres.
** PCI centres that have more cases submitted to Heartbeat than the number of HIPE cases are counted as having 100% coverage.
\+ University Hospital Waterford increased its primary PCI service to be provided from 8.00am to 8.00pm, Monday to Friday, in September 2022. Prior to that, University Hospital Waterford provided primary PCI to patients with a STEMI from 8.00am to 5.00pm, Monday to Friday.
++ This number is the sum of cases submitted to Heartbeat by the PCI centre and cases submitted by another PCI centre where the patient was also treated.

CHAPTER 4

DEMOGRAPHIC AND CARDIOVASCULAR RISK FACTOR PROFILE

CONTENTS

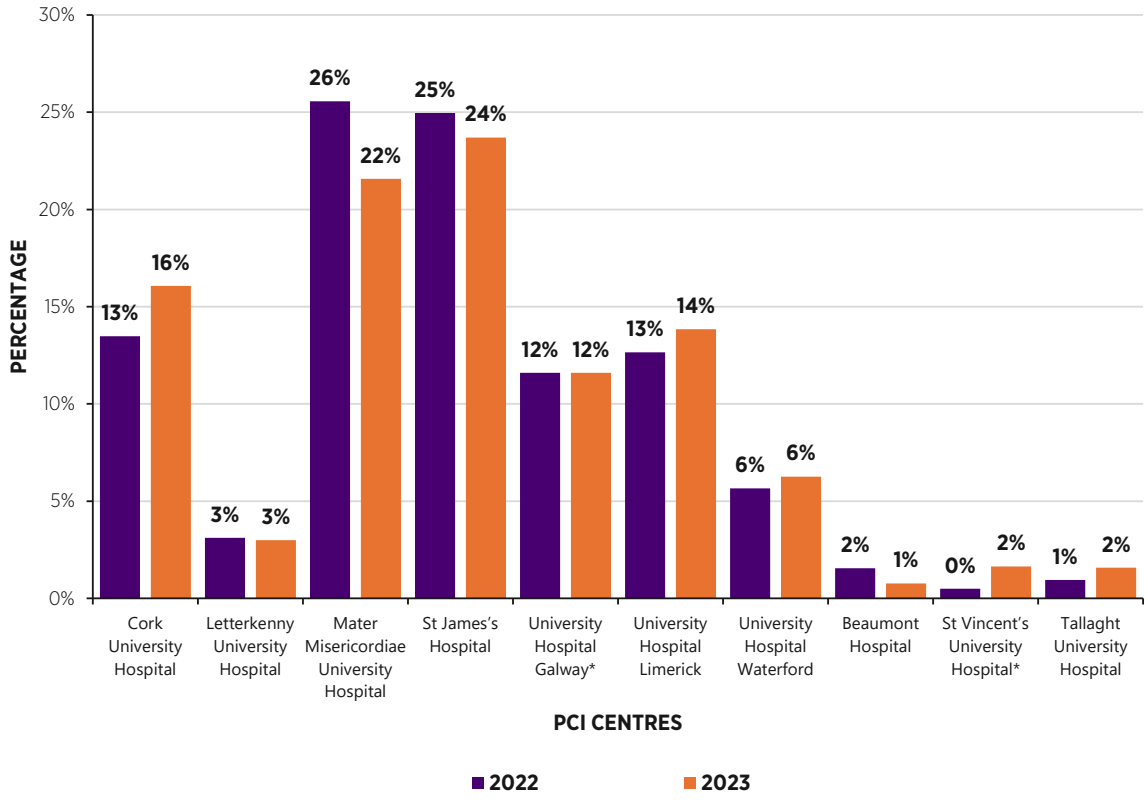
CHAPTER 4: DEMOGRAPHIC AND CARDIOVASCULAR RISK FACTOR PROFILE

SCOPE OF CHAPTER

Chapter 4 presents data on the demographic and cardiovascular risk factor profile of all cases submitted to the Heartbeat portal in 2022 and 2023. The data include only cases that triggered the ORS protocol (Figure 1.2) and subsequent admission to a PCI centre. Comparisons with the *Irish Heart Attack Audit National Report 2021* (NOCA, 2023a) and other international reports were made, where applicable. Emerging trends in age and sex demographics, comorbidities, and cardiovascular risk factors, including smoking, are outlined and discussed.

HEARTBEAT CASE SUBMISSIONS, 2022 AND 2023

A total of 1,803 cases were submitted to the Heartbeat portal during the 2022 reporting period and 1,836 during the 2023 reporting period. This was an increase from 1,742 cases in 2021. Figure 4.1 displays the proportion of all cases submitted by each participating hospital during the reporting periods. St James's Hospital and the Mater Misericordiae University Hospital together continue to receive almost one-half of all admissions to PCI centres.



* Coverage was below 80%.[5]

FIGURE 4.1: PROPORTION OF HEARTBEAT CASE SUBMISSIONS, BY PERCUTANEOUS CORONARY INTERVENTION CENTRE, BY YEAR (N=3639)

[5] Coverage was below 80% for University Hospital Galway in 2022, and for St Vincent's University Hospital in both 2022 and 2023.

INCIDENCE OF STEMI

Table 4.1 shows the incidence of STEMI per 10,000 and per 1 million of the total population in Ireland in 2016 and 2022. The crude incidence rate of STEMI has remained stable between 2016 and 2022 (402 per 1 million of the population in 2016 compared with 397 per 1 million of the population in 2022). The incidence of STEMI also increased with age. It was previously hypothesised that the incidence of STEMI may decrease in time with ageing population demographics, a reduction in population smoking rates and improvements in cardiovascular risk factor control. However, it is interesting to observe that the rate has remained static. Furthermore, with the incidence remaining stable, and as the population has grown over this time interval, it means that the PCI centres are treating a higher volume of cases per year, which places a strain on current service resourcing and has implications for future service planning given the projected future population growth.

TABLE 4.1: RATE OF ST ELEVATION MYOCARDIAL INFARCTION IN THE POPULATION, BY AGE GROUP AND YEAR

Year	Age group	Number of Heartbeat cases	Number of STEMI cases	Population in Ireland[6]	STEMI rate per 10,000 of the population	STEMI rate per 1 million of the population
2016[7]	**Total (aged 19 years and over)**	**1748**	**1412**	**3 510 069**	**4.02**	**402.3**
2022	19–40 years	71	49	1 466 083	0.33	33.4
	41–64 years	930	790	1 621 422	4.87	487.2
	65–79 years	632	529	595 288	8.89	888.6
	≥80 years	202	165	181 027	9.11	911.5
	Total (aged 19 years and over)	**1835**	**1533**	**3 863 820**	**3.97**	**396.8**

[6] Central Statistics Office (2024).
[7] Data from 2016 did not include University Hospital Waterford.

CONFIRMED STEMI DIAGNOSIS AND ALTERNATIVE DIAGNOSES

Each case submitted to the Heartbeat portal as a possible STEMI had a confirmed discharge diagnosis. The potential diagnostic categories that could be recorded included: STEMI, NSTEMI, unstable angina, pericarditis, myocarditis, takotsubo cardiomyopathy, non-cardiac chest pain, and other/unknown. In 2022 and 2023, 85% of cases had a confirmed diagnosis of a STEMI, 10% had an alternative diagnosis, and 5% were reported as 'other/unknown' (Figure 4.2). The distribution of the diagnoses remains consistent with the 2021 figures.

In 2022, the most common alternative diagnosis was pericarditis (n=54, 29%), followed by non-cardiac chest pain (n=49, 26%). The most common alternative diagnoses in 2023 were NSTEMI (n=56, 31%) and non-cardiac chest pain (n=56, 31%). The breakdown of alternative discharge diagnoses is available by hospital in the supplementary frequency tables in Appendix 8. The proportion of STEMI diagnoses varied between hospitals and years, from 93% in Cork University Hospital in 2022 to 73% in non-designated 9.00am to 5.00pm, Monday to Friday PCI centres in 2023.

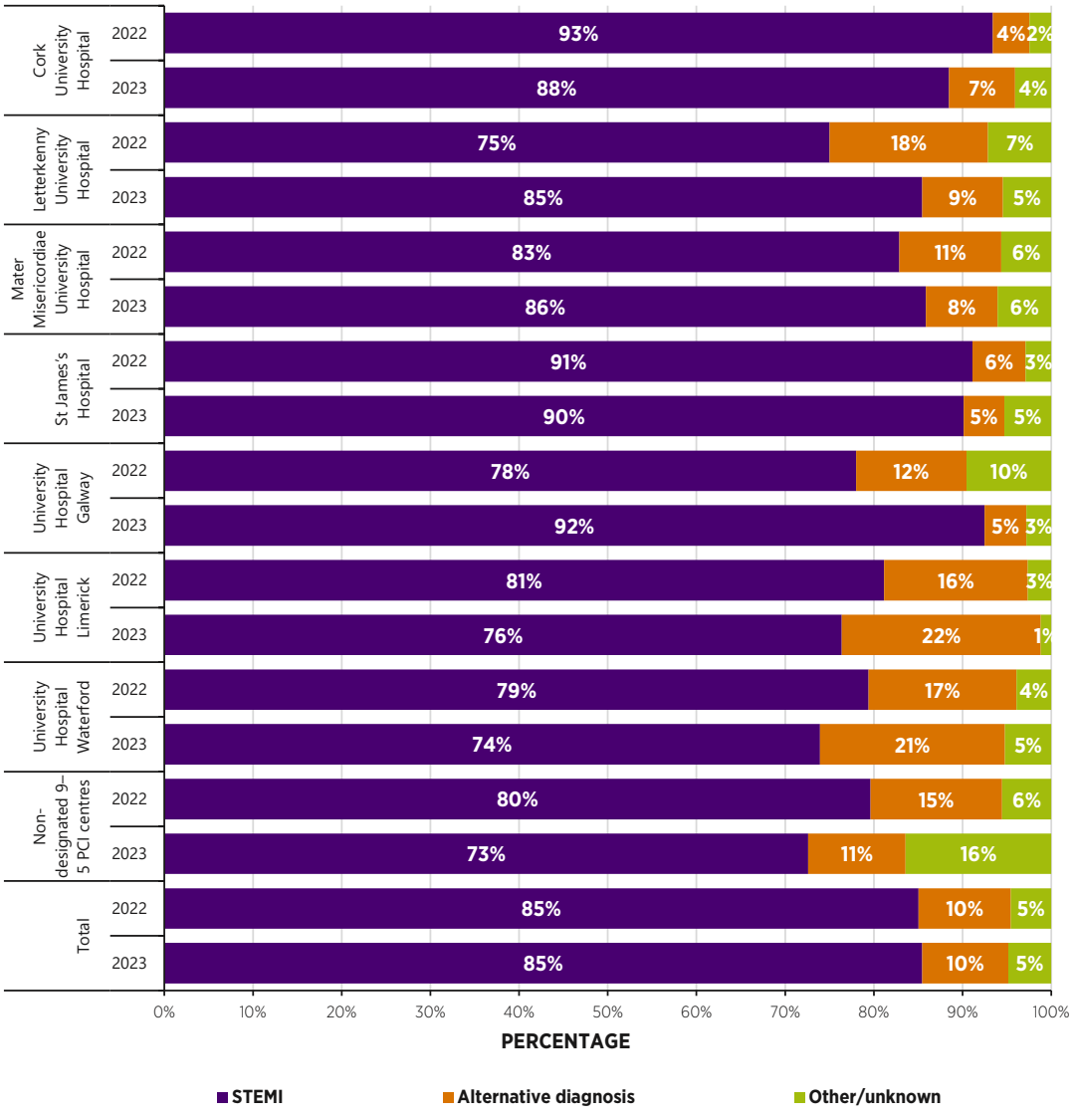


FIGURE 4.2: DISCHARGE DIAGNOSIS, BY PERCUTANEOUS CORONARY INTERVENTION CENTRE AND YEAR (N=3639)

STEMI, SEX AND AGE

Of the 3,102 patients with a confirmed diagnosis of a STEMI treated in PCI centres in 2022 and 2023 (Figure 4.3), the majority were male (n=2398, 77%), which is unchanged from 2021 (NOCA, 2023a).[8]

The mean and median age of patients with a STEMI in 2022 and 2023 was 63 years (interquartile range (IQR): 54–73 years), which is consistent with 2021 results. For males, the median age was 62 years (IQR: 53–71 years). The female patients with a STEMI were older, with a median age of 69 years (IQR: 60–78 years). There was a larger proportion of older females aged 65 years and over (n=434, 62%) compared with males (n=986, 41%).

For males, the median age was 62 years (IQR: 53–71 years)

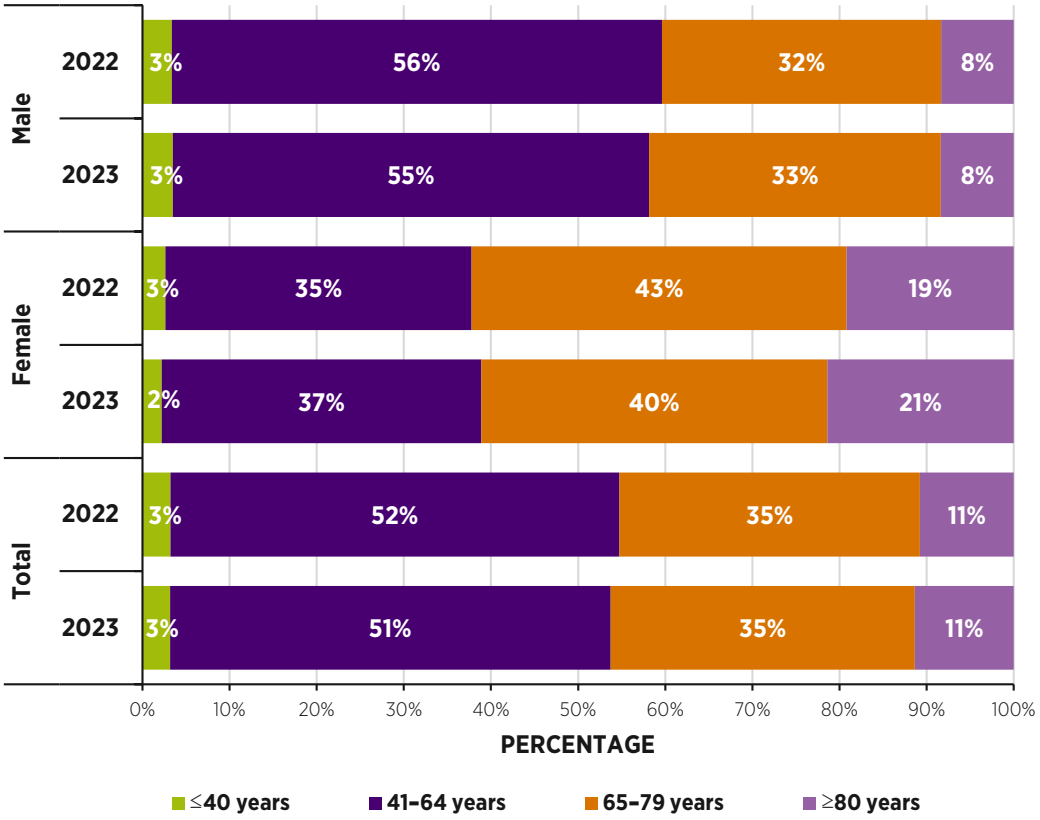


FIGURE 4.3: PERCENTAGE OF ST ELEVATION MYOCARDIAL INFARCTION CASES, BY SEX, AGE GROUP AND YEAR (N=3102)

[8] All references to 2021 results refer to this reference.

CARDIOVASCULAR DISEASE HISTORY AND KNOWN COMORBIDITY PROFILE OF PATIENTS WITH A STEMI

In 2022 and 2023, 31% (n=965) of patients with a STEMI had at least one known atherosclerotic cardiac diagnosis such as angina, a prior cardiovascular event such as a myocardial infarction (MI) or a PCI, or a known non-cardiac comorbidity. The proportion of patients with a STEMI with at least one known comorbidity has increased gradually, from 27% in 2021, to 29% in 2022 and 33% in 2023, which was statistically significant (p<0.05). During 2022 and 2023, the most frequently reported conditions were previous PCI (n=399, 13%), previous angina (n=392, 13%) and previous MI (n=358, 12%). Sixty-six percent (n=2062) of patients had no known comorbidity recorded.

Figure 4.4 demonstrates sex-related differences in prior cardiovascular disease and comorbidity rates by year. As previously outlined, female patients with a STEMI tended to be older on presentation and were more likely to have a documented cardiac or other relevant comorbidity.

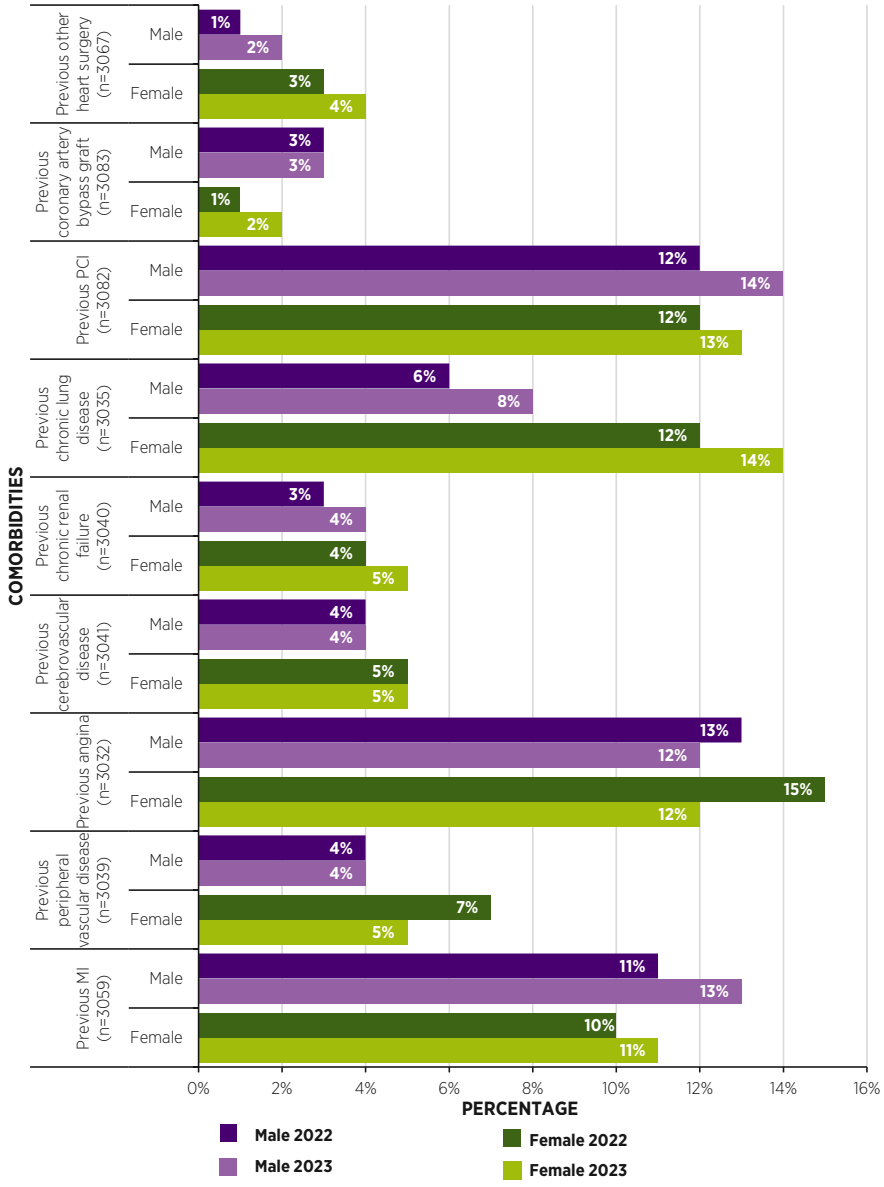


FIGURE 4.4: PRIOR CARDIOVASCULAR DISEASE AND MAJOR COMORBIDITIES IN PATIENTS WITH AN ST ELEVATION MYOCARDIAL INFARCTION, BY SEX AND YEAR[9]

[9] The proportions were calculated separately (excluding cases where comorbidities were unknown) for each prior cardiovascular disease and comorbidity. One patient may have had one or more cardiovascular diseases and comorbidities; therefore, some patients are counted more than once.

PRIOR CORONARY HEART DISEASE

In 2022, the proportion of patients with a STEMI who had a pre-existing diagnosis of coronary heart disease (prior MI, prior angina, prior PCI, and/or prior coronary artery bypass graft (CABG)) was 17% (n=267), which was unchanged from 2021; in 2023, this increased to 20% (n=308). Figure 4.5 displays the proportion of patients with a STEMI admitted with prior coronary heart disease (CHD) by sex, age group and year.

In total, there was little variation between male and female patients with a STEMI (18% male versus 17% female in 2022, and 20% male versus 19% female in 2023) who had at least one pre-existing diagnosis of coronary heart disease. In almost all age groups, male patients had a larger proportion of pre-existing diagnosis of coronary heart disease when compared with female patients.

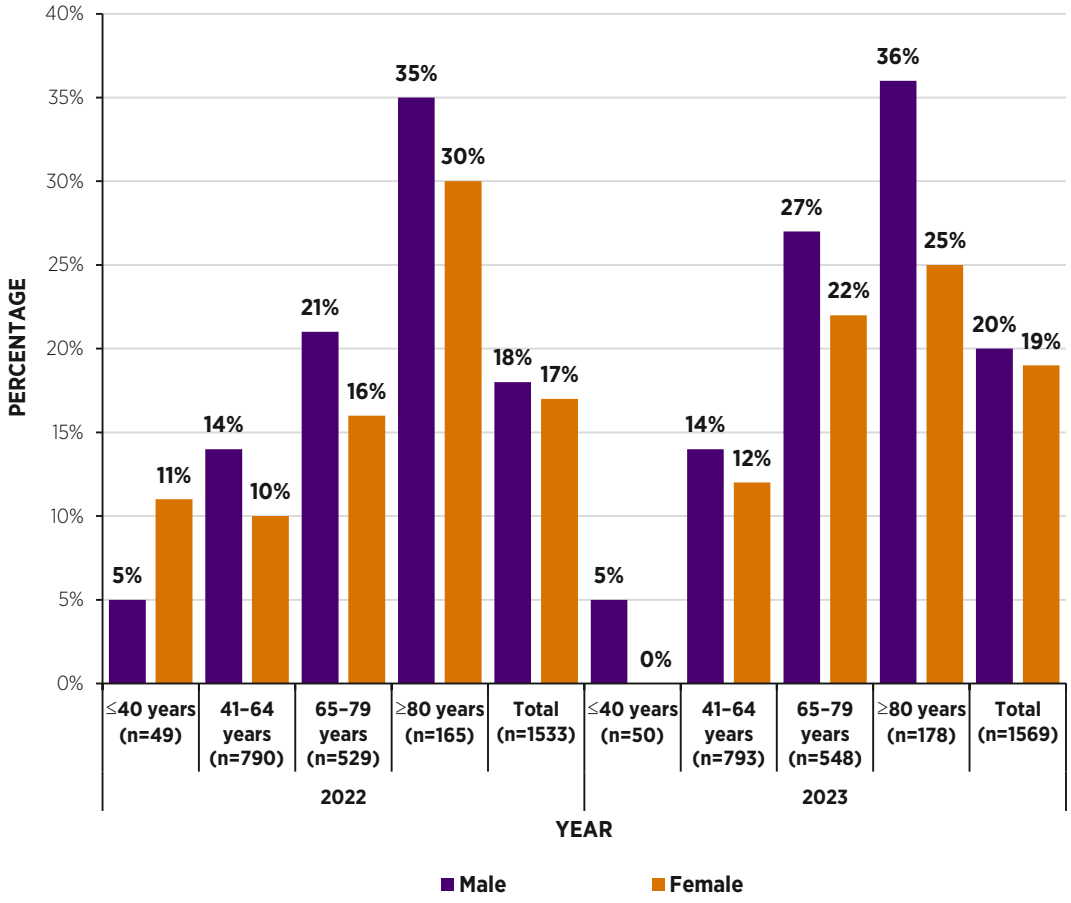


FIGURE 4.5: PROPORTION OF PATIENTS WITH AN ST ELEVATION MYOCARDIAL INFARCTION WITH PRIOR CORONARY HEART DISEASE, BY SEX, AGE GROUP AND YEAR (N=3102)

DIABETES PROFILE IN PATIENTS WITH A STEMI

While most patients with a STEMI during 2022 and 2023 did not have diabetes (n=2304, 74%), 21% (n=645) of patients had a diagnosis of diabetes before or during admission. This proportion has gradually increased from 18% in 2021, to 19% in 2022 and 22% in 2023. This increase could be attributed to improved data quality, as the proportion of patients with unknown diabetes status decreased from 8% (n=116) in 2022 to 2% (n=37) in 2023.

Type 2 diabetes is not recorded as a specified data point in the Heartbeat dataset, but has been previously inferred from the 'diabetes controlled with diet or oral medication' data point. This report may underestimate the true prevalence of type 2 diabetes in patients with a STEMI, as the Heartbeat dataset does not record the subtype of diabetes as a specified data point. The HIPE system captures data on diabetes based on diabetic type, e.g. type 2. The IHAA is working with the HPO to assess the congruence between the Heartbeat and HIPE datasets and the option to report on diabetes using HIPE data. Further detail is provided in Chapter 9.

Figure 4.6 shows the distribution of patients with a STEMI diagnosed with diabetes, by sex, age group and year. In both 2022 and 2023, male patients with a STEMI had a lower rate of diabetes compared with female patients.

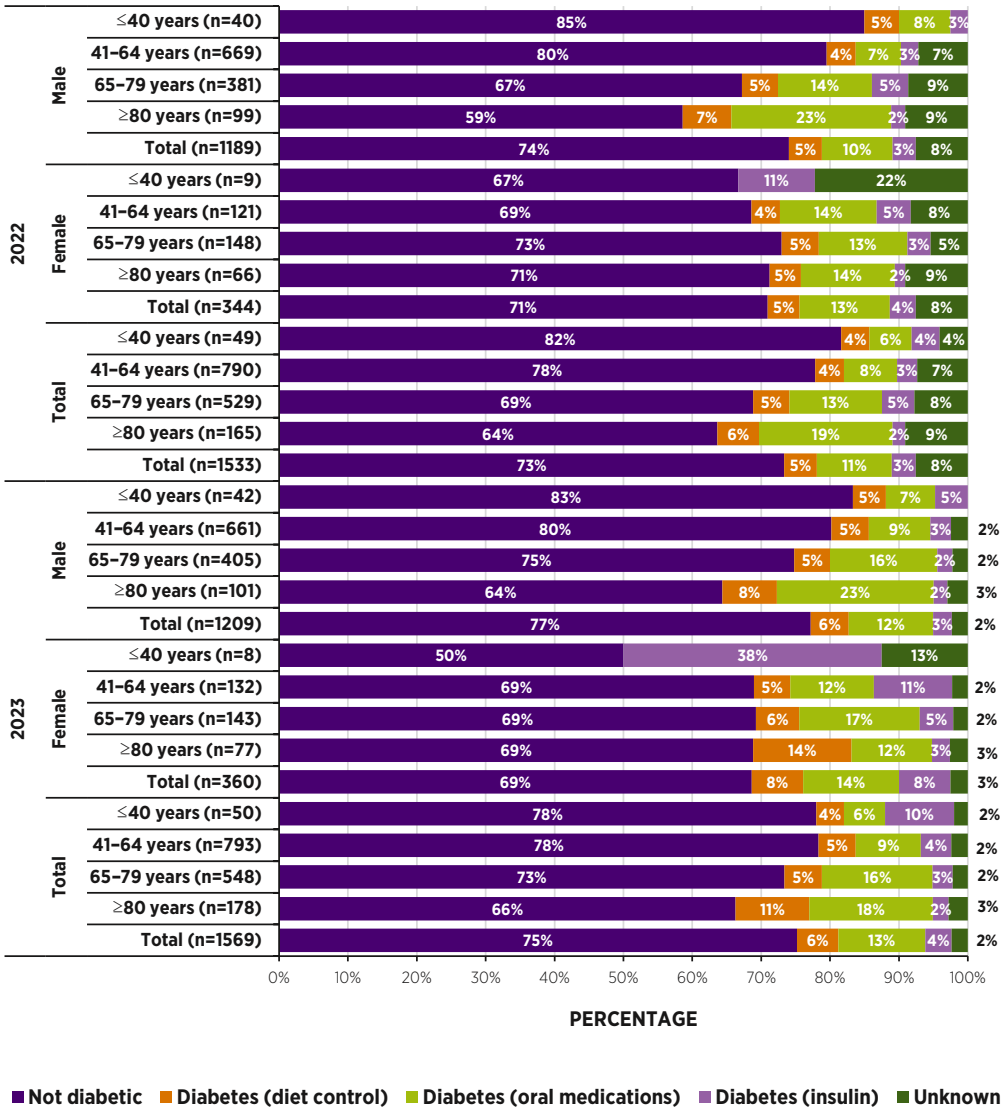


FIGURE 4.6: DIABETES PROFILE OF PATIENTS WITH AN ST ELEVATION MYOCARDIAL INFARCTION, BY SEX, AGE GROUP AND YEAR (N=3102)

SMOKING AND AGE PROFILE OF PATIENTS WITH A STEMI

In both reporting years, 35% (n=534 in 2022; n=556 in 2023) of patients with a diagnosis of a STEMI were current smokers. Although the proportion of patients with a STEMI who currently smoke has decreased from 39% in 2021, the proportion of patients with a STEMI who currently smoke remains substantially higher than the national population average, which was reported to be 18% in 2022 (Department of Health, 2023). The proportion of those who have given up smoking was lower among STEMI patients (27%) when compared with the national average (33%). Use of nicotine replacement therapy or electronic vaping products is currently not collected as part of the Heartbeat dataset.

On average, smokers present with a STEMI 10 years earlier than people who have never smoked

Smoking causes STEMI at a younger age. On average, smokers present with a STEMI 10 years earlier than people who have never smoked (mean age of current smokers with a STEMI: 57 years; mean age of never smokers with a STEMI: 67 years).

This premature STEMI risk was even more pronounced in female smokers. Among males, current smokers presenting with a STEMI had a median age of 56 years (IQR: 48–63 years) compared with a median age of 65 years for males with a STEMI who have never smoked (IQR: 56–73 years). Among females, current smokers presenting with a STEMI had a median age of 63 years (IQR: 53–70 years) compared with a median age of 74 years for females with a STEMI who have never smoked (IQR: 66–83 years).

Figure 4.7 shows the age distribution of patients with a STEMI by sex, age group and year. The majority of patients aged under 40 years with a STEMI were current smokers (n=70, 71%), which remains unchanged from 2021. As age increased, the proportion of current smokers decreased. This highlights the degree to which smoking causes premature CHD events, with patients of both sexes who have never smoked experiencing a STEMI when they were considerably older compared with current smokers of both sexes.

In 2022 and 2023, of the 575 patients with a STEMI who had prior CHD, 25% (n=142) were described as current smokers, which represents almost a 10% decrease from 2021, when it was reported that 34% of patients with a STEMI who had prior CHD were current smokers. The proportion of former smokers had increased, from 30% in 2021, to 38% in 2022 and 2023. This highlights the importance of continuing supports for smokers who have experienced a STEMI in order to reinforce quitting and to maintain abstinence from smoking. Moreover, this finding highlights smoking relapse as a cause of higher future risk of a second heart attack.

In 2022 and 2023, of those who were reported as current smokers (n=1090), 86% (n=934) received smoking cessation advice.

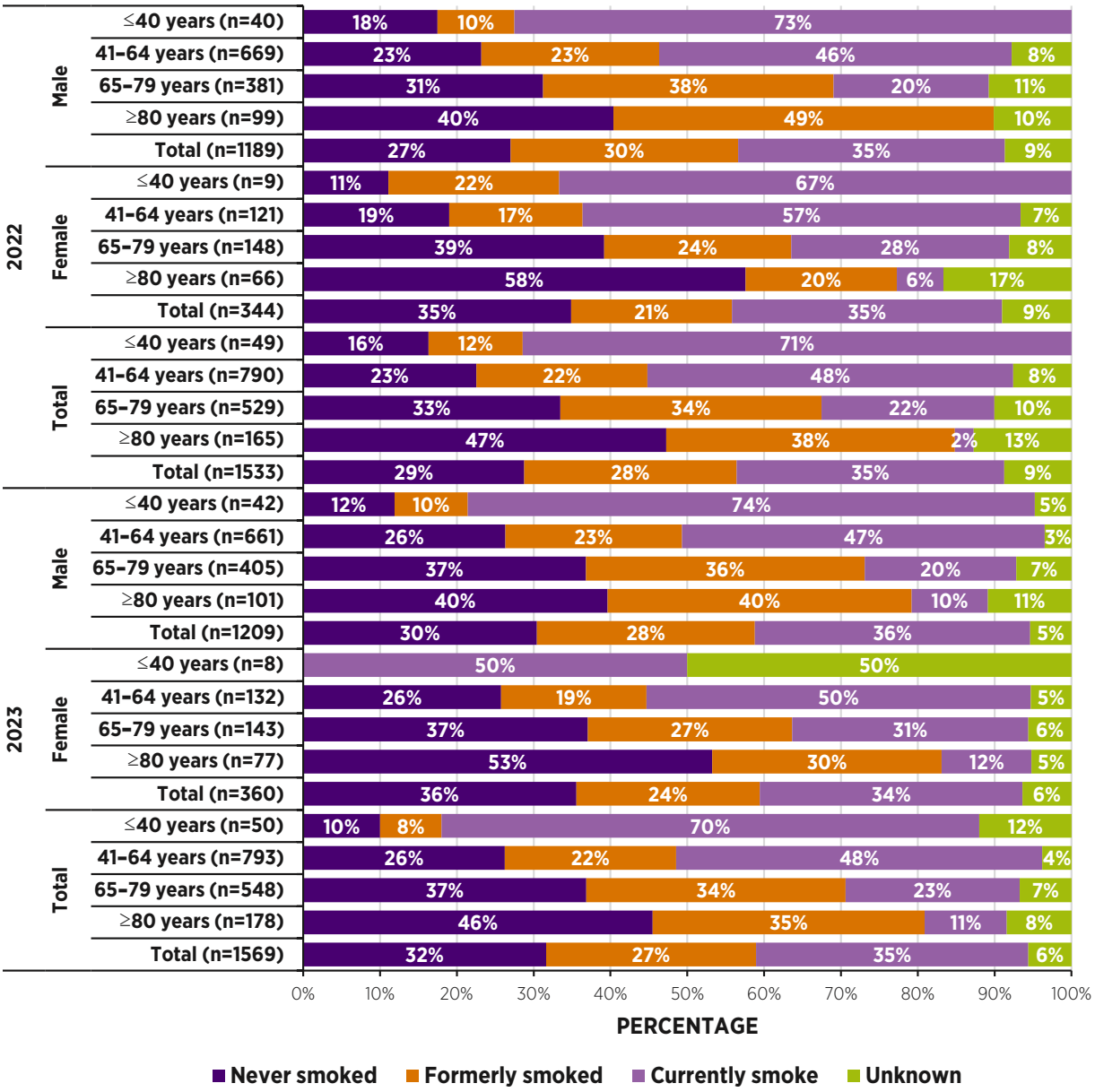


FIGURE 4.7: SMOKING PROFILE OF PATIENTS WITH AN ST ELEVATION MYOCARDIAL INFARCTION, BY SEX, AGE GROUP AND YEAR (N=3102)

CARDIOVASCULAR RISK FACTOR PROFILE OF PATIENTS WITH A STEMI

The most common risk factors for heart attack were hypertension(46%) and hypercholesterolaemia (42%)

In 2022, 86% (n=1311) of patients with a STEMI had at least one cardiovascular risk factor. This increased to 88% (n=1388) in 2023; however, this increase could be attributed to improved data quality. For instance, in 2022, the diabetes status was unknown in 8% (n=116) compared to just 2% (n=37) in 2023 (Figure 4.6).

Table 4.2 shows the proportion of cardiovascular risk factors by year. The most prevalent risk factors were hypertension (n=1442, 46%) and hypercholesterolaemia (n=1311, 42%).

In 2022, an additional data point – body mass index (BMI) – was added to the Heartbeat dataset. The completeness of this data point was 90% in 2022 and 95% in 2023. Table 4.2 shows that more than one-quarter of patients with a STEMI had a BMI of 30 or higher. The proportion of male patients who had a BMI of 30 or higher was similar to that of female patients (male: 28%; female: 27%). This was slightly higher than the national population, 23% of whom were reported to be obese in 2016 (Department of Health, 2016). For a detailed distribution of BMI by sex and year, see the supplementary frequency tables in Appendix 8.

TABLE 4.2: CARDIOVASCULAR RISK FACTOR PROFILE OF PATIENTS WITH ST ELEVATION MYOCARDIAL INFARCTION, BY YEAR

	2022		2023	
	N	%	N	%
Previous hypertension	687	45%	755	48%
Previous hypercholesterolaemia	669	44%	642	41%
Current smoking	534	35%	556	35%
Prior cardiovascular disease	362	24%	401	26%
Diabetes	293	19%	352	22%
BMI ≥30	426	28%	423	27%

Figure 4.8 shows the proportion of patients with a STEMI who have one to six cardiovascular risk factors. BMI was introduced in 2022 as the sixth risk factor, therefore making the comparison with earlier reports unsound. Across the reporting period, more than one-half of patients with a STEMI (53% in 2022; 56% in 2023) had one or two cardiovascular risk factors.

A substantial proportion of patients had three or more potentially modifiable cardiovascular risk factors on presentation (33% in 2022 and 32% in 2023). A very small number of patients (n=7, 0.2%) had all six risk factors. Identifying these individuals with multiple risk factors at an earlier stage in primary care, chronic disease management programmes, the Making Every Contact Count programme and, most importantly, adequately addressing those modifiable risk factors provides an opportunity to help reduce the incidence of cardiovascular events.

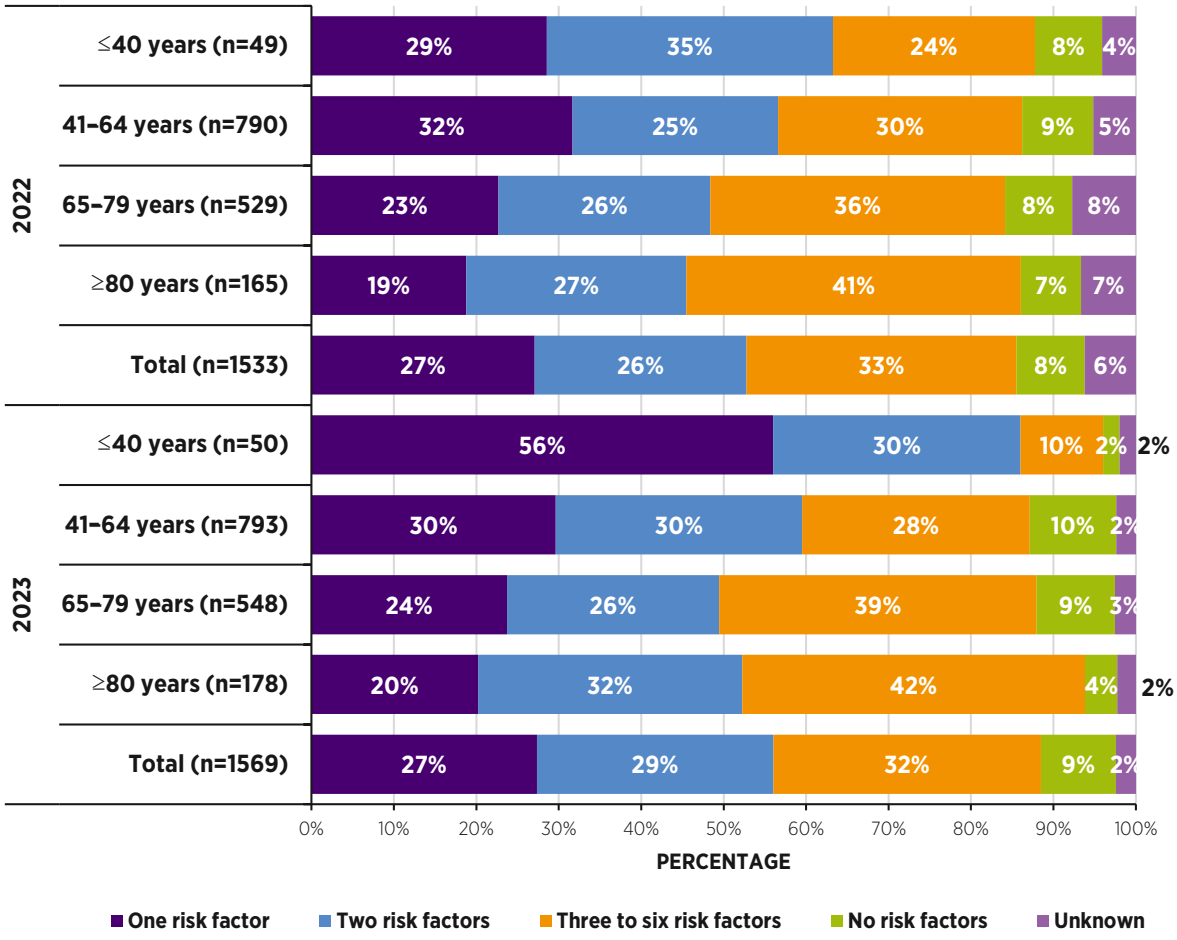


FIGURE 4.8: PREVALENCE OF RISK FACTORS FOR PATIENTS WITH AN ST ELEVATION MYOCARDIAL INFARCTION, BY AGE GROUP AND YEAR (N=3102)

KEY FINDINGS FROM CHAPTER 4

- The incidence of STEMI has remained stable between 2016 and 2022 (402 per 1 million of the population in 2016 compared with 397 per 1 million of the population in 2022). As the population increases, there is an increased pressure on the PCI centres to manage more cases per year than they have previously, with service resourcing and planning implications.
- The majority (77%) of patients with a STEMI in 2022 and 2023 were male (Figure 4.3), with a median age of 62 years. The female patients with a STEMI in 2022 and 2023 were older, with a median age of 69 years.
- The proportion of STEMI patients with at least one known comorbidity has increased gradually, from 27% in 2021, to 29% in 2022 and 33% in 2023 (Figure 4.4).
- Although the proportion of patients with a STEMI who currently smoke has decreased from 39% in 2021 to 35% in 2022 and 2023, it remains higher than the national population average percentage of current –smokers, which was 18% in 2022 (Department of Health, 2023).
- In 2022, 86% of patients with a STEMI, and 88% in 2023, had at least one cardiovascular risk factor (Table 4.2); 33% had three or more cardiovascular risk factors across 2022 and 2023.

OPPORTUNITY FOR FURTHER QUALITY IMPROVEMENT

Public awareness of the risk factors for heart attack could be improved through an awareness campaign.

Public awareness of the detrimental effect of smoking on heart attack risk could be improved through the diffusion of IHAA results in public awareness campaigns.

CHAPTER 5
PATHWAY TO A PCI CENTRE

CONTENTS

CHAPTER 5: **PATHWAY TO A PCI CENTRE**

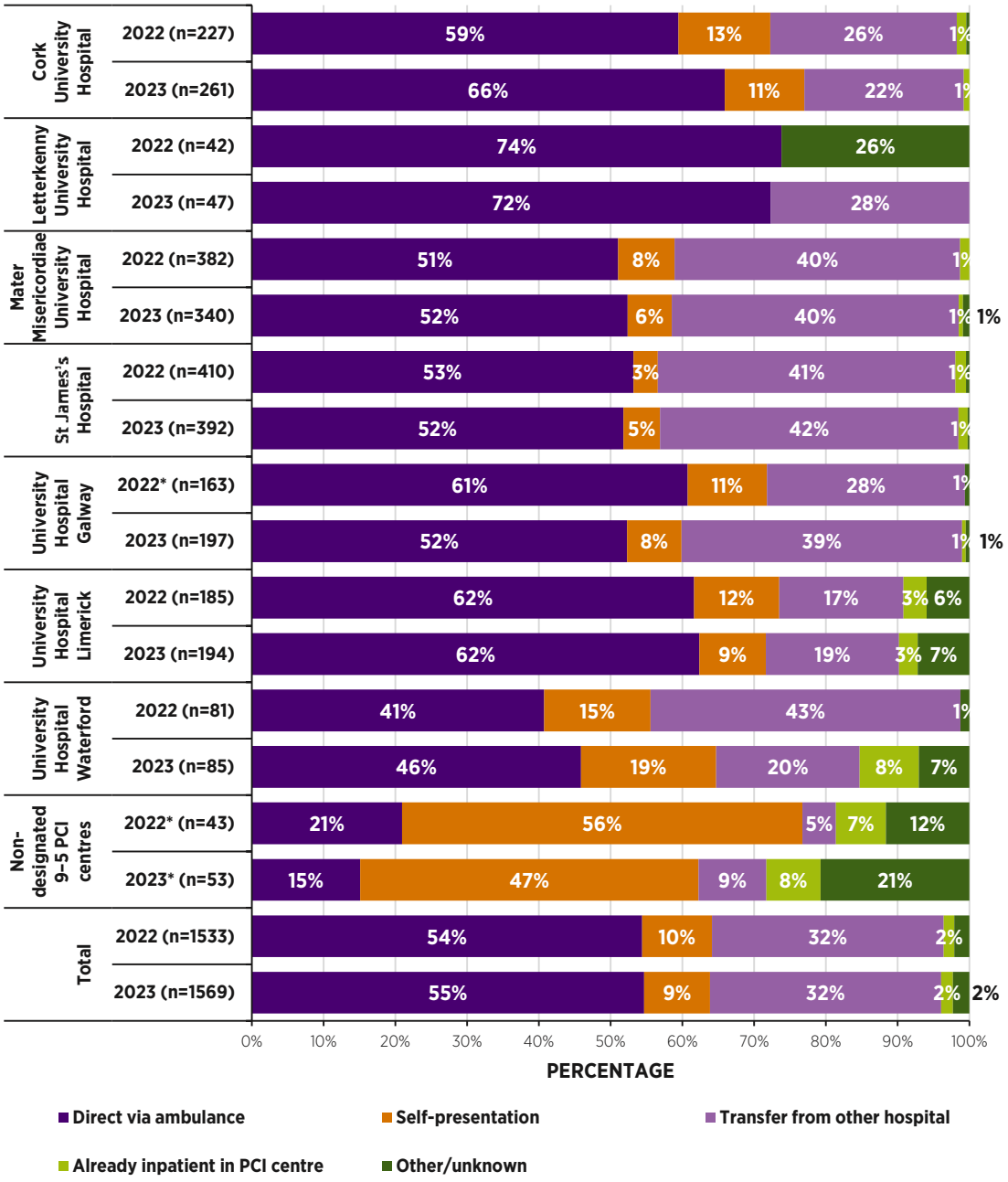
SCOPE OF CHAPTER 5

This chapter reports the key time intervals for all patients with a STEMI recorded in the Heartbeat portal (N=3102) on the pathway from the initial call for help to arrival at the PCI centre in 2022 and 2023. Measuring timeliness for different aspects of the pathway to a PCI centre is complex and varies depending on treatment location and how a patient accessed STEMI care. Appendix 7 provides detailed definitions of each data point used in order to calculate the time intervals described in this chapter. For most patients with a STEMI, PCI was the primary reperfusion strategy. Patients who had thrombolysis performed as a primary reperfusion strategy but who were also transported to a PCI centre are included in this chapter. However, for timeliness of the pathway to a PCI centre, only patients who had PCI as a primary reperfusion strategy are included.

SOURCE OF REFERRAL TO A PCI CENTRE

How a patient accesses care may influence the type of reperfusion therapy that they receive and the timeliness of reperfusion. Figure 5.1 shows the sources of referral to PCI centres in 2022 and 2023. During 2022 and 2023, more than one-half (n=1692, 55%) of patients with a STEMI were brought directly by ambulance to a PCI centre. This was a reduction from 58% in 2021 (NOCA, 2023a) and 62% in 2020 (NOCA, 2022a).

During 2022 and 2023, one-third (n=1000, 32%) of patients were transferred to a PCI centre from another hospital. This was a slight increase in comparison with 2021 (29%). The proportion of patients with a STEMI who arrived directly by ambulance ranged from 43% (n=72) in University Hospital Waterford to 73% (n=65) in Letterkenny University Hospital. The location of primary PCI sites and the number of hospitals with an emergency department (ED) service nearby may impact on the proportion of patients who access a PCI centre directly. Non-designated, 9.00am to 5.00pm weekday PCI centres have been amalgamated in this analysis, as each non-designated centre treated a small number of patients and the ORS protocol does not recommend transfer to these sites for primary PCI.



* Coverage was below 80%.

FIGURE 5.1: REFERRAL SOURCE TO A PERCUTANEOUS CORONARY INTERVENTION CENTRE FOR ALL PATIENTS, BY HOSPITAL (N=3102)[10,11,12]

[10] Non-designated, 9.00am to 5.00pm weekday PCI centres include Beaumont Hospital (n=29), St Vincent's University Hospital (n=29) (coverage was below 80%) and Tallaght University Hospital (n=38). Referral sources for these hospitals are included in the corresponding frequency table in Appendix 5.
[11] The 'transfer from other hospital' category includes transfer from other hospital (n=972) and inpatient transfer from other hospital (n=28).
[12] In 2022, transfer patients were recorded as 'other/unknown' in Letterkenny University Hospital. This has been rectified for 2023, and only 2023 transfer data for Letterkenny University Hospital are reported on in this report.

INTERVAL FROM ONSET OF SYMPTOMS TO CALL FOR HELP FOR PATIENTS WHO ARRIVED DIRECTLY BY AMBULANCE

The quicker a person who is experiencing heart attack symptoms calls for help, the more likely they are to receive timely treatment, thereby reducing damage to the heart. For those who arrived at a PCI centre directly by ambulance, the call for help time is the time that the 112 or 999 call was received in the ambulance dispatch centre. Figure 5.2 shows the proportion of patients with a STEMI in 2022 and 2023 whose interval between the time of symptom onset and the time of the call for help was within 60 minutes, by sex and year.

In 2023, only 49% of patients called for help within 60 minutes

In 2022, the interval between symptom onset and call for help was within 60 minutes for 45% (n=378) of patients with a STEMI who arrived at a PCI centre directly by ambulance; this increased to 49% (n=419) in 2023, and both of these represented an increase from 44% in 2021. In both years, there was a larger proportion of male patients with an interval between symptom onset and call for help within 60 minutes when compared with female patients.

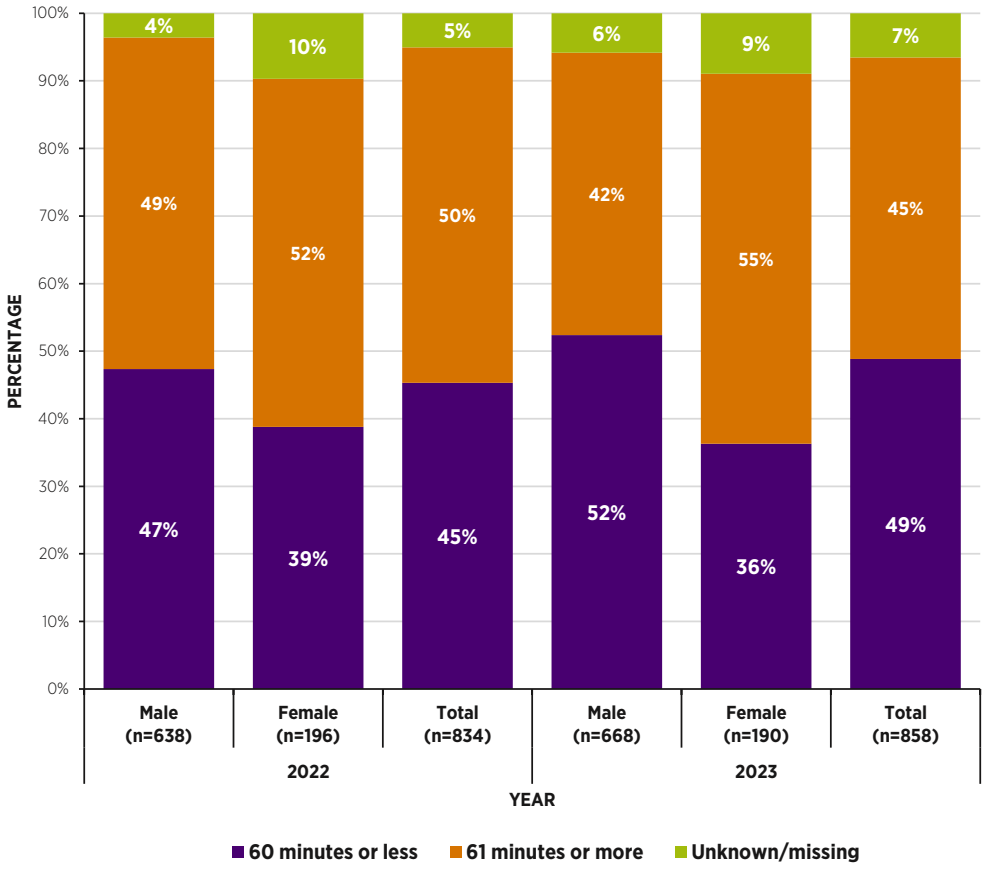


FIGURE 5.2: PROPORTION OF PATIENTS WITH AN ST ELEVATION MYOCARDIAL INFARCTION WITH A SYMPTOM ONSET TO CALL FOR HELP INTERVAL WITHIN 60 MINUTES, BY SEX AND YEAR (n=1692)[13]

[13] Figure 5.2 only includes patients who arrived at a PCI centre directly by ambulance

DOOR IN DOOR OUT TIME

The 2023 European Society of Cardiology (ESC) acute coronary syndrome (ACS) guideline (Byrne *et al*., 2023) defines the 'door in door out' (DIDO) time as the duration of time between the patient's arrival at the non-PCI-capable hospital and the patient's departure in an ambulance en route to the PCI centre. A DIDO time of 30 minutes or less is recommended in order to expedite reperfusion therapy. In 2022, the date and time the patient left the non-PCI-capable hospital was added to the Heartbeat dataset. Data were incomplete for 2022; therefore, only data from 2023 are reported on in this report.

In 2023, 404 patients with a STEMI were transferred from a non-PCI-capable hospital to a PCI centre with the intention to treat them with primary PCI. In this analysis, the DIDO time is reported on cases transferred from the ED (n=363) in the first hospital. This includes cases where the first positive ECG was diagnosed in the ED (n=324) and those diagnosed before arrival at the first hospital, either in the ambulance (n=33) or in a general practitioner (GP) surgery (n=6). The remaining 41 cases had the STEMI diagnosed while already an inpatient in the hospital (either in a general ward or a coronary care unit/high dependency unit) and are excluded from this analysis.

In 2023, the median DIDO time was 97 minutes (IQR: 62–195 minutes). Figure 5.3 shows that only 4% of patients with a STEMI achieved the DIDO target of 30 minutes or less in 2023. The median DIDO time for those diagnosed with STEMI before arrival at hospital was 61 minutes (IQR: 45–119 minutes), and for those diagnosed in the ED, it was 100 minutes (IQR: 64–199 minutes). It is unsurprising that there is a longer DIDO time for those who arrive in ED without a diagnosis of STEMI, as it may take some time to make this diagnosis with an ECG after arrival. The median time to first positive ECG for those who arrived in ED without a diagnosis of STEMI was 22 minutes (IQR: 9–65 minutes) (Figure 5.4). Further analysis of the reason why an ambulance would transport a patient with a STEMI-positive ECG to a non-PCI-capable hospital is a recommendation in this report.

A DIDO time of 30 minutes or less is recommended in order to expedite reperfusion therapy.

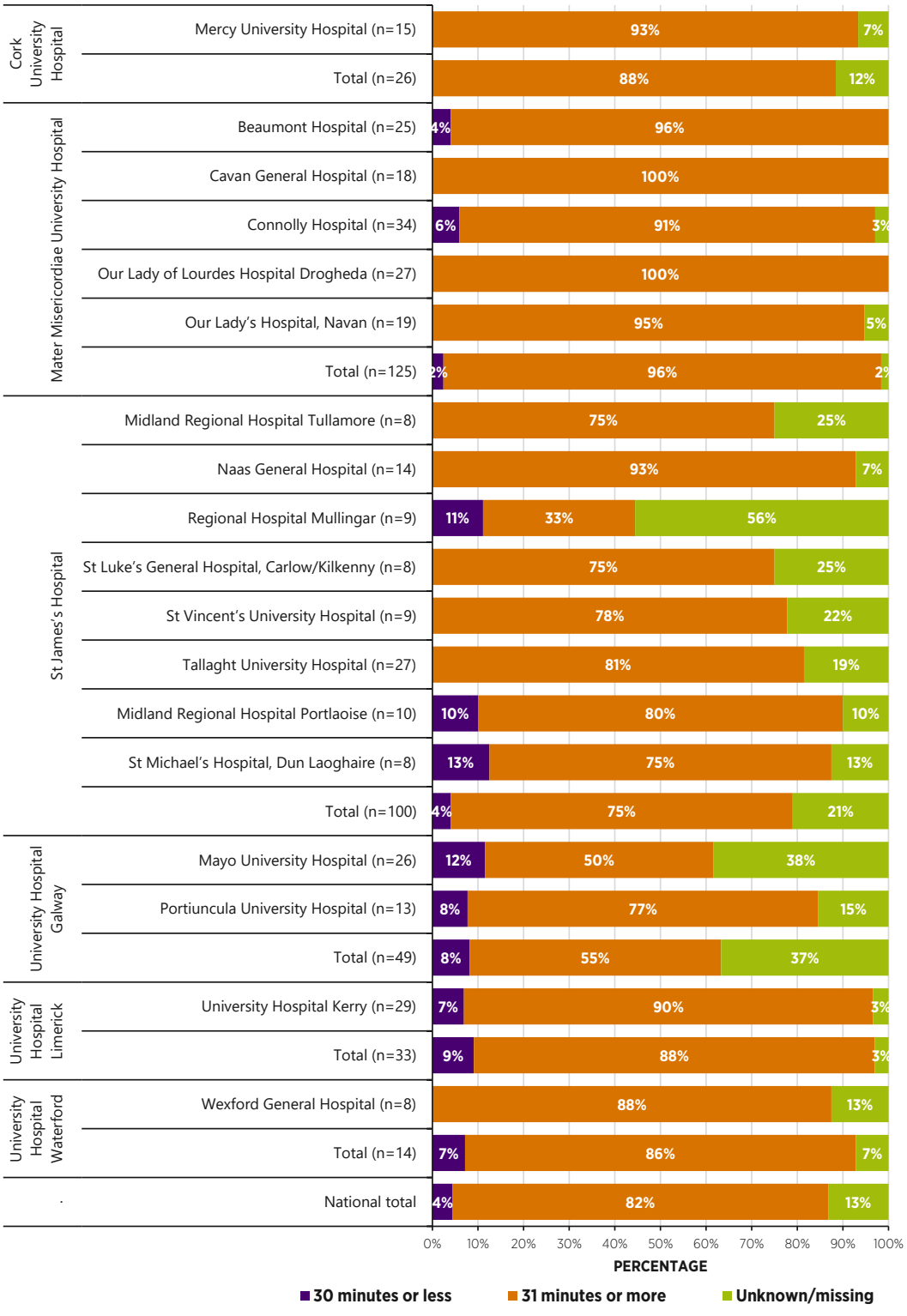


FIGURE 5.3: PROPORTION OF PATIENTS WITH AN ST ELEVATION MYOCARDIAL INFARCTION WHO WERE TRANSFERRED TO THE PERCUTANEOUS CORONARY INTERVENTION CENTRE AND WHO ACHIEVED THE DOOR IN DOOR OUT TARGET OF 30 MINUTES OR LESS, BY PERCUTANEOUS CORONARY INTERVENTION CENTRE AND REFERRING HOSPITAL, 2023 (n=363)[14]

[14] Hospitals that had fewer than five patients were excluded individually from Figure 5.3.

HOSPITAL ARRIVAL TO ECG TIME FOR THOSE TRANSFERRED TO A PCI CENTRE

The 2023 ESC ACS guideline (Byrne *et al.,* 2023) recommends that the first 12-lead ECG be obtained within 10 minutes of arrival at hospital. Heartbeat records the date and time of the first diagnostic ECG but does not record if that was the first ECG performed. In 2023, 324 patients with a STEMI were transferred from the ED for primary PCI. Of those, 310 had the date and time of the first hospital arrival and time of first positive ECG recorded. The median time to first positive ECG for this cohort was 22 minutes (IQR: 9–65 minutes). The median time differed among hospitals, with just 37% of hospitals achieving a median time to first positive ECG of 10 minutes or less (Figure 5.4). These results represent patients who self-presented to a non-PCI-capable hospital.

In 2023, for all patients who self-presented to a PCI centre (n=144), the median time from arrival at the PCI centre to first positive ECG was 17 minutes (IQR: 7–46 minutes), with 31% (n=45) of patients achieving a door to first positive ECG time of 10 minutes or less. The 2023 ESC ACS guideline (Byrne *et al.,* 2023) suggests that this cohort of patients who self-present to a PCI centre should have their timeliness measured as a separate cohort, and this will be done by each PCI centre in the next IHAA reporting period for all metrics.

We recommend caution in the interpretation of these time intervals, however, as the time to first positive ECG is different to the time to first ECG performance in the ED. Some patients may develop ECG changes in time with ongoing chest pain. Capturing the date and time of the first ECG in order to measure against the ESC ACS guideline of the first ECG being performed within 10 minutes of hospital arrival is a recommendation in this report.

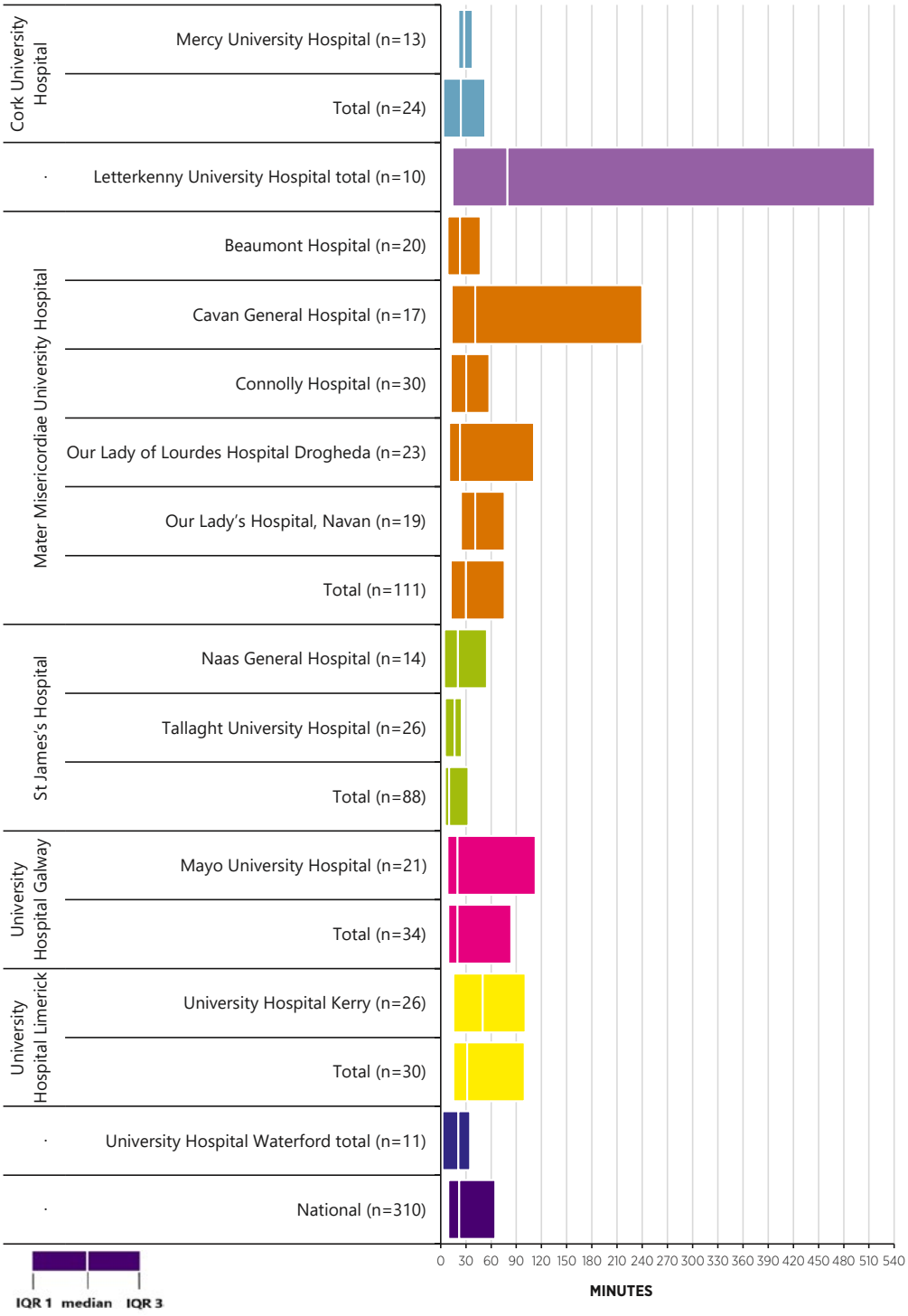


FIGURE 5.4: MEDIAN TIME FROM HOSPITAL ARRIVAL TO FIRST POSITIVE ELECTROCARDIOGRAM FOR PATIENTS WHO WERE TRANSFERRED TO THE PERCUTANEOUS CORONARY INTERVENTION CENTRE AND HAD ST ELEVATION MYOCARDIAL INFARCTION DIAGNOSED IN THE EMERGENCY DEPARTMENT, BY PERCUTANEOUS CORONARY INTERVENTION CENTRE AND REFERRING HOSPITAL, 2023 (n=310)[15,16]

[15] Non-designated 9–5 PCI centres and hospitals that had fewer than five patients were excluded individually from Figure 5.4. Patients for whom time information was not recorded or for whom it was recorded incorrectly were excluded from Figure 5.4 (n=23).
[16] Ten patients with a STEMI were transferred from Letterkenny University Hospital to Altnagelvin Area Hospital.

INTERVAL FROM FIRST MEDICAL CONTACT TO ARRIVAL AT PCI CENTRE

Standard: It is recommended that all patients with a STEMI be considered for primary PCI unless the estimated interval between first medical contact and arrival at a PCI centre exceeds 90 minutes. If the estimated travel time exceeds 90 minutes, thrombolysis should be administered (HSE, 2012).

Patients who had thrombolysis as a primary reperfusion strategy were excluded from analysis of timeliness of arrival at a PCI centre.[17] Timeliness for this group of patients will be discussed in Chapter 6.

Timeliness of reperfusion has been reported as a national key performance indicator (KPI) since 2013. Timely primary PCI is considered to have been achieved when the time between first medical contact (FMC) and balloon/wire cross is 120 minutes or less (HSE, 2012; Hamm *et al*., 2011).

The target of 120 minutes or less includes two key time intervals. The first is the interval from FMC to arrival at the PCI centre, referred to as 'FMC to door' (FMCTD) time. The ORS goal for FMCTD is 90 minutes or less. The second is the interval between arrival at the PCI centre and the time of reperfusion (balloon/wire cross). This is referred to as the 'door to balloon' (DTB) time, and the goal is 30 minutes or less. The complete patient pathway is referred to as 'FMC to balloon' (FMCTB) time, which has a goal of 120 minutes or less (Figure 5.5). Chapter 6 reports on the DTB and FMCTB times.

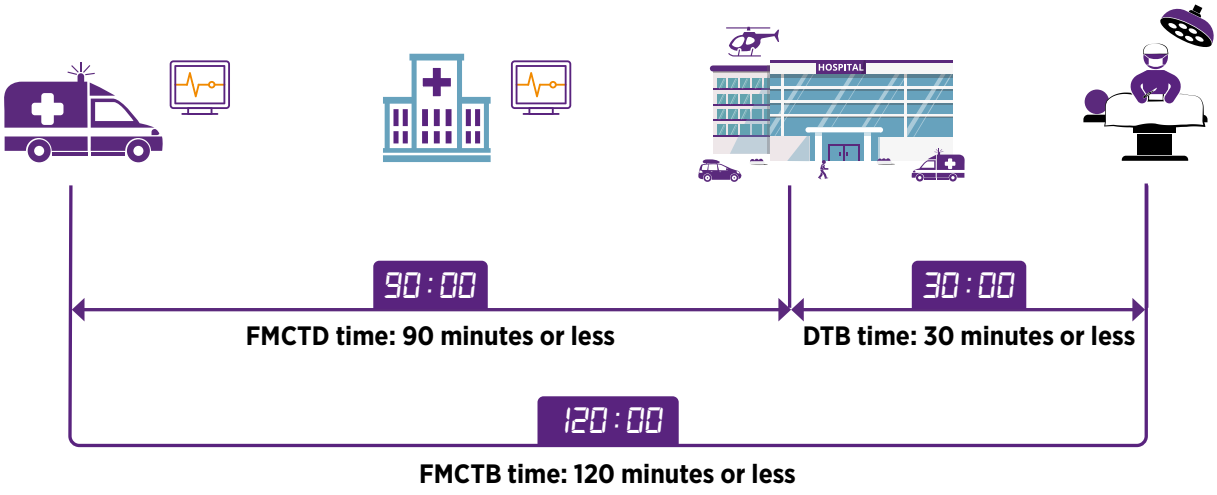


FIGURE 5.5: TIME INTERVAL GOALS

As described in Chapter 2, the time of FMC for all patients with a STEMI is the time of the first diagnostic ECG. During 2022 and 2023, one-half (n=1577, 51%) of patients had the first positive 12-lead ECG performed in a pre-hospital location by ambulance personnel; 42% (n=1302) had this performed in the ED; and 3% (n=95) of patients had the first positive 12-lead ECG performed in a GP surgery. The figures did not vary between the 2 years. For further information on the location where the first positive 12-lead ECG was recorded, see Appendix 8.

[17] The National Clinical Programme for Acute Coronary Syndrome recommends transferring thrombolysed patients to a PCI centre as soon as possible in order to ensure that either rescue angioplasty can be performed in a timely manner if needed or angiography can be performed within 3–24 hours.

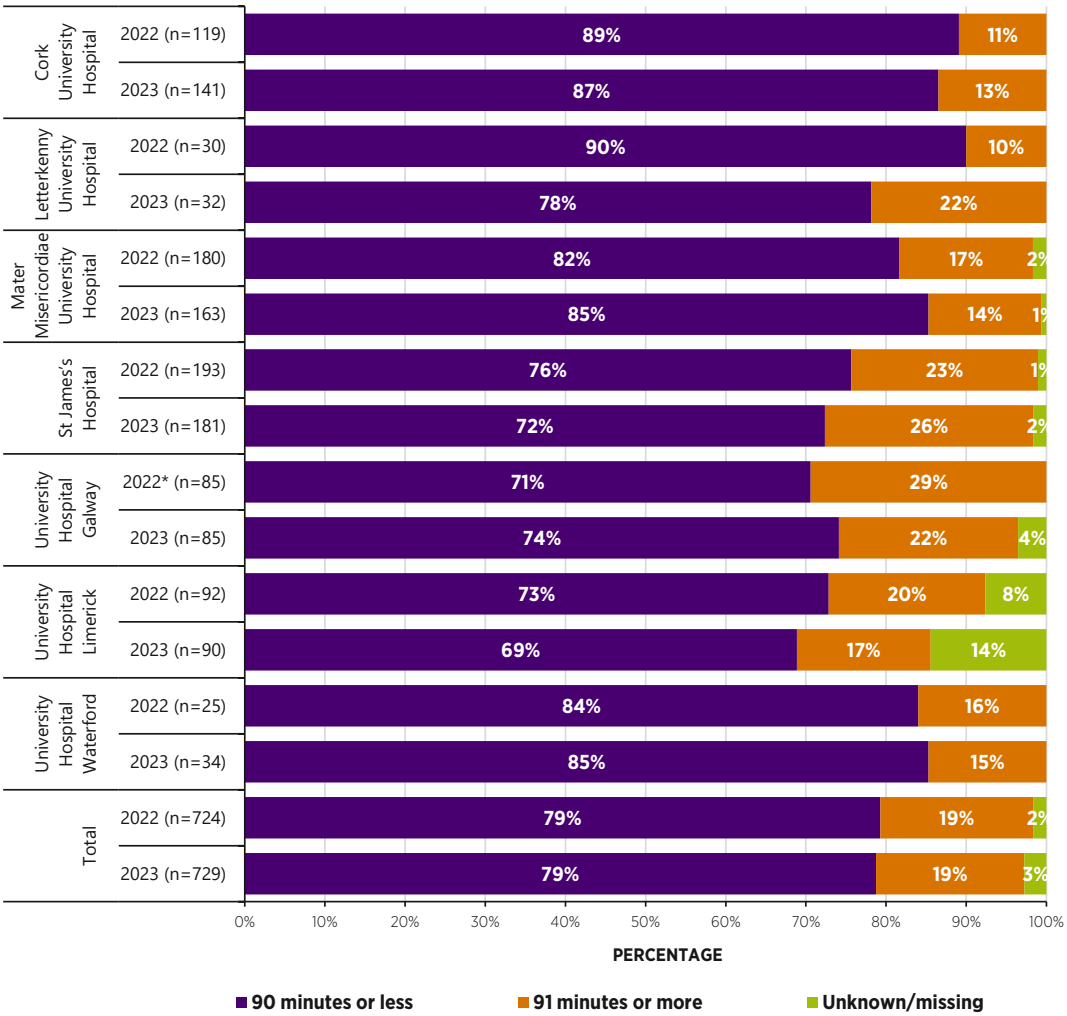
FIRST MEDICAL CONTACT TO DOOR TIME

For the overall population with a STEMI, in 2022, the median FMCTD time was 75 minutes (IQR: 50–110 minutes), and in 2023 it was 73 minutes (IQR: 46–106 minutes).

FMCTD TIME – DIRECT BY AMBULANCE TO A PCI CENTRE

For patients with a STEMI who arrived directly by ambulance to a primary PCI centre, the time of FMC is defined as the time of the first positive ECG performed by an ambulance practitioner. Figure 5.6 shows the proportion of patients with a STEMI who arrived at the PCI centre within the target of 90 minutes or less, by PCI centre and year. During 2022 and 2023, a total of 79% (n=1148) of patients achieved a timely FMCTD time; this proportion did not differ from that reported in 2021 (80%). The median FMCTD time for all patients who arrived at a PCI centre by ambulance was 58 minutes (IQR: 39–83 minutes), and this also did not differ from that reported in 2021 (median: 58 minutes; IQR: 38–82 minutes).

The median FMCTD time for all patients who arrived at a PCI centre by ambulance was 58 minutes



* Coverage was below 80%.

FIGURE 5.6: PROPORTION OF PATIENTS WITH AN ST ELEVATION MYOCARDIAL INFARCTION WHO ARRIVED AT A PERCUTANEOUS CORONARY INTERVENTION CENTRE DIRECTLY BY AMBULANCE WITHIN THE TARGET TIME OF 90 MINUTES, BY PERCUTANEOUS CORONARY INTERVENTION CENTRE AND YEAR (n=1453)[18,19]

[18] Hospitals: Beaumont Hospital, St Vincent's University Hospital (coverage was below 80%) and Tallaght University Hospital are not presented individually in Figure 5.6, as they had fewer than five patients, but they are included in the national figure.

[19] Patients who had hospital or pre-hospital thrombolysis (n≤5) were excluded. Only patients who had their first 12-lead ECG performed by an ambulance practitioner were included in the analysis.

FMCTD TIME – TRANSFERRED TO A PCI CENTRE FROM FIRST HOSPITAL

In 2023, 33% (n=132) of patients with a STEMI were transferred from the first hospital of arrival to a PCI centre within 90 minutes (Figure 5.7); this is compared with 30% in 2022, and 33% in 2021. The median FMCTD time for patients with a STEMI who were transferred to a PCI centre for primary PCI was 114 minutes (IQR: 82–179 minutes).

* Coverage was below 80%.

FIGURE 5.7: PROPORTION OF PATIENTS WITH AN ST ELEVATION MYOCARDIAL INFARCTION WHO WERE TRANSFERRED TO A PERCUTANEOUS CORONARY INTERVENTION CENTRE AND WHO ARRIVED WITHIN THE TARGET TIME OF 90 MINUTES, BY PERCUTANEOUS CORONARY INTERVENTION CENTRE AND YEAR (n=818)[20]

[20] Non-designated 9–5 PCI centres and hospitals that had five cases or fewer are not presented in Figure 5.7.

AMBULANCE OFFLOAD LOCATION FOR PATIENTS BROUGHT FOR PRIMARY PCI

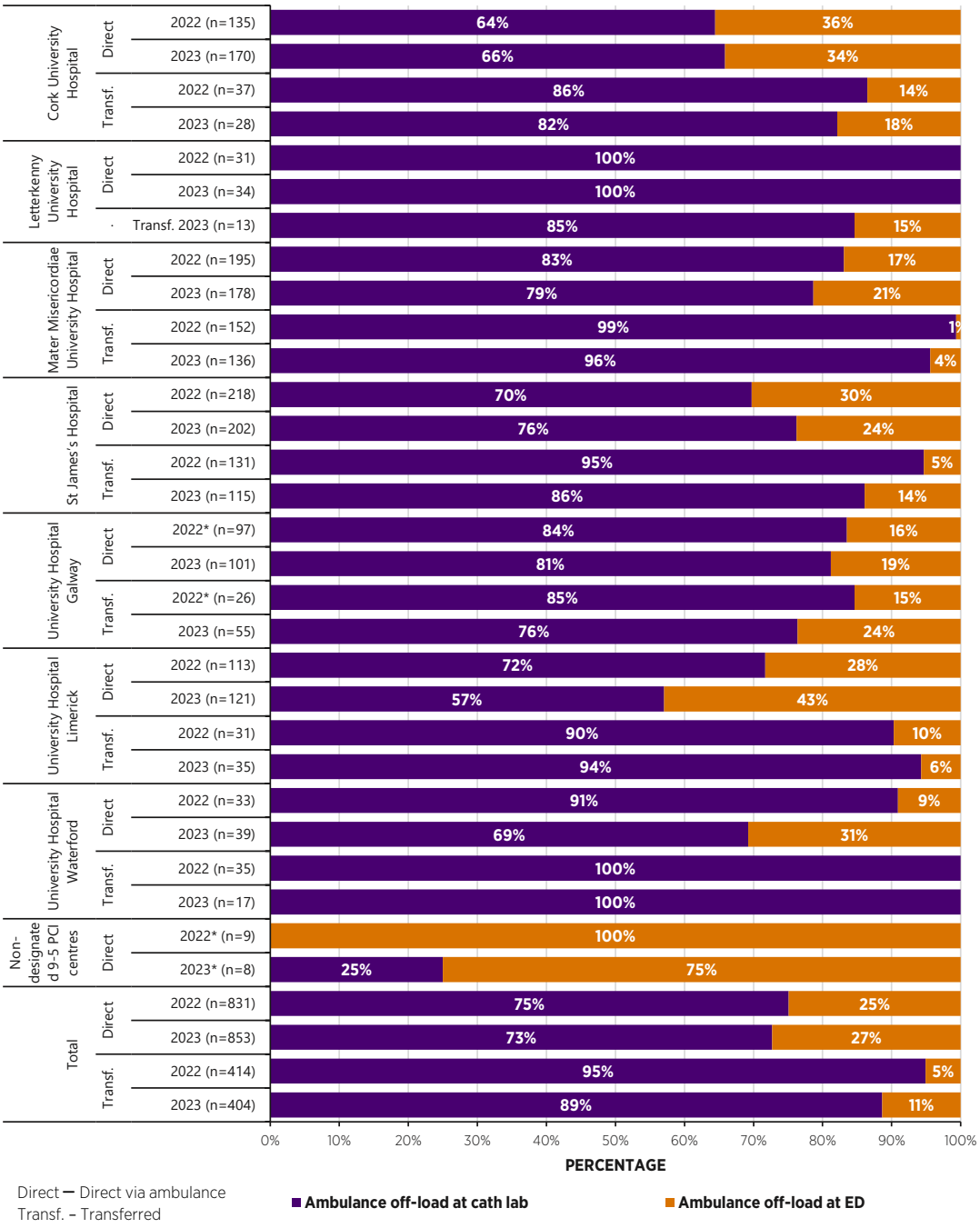
75% of those brought directly by ambulance to the PCI centre bypassed the ED and went straight to the cath lab.

For patients with a STEMI, the ESC recommends an ED bypass direct to the catheterisation laboratory (cath lab) in at least 80% of cases (Ibanez *et al*., 2018). Figure 5.8 shows the ambulance offload location for patients who arrived at the PCI centre directly by ambulance and for patients who were transferred from another hospital to a PCI centre. In 2022, among those who arrived at the PCI centre directly by ambulance, 75% (n=624) were brought directly to the cath lab, bypassing the ED; this is compared with 73% (n=620) in 2023. This was consistent with the percentage reported in 2021 (73%) (NOCA, 2023a). Direct arrival at the cath lab may not be possible for valid reasons, such as staff availability outside normal working hours (e.g. where the anticipated arrival time of the patient is sooner the 30-minute threshold for the on-call staff to arrive on site) or because the cath lab may be occupied (out of hours) by another patient. In such circumstances, it may be safer for the patient to be managed in the ED with nursing, medical care and monitoring prior to transferring to the cath lab. Cases transported to Altnagelvin Area Hospital are accepted if they are stable and can be delivered directly to the cath lab; if not, the patients are stabilised in Letterkenny University Hospital prior to transport to Altnagelvin Area Hospital for primary PCI.

For patients who were transferred to a PCI centre, 95% (n=393) were brought directly to the cath lab in 2022; this decreased to 89% (n=358) in 2023.

During 2022 and 2023, the majority of patients who were admitted directly or transferred to a PCI centre (n=2078/2502, 83%) were stable on admission to the PCI centre, compared with 85% in 2021 (NOCA, 2023a). However, a small proportion of patients (n=127, 5%) were in cardiogenic shock on admission to the PCI centre,[21] and 9% (n=233) had a resuscitated arrest on arrival. For more detailed information on patients' clinical status on arrival at the PCI centre, by hospital, see Appendix 8 (Table 8.3).

[21] The denominator excludes patients who received thrombolysis and only includes those who arrived directly via ambulance to a PCI centre, or were transferred to a PCI centre (n=2502).



* Coverage was below 80%.

FIGURE 5.8: LOCATION OF AMBULANCE OFFLOAD AT THE PERCUTANEOUS CORONARY INTERVENTION CENTRE FOR PATIENTS WHO ARRIVED DIRECTLY BY AMBULANCE OR WERE TRANSFERRED FROM ANOTHER HOSPITAL, BY PERCUTANEOUS CORONARY INTERVENTION CENTRE AND YEAR (n=2502)[22, 23, 24]

[22] Patients who had hospital and pre-hospital thrombolysis were excluded from this analysis.
[23] For patients who were transferred to a non-designated, 9.00am to 5.00pm weekday PCI centre: Beaumont Hospital, St Vincent's University Hospital and Tallaght University Hospital were not included individually in Figure 5.8 due to the small number of admissions. However, they are included in the totals for this figure.
[24] Letterkenny University Hospital refers to the Altnagelvin Area Hospital PCI centre, which provides the primary PCI service for Letterkenny. In 2022, cases transferred from Letterkenny University Hospital to Altnagelvin Area Hospital (e.g. walk-in patients/inpatients) were recorded as 'other' and were excluded from the analysis. The recording of these cases was corrected for 2023.

KEY FINDINGS FROM CHAPTER 5

- The timeliness of call for help has improved, with 49% of patients with a STEMI in 2023 who arrived at a PCI centre directly by ambulance calling for help within 60 minutes of the onset of symptoms, compared with 44% in 2021 (Figure 5.2).
- The proportion of patients brought directly by ambulance to a PCI centre decreased in 2022 and 2023 (54% and 55%, respectively) compared with 2021 (58%).
- The majority of patients (n=1148, 79%) who were brought directly to a PCI centre by ambulance in 2022 and 2023 arrived within the recommended time frame of 90 minutes (Figure 5.6) compared with only one-third of those who were transferred from another hospital to a PCI centre (Figure 5.7).
- In 2023, the median DIDO time was 97 minutes (IQR: 62–195 minutes), and only 4% of patients with a STEMI achieved the DIDO target of 30 minutes or less (Figure 5.3).
- The median time to first positive ECG for patients diagnosed in the ED of a non-PCI-capable hospital was 22 minutes (IQR: 9–65 minutes), and for those who self-presented to a PCI centre (n=144), the median time from arrival at the PCI centre to first positive ECG was 17 minutes (IQR: 7–46 minutes).

OPPORTUNITY FOR FURTHER QUALITY IMPROVEMENT

Public awareness of the importance of calling 112 or 999 could be improved through an awareness campaign.

Develop a DIDO quality improvement (QI) project in order to improve the pathway to a primary PCI centre for patients with a STEMI who arrive at a non-PCI-capable hospital and are transferred to a primary PCI centre.

Develop a QI project in order to improve the time to ECG for all patients with chest pain.

CHAPTER 6

REPERFUSION THERAPY FOR PATIENTS WITH A STEMI

CONTENTS

CHAPTER 6: REPERFUSION THERAPY FOR PATIENTS WITH A STEMI

SCOPE OF CHAPTER 6

This chapter describes the reperfusion therapy, as recorded on the Heartbeat portal, received by all patients with a STEMI during the reporting period. It focuses on the analysis of the cohort for whom reperfusion was not contraindicated and reports on the timeliness of the two types of reperfusion therapy provided: primary PCI and thrombolysis. The results of four key quality indicators (KQIs) as reported in the IHAA dashboard are also highlighted. Appendix 7 provides detailed definitions of the composite data points reported in this chapter. References to 2021 data are the results of the *Irish Heart Attack Audit National Report 2021* (NOCA, 2023a).

REPERFUSION THERAPY TYPE

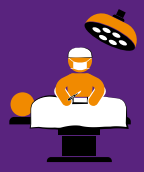
Overall, 1,533 patients with a STEMI were recorded on the Heartbeat portal in 2022 and 1,569 were recorded in 2023. In 2022, 74% (n=1139) of these patients had a primary PCI and 6% (n=85) had thrombolysis as the primary reperfusion strategy. In 2023, 78% (n=1223) had a primary PCI and 7% (n=108) had thrombolysis. Fifteen percent of patients in 2022 (n=235), and 9% in 2023 (n=139), had a contraindication to reperfusion. Where the primary reperfusion strategy was initially primary PCI, an additional 5% of patients in 2022 (n=73), and 6% in 2023 (n=97), did not require reperfusion after angiography (Table 6.1).

The proportion of patients who received a primary PCI decreased from 84% in 2020 to 79% in 2021, with a further decrease to 74% in 2022; however, this increased to 78% in 2023 (Figure 6.1). In 2022, there was an increase in the proportion of patients with contraindications to reperfusion therapy (15%), compared with 12% in 2021, but this also decreased in 2023, to 9%. For both 2022 and 2023, the most common contraindication was late (after more than 12 hours) presentation to the hospital (2022: 90%; 2023: 91%; see Table 8.4 in Appendix 8). The type of reperfusion therapy performed, categorised by hospital and year, is displayed in Table 6.1.

Analysis of timeliness of reperfusion excludes patients with a contraindication to reperfusion therapy. The IHAA dashboard reports on the percentage of eligible patients with a STEMI who received reperfusion.

KQI 1: Percentage of eligible patients with a STEMI who were offered reperfusion.

TARGET: 95% 2022 RESULT: 94% 2023 RESULT: 93%



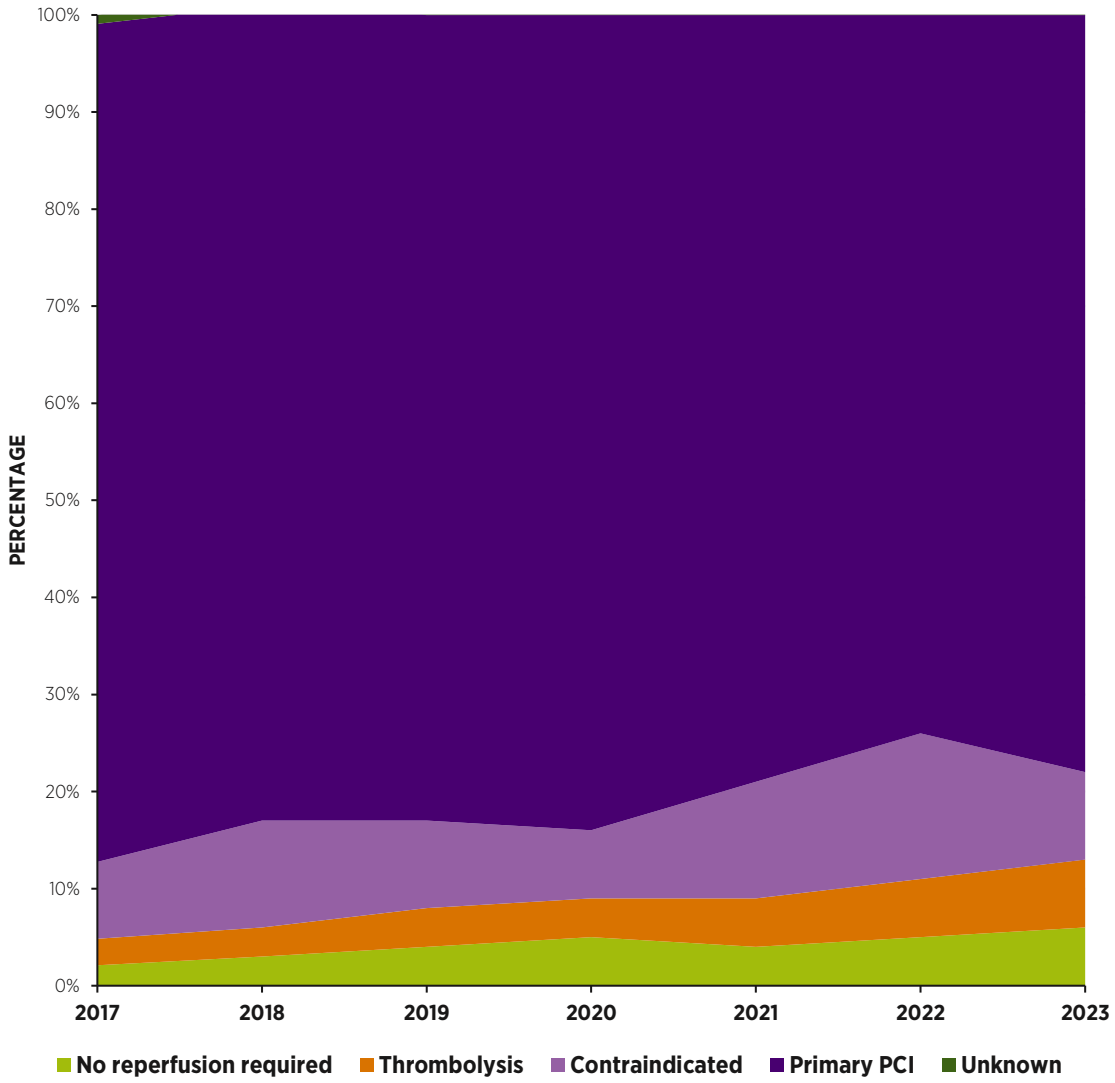


FIGURE 6.1: FIRST REPERFUSION THERAPY TYPE FOR PATIENTS ADMITTED TO A PERCUTANEOUS CORONARY INTERVENTION CENTRE WITH A CONFIRMED ST ELEVATION MYOCARDIAL INFARCTION, BY YEAR (N=10222)

TABLE 6.1: FIRST REPERFUSION THERAPY TYPE FOR PATIENTS ADMITTED TO A PERCUTANEOUS CORONARY INTERVENTION CENTRE WITH A CONFIRMED ST ELEVATION MYOCARDIAL INFARCTION, BY HOSPITAL AND YEAR (N=3102)

		2022		2023	
		N	**%**	**N**	**%**
Cork University Hospital	Thrombolysis	24	11%	32	12%
	Primary PCI	145	64%	178	68%
	No reperfusion required	17	7%	11	4%
	Contraindicated	41	18%	40	15%
	Unknown	0	0%	0	0%
	Total	**227**	**100%**	**261**	**100%**
Letterkenny University Hospital[25]	Thrombolysis	0	0%	0	0%
	Primary PCI	38	90%	47	100%
	No reperfusion required	~	*	0	0%
	Contraindicated	0	0%	0	0%
	Unknown	*	*	0	0%
	Total	**42**	**100%**	**47**	**100%**
Mater Misericordiae University Hospital	Thrombolysis	0	0%	0	0%
	Primary PCI	299	78%	284	84%
	No reperfusion required	~	*	~	*
	Contraindicated	56	15%	33	10%
	Unknown	~	*	~	*
	Total	**382**	**100%**	**340**	**100%**
St James's Hospital	Thrombolysis	39	10%	49	13%
	Primary PCI	305	74%	302	77%
	No reperfusion required	9	2%	27	7%
	Contraindicated	57	14%	14	4%
	Unknown	0	0%	0	0%
	Total	**410**	**100%**	**392**	**100%**
University Hospital Galway[26]	Thrombolysis	19	12%	24	12%
	Primary PCI	106	65%	143	73%
	No reperfusion required	8	5%	15	8%
	Contraindicated	30	18%	15	8%
	Unknown	0	0%	0	0%
	Total	**163**	**100%**	**197**	**100%**
University Hospital Limerick	Thrombolysis	~	*	~	*
	Primary PCI	155	84%	158	81%
	No reperfusion required	~	*	*	*
	Contraindicated	24	13%	24	12%
	Unknown	0	0%	0	0%
	Total	**185**	**100%**	**194**	**100%**
University Hospital Waterford	Thrombolysis	0	0%	~	*
	Primary PCI	64	79%	73	86%
	No reperfusion required	~	*	9	11%
	Contraindicated	12	15%	~	*
	Unknown	*	*	0	0%
	Total	**81**	**100%**	**85**	**100%**
Beaumont Hospital	Thrombolysis	~	*	0	0%
	Primary PCI	12	60%	7	78%
	No reperfusion required	0	0%	0	0%
	Contraindicated	*	*	~	*
	Unknown	0	0%	*	*
	Total	**20**	**100%**	**9**	**100%**
St Vincent's University Hospital[27]	Thrombolysis	0	0%	~	*
	Primary PCI	8	100%	17	81%
	No reperfusion required	0	0%	~	*
	Contraindicated	0	0%	0	0%
	Unknown	0	0%	0	0%
	Total	**8**	**100%**	**21**	**100%**
Tallaght University Hospital	Thrombolysis	0	0%	0	0%
	Primary PCI	7	47%	14	61%
	No reperfusion required	0	0%	0	0%
	Contraindicated	8	53%	9	39%
	Unknown	0	0%	0	0%
	Total	**15**	**100%**	**23**	**100%**
Total	Thrombolysis	85	6%	108	7%
	Primary PCI	1139	74%	1223	78%
	No reperfusion required	*	*	*	*
	Contraindicated	235	15%	139	9%
	Unknown	~	*	~	*
	Total	**1533**	**100%**	**1569**	**100%**

Non-designated 9.00 am to 5.00pm, Monday to Friday PCI centres

~ Denotes five cases or fewer.

* Further suppression required in order to prevent disclosure of five cases or fewer.

[25] Only cases who were treated in Altnagelvin Area Hospital were submitted to Heartbeat from Letterkenny University Hospital. Other cases with a STEMI who attended Letterkenny University Hospital were transferred to University Hospital Galway and recorded on Heartbeat there.

[26] University Hospital Galway had coverage below 80% in 2022.

[27] St Vincent's University Hospital had coverage below 80% in 2022 and 2023.

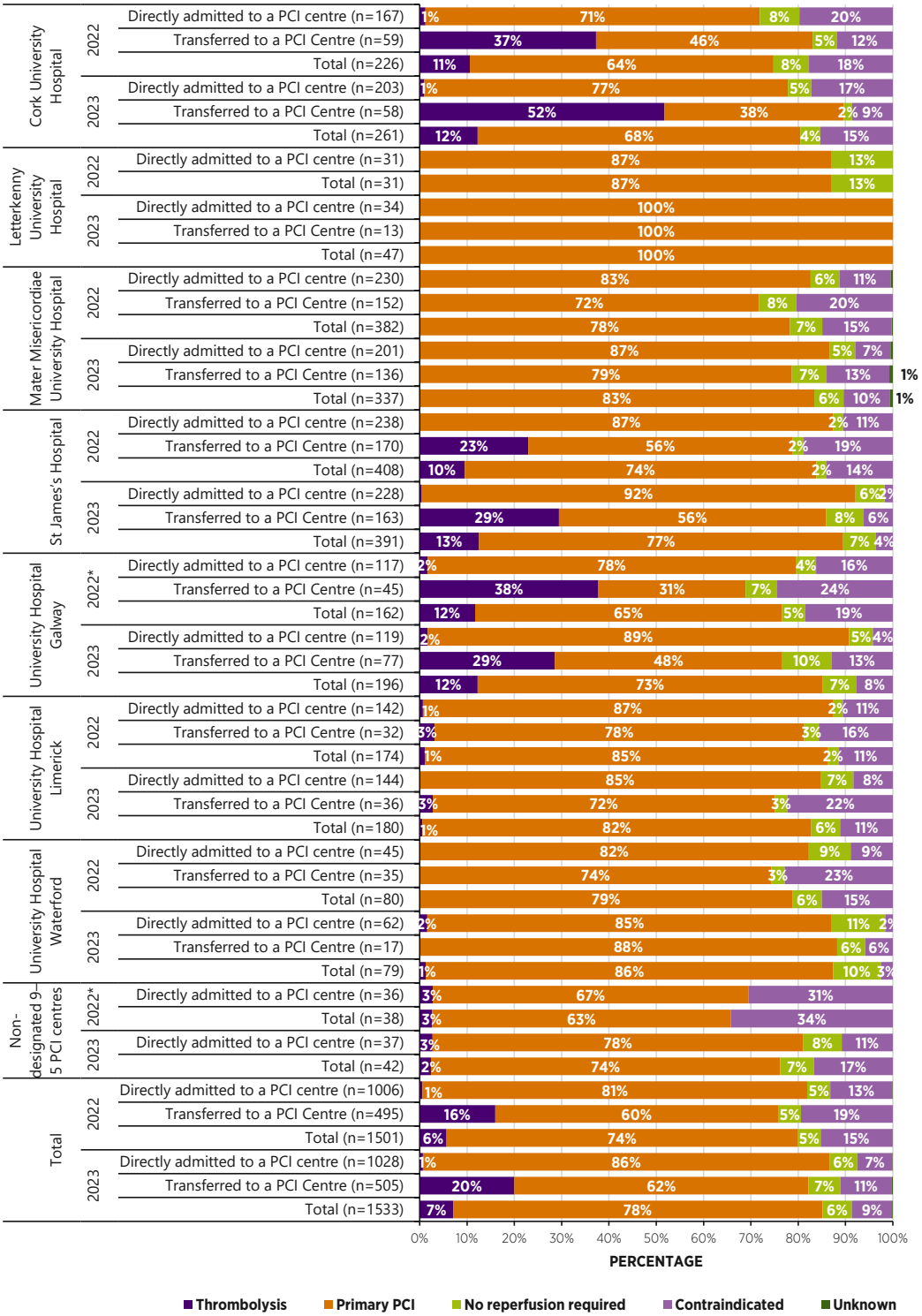
REPERFUSION THERAPY TYPE BY REFERRAL SOURCE

How a patient accesses care may influence the type of reperfusion therapy they receive. If a patient self-presents with a STEMI to a non-PCI hospital, and if an inter-hospital transfer cannot be achieved in a timely fashion, the patient should be treated with thrombolysis and subsequently transferred to a PCI centre (sometimes called a pharmaco-invasive strategy or the 'drip-and-ship' strategy). In this scenario, the ORS protocol recommends administration of thrombolysis within 30 minutes of diagnosis of a STEMI. If a patient can be transferred to a PCI centre (for primary PCI) in 90 minutes or less, the 2023 ESC ACS guideline (Byrne *et al*., 2023) recommends that the time between arrival at the first hospital and departure to a PCI centre should be within 30 minutes. This is known as the DIDO time.

The type of reperfusion therapy by referral source is displayed in Figure 6.2. Although the vast majority of patients with a STEMI who presented directly to a PCI centre in 2022 and 2023 had a primary PCI, this proportion decreased from 86% in 2021 to 81% in 2022, before rising to 86% again in 2023.

During the 2 reporting years, patients who arrived at a PCI centre directly were more likely to receive a primary PCI (n=1701, 84%) when compared with patients who were transferred to a PCI centre (n=610, 61%). However, 18% (n=180) of transferred patients who initially presented to non-PCI-capable hospitals had thrombolysis as their initial reperfusion strategy.

There was an increase in the proportion of patients who were treated with thrombolysis prior to transfer to a PCI centre in 2023, to 20% (n=101) compared with 18% in 2021 (NOCA, 2023a), with variation between primary PCI centres. Similar to 2021, in 2023 Cork University Hospital, St James's Hospital and University Hospital Galway had more than 29% of patient's thrombolysed prior to transfer compared with less than 10% in the other PCI centres. This could reflect longer travel distance or improved adherence to the ORS protocol.



* Coverage was below 80%.

FIGURE 6.2: REPERFUSION THERAPY TYPE, BY REFERRAL SOURCE, PERCUTANEOUS CORONARY INTERVENTION CENTRE AND YEAR (N=3034)[28,29]

[28] 'Directly admitted to a PCI centre' includes patients who arrived at the PCI centre directly via ambulance, those who were inpatients in a PCI centre, and patients who self-presented to a PCI centre. Non-designated, 9.00am to 5.00pm weekday PCI centres include Beaumont Hospital, St Vincent's University Hospital (coverage was below 80%) and Tallaght University Hospital. Data on reperfusion therapy type for these hospitals are included in the corresponding frequency table in Appendix 5.

[29] Patients for whom the source of referral was not recorded, or for whom it was recorded as 'other', are excluded from Figure 6.2 (n=68).

TIMELINESS OF REPERFUSION

DOOR TO BALLOON TIME

Chapter 5 described the first part of the pathway to timely primary PCI, namely the FMCTD time, with a target from FMC to arrival at the door of the PCI centre of 90 minutes or less. The second part of the pathway is the time interval from arrival at the PCI centre to reopening the artery responsible for the heart attack by primary PCI. This is described as the DTB time, and the target is 30 minutes or less (HSE, 2012), allowing the PCI centre 30 minutes to receive the patient and provide primary PCI within the FMCTB target of 120 minutes or less (Figure 6.3).

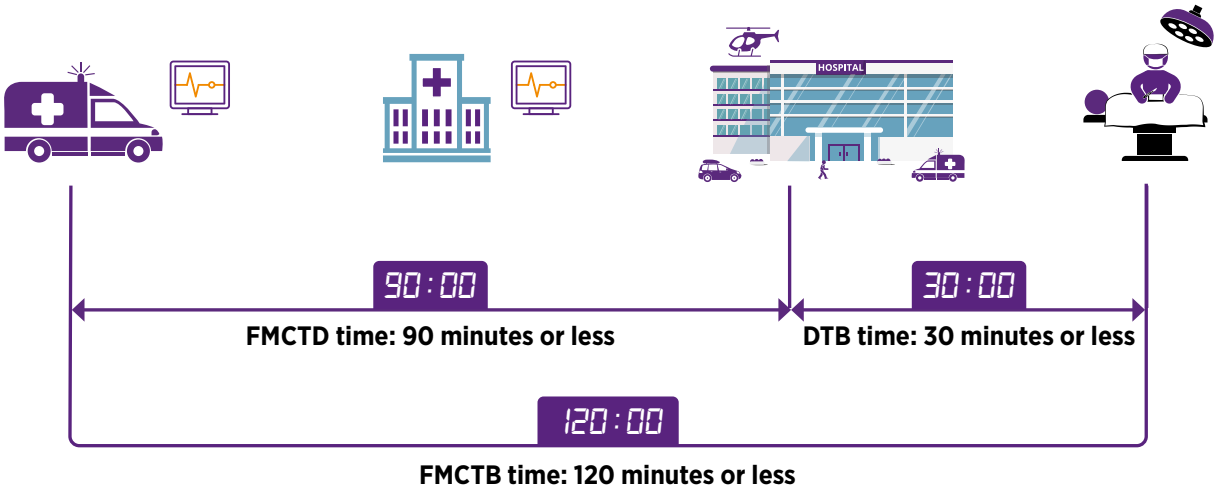


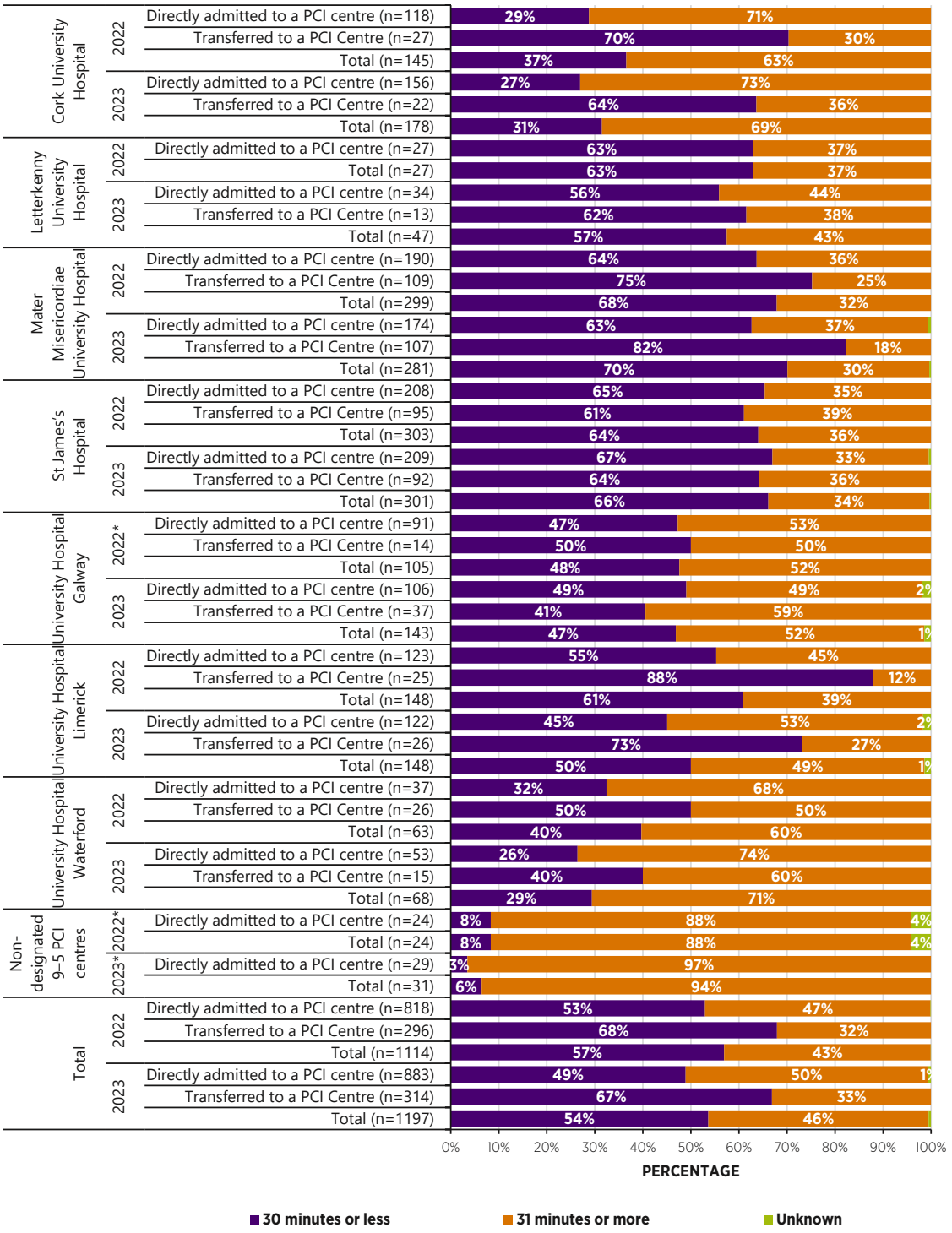
FIGURE 6.3: TIME INTERVAL GOALS

The proportion of patients with a STEMI who achieved a DTB time of 30 minutes or less decreased from 59% in 2021 to 57% in 2022, and to 54% in 2023. A larger proportion of patients who were transferred to a PCI centre had a DTB time of 30 minutes or less (2022: 68%; 2023: 67%) in comparison with patients who arrived directly at a PCI centre (2022: 53%; 2023: 49%) (Figure 6.4). This is because the longer transfer times allowed the cath lab team time to arrive on site prior to the patient's arrival compared with patients who were brought directly to the PCI centre, when rapid ambulance transfer, especially in urban areas, may mean that the patient arrives before the clinical team.

There was variation between PCI centres and the reporting years in achieving a DTB time of 30 minutes or less, ranging from 68% (n=203) in the Mater Misericordiae University Hospital to 37% (n=53) in Cork University Hospital in 2022. In 2023, 70% (n=197) of patients in the Mater Misericordiae University Hospital achieved a DTB time of 30 minutes or less compared with 29% (n=20) in University Hospital Waterford[30].

This variation warrants further attention within each PCI centre in order to try to understand and identify delays/local factors contributing to this variation. Within the non-designated, 9.00am to 5.00pm weekday PCI centres, only 8% (n≤5) of patients in 2022 and 6% (n≤5) of patients in 2023 achieved a DTB time of 30 minutes or less. The median DTB time for all patients with a STEMI who received primary PCI in 2022 was 28 minutes (IQR: 19–47 minutes), and in 2023 this was 29 minutes (IQR: 20–52 minutes). For those admitted directly to a PCI centre, the median DTB time was 30 minutes (IQR: 19–55 minutes) in 2022 and 31 minutes (IQR: 20–66 minutes) in 2023. For those who were transferred to a PCI centre, it was 25 minutes for both 2022 and 2023 (2022 IQR: 17–36 minutes; 2023 IQR: 17–35 minutes). Appendix 8 (Table 8.6) displays the median DTB times and IQRs for the reporting period by referral source and hospital.

[30] University Hospital Waterford it is not a 24/7 PCI centre.



* Coverage was below 80%.

FIGURE 6.4: DOOR TO BALLOON TIME FOR PATIENTS DIRECTLY ADMITTED OR TRANSFERRED TO A PERCUTANEOUS CORONARY INTERVENTION CENTRE, BY PERCUTANEOUS CORONARY INTERVENTION CENTRE AND YEAR (n=2311)[31]

[31] Non-designated, 9.00am to 5.00pm weekday PCI centres include Beaumont Hospital, St Vincent's University Hospital (coverage was below 80%) and Tallaght University Hospital. DTB times for these hospitals are included in the corresponding frequency table in Appendix 5.

DEFINING TIMELY REPERFUSION

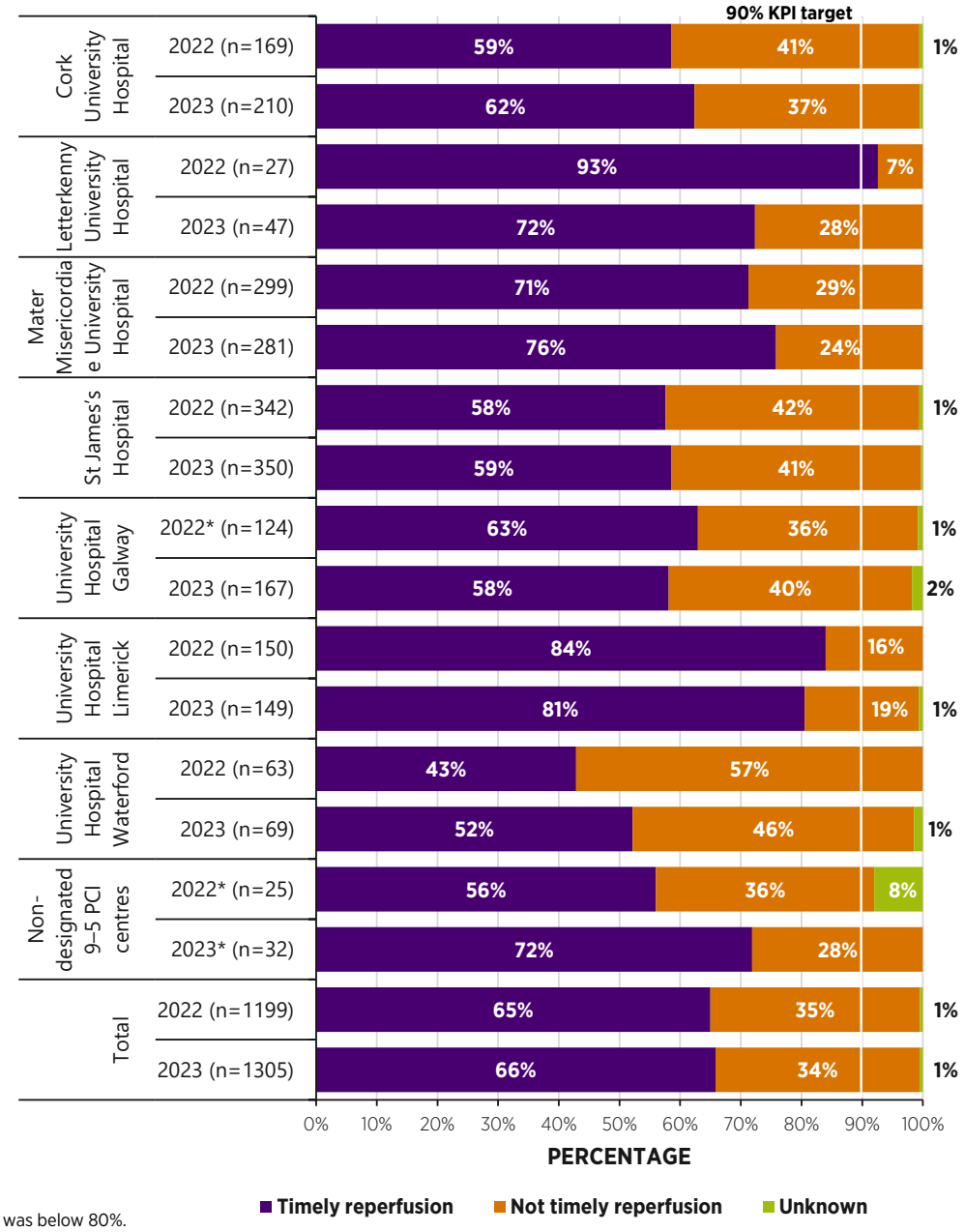
Timely primary PCI is recognised internationally as the preferred treatment for STEMI (Byrne *et al*., 2023). Where primary PCI cannot be delivered within a clinically acceptable time frame, thrombolysis is recommended, with early transfer to a PCI centre for angiography (HSE, 2012). Table 6.2 displays definitions for timely thrombolysis and timely primary PCI. The *Acute Coronary Syndromes Programme Model of Care* (HSE, 2012) has an agreed target that 90% of patients with a STEMI (who do not have a contraindication to reperfusion) should receive timely reperfusion.

TABLE 6.2: DEFINITION OF TIMELY THROMBOLYSIS AND TIMELY PRIMARY PERCUTANEOUS CORONARY INTERVENTION

Timely thrombolysis	Timely thrombolysis is defined as an interval between the FMC and initiation of thrombolysis (often known as the 'door to needle' time) of 30 minutes or less (HSE, 2012; Hamm *et al*., 2011). Thrombolysis can be given pre-hospital or in hospital. For thrombolysis given pre-hospital, the FMC is defined as the time of the first positive ECG. For thrombolysis given in hospital, the FMC is defined as the time of arrival at the first hospital, except for inpatients, where the FMC is defined as the first positive ECG.
Timely primary PCI	Timely primary PCI is defined as an interval between the FMC and balloon/wire cross of 120 minutes or less (HSE, 2012; Hamm *et al*., 2011). From 2021 onwards, the FMC is defined as the time of the first diagnostic ECG in all cases.

TIMELY REPERFUSION IN ALL PATIENTS WITH A STEMI

Figure 6.5 shows the proportion of patients with a STEMI who received timely reperfusion, whether that was thrombolysis or primary PCI. Overall, the proportion of patients with a STEMI who received timely reperfusion has decreased from 69% in 2021, to 65% in 2022 and 66% in 2023, which is well below the target of 90%. The median time to reperfusion (either primary PCI or thrombolysis) in 2022 was 96 minutes (IQR: 70–132 minutes), and in 2023 this was 95 minutes (IQR: 69–127 minutes). There is variation between PCI centres, with only one PCI centre reaching the 90% target during the 2-year reporting period.



* Coverage was below 80%.

FIGURE 6.5: PROPORTION OF PATIENTS WHO RECEIVED TIMELY PRIMARY PERCUTANEOUS CORONARY INTERVENTION AND THROMBOLYSIS REPERFUSION, BY PERCUTANEOUS CORONARY INTERVENTION CENTRE AND YEAR (n=2504)[32,33]

[32] Non-designated, 9.00am to 5.00pm weekday PCI centres include Beaumont Hospital (coverage was below 80%), St Vincent's University Hospital and Tallaght University Hospital. Data on timeliness of reperfusion for these hospitals are included in the corresponding frequency table in Appendix 5.

[33] Patients for whom the source of referral was not recorded, or for whom it was recorded as 'other', or cases who did not have timeliness of reperfusion recorded, are excluded from Figure 6.5.

TIMELINESS OF THROMBOLYSIS THERAPY

Figure 6.6 shows the proportion of patients with a STEMI who received timely thrombolysis in 2022 and 2023. Of those treated with a thrombolysis strategy, 29% (n=25) of patients with a STEMI in 2022 received timely thrombolysis, compared with 21% (n=23) in 2023.

With the introduction of the ORS protocol in 2013, thrombolysis is only recommended when primary PCI cannot be delivered within 120 minutes of the time of FMC. As a result, the majority (54% in 2022 and 55% in 2023) of patients with a STEMI were brought directly by ambulance to PCI centres, bypassing non-PCI-capable hospitals; however, almost one-third (32% in both 2022 and 2023) still presented to non-PCI-capable hospitals (Figure 5.1). In the non-PCI-capable hospitals, the ORS protocol advocates for immediate transfer to a PCI centre within 90 minutes, if possible. No information is recorded on Heartbeat for patients with a STEMI who receive thrombolysis and are not transferred to a PCI centre.

Only 25% of patients with a STEMI received timely thrombolysis in 2022 and 2023

The number of cases treated by thrombolysis continues to increase (from 81 in 2021, to 85 in 2022 and 108 in 2023). This may reflect a greater focus on the delivery of thrombolysis for patients who cannot be transferred for primary PCI in a timely manner. However, only 25% (n=48) of patients received timely thrombolysis during the 2 reporting years. The reasons for this are unclear and may differ between individual PCI centres. Improving the timeliness of thrombolysis was a recommendation in the 2021 IHAA report (NOCA, 2023a). A national QI project (developed by the National Heart Programme in conjunction with the HSE National Quality and Patient Safety Directorate, the National Ambulance Service and the Royal College of Physicians of Ireland and the IHAA) is under way and, among other goals, it aims to improve access to timely thrombolysis as part of a pharmaco-invasive reperfusion strategy where timely access to primary PCI is either not feasible or unavailable.

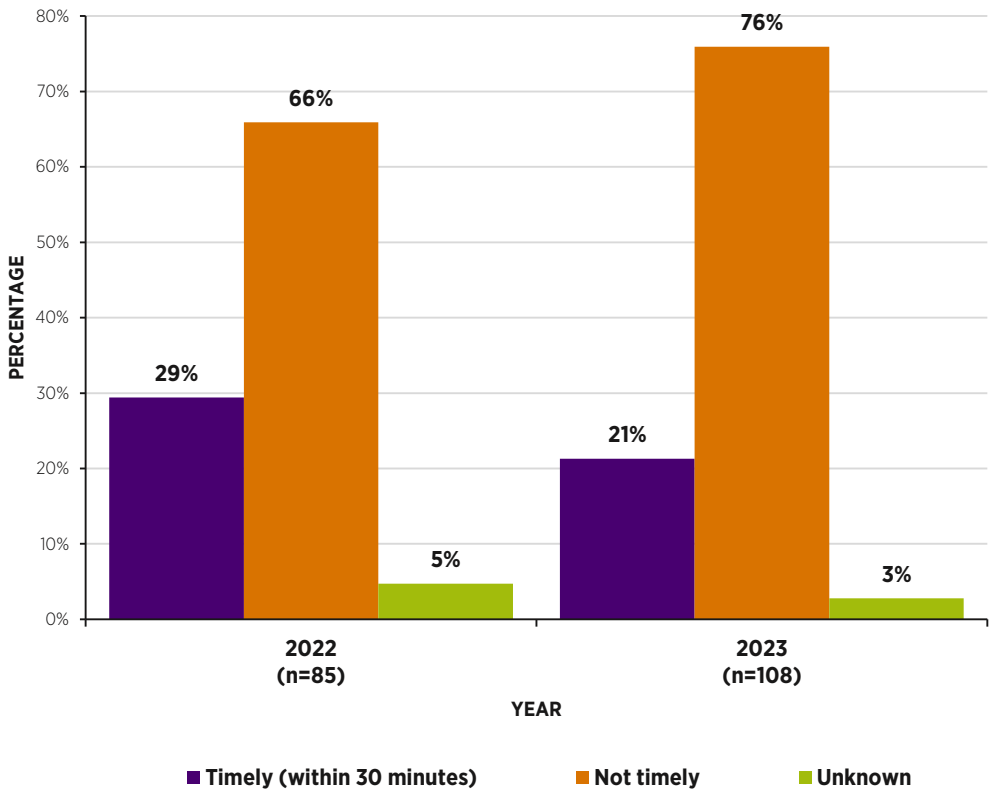


FIGURE 6.6: PROPORTION OF PATIENTS WHO RECEIVED TIMELY REPERFUSION WITH THROMBOLYSIS, BY YEAR (n=193)

TIMELINESS OF PRIMARY PCI THERAPY

Overall, 68% (n=754) of patients with a STEMI in 2022, and 70% (n=836) in 2023, received primary PCI within 120 minutes of FMC, which is below the KQI target of 90%. This is compared with 73% in 2021. In 2022, only two PCI centres (Letterkenny University Hospital and University Hospital Limerick) achieved the KQI target of 90%. In 2023, only Mater Misericordiae University Hospital achieved the 90% target.

Timeliness varied depending on whether the patient accessed the PCI centre directly (by either already being an inpatient in a PCI centre, self-presenting to the PCI centre, or being transported directly by ambulance to a PCI centre) or was transferred (from a non-PCI-capable hospital). Seventy-eight percent (n=640) of patients with a STEMI who were admitted directly to a PCI centre in 2022, and 79% (n=695) in 2023, had timely reperfusion (Figure 6.7), a decrease from 82% in 2021.

KQI 2: Percentage of patients with a STEMI who were brought directly to a primary PCI centre who had timely primary PCI

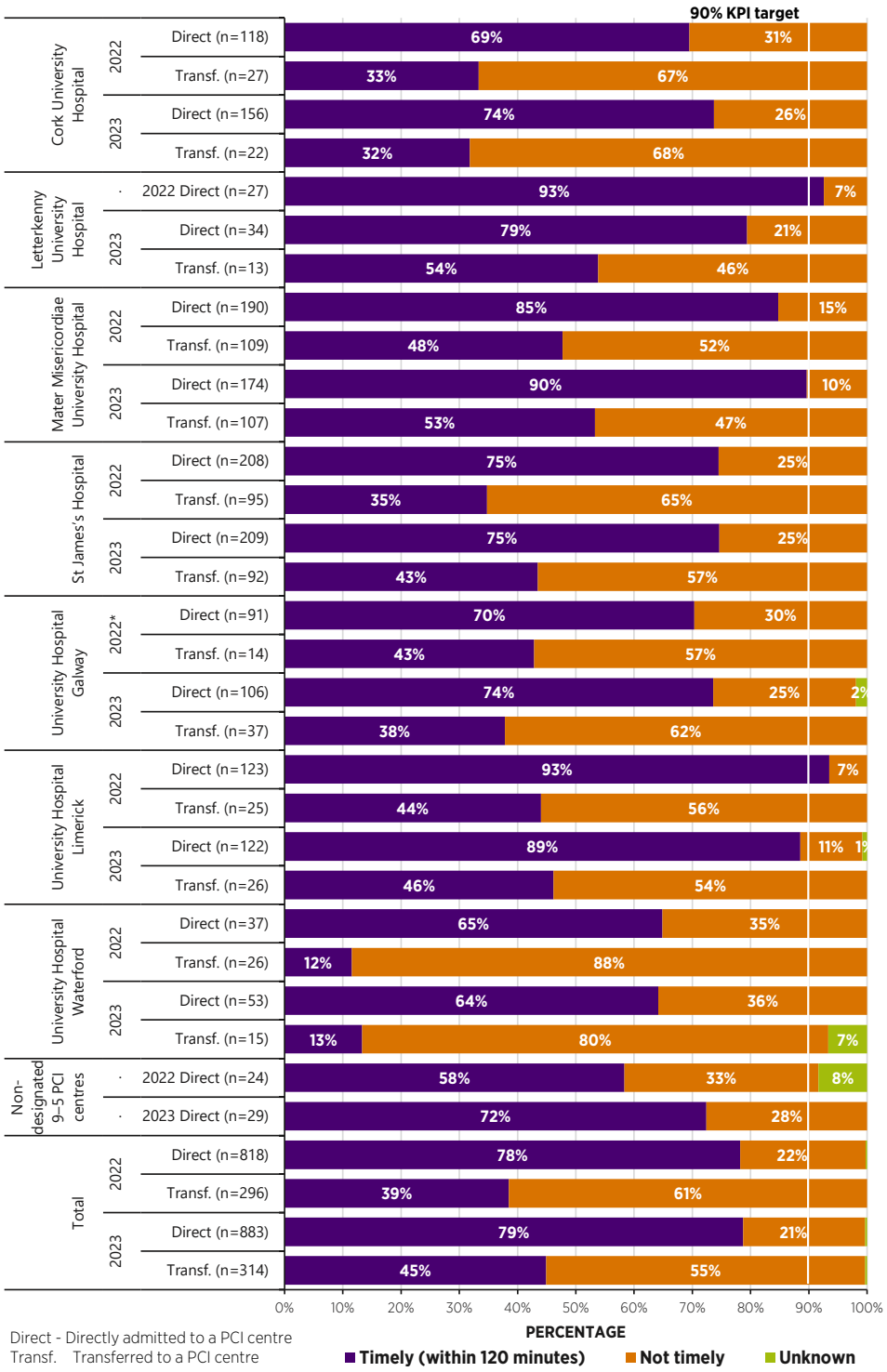
TARGET: 90% 2022 RESULT: 78% 2023 RESULT: 79%

Patients who were transferred to a PCI centre from another hospital achieved the KQI target in 39% of cases (n=114) in 2022, and in 45% of cases (n=141) in 2023. The percentage reported in 2021 was 41%. Figure 6.7 shows the proportion of patients who received timely primary PCI, by referral source and PCI centre.

Figure 6.8 displays the timeliness of primary PCI, by PCI centre and referring hospital, as a total for both 2022 and 2023. Due to small number of patients in individual hospitals, caution should be applied when interpreting results.

KQI 3: Percentage of patients with a STEMI who were transferred from a non-PCI-capable hospital to a primary PCI centre who had timely primary PCI

TARGET: 90% 2022 RESULT: 39% 2023 RESULT: 45%



* Coverage was below 80%.

FIGURE 6.7: PROPORTION OF TIMELY PRIMARY PERCUTANEOUS CORONARY INTERVENTION FOR PATIENTS ADMITTED DIRECTLY OR TRANSFERRED TO A PERCUTANEOUS CORONARY INTERVENTION CENTRE, BY PERCUTANEOUS CORONARY INTERVENTION CENTRE AND YEAR (n=2311)[34,35]

[34] 'Directly admitted to a PCI centre' includes patients who arrived at a PCI centre directly via ambulance, those who were inpatients in a PCI centre, and patients who self-presented at a PCI centre.

[35] Non-designated, 9.00am to 5.00pm weekday PCI centres include Beaumont Hospital, St Vincent's University Hospital (coverage was below 80%) and Tallaght University Hospital. Data on timeliness for these hospitals are included in the corresponding frequency table in Appendix 5. Data on timeliness for hospitals that had five cases or fewer are not presented in Figure 6.7.

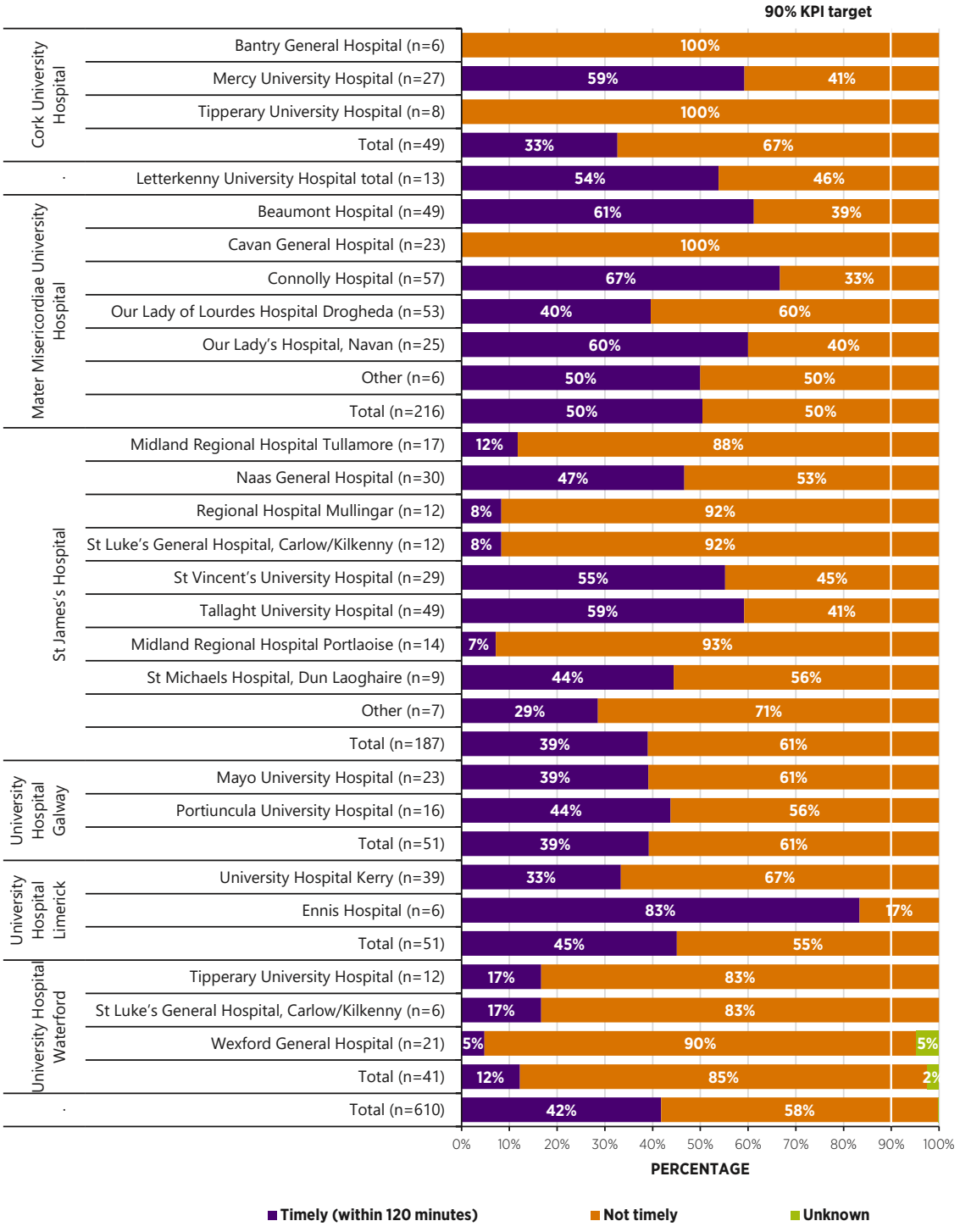


FIGURE 6.8: PROPORTION OF TIMELY PRIMARY PERCUTANEOUS CORONARY INTERVENTIONS FOR PATIENTS WHO WERE TRANSFERRED TO A PERCUTANEOUS CORONARY INTERVENTION CENTRE, BY REFERRING HOSPITAL, FOR 2022 AND 2023 (n=610)[36,37]

[36] Data on timeliness for these hospitals are included in the corresponding frequency table in Appendix 5. Data on timeliness for hospitals that had five cases or fewer are not presented in Figure 6.8.
[37] University Hospital Galway (in 2022) and St Vincent's University Hospital (in 2022 and 2023) had coverage below 80%.

Overall, the median FMCTB time was 99 minutes (IQR: 73–135 minutes) in 2022, and 98 minutes (IQR: 73–129 minutes) in 2023, both of which represented an increase from 96 minutes in 2021. For patients who arrived directly at a PCI centre, the median FMCTB time was 89 minutes (IQR: 67–116 minutes) in 2022 and 87 minutes (IQR: 67–115 minutes) in 2023, and both years were similar to the median of 88 minutes in 2021. For patients who were transferred to a PCI centre, the median FMCTB time was 138 minutes (IQR: 106–193 minutes) in 2022 and 129 minutes (IQR: 103–196 minutes) in 2023 (Table 6.3); in 2021, this was 135 minutes.

TABLE 6.3: FIRST MEDICAL CONTACT TO BALLOON TIME, MEDIAN AND INTERQUARTILE RANGE, BY REFERRAL SOURCE (n=2305)[38]

		Number of patients	Median (h:mm[39])	IQR 1 (h:mm)	IQR 3 (h:mm)
2022	Directly admitted to a PCI centre	816	1:29	1:07	1:56
	Transferred to PCI centre	296	2:18	1:46	3:13
2023	Directly admitted to a PCI centre	880	1:27	1:07	1:55
	Transferred to PCI centre	313	2:09	1:43	3:16

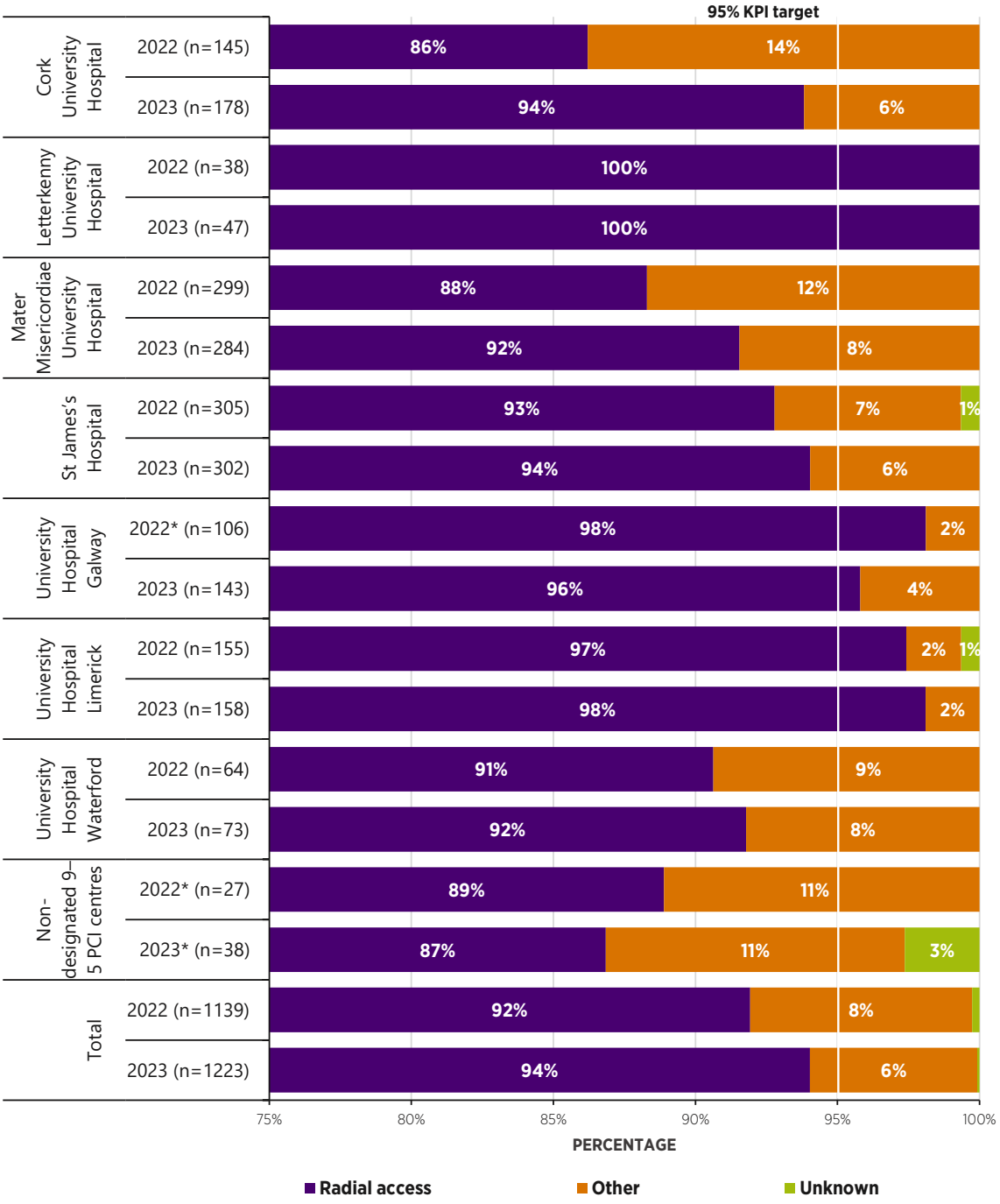
ARTERIAL ACCESS

Primary PCI requires arterial access, which carries an inherent risk of vascular injury or bleeding complications. Bleeding complications are associated with a higher risk of future recurrent ischaemic events and with higher mortality. Traditionally, PCI procedures were performed via a femoral artery approach. The ESC guidelines for STEMI management now recommend access using the radial artery approach for all patients undergoing a PCI procedure (Ibanez *et al*., 2018). This enables early mobilisation and reduces the risk of vascular and bleeding complications, and is associated with a reduction in mortality, based on the clear clinical advantages demonstrated in several large-scale clinical trials of radial versus femoral arterial access. Figure 6.9 displays the proportion of patients who received each type of arterial access in each PCI centre. During the reporting period, the majority of patients (92% in 2022 and 94% in 2023) received primary PCI through radial access, similar to 2021 (93%; NOCA, 2023a). The type of arterial access varied slightly between hospitals.

KQI 4: Percentage of patients with a STEMI who had radial access for primary PCI

TARGET: 95% 2022 RESULT: 92% 2023 RESULT: 94%

[38] Patients for whom the source of referral was not recorded, or for whom it was recorded as 'other', are excluded from Table 6.3 (n=51).
[39] Hour(s):minute(s)



* Coverage was below 80%.

FIGURE 6.9: TYPE OF ARTERIAL ACCESS, BY PERCUTANEOUS CORONARY INTERVENTION CENTRE (n=2362)[40, 41]

[40] Figure 6.9 includes only patients who were not contraindicated and had a primary PCI performed.
[41] Non-designated, 9.00am to 5.00pm weekday PCI centres include Beaumont Hospital (coverage was below 80%), St Vincent's University Hospital (coverage was below 80%) and Tallaght University Hospital.

KEY FINDINGS FROM CHAPTER 6

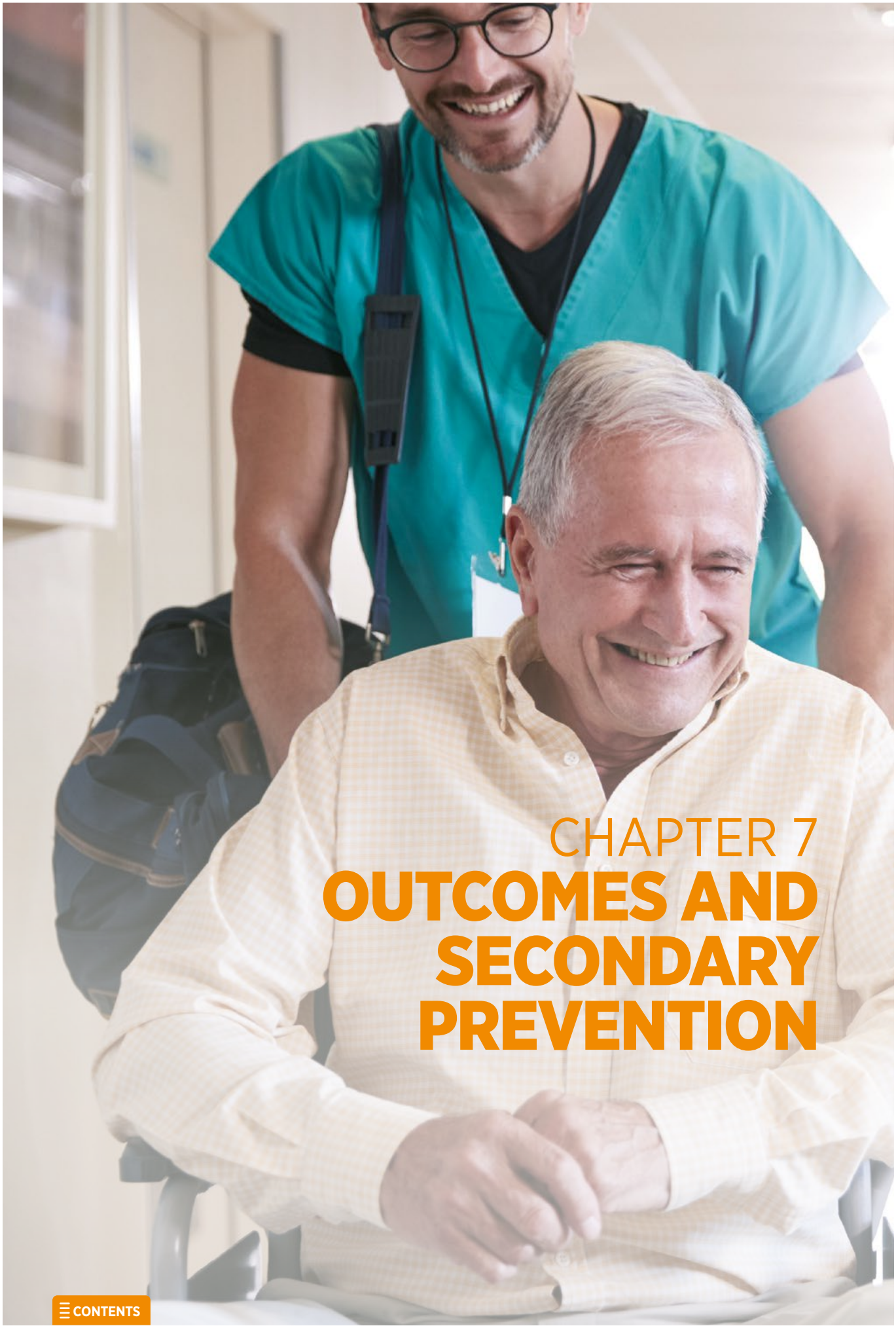
- Although the vast majority of patients with a STEMI who presented directly to a PCI centre had a primary PCI, the proportion has decreased since 2021, from 86% to 81% in 2022, before rising to 86% again in 2023.
- Overall, timely primary PCI (within 120 minutes of FMC) was achieved in 68% of patients with a STEMI in 2022, and 70% in 2023. Among patients with a STEMI who were admitted directly to a PCI centre, 78% had timely primary PCI in 2022 and 79% had timely primary PCI in 2023, compared with 39% of transferred patients in 2022 and 45% of transferred patients in 2023.
- Twenty-nine percent (n=25) of patients with a STEMI received timely thrombolysis in 2022, compared with 21% (n=23) in 2023.

OPPORTUNITY FOR FURTHER QUALITY IMPROVEMENT

Develop a QI project in order to improve the timeliness of thrombolysis when transfer for primary PCI within 90 minutes is not feasible.

Develop a QI project in order to improve the DTB time in hospitals not reaching the target of 30 minutes or less.

Develop a QI project in order to increase the use of radial arterial access for primary PCI.



CHAPTER 7
OUTCOMES AND SECONDARY PREVENTION

CONTENTS

CHAPTER 7: OUTCOMES AND SECONDARY PREVENTION

SCOPE OF CHAPTER 7

This chapter presents the outcomes of care and key treatments aimed at the secondary prevention of further cardiovascular events for patients with a STEMI recorded on the Heartbeat portal in 2022 and 2023. References to 2021 refer to the results reported in the *Irish Heart Attack Audit National Report 2021* (NOCA, 2023a).

AMENDMENTS IN THE REPORTING OF OUTCOME DATA FROM THE HEARTBEAT DATASET

The *Irish Heart Attack Audit National Report 2021* (NOCA, 2023a) detailed the limitations of outcome data in the Heartbeat dataset. However, the quality of outcome data improved in both 2022 and 2023 (Appendix 6), and for this reporting period, additional outcome measures are presented:

- incidence of left ventricular dysfunction
- incidence of congestive heart failure
- unadjusted in-hospital mortality
- risk-adjusted in-hospital mortality
- unadjusted 30-day mortality.

Data quality limits complete reporting for 2022 outcomes, and commentary is made on data quality in the relevant sections of this chapter.

OUTCOMES

LEFT VENTRICULAR FUNCTION OUTCOMES

The majority of patients with a STEMI had a non-anterior infarction (2022: 57%, n=871; 2023: 56%, n=874). Anterior infarctions were reported in 43% (n=655) of patients in 2022 and in 44% (n=693) of patients in 2023.[42]

Left ventricular function (LVF) was assessed in 82% (n=1258) of patients in 2022 and in 88% (n=1373) of patients in 2023. Of those who had an anterior infarction, 84% (n=547) had LVF assessed in 2022 and 88% (n=610) had LVF assessed in 2023. Of those with a non-anterior infarction, 81% (n=707) had LVF assessed in 2022 and 87% (n=762) had LVF assessed in 2023. Out of those who did not have LVF assessed, the majority were transferred to another hospital for ongoing care (79% in 2022 and 74% in 2023) and may have had assessment of LVF performed there prior to discharge; however, this information is not available.

In patients who had a documented assessment of LVF, the vast majority were assessed by echocardiogram (98% in both 2022 and 2023); a small proportion were assessed by left ventricular angiography (2% in both 2022 and 2023). There were no differences in the proportion of those who were assessed by echocardiogram versus angiography, or by the infarction location, between the 2 reporting years.[43]

Timely reperfusion was associated with lower proportions of severely reduced LVF (to less than 30%) compared with non-timely reperfusion. In 2022, 12% (n=80) of patients who received timely reperfusion had severely reduced LVF compared with 16% (n=53) who did not receive timely reperfusion. In 2023, 11% (n=80) of patients who received timely reperfusion had severely reduced LVF compared with 16% (n=61) who did not receive timely reperfusion. Figure 7.1 shows the distribution of LVF results by infarct type, timeliness of reperfusion and year.

[42] Infarction type was unknown in nine cases during 2022 and 2023.
[43] Anterior: echocardiogram: 2022: 98%, 2023: 98%; angiogram: 2022: 2%, 2023: 1%. Non-anterior: echocardiogram: 2022: 98%, 2023: 98%; angiogram: 2022: 2%, 2023: 2%.

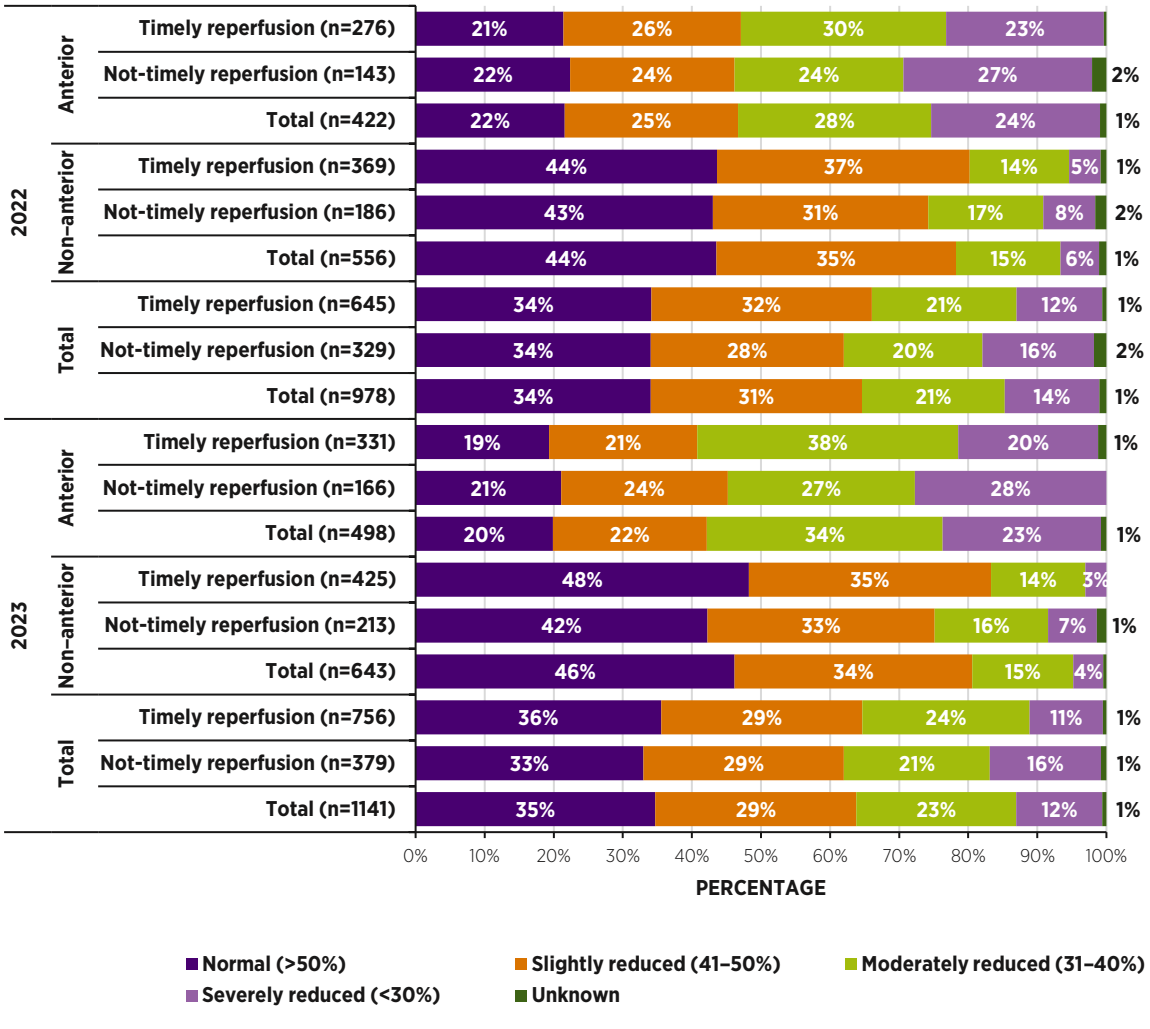


FIGURE 7.1: LEFT VENTRICULAR FUNCTION RESULTS, BY INFARCT TYPE, TIMELINESS OF REPERFUSION AND YEAR (n=2109)[44]

[44] Patients for whom the source of referral was not recorded, or for whom it was recorded as 'other', or cases who did not have timeliness of reperfusion recorded, are excluded from Figure 7.1.

CONGESTIVE HEART FAILURE OUTCOMES

The majority of patients with a STEMI did not show signs of congestive heart failure in the cath lab (2022: 84%, n=1288; 2023: 83%, n=1310). In both reporting years, cardiogenic shock[45] was reported in 8% of patients (2022: n=120; 2023: n=133). Figure 7.2 shows congestive heart failure by infarct type and year.

Among those who had cardiogenic shock, the unadjusted in-hospital mortality was 43% (n=52) in 2022 and 46% (n=61) in 2023.

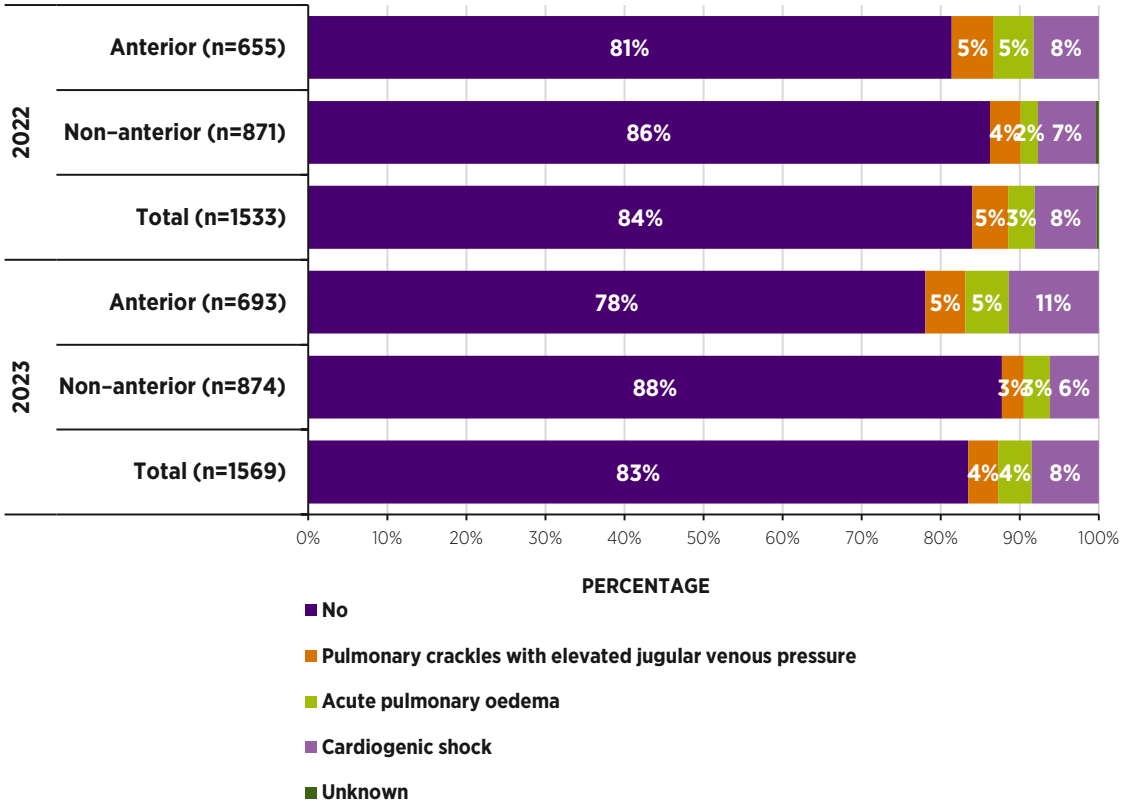


FIGURE 7.2: CONGESTIVE HEART FAILURE, BY YEAR AND INFARCT TYPE (N=3102)[46]

[45] Calculated based on the whole population with a STEMI (N=3102)..
[46] Cases where infarct type was unknown (n=9) are not presented in Figure 7.2.

UNADJUSTED IN-HOSPITAL MORTALITY

The IHAA data collect the survival status on discharge from hospital. This accounts for the survival status at the point of discharge from hospital, whether the patient is discharged directly from a PCI centre or from another hospital following transfer from a PCI centre to complete their acute STEMI care. Completeness of this data point has increased from 76% in 2021, to 80% in 2022 and 96% in 2023 (Figure 7.3).

As the completeness of the 'survival status on discharge' data point reached more than 80% nationally in both 2022 and 2023 (although this was not the case in all hospitals),[47] unadjusted in-hospital mortality was reported at a national level using this data point.[48] Previous NOCA reports used the Hospital In-Patient Enquiry discharge code on discharge from the PCI centre only when reporting unadjusted mortality; this should be considered when comparing mortality rates between this report and previous reports.

* Coverage was below 80%.

FIGURE 7.3: PERCENTAGE COMPLETENESS OF 'SURVIVAL AT DISCHARGE' DATA POINT, BY PERCUTANEOUS CORONARY INTERVENTION CENTRE AND YEAR (N=3102) [49,50]

[47] St James's Hospital had 37% completeness in 2022.
[48] This data point was also used in the risk-adjusted in-hospital mortality model.
[49] Non-designated, 9.00am to 5.00pm weekday PCI centres include Beaumont Hospital, St Vincent's University Hospital and Tallaght University Hospital. Completeness data for these hospitals are included in the corresponding frequency table in Appendix 5.
[50] Those who died while in hospital were categorised as complete.

In 2022, 6.4% (n=98) of patients with a STEMI died during their stay in hospital, which was similar to the 6.1% (n=95) reported in 2023. This corresponds to an unadjusted in-hospital mortality rate of 6.2% for both years combined. This is not comparable with 2021, as the unadjusted mortality rate reported in 2021 was the mortality rate of the PCI centres only.

The unadjusted in-hospital mortality rate was higher in older age groups in both reporting years. In those aged 75 years and over, the mortality rate was 11.9% (n=36) in 2022 and 13.1% (n=43) in 2023, compared with 7.2% (n=28) in 2022 and 7.3% (n=29) in 2023 for those aged 65–74 years. The unadjusted mortality rate for those aged under 64 years was 4.1% (n=34) in 2022 and 2.7% (n=23) in 2023.

Table 7.1 shows the unadjusted in-hospital mortality rate of those who received timely primary PCI versus non-timely primary PCI in 2022 and 2023. In 2022, those who received primary PCI had a 4.3% (n=49) mortality rate, similar to the 4.4% (n=54) mortality rate reported in 2023. Timely primary PCI was associated with reduced mortality. In 2022, those who received timely primary PCI had an unadjusted mortality rate of 2.7% (n=20) compared with 7.8% (n=28) for those who did not receive timely primary PCI. In 2023, the mortality rate between the two groups was less notable, at 4.1% (n=34) for those who received timely primary PCI compared with 5.3% (n=19) for those who did not receive timely primary PCI.

It is important to note that the data quality for the in-hospital mortality data point improved in 2023 compared with 2022. In 2022, 20% of patients with a STEMI did not have 'survival at discharge' data recorded, compared with 4% in 2023 (Figure 7.3). The completeness of this data point may have had an effect on the unadjusted hospital mortality rates shown in Table 7.1.

TABLE 7.1 UNADJUSTED MORTALITY RATE FOR PATIENTS WITH AN ST ELEVATION MYOCARDIAL INFARCTION WHO RECEIVED PRIMARY PERCUTANEOUS CORONARY INTERVENTION, AND WHO RECEIVED TIMELY VERSUS NON-TIMELY PRIMARY PERCUTANEOUS CORONARY INTERVENTION, BY YEAR

Year	Unadjusted in-hospital mortality rate in those who received primary PCI	Unadjusted in-hospital mortality rate in those who received timely primary PCI	Unadjusted in-hospital mortality rate in those who did not receive timely primary PCI
2022	4.3% (n=49)	2.7% (n=20)	7.8% (n=28)
2023	4.4% (n=54)	4.1% (n=34)	5.3% (n=19)

In 2023, the unadjusted in-hospital mortality rate in patients who received thrombolysis as the initial reperfusion strategy was 4.6% (n≤5). The number of cases was too small to provide meaningful analysis on mortality based on the timeliness of thrombolysis. In 2023, those who received no reperfusion therapy, the unadjusted in-hospital mortality rate was 22.7% (n=22).

RISK-ADJUSTED IN-HOSPITAL MORTALITY

Development of a risk-adjusted in-hospital mortality model has been an objective of the IHAA since its establishment in 2020. The Global Registry of Acute Coronary Events (GRACE) was used as the model to assess the risk of in-hospital mortality in patients with a STEMI. In 2022, additional data points were added to the Heartbeat dataset in order to facilitate the calculation of the GRACE score, and a risk-adjustment model to report on risk-adjusted in-hospital mortality by PCI centre was developed. The IHAA will follow the NOCA procedure of statistical outlier management. This procedure aims to ensure that statistical outliers identified through the processes of national clinical audit are appropriately managed and lead to learning with the potential for the improvement of clinical care. Further information on the development of the risk-adjustment model is presented in Chapter 9. The list of the data points used in the GRACE model and their completeness by hospital is available in Appendix 6.

IHAA RISK-ADJUSTED IN-HOSPITAL MORTALITY

As the completeness of all data points required in order to inform the model reached more than 80% in all primary PCI centres[51] in 2023, and because there were no concerning statistically significant outliers, it was agreed that the data from 2023 could be presented in this report.[52] Quarterly reports of any statistical outliers will commence in 2024. Figure 7.4 presents the survival status (alive or dead) on discharge from hospital among patients with a STEMI who were treated in each PCI centre by GRACE risk score of predicted mortality (low, intermediate or high risk of mortality). As can be appreciated visually, no predicted low-risk GRACE score deaths occurred, with the majority of deaths occurring in patients with a predicted high risk of mortality based on their GRACE score.

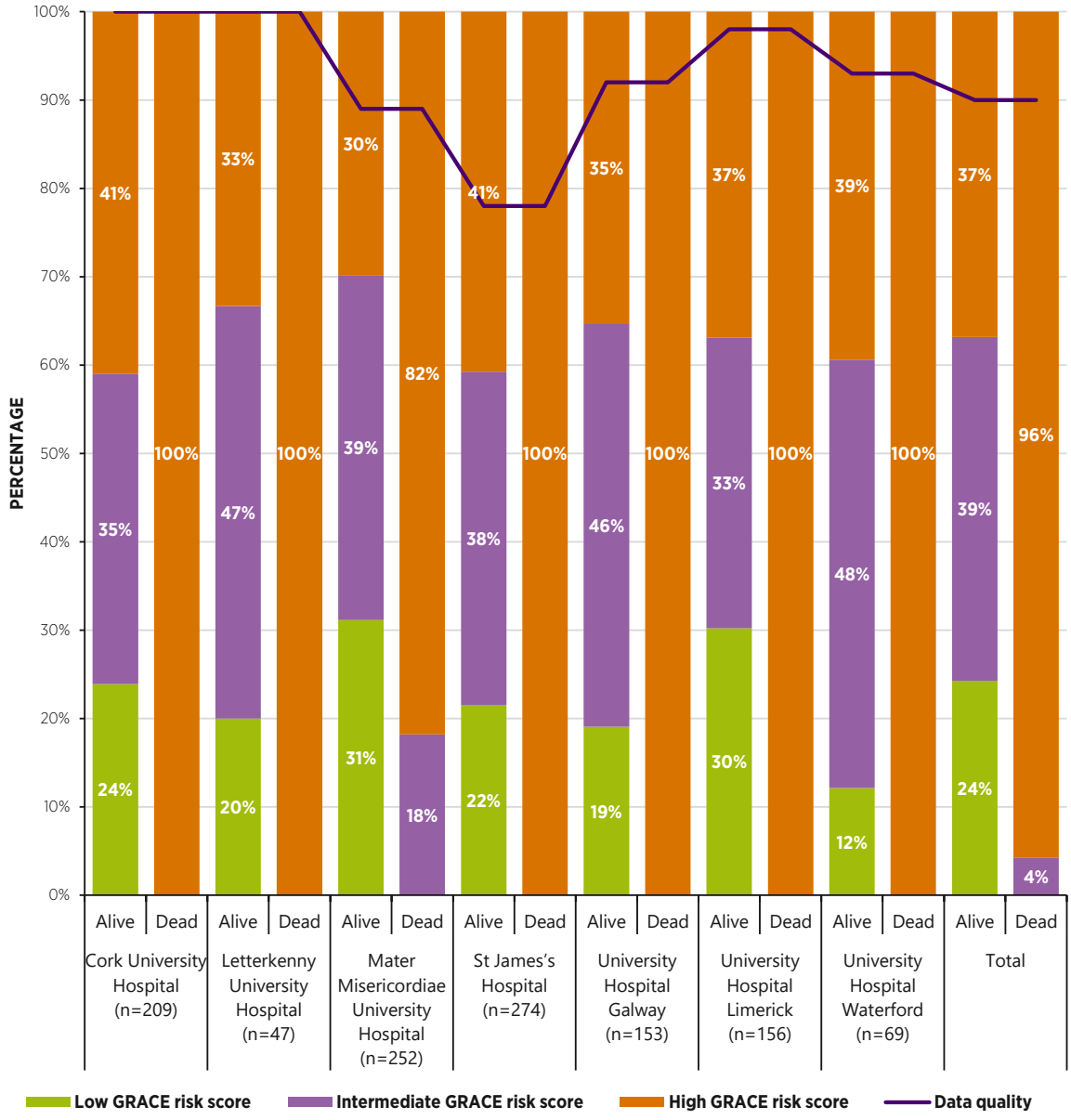


FIGURE 7.4: SURVIVAL AT DISCHARGE BY GLOBAL REGISTRY OF ACUTE CORONARY EVENTS STRATIFICATION AND DATA QUALITY, BY PERCUTANEOUS CORONARY INTERVENTION CENTRE, 2023 (n=1160)

[51] In 2023, St James's Hospital had a completeness of 78% of data points used in the model.
[52] In 2022, completeness was not achieved in all hospitals for all data points.

STANDARDISED MORTALITY RATIO FUNNEL PLOT

Standardised mortality ratio (SMR) funnel plots (Figure 7.5) are scatter plots of individual hospitals' SMRs. The upper and lower borders of the funnel are represented by the 99.8% and 95.0% control limits. These borders represent the upper and lower limits of what is referred to as 'expected variation'.

An SMR is expected to appear within the 99.8% control limits 998 times out of 1,000. Statistically, 1 in 500 observations can be expected to appear outside these control limits by chance alone. In other words, if an SMR appears outside these limits, it is very unlikely that this is due to chance. These observations represent variation worthy of further review (NOCA, 2023b). The black dotted line in Figure 7.5 represents an SMR of 1. The SMR of 1 means that the number of observed deaths is the same as the expected mortality.

Funnel plots make it very easy to identify these observations worthy of further review. A hospital's SMR should only be compared with its own control limits. There is no basis for ranking institutions into 'league tables' (Spiegelhalter, 2005); therefore, it is not valid to compare SMRs between hospitals.

Figure 7.5 presents the SMRs for five PCI centres in a funnel plot for the year 2023. The funnel plot does not perform well with small numbers of expected deaths; therefore, Beaumont Hospital, St Vincent's University Hospital, Tallaght University Hospital, Letterkenny University Hospital and University Hospital Waterford were not included in the figure. However, their SMRs and control limits are available in the frequency tables in Appendix 5.

Figure 7.5 shows that four PCI centres had an SMR within the 95% control limits, indicating that their SMRs were within the expected range for 2023. Cork University Hospital had an SMR of 0.23, which was below the 95% lower control limit (0.59), meaning that the number of observed deaths was lower than the model suggested. No PCI centre had a mortality rate higher than the expected range.

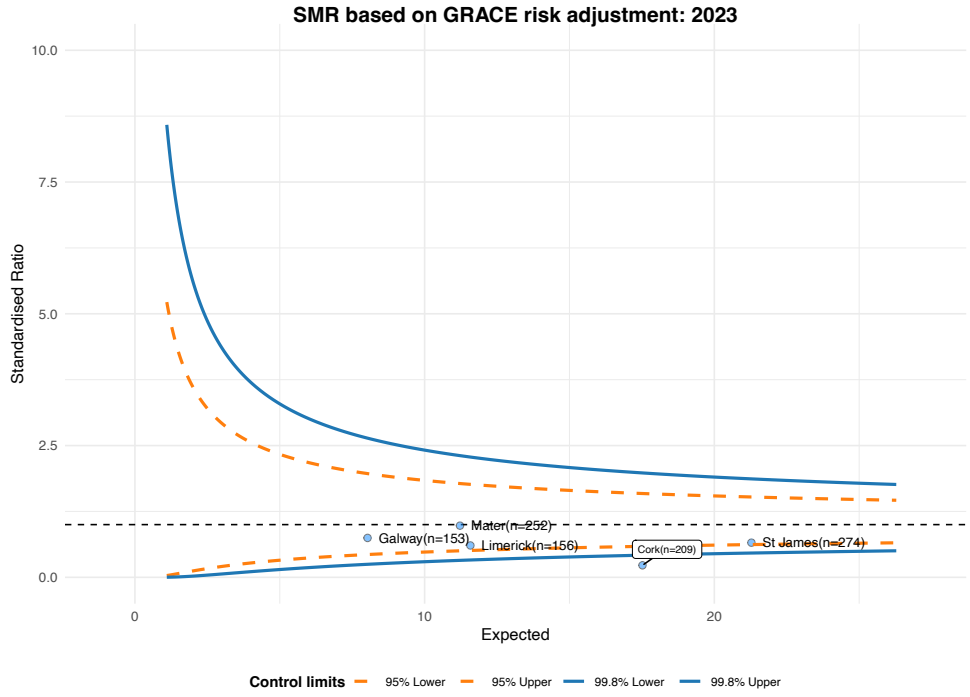


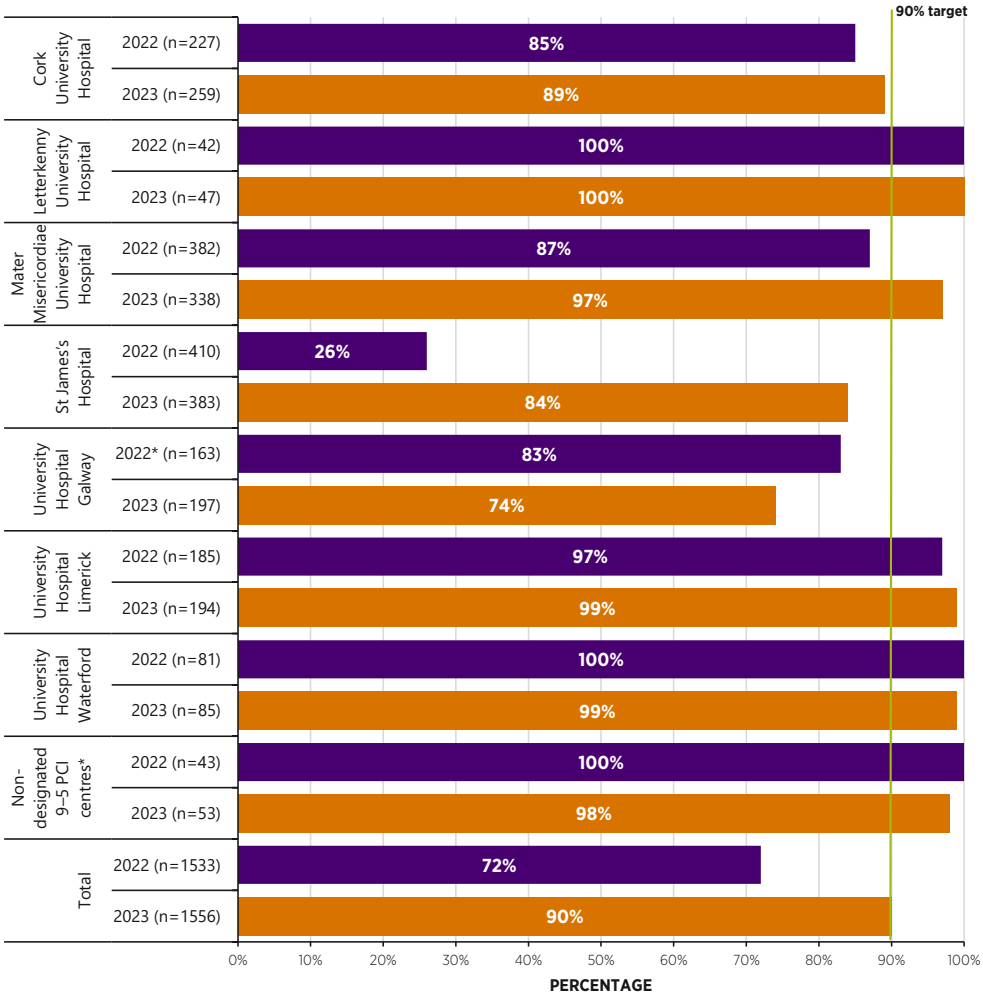
FIGURE 7.5: STANDARDISED IN-HOSPITAL MORTALITY RATIO, 2023 [53,54]

It is important to note that the logistic regression model coefficients that are available to be fitted for the GRACE probability of death were estimated in 2014 (Center for Outcomes Research, 2014), and therefore may be outdated and no longer appropriate. The logistic regression model coefficients can be developed using IHAA data; however, at the time of writing this report, there was not a sufficient amount of data for this implementation.

[53] Hospitals that had five deaths or fewer (Beaumont Hospital, St Vincent's University Hospital, Tallaght University Hospital, Letterkenny University Hospital and University Hospital Waterford) were not included in Figure 7.5.
[54] The "n" values for each hospital in Figure 7.5 represent the total number of patients with a STEMI in 2023.

30-DAY MORTALITY

The ESC acute coronary syndrome (ACS) guideline (Byrne *et al*., 2023) recommends that 30-day risk-adjusted mortality be adopted as an outcome measure for STEMI care. In 2022, the IHAA outlined a strategic aim to adopt this metric. With this aim in mind, the completeness of recording 30-day mortality, with a target of 90% completeness, was established as a KQI. These data are presented in Figure 3.1, with completeness of the 'survival status at 30 days' data point increasing from 56% in 2020 to 72% in 2022 and to 90% in 2023. The completeness rate of this data point for 2022 and 2023 is displayed by hospital in Figure 7.6. While there has been progress, the level of completeness of this data point in 2022 remains too low for meaningful analysis and presentation. However, for 2023, the data show that the national unadjusted 30-day mortality rate was 6.8%.



* Coverage was below 80%.

FIGURE 7.6: PERCENTAGE COMPLETENESS OF THE 'SURVIVAL STATUS AT 30 DAYS' DATA POINT, BY PERCUTANEOUS CORONARY INTERVENTION CENTRE AND YEAR (n=3089) [55,56]

KQI 8: Percentage completeness of survival status at 30 days

TARGET: 90% 2022 RESULT: 72% 2023 RESULT: 90%

[55] Non-designated, 9.00am to 5.00pm weekday PCI centres include Beaumont Hospital, St Vincent's University Hospital (coverage was below 80%) and Tallaght University Hospital. Completeness data for these hospitals are included in the corresponding frequency table in Appendix 5.

[56] Those who died while in hospital were categorised as complete. Patients who were not a resident in Ireland were not included in the analysis for Figure 7.6.

BLEEDING AND STROKE COMPLICATIONS

In 2022, 1,224 patients had a reperfusion, of which 31 (3%) had a bleed (26 of these received a primary PCI and 5 received thrombolysis). In 2023, of those who had a reperfusion (n=1331), 39 (3%) had a bleed (33 of these received a primary PCI and 6 received thrombolysis). Bleeding complications were defined as intracranial haemorrhage, retroperitoneal haemorrhage, or other bleeding event (this last category was subdivided into three categories based on haemoglobin fall: ≥5 grams per decilitre (g/dL); ≥3 g/dL but <5 g/dL; and <3 g/dL). The incidence of bleeding by reperfusion type is presented in Appendix 8.

In 2022, 1.6% (n=20) of patients who had a reperfusion (n=1224) sustained a stroke; 14 (1%) were classified as ischaemic stroke (13 of these received a primary PCI and 1 received thrombolysis) and 6 (0.5%) as haemorrhagic stroke (5 of these received a primary PCI and 1 received thrombolysis). In 2023, 1.3% (n=17) of patients who had a reperfusion (n=1331) sustained a stroke; 9 (0.7%) were classified as ischaemic stroke (8 of these received a primary PCI and 1 received thrombolysis) and 8 (0.6%) as haemorrhagic stroke (7 of these received a primary PCI and 1 received thrombolysis). The incidence of stroke by reperfusion type and hospital is presented in Appendix 8.

LENGTH OF STAY AT A PCI CENTRE

For all patients with a STEMI who were discharged alive from a PCI centre during the reporting period, the median length of stay (LOS) at the PCI centre in 2022 and 2023 was 3 days (2022 IQR: 1–5 days; 2023 IQR: 1–6 days) which was unchanged from 2021. For patients who completed their inpatient stay at the PCI centre, the median LOS was 4 days (IQR: 3–8 days) for both reporting years, which was also unchanged from 2021. This meets the relevant KPI in the *Acute Coronary Syndromes Programme Model of Care* (HSE, 2012) of a median LOS of 4 days. However, LOS ranged between PCI centres, from 3 days to 6 days.

For patients who were transferred to another acute hospital for ongoing STEMI care, the LOS in the PCI centre was 1 day (IQR: 1–2 days) for both reporting years (Table 7.2). In these cases, the LOS of the complete inpatient stay is unknown.

TABLE 7.2: LENGTH OF HOSPIAL STAY IN THE PERCUTANEOUS CORONARY INTERVENTION CENTRE, BY PERCUTANEOUS CORONARY INTERVENTION CENTRE (NUMBER OF PATIENTS: 2,932; NUMBER OF DAYS: 15,053)[57]

		2022			2023		
		Transfer to another hospital for ongoing STEMI care	Completed STEMI care in the PCI centre	Total	Transfer to another hospital for ongoing STEMI care	Completed STEMI care in the PCI centre	Total
Cork University Hospital	Number of patients	45	169	214	51	198	249
	Number of days	182	1252	1434	130	1328	1458
	Median LOS (days)	2	5	4	1	4	4
	IQR 1 (days)	1	3	3	1	3	3
	IQR 3 (days)	3	8	7	2	8	6
Letterkenny University Hospital	Number of patients	~	*	41	~	*	45
	Number of days	8	299	307	1	276	277
	Median LOS (days)	4	5	5	1	5	5
	IQR 1 (days)	1	3	3	1	3	3
	IQR 3 (days)	7	10	10	1	8	8
Mater Misericordiae University Hospital	Number of patients	269	89	358	230	93	323
	Number of days	397	1043	1440	559	738	1297
	Median LOS (days)	1	6	1	1	6	1
	IQR 1 (days)	1	3	1	1	4	1
	IQR 3 (days)	1	17	3	1	10	4
St James's Hospital	Number of patients	251	133	384	208	159	367
	Number of days	651	1262	1913	431	1379	1810
	Median LOS (days)	1	5	3	1	6	3
	IQR 1 (days)	1	4	1	1	4	1
	IQR 3 (days)	3	11	5	2	10	6
University Hospital Galway**	Number of patients	57	102	159	70	117	187
	Number of days	193	709	902	334	771	1105
	Median LOS (days)	2	4	4	2	5	4
	IQR 1 (days)	1	3	2	1	3	2
	IQR 3 (days)	3	8	6	4	7	6
University Hospital Limerick	Number of patients	34	139	173	47	135	182
	Number of days	160	668	828	198	622	820
	Median LOS (days)	2	3	3	2	3	3
	IQR 1 (days)	1	3	3	1	3	2
	IQR 3 (days)	4	5	4	5	4	4
University Hospital Waterford	Number of patients	33	45	78	27	53	80
	Number of days	102	253	355	135	353	488
	Median LOS (days)	1	4	4	2	5	4
	IQR 1 (days)	1	4	1	1	3	3
	IQR 3 (days)	2	5	5	5	7	7
Non-designated 9–5 PCI centres**	Number of patients	~	*	41	*	44	51
	Number of days	1	240	241	47	331	378
	Median LOS (days)	1	3	3	5	4	4
	IQR 1 (days)	1	2	2	1	3	3
	IQR 3 (days)	1	6	5	13	7	8
Total	Number of patients	692	756	1448	641	843	1484
	Number of days	1694	5726	7420	1835	5798	7633
	Median LOS (days)	1	4	3	1	4	3
	IQR 1 (days)	1	3	1	1	3	1
	IQR 3 (days)	2	8	5	2	8	6

~ Denotes five cases or fewer.
* Further suppression required in order to prevent disclosure of five cases or fewer.
** Coverage was below 80%.

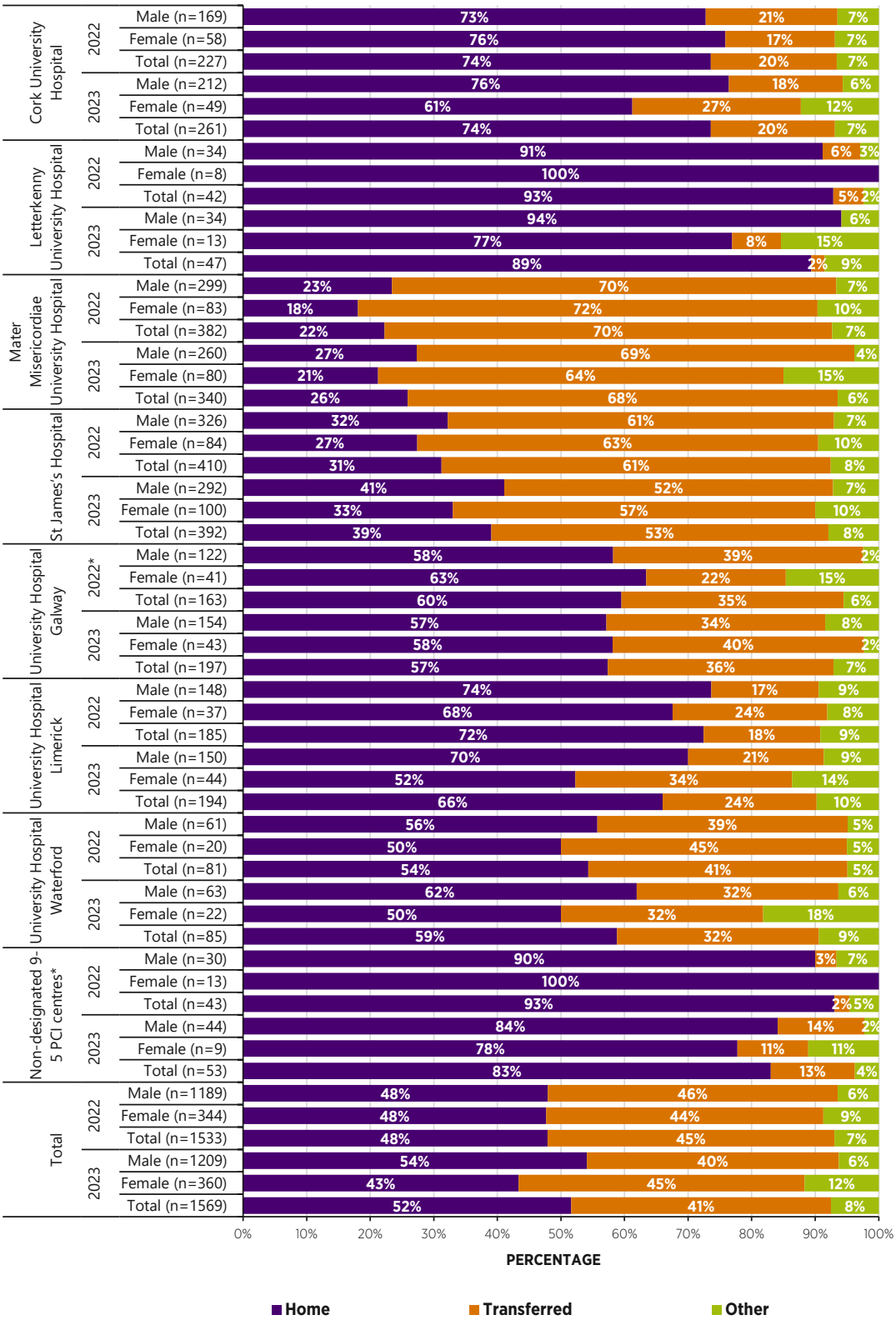
[57] Only includes patients who were alive on discharge.

DISCHARGE DESTINATION FROM THE PCI CENTRE

Forty-eight percent (n=734) of patients with a STEMI in 2022, and 52% (n=810) in 2023, were discharged directly home from a PCI centre. A higher proportion of patients were transferred to another acute hospital for ongoing STEMI care in 2022 (45%, n=692) when compared with 2023 (41%, n=641). The 'other' destination category represents discharge to an alternative destination: nursing home, died, and other (2022: n=107, 7%; 2023: n=118, 8%). Figure 7.7 displays the discharge destination by PCI centre, sex and year.

Over 40% of patients are transferred from PCI centres to other acute hospitals for ongoing STEMI care.

In 2023, a larger proportion (54%, n=654) of male patients with a STEMI were discharged directly home from a PCI centre compared with female patients (43%, n=156). No such difference between sexes was observed in 2022 (48% for both male and female patients). There was variation in discharge destination between PCI centres. Some centres, such as Letterkenny University Hospital, are single entities for primary PCI and hospital care, while the other primary PCI centres serve a network of non-PCI hospitals and therefore repatriate/transfer patients at a higher rate.



* Coverage was below 80%.

FIGURE 7.7: DISCHARGE DESTINATION FROM PERCUTANEOUS CORONARY INTERVENTION CENTRES, BY PERCUTANEOUS CORONARY INTERVENTION CENTRE, SEX AND YEAR (N=3102)[58]

[58] Non-designated, 9.00am to 5.00pm weekday PCI centres include Beaumont Hospital, St Vincent's University Hospital (coverage was below 80%) and Tallaght University Hospital. Discharge destination data for these hospitals are included in the corresponding frequency table in Appendix 5.

SECONDARY PREVENTION

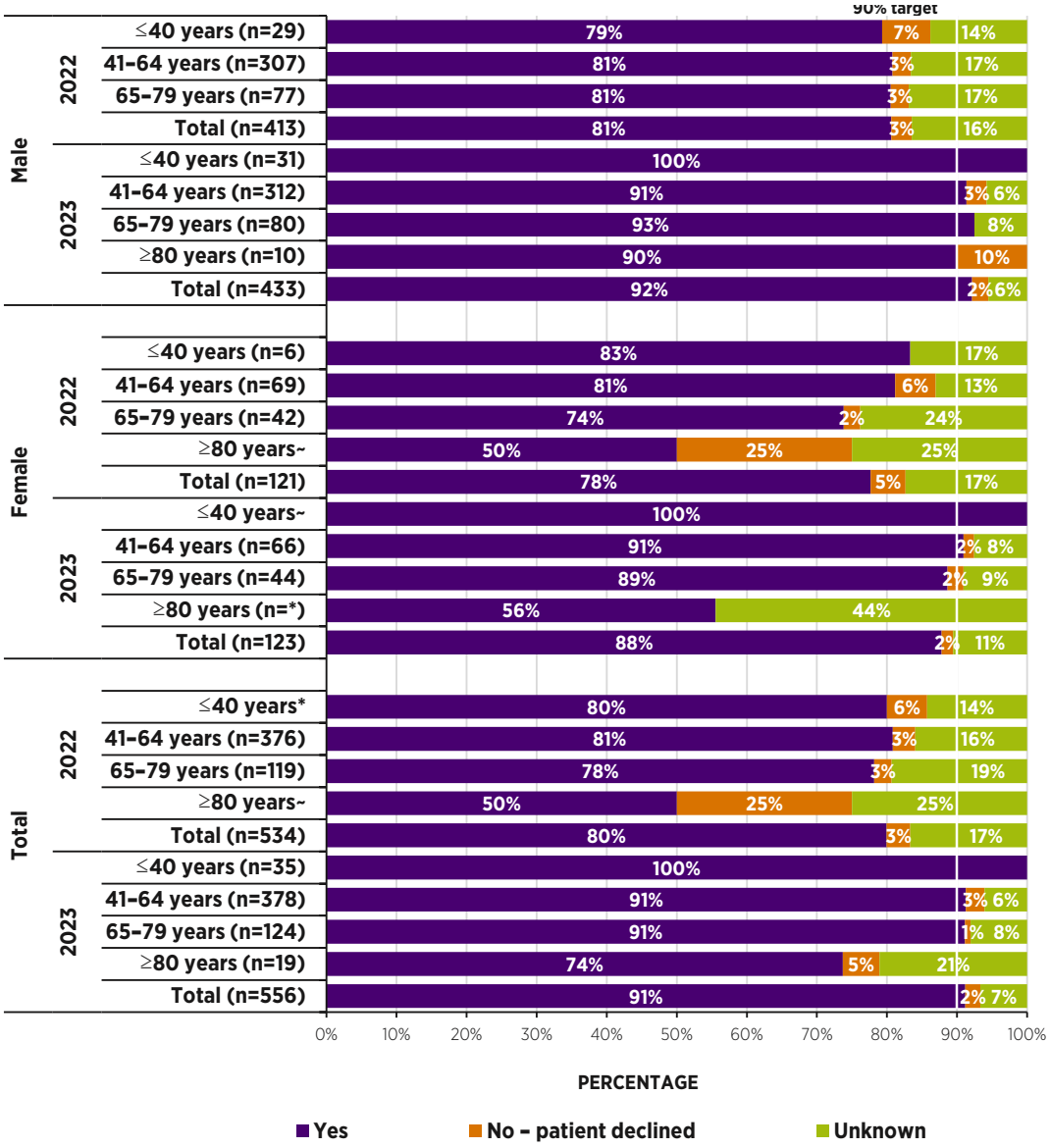
Secondary prevention of further cardiovascular or coronary heart disease events is key to the *Acute Coronary Syndromes Programme Model of Care* (HSE, 2012). The IHAA reports on this under three headings: (1) smoking cessation, (2) secondary prevention medication and (3) cardiac rehabilitation. Each is reported as a KQI in the IHAA dashboard.

SMOKING CESSATION

As described in Chapter 4, across both reporting years, 35% (n=534 in 2022; n=556 in 2023) of patients with a STEMI were classified as current smokers (Figure 4.7), a decrease from 39% in 2021 (NOCA, 2023a). Figure 7.8 displays the proportion of patients with a STEMI who were smokers and who received smoking cessation advice, by sex and age group. In 2022, 80% (n=427) of patients with a STEMI who were current smokers were recorded as receiving smoking cessation advice. In 2023, this had increased to 91% (n=507), meeting the associated KQI target of 90% (HSE, 2012). All current smokers aged under 40 years received smoking cessation advice in 2023, compared with 80% in 2022.

KQI 6: Percentage of patients with a STEMI who smoke who were offered smoking cessation advice

TARGET: 90% 2022 RESULT: 80% 2023 RESULT: 91%



~ Denotes five cases or fewer.
* Further suppression required in order to prevent disclosure of five cases or fewer.

FIGURE 7.8: SMOKING CESSATION ADVICE PROVIDED, BY SEX AND AGE GROUP (n=1090)[59]

[59] Figure 7.8 includes patients reported as current smokers only.

SECONDARY PREVENTION MEDICATION ON DISCHARGE

The proportion of patients with a STEMI who had an appropriate secondary prevention medication discharge bundle recorded increased from 74% in 2021, to 75% in 2022 and to 86% in 2023. Although the target of 90% (HSE, 2012) was not met in 2023, the increase from 2021 is notable. Appendix 8 presents these data by PCI centre.

Figure 7.9 shows the proportion of each of the secondary prevention medications prescribed on discharge, excluding cases for which no information was recorded,[60] for each of the medications. In 2022 and 2023, statins (2022: 99%; 2023: 98%) and aspirin (2022: 99%; 2023: 98%) were the most prescribed secondary prevention medications. A second antiplatelet agent was prescribed in 97% of cases in 2022 and in 96% of cases in 2023, followed by beta-blockers (95% in 2022 and 93% in 2023) and angiotensin-converting enzyme inhibitors (ACEIs) or angiotensin II receptor blockers (ARBs) (88% in 2022 and 87% in 2023). These findings are consistent with the 2021 data (NOCA, 2023a).

KQI 5: Percentage of patients with a STEMI who were discharged with an appropriate secondary prevention medication discharge bundle

TARGET: 90% 2022 RESULT: 75% 2023 RESULT: 86%

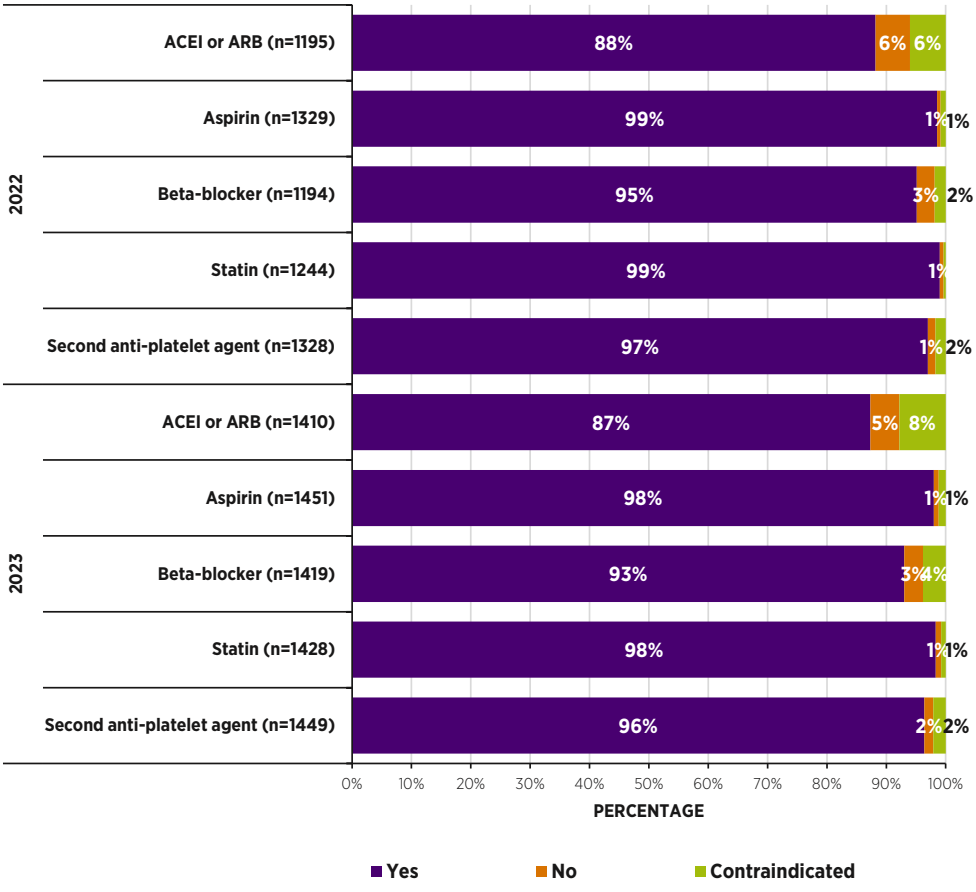


FIGURE 7.9: PROPORTION OF PATIENTS PRESCRIBED SECONDARY PREVENTION MEDICATION ON DISCHARGE[61]

[60] Proportion of unknown and missing information: second anti-platelet agent: 2022: 7%; 2023: 2%; statin: 2022: 13%; 2023: 3%; beta-blocker: 2022: 17%; 2023: 4%; aspirin: 2022: 7%; 2023: 2%; angiotensin-converting enzyme inhibitor (ACEI) or angiotensin II receptor blocker (ARB): 2022: 17%; 2023: 4%.

[61] Patients who had no information recorded are excluded from Figure 7.9. Each patient may have been prescribed one or more medications, and may therefore be counted more than once. Figure 7.9 excludes patients who were dead on discharge.participate due to comorbidity, and those who were dead on discharge.

CARDIAC REHABILITATION

Cardiac rehabilitation (CR) is a recognised standard of care for patients with a STEMI, as set out in the current Irish cardiovascular policy, *Changing Cardiovascular Health: National Cardiovascular Health Policy 2010 – 2019* (Department of Health, 2010) and in the ESC guidelines for STEMI management (Ibanez *et al*., 2018). The *Acute Coronary Syndromes Programme Model of Care* (HSE, 2012) target is for 90% of patients with a STEMI to be referred to an early CR programme/secondary prevention programme on discharge. CR phase 3 consists of an exercise programme and educational classes, typically scheduled over 6–12 weeks.

In 2022, 57% (n=666) of eligible patients with a STEMI were referred to CR phase 3; this increased to 91% (n=986) in 2023. Figure 7.10 displays the recorded CR phase 3 referral rate by hospital and year. As in 2021 (NOCA, 2023a), there was a large variation between PCI centres in the proportion of patients recorded as being referred for CR phase 3. Until 2023, there were ongoing challenges capturing follow-up data in the two largest PCI centres (St James's Hospital and the Mater Misericordiae University Hospital) which led to a large amount of unknown data. Some additional resourcing by the PCI centres for data collection, new data collection processes, and linkages between referring hospitals have led to improved data completeness in both hospitals in 2023. A case study from St James's Hospital is presented in Chapter 8 detailing a successful QI project leading to improved capture of follow-up data in 2023. Due to the differences in data completeness across PCI centres, caution should be applied when making comparisons between PCI centres in relation to the 2022 data. Monitoring the rate of referral to CR phase 3 has been included in the IHAA dashboard as a KQI, and the national target of 90% was met in 2023 (91%).

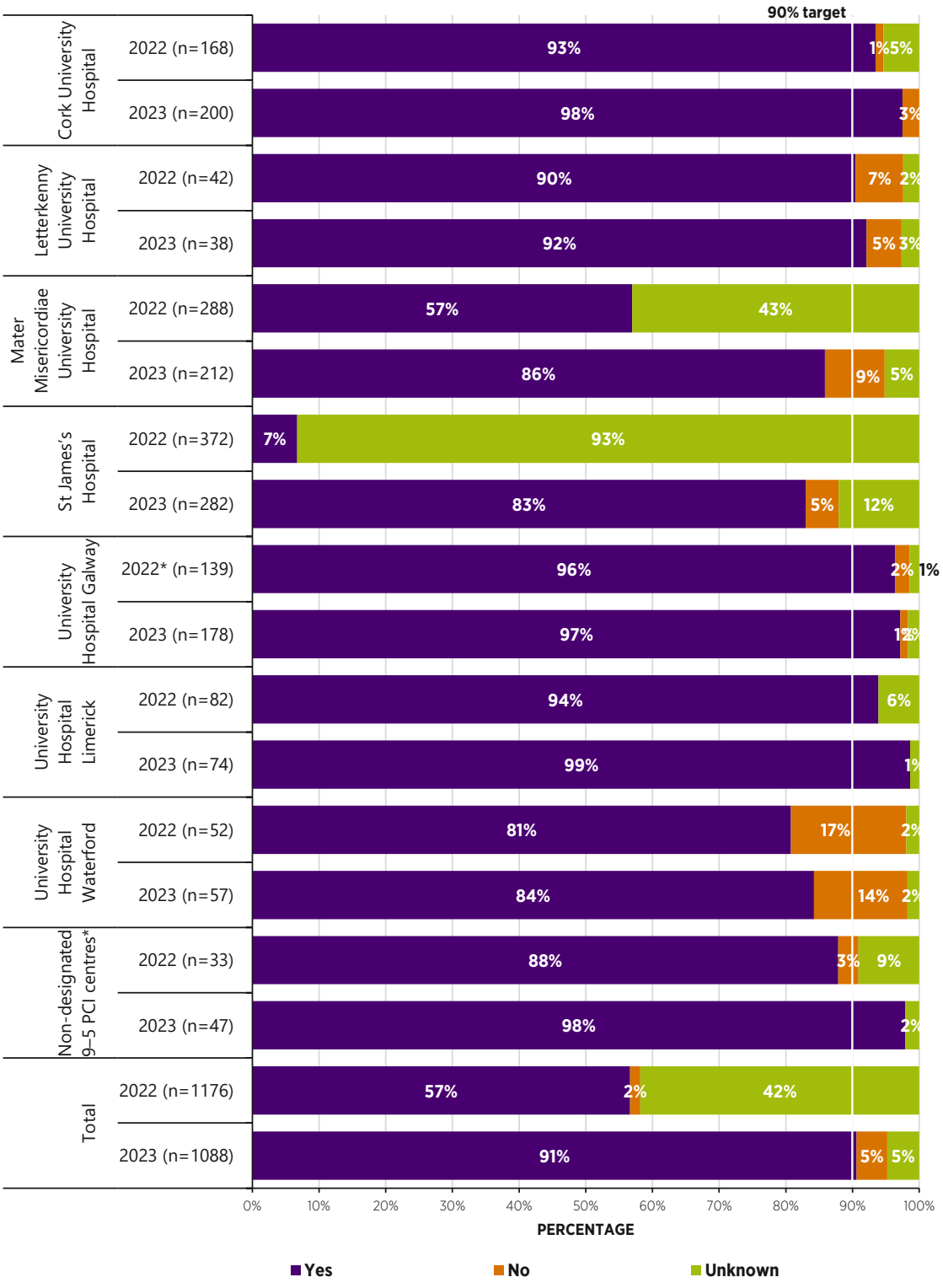
KQI 7: Percentage of eligible patients with a STEMI referred for cardiac rehabilitation phase 3

TARGET: 90% 2022 RESULT: 57% 2023 RESULT: 91%

Heartbeat contains a data point intended to provide a robust indicator of the delivery of CR phase 3: 'date of first phase 3 CR appointment'. In 2022, the IHAA set out to collect data on the timeliness and delivery of CR phase 3 as a strategic aim. With this aim in mind, the completeness of recording this data point, 'date of first phase 3 CR appointment', with a target of 90% completeness, was established as a KQI on the IHAA dashboard. The completeness of the data point 'date of first phase 3 CR appointment' has improved from 25% in 2021 (NOCA, 2023a) to 33% in 2022, and to 52% in 2023.

KQI 9: Percentage of patients who have a cardiac rehabilitation phase 3 date recorded

TARGET: 90% 2022 RESULT: 33% 2023 RESULT: 52%



* Coverage was below 80%.

FIGURE 7.10: PROPORTION OF PATIENTS WITH AN ST ELEVATION MYOCARDIAL INFARCTION REFERRED FOR CARDIAC REHABILITATION PHASE 3, BY PERCUTANEOUS CORONARY INTERVENTION CENTRE AND YEAR (n=2264)[62]

[62] Non-designated, 9.00am to 5.00pm weekday PCI centres include Beaumont Hospital, St Vincent's University Hospital (coverage was below 80%) and Tallaght University Hospital. CR phase 3 referral data for these hospitals are included in the corresponding frequency table in Appendix 5. Figure 7.10 excludes patients who declined, those who were unable to participate due to comorbidity, and those who were dead on discharge.

KEY FINDINGS FROM CHAPTER 7

- The unadjusted in-hospital mortality rate was 6.4% in 2022 and 6.1% in 2023. Timely primary PCI was associated with a significantly reduced mortality rate in 2022 (2.7% versus 7.8%), and with a less marked reduction in mortality in 2023 (4.1% versus 5.3%).
- Risk-adjusted in-hospital mortality indicated that no PCI centre had a mortality rate that was higher than the expected range.
- Timely reperfusion was associated with lower proportions of severely reduced LVF (to less than 30%) compared with non-timely reperfusion.
- In 2023, smoking cessation advice was given to patients who smoke in 91% of cases, which was an increase from 80% in 2022 and achieved the target of 90% set out in the *Acute Coronary Syndromes Programme Model of Care* (HSE, 2012).
- In 2023, 86% (n=1274) of patients with a STEMI had an appropriate secondary prevention medication discharge bundle recorded, which was an increase from 75% (n=1074) in 2022 but remained below the 90% target set out in the *Acute Coronary Syndromes Programme Model of Care* (HSE, 2012).
- Ninety-one percent of eligible patients with a STEMI in 2023 were referred to CR phase 3, which was an increase from 57% in 2022 and achieved the KQI target of 90%.

OPPORTUNITY FOR FURTHER QUALITY IMPROVEMENT

Develop a QI project in order to improve the capture of 30-day mortality status.

Develop a QI project in order to improve the rate of referral to, and uptake of, CR phase 3.

Develop a QI project in order to increase the delivery of smoking cessation programmes.

CHAPTER 8
QUALITY IMPROVEMENT

CONTENTS

CHAPTER 8: **QUALITY IMPROVEMENT**

The purpose of this chapter is to highlight and promote QI initiatives in relation to the IHAA. Clinical audit is one of a range of QI methodologies that can deliver improved processes and outcomes for patients (HSE, 2019). Clinical audit can provide data in order to support QI at all levels, from the local clinical team through to organisational management and national policy-making. The IHAA wishes to ensure that the audit findings support QI at local, national and policy levels.

HOW CAN THE IHAA DRIVE QI?

Throughout this report, opportunities for QI have been highlighted based on findings and supported by the annual IHAA dashboard trends (Figure 8.1). The suggested QI initiatives could be developed at local hospital level using IHAA data to monitor impacts and report back to other PCI centres in order to drive QI. The data quality QI project in St James's Hospital, highlights how new practices, and learnings can be shared in order to improve data quality in all services. The IHAA data can support national QI collaborations such as the STEMI Care Pathway Quality Improvement Project. Policy decisions, such as rolling out public awareness campaigns in relation to educating people on the symptoms of a heart attack and the importance of calling 112 or 999, could be evaluated using the IHAA data.

THE IHAA DASHBOARD

In 2021, the IHAA Governance Committee agreed nine KQIs. Seven were based on the key performance indicators (KPIs) published in the *Acute Coronary Syndromes Programme Model of Care* (HSE, 2012), and two data KQIs were agreed in order to support improved collection of follow-up data. The implementation of the IHAA dashboard (Figure 8.1) allows individual hospital teams and hospital management access to timely data with the aim of driving QI locally.

FIGURE 8.1: IRISH HEART ATTACK AUDIT DASHBOARD, 2023

IHAA KEY QUALITY INDICATOR TRENDS

Almost all KQI results improved in 2023, with both KQI 6 (the percentage of patients with a STEMI who actively smoke who were offered smoking cessation advice) and KQI 7 (the percentage of eligible patients with a STEMI who were referred for CR phase 3) now achieving the target of 90% (Figure 8.5). KQI 1 (the percentage of eligible patients with a STEMI who received reperfusion) dropped below the target in both 2022 and 2023 (Figure 8.2), and the percentage of patients with a STEMI who had timely primary PCI remained consistently below the target of 90%, particularly for those who were transferred to a PCI centre (Figure 8.3). These findings have been reported in detail in Chapter 6 and support the recommendation made in the *Irish Heart Attack Audit National Report 2021* (NOCA, 2023a) that there should be a national and regional focus on QI in the STEMI care pathway. In 2023, the National Heart Programme and the National Ambulance Service, in collaboration with the HSE National Quality and Patient Safety Directorate, the National Centre for Clinical Audit and the Royal College of Physicians of Ireland, have embarked on a QI project focusing on the STEMI care pathway, referred to as the STEMI Care Pathway Quality Improvement Project. This should drive improvements in the STEMI care pathway, ensuring that patients with a STEMI receive timely reperfusion.

Figure 8.4 indicates the increasing use of the radial artery during the primary PCI procedure. While this has increased, it has not yet reached the target of 95% nationally, and all PCI centres should review their own results and implement change as required. The completeness of the two data quality KQIs, KQI 8 (the percentage completeness of the 'survival status at 30 days' data point recorded in Heartbeat) and KQI 9 (the percentage of patients who have a CR phase 3 date recorded) (Figure 8.6), is increasing annually, with data QI being a focus of all audit coordinator meetings and workshops.

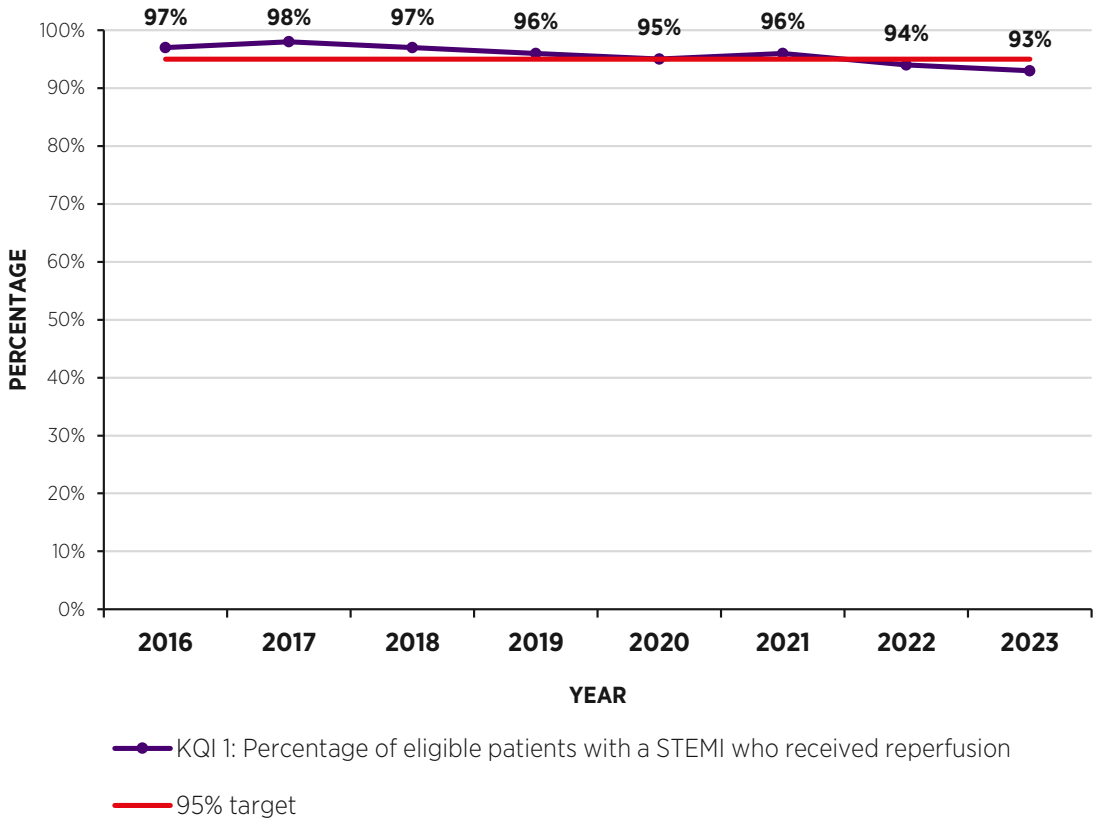


FIGURE 8.2: KQI 1: PERCENTAGE OF ELIGIBLE PATIENTS WITH AN ST ELEVATION MYOCARDIAL INFARCTION WHO RECEIVED REPERFUSION, BY YEAR

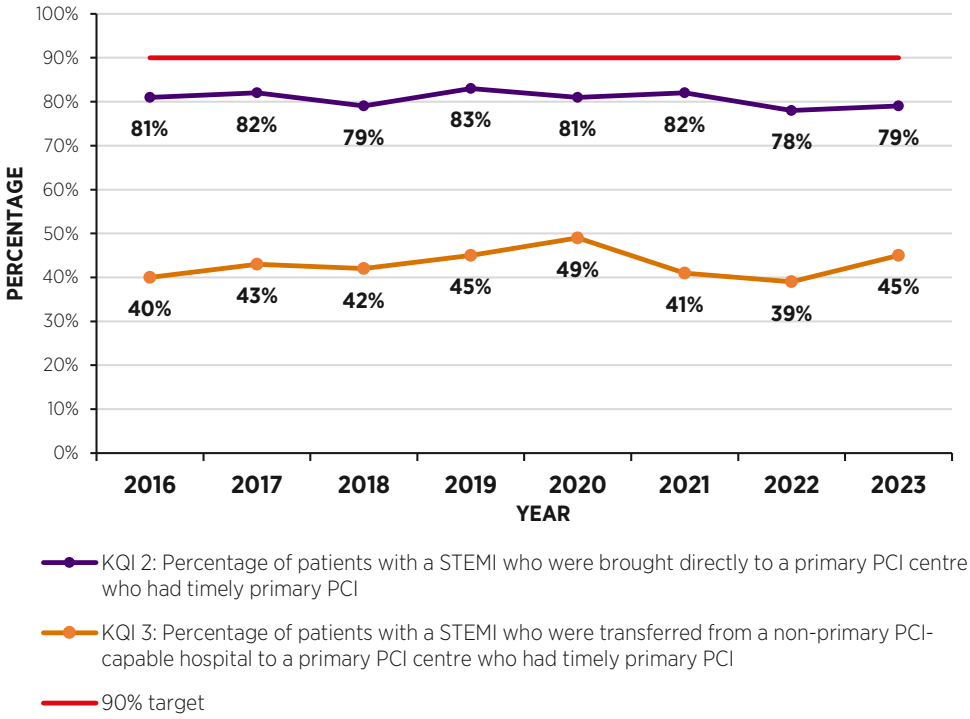


FIGURE 8.3: KQI 2: PERCENTAGE OF PATIENTS WITH AN ST ELEVATION MYOCARDIAL INFARCTION WHO WERE BROUGHT DIRECTLY TO A PRIMARY PERCUTANEOUS CORONARY INTERVENTION CENTRE WHO HAD TIMELY PRIMARY PERCUTANEOUS CORONARY INTERVENTION AND KQI 3: PERCENTAGE OF PATIENTS WITH AN ST ELEVATION MYOCARDIAL INFARCTION WHO WERE TRANSFERRED TO A PRIMARY PERCUTANEOUS CORONARY INTERVENTION CENTRE WHO HAD TIMELY PRIMARY PERCUTANEOUS CORONARY INTERVENTION, BY YEAR.

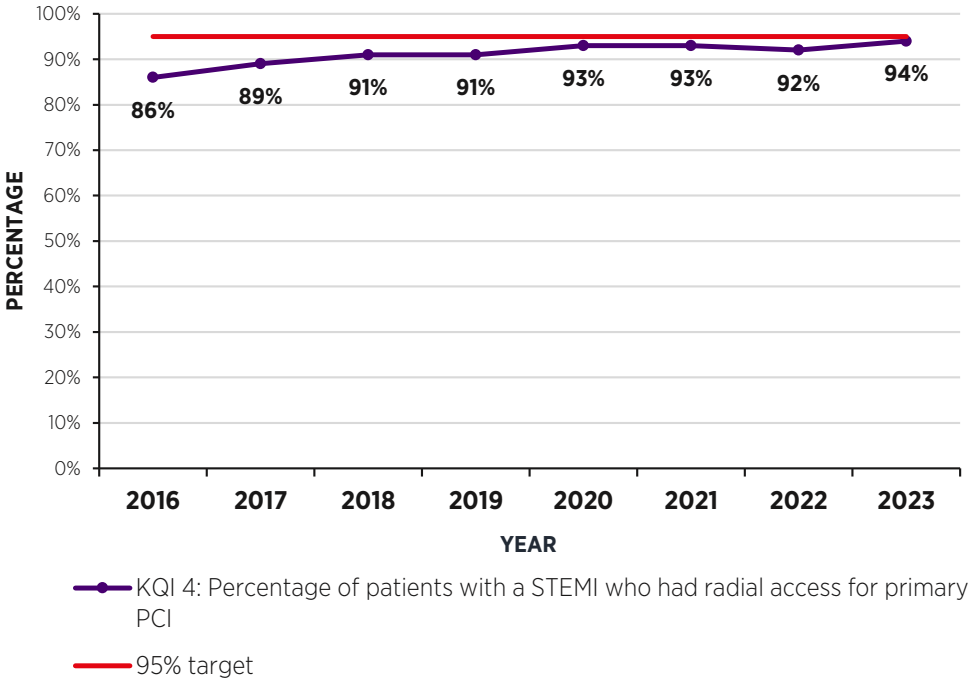


FIGURE 8.4: KQI 4: PERCENTAGE OF PATIENTS WITH AN ST ELEVATION MYOCARDIAL INFARCTION WHO HAD RADIAL ACCESS FOR PRIMARY PERCUTANEOUS CORONARY INTERVENTION, BY YEAR

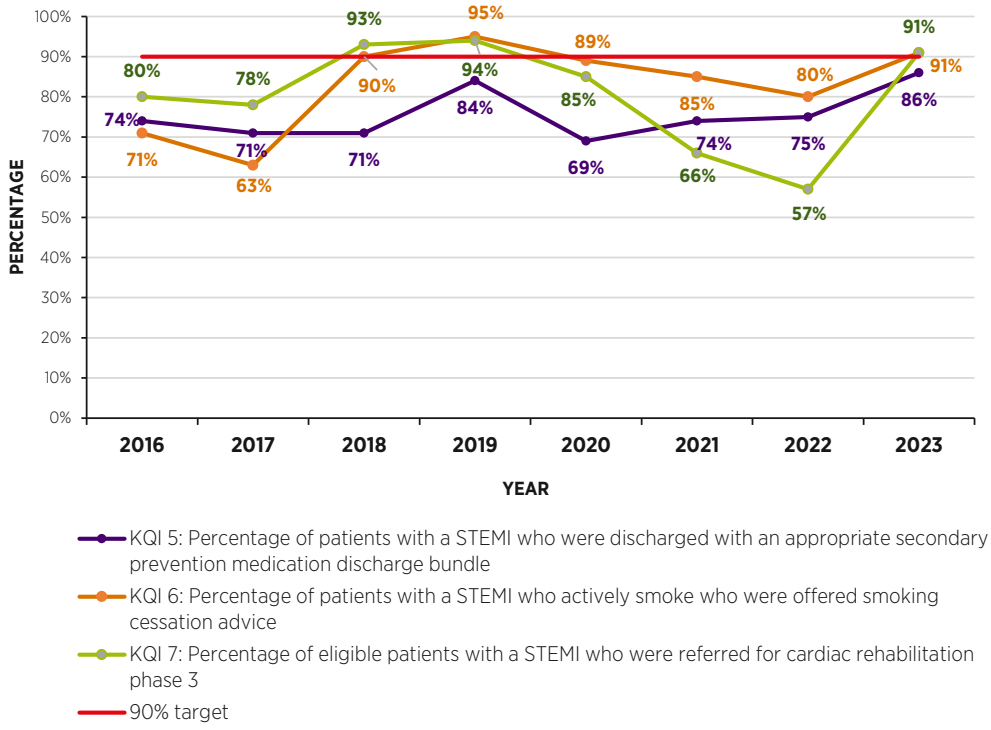


FIGURE 8.5: KQI 5: PERCENTAGE OF PATIENTS WITH AN ST ELEVATION MYOCARDIAL INFARCTION WHO WERE DISCHARGED WITH AN APPROPRIATE SECONDARY PREVENTION MEDICATION DISCHARGE BUNDLE, KQI 6: PERCENTAGE OF PATIENTS WITH AN ST ELEVATION MYOCARDIAL INFARCTION WHO ACTIVELY SMOKE WHO WERE OFFERED SMOKING CESSATION ADVICE, AND KQI 7: PERCENTAGE OF ELIGIBLE PATIENTS WITH AN ST ELEVATION MYOCARDIAL INFARCTION WHO WERE REFERRED FOR CARDIAC REHABILITATION PHASE 3, BY YEAR

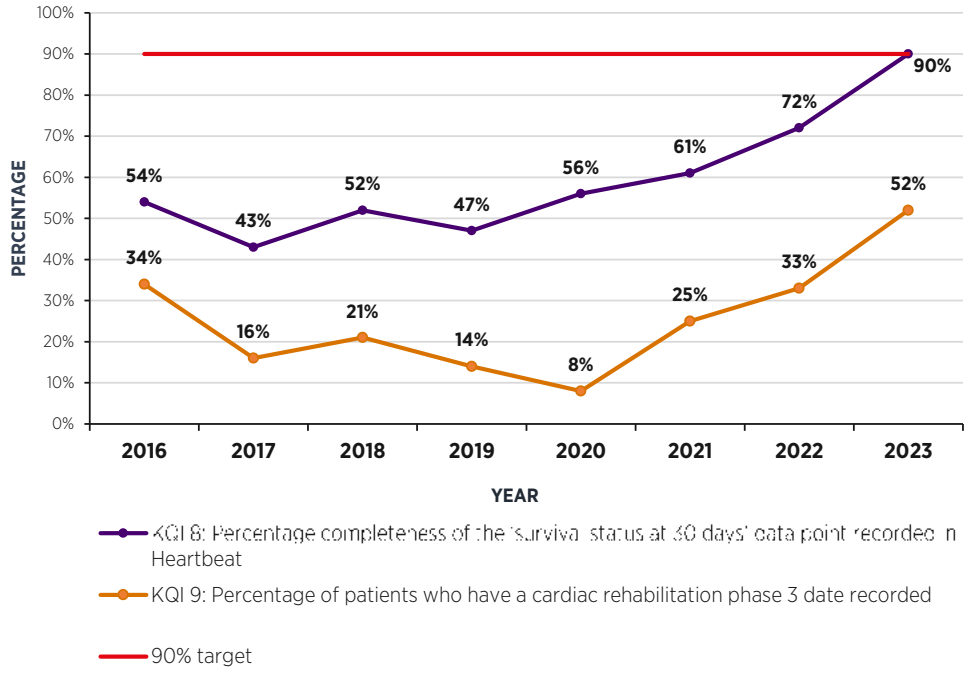


FIGURE 8.6: KQI 8: PERCENTAGE COMPLETENESS OF THE 'SURVIVAL STATUS AT 30 DAYS' DATA POINT RECORDED IN HEARTBEAT AND KQI 9: PERCENTAGE OF PATIENTS WHO HAVE A CARDIAC REHABILITATION PHASE 3 DATE RECORDED

HOW TO DELIVER QI

"Clinical audit is a clinically led quality improvement process that seeks to improve patient care and outcomes through systematic review of care against explicit criteria and acting to improve care when standards are not met. The process involves the selection of aspects of the structure, processes and outcomes of care which are then systematically evaluated against explicit criteria. If required, improvements should be implemented at an individual, team or organisation level and then the care re-evaluated to confirm improvements"

(Department of Health and Children, 2008, p. 152).

The HSE National Centre for Clinical Audit was established in 2021 in order to implement the recommendations of the *National Review of Clinical Audit* report (HSE, 2019). The HSE National Centre for Clinical Audit provides a national focus for clinical audit in order to ensure that those who are conducting local, regional and national audits have access to best practice information. The National Centre for Clinical Audit provides clinical audit training in order to support clinical teams to develop and run QI projects.

Clinical audit projects

Throughout this report, the following suggested areas for QI have been highlighted:

• Develop a 'door in door out' (DIDO) QI project in order to improve the pathway to a primary PCI centre for patients with a STEMI who arrive at a non-PCI-capable hospital and are transferred to a primary PCI centre.
• Develop a QI project in order to improve the time to electrocardiogram (ECG) for all patients presenting with acute chest pain.
• Develop a QI project in order to improve the timeliness of thrombolysis when transfer for primary PCI within 90 minutes is not feasible.
• Develop a QI project in order to improve the 'door to balloon' (DTB) time in hospitals not reaching the target of 30 minutes or less.
• Develop a QI project in order to increase the use of radial arterial access for primary PCI.
• Develop a QI project in order to improve the capture of 30-day mortality status.
• Develop a QI project in order to improve the rate of referral to, and uptake of, CR phase 3.

The IHAA recommends that all clinical teams should participate in a QI project and that all learnings can be shared through the NOCA Quality Improvement Champion Award, in workshops and meetings, and in future IHAA annual reports.

The IHAA also recommends that all teams providing care to patients with a STEMI participate in the forthcoming STEMI Care Pathway Quality Improvement Project and view their own data via the IHAA dashboard in order to identify hospital-specific areas of QI.

DATA QUALITY IMPROVEMENT PROJECT
ST JAMES'S HOSPITAL

BACKGROUND

St James's Hospital (SJH) provides 24/7 primary PCI services, treating 25% of Ireland's cases. A 2022 local audit showed only 10-15% of patients with a STEMI were from SJH's catchment area. Follow-up data from other hospitals was often inaccessible, affecting data reliability. The cardiology team in SJH undertook a QI project to improve the data quality of follow-up variables. For further information on this project please see Appendix 9.

PRE QI-INITIATIVES STATISTICS

In 2022, SJH's follow-up data completeness was low:

Survival status on discharge	Referral for phase 3 cardiac rehabilitation (CR)	Date of first phase 3 CR appointment	Survival status at 30 days post-MI
ST JAMES'S 37% VS NATIONAL 80%	ST JAMES'S 7% VS NATIONAL 57%	ST JAMES'S 8% VS NATIONAL 33%	ST JAMES'S 26% VS NATIONAL 72%

QUALITY IMPROVEMENT STEPS

Revision of the STEMI data form.	Improved HIPE STEMI coding.
Training of clinical teams on data documentation.	Increased referrals to CR and smoking cessation services.
Scanning of ECG & ambulance forms into electronic records.	Updated discharge checklists.
Gained access to multiple electronic systems.	Scheduled 30-day follow-up calls.

POST QI-INITIATIVES STATISTICS

In 2023, data completeness improved:

Survival status on discharge	Referral for phase 3 cardiac rehabilitation (CR)	Date of first phase 3 CR appointment	Survival status at 30 days post-MI
ST JAMES'S 88% VS NATIONAL 96%	ST JAMES'S 83% VS NATIONAL 91%	ST JAMES'S 52% VS NATIONAL 52%	ST JAMES'S 84% VS NATIONAL 90%

LEARNINGS

- Data collection should begin at initial patient contact and involve all healthcare team members.
- Effective coordination among all members of the healthcare team across the patient's journey are critical.
- High-quality data enhances accurate local and national reporting, with challenges in follow-up data collection needing consideration at national level.

CONCLUSION

Effective data collection and team coordination enhanced reporting accuracy.

CHAPTER 9
AUDIT UPDATE

CONTENTS

CHAPTER 9: **AUDIT UPDATE**

The purpose of this chapter is to present an update on previous IHAA national report recommendations, to highlight how IHAA data are utilised by other services, and to present other IHAA activities and projects undertaken by the IHAA in collaboration with other stakeholders, including:

- the risk-adjusted mortality reporting project
- the HIPE–Heartbeat STEMI diagnosis reconciliation project
- the EuroHeart registry project
- HIPE coding of diabetes and Heartbeat recording of diabetes.

UPDATE ON PREVIOUS IHAA NATIONAL REPORT RECOMMENTATIONS

Table 9.1 displays an update on the recommendations from the *Irish Heart Attack Audit National Report 2017-2020* (NOCA, 2022a) and the *Irish Heart Attack Audit National Report 2021* (NOCA, 2023a).

TABLE 9.1: UPDATE OF RECOMMENDATIONS FROM THE *IRISH HEART ATTACK AUDIT NATIONAL REPORT 2017-2020* AND THE *IRISH HEART ATTACK AUDIT NATIONAL REPORT 2021.*

RECOMMENDATION	STATUS
Implement a national STEMI transfer form for use when transferring patients from a non-PCI hospital to a PCI centre.	**Action on this recommendation is in progress:** • **The IHAA has established links with the National Emergency Medicine Programme, which is designing an emergency inter-hospital transfer document that includes all data necessary in order to expedite patient treatment and facilitate effective audit. The document is awaiting piloting in a Dublin hospital.**
Improve the data quality of the follow-up dataset within the Heartbeat portal.	**Action on this recommendation is in progress.** **The initiatives implemented in 2022 are ongoing, and data quality has improved as per the data quality statement in Chapter 3:** • **IHAA audit coordinator workshops are being held annually.** • **The completeness of the 'survival status at 30 days' and 'date of first phase 3 CR appointment' data points are reported as KQIs on the IHAA dashboard.** • **The IHAA has supported any requests for additional data collection support in hospitals where data collection is challenging.** • **Bimonthly IHAA audit coordinator meetings are held (as a support and information-sharing forum).**
Introduce a KPI that measures the DIDO time with the aim of achieving the ESC's guideline target of 30 minutes or less.	**Action on this recommendation is in progress:** • **DIDO times have been reported for 2023 by each hospital.** • **DIDO results will inform future QI initiatives.** **The development of a national KPI in order to monitor the DIDO time requires further consideration, as DIDO reports on care received by patients outside of the PCI centres.**
Improve timeliness of reperfusion for patients with a STEMI presenting to non-PCI centres.	**Action on this recommendation is in progress:** • **Primary PCI centres have informally established links with their referring hospital networks.**

Develop a public awareness campaign to encourage people with heart attack symptoms to call 112 or 999 immediately for emergency help in order to facilitate pre-hospital ECG diagnosis of a STEMI.	**The National Heart Programme, National Ambulance Service and Irish Heart Foundation have collaboratively developed a business case for a public awareness campaign. Funding will be sought for 2025 and a targeted public awareness campaign will be designed. The campaign will incorporate the findings of the national STEMI Care Pathway Quality Improvement Project.**
Improve the identification and control of cardiovascular risks.	**The Integrated Care Programme for the Prevention and Management of Chronic Disease has begun the implementation of the recommendations set out in the *National Framework for the Integrated Prevention and Management of Chronic Disease in Ireland 2020-2025* (HSE, 2020).**
Improve public awareness of the adverse impact of smoking on heart attack risk.	**In 2023, NOCA met with the HSE Health and Wellbeing team in order to identify areas where the IHAA results on smoking could be used to drive health messaging. A case for a new Healthy Ireland Men's Health Plan is in development, and the IHAA will continue to share findings to support this project.**
There should be a national and regional focus on QI in the STEMI care pathway.	**This recommendation is in progress:** • **Leadership of the National Heart Programme has been extended to include a specific focus on acute coronary syndrome through the appointment of a second National Heart Programme Clinical Co-Lead. Following a successful recruitment campaign, the Clinical Co-Lead began in this post on 1 July 2024.** • **The National Heart Programme and the National Ambulance Service, in collaboration with the HSE National Quality and Patient Safety Directorate, the National Centre for Clinical Audit and the Royal College of Physicians of Ireland, have embarked on a QI project focusing on the STEMI care pathway, referred to as the STEMI Care Pathway Quality Improvement Project.** • **Scoping discussions and stakeholder mapping have been undertaken throughout the first two quarters of 2024. A face-to-face meeting of key stakeholders was convened on 29 May 2024, the outcomes of which informed the focus of the project and the STEMI care metrics which will be addressed for QI. Planning of the project continues.**
Support patients with a STEMI to reduce the risk of further heart attack by increasing the rate of referral to CR phase 3.	**This recommendation is in progress:** • **The rate of referral to CR phase 3 is monitored quarterly as a KQI on the IHAA dashboard and disseminated to clinical and management teams in PCI centres.** • **The completeness of recording the date of commencement of CR phase 3 is also monitored quarterly as a KQI on the IHAA dashboard. Completeness of the 'date of first phase 3 CR appointment' data point continues to increase, from 25% in 2021, to 33% in 2022 and 52% in 2023.**

VALUE OF AUDIT

It takes many years to embed the capture of high-quality data into practice. Increasing visibility of the quality of STEMI care in hospitals in Ireland through the publication of the IHAA annual reports has led to increased participation and improved data quality. All hospitals that provide a primary PCI service are now participating in the audit.

In September 2023, NOCA launched the *Irish Heart Attack Audit National Report 2021* (NOCA, 2023a) online. In addition, the IHAA dashboard is now available at each PCI centre and is refreshed quarterly.

The IHAA data inform the national acute coronary syndrome (ACS) KPIs, which in turn inform the HSE's annual National Service Plan. In addition, the national KPIs are included in the quarterly NOCA reports that are sent to Hospital Group managers.

The recommendations within the IHAA and the follow-up on previous recommendations will, if implemented, lead to improved outcomes for patients by increasing heart attack awareness in the population; improve the timeliness of reperfusion therapies; support the reporting of risk-adjusted outcomes; and provide information to support the roll-out of QI initiatives.

AUDIT ACTIVITY

IHAA AUDIT COORDINATOR ENGAGEMENT

Virtual audit coordinator meetings were held every 2 months in 2022 and 2023 in order to support the audit coordinators with data collection, training and identification of areas for improvement.

In April 2024, an IHAA audit coordinator workshop was held in the Royal College of Surgeons in Ireland. The agenda for this workshop included the vision of the IHAA, review of the current dataset and definitions, agreement of additional Heartbeat data points, and data QI initiatives. Continuous professional development points were also provided.

FIGURE 9.1: IRISH HEART ATTACK AUDIT COORDINATOR WORKSHOP 2024

Left to right: Laura Donohue, April Villalobos, Sreeji Kurup, Maria Kehoe, Joan McCormack, Yvonne McConnon, Catriona Ahern, Ronan Margey, Catherine Markham, Elizabeth O'Connor, Jamie Byrne, Mairead Hanrick and Ciara Power.

RISK-ADJUSTED IN-HOSPITAL MORTALITY REPORTING PROJECT

BACKGROUND

Mortality on discharge from hospital has been recorded in the Heartbeat dataset since 2013. As the completeness of this data point has improved over the years, it was appropriate to report mortality at hospital level. However, appropriate risk adjustment should be applied prior to reporting mortality at hospital level.

Mortality risk adjustment is a process that assesses differences in the likelihood of death among individuals or groups. Risk-adjusted mortality rate means that a mortality rate has been statistically adjusted in order to account for the predicted risk of death. It is used in order to assess the performance of institutions, doctors, procedures, healthcare systems, etc. while considering other factors that could influence a patient's risk of death, such as characteristics in the patient population that make individuals in that population more or less likely to die (Association of Health Care Journalists, n.d.).

In 2022, the NOCA data analytical and research team, as well as the IHAA Clinical Lead and Audit Manager commenced a project to develop a risk-adjusted in-hospital mortality model for the IHAA and a strategy to manage statistical outliers.

THE GLOBAL REGISTRY OF ACUTE CORONARY EVENTS

The Global Registry of Acute Coronary Events (GRACE) model is used in order to assess the risk of mortality for the entire spectrum of ACS treated in general clinical practice. The GRACE model was set up as a prospective triage tool that provides an excellent ability to assess the risk for death. GRACE scores can be used as a simple nomogram to stratify the estimated risk in individual patients into three categories: low, intermediate and high risk of mortality (GRACE, 2024; Granger *et al*., 2003) (Figure 9.2), or to estimate the probability of death.

STE-ACS: IN-HOSPITAL MORTALITY

Risk Category (tertiles)	GRACE Risk Score	Probability of Death In-Hospital (%)
Low	49-125	<2
Intermediate	126-154	2-5
High	155-319	>5

FIGURE 9.2: GLOBAL REGISTRY OF ACUTE CORONARY EVENTS RISK SCORE STRATIFICATION

The eight data points that are used in order to calculate the GRACE score and the GRACE probability of death are:

1.	AGE	**5.**	KILLIP CLASSIFICATION
2.	PULSE	**6.**	CARDIOGENIC SHOCK
3.	SYSTOLIC BLOOD PRESSURE	**7.**	ST SEGMENT DEVIATION
4.	CREATININE	**8.**	ELEVATED CARDIAC ENZYME.

METHOD

In 2022, additional data points were added to the Heartbeat dataset in order to ensure that all data points required to calculate the GRACE score were available for analysis. For a detailed description of the data points in the Heartbeat dataset that are used to estimate the GRACE score, see Appendix 7. Data quality of the items were monitored through data validation reports that were provided to each hospital on a quarterly basis. The completeness of the GRACE score data points can be viewed in Appendix 6.

The GRACE score data points can be used in order to obtain the estimated risk of death using logistic regression model analysis. The estimated coefficients for each data point and the intercept were taken from the Center for Outcomes Research (Center for Outcomes Research, 2014). The output of the expected death from the logistic regression model was used in order to plot a standardised mortality ratio (SMR)[63] funnel plot.

Table 9.2 shows the summary of validations of GRACE data points for 2022 and 2023. The total number of cases used in calculating the GRACE score in 2023 was 1,160 (90%). For a detailed breakdown of GRACE data points by hospital, see Appendix 6.

TABLE 9.2 DATA VALIDATION SUMMARY OF GLOBAL REGISTRY OF ACUTE CORONARY EVENTS SCORE, BY YEAR

	2022			2023		
	Accurate data		Total	Accurate data		Total
	N	%		N	%	
Survival status on discharge	**927**	**78%**	**1196**	**1238**	**96%**	**1292**
Heart rate validation	1188	99%	1196	1277	99%	1292
Systolic blood pressure validation	1188	99%	1196	1278	99%	1292
Creatinine level validation	1037	87%	1196	1251	97%	1292
Killip classification validation	1193	100%	1196	1292	100%	1292
Cardiac arrest at admission validation	1196	100%	1196	1292	100%	1292
ST segment deviation	1196	100%	1196	1292	100%	1292
Elevated cardiac enzyme levels validation	1027	86%	1196	1236	96%	1292
GRACE validation total	1029	86%	1196	1236	96%	1292
GRACE validation total including survival status	**804**	**67%**	**1196**	**1160**	**90%**	**1292**

It is important to note that the logistic regression model coefficients that are available to be fitted for the GRACE probability of death were estimated in 2014, and therefore may be outdated and no longer appropriate. The logistic regression model coefficients can be developed using IHAA data; however, at the time of writing this report, there was not a sufficient amount of data for this implementation.

[63] An SMR describes whether a specific population is more, less, or equally as likely to die as a standard/reference population (Nicholls, 2020).

STANDARDISED MORTALITY RATIO FUNNEL PLOT

SMR funnel plots (Figure 9.3) are scatter plots of individual hospitals' SMRs. The upper and lower borders of the funnel are represented by the 95.0% and 99.8% control limits. These borders represent the upper and lower limits of what is referred to as 'expected variation'.

An SMR is expected to appear within the 99.8% control limits 998 times out of 1,000. Statistically, 1 in 500 observations can be expected to appear outside these control limits by chance alone. In other words, if an SMR appears outside these limits, it is very unlikely that this is due to chance. These observations represent variation worthy of further review (NOCA, 2023b).

Funnel plots make it very easy to identify these observations worthy of further review. A hospital's SMR should only be compared with its own control limits. There is no basis for ranking institutions into 'league tables' (Spiegelhalter, 2005); therefore, it is not valid to compare SMRs between hospitals.

The package FunnelPlotR (funnel plots for comparing institutional performance) (GitHub, Inc., n.d.) in the R software package was used in order to create the funnel plot using validated Heartbeat data.

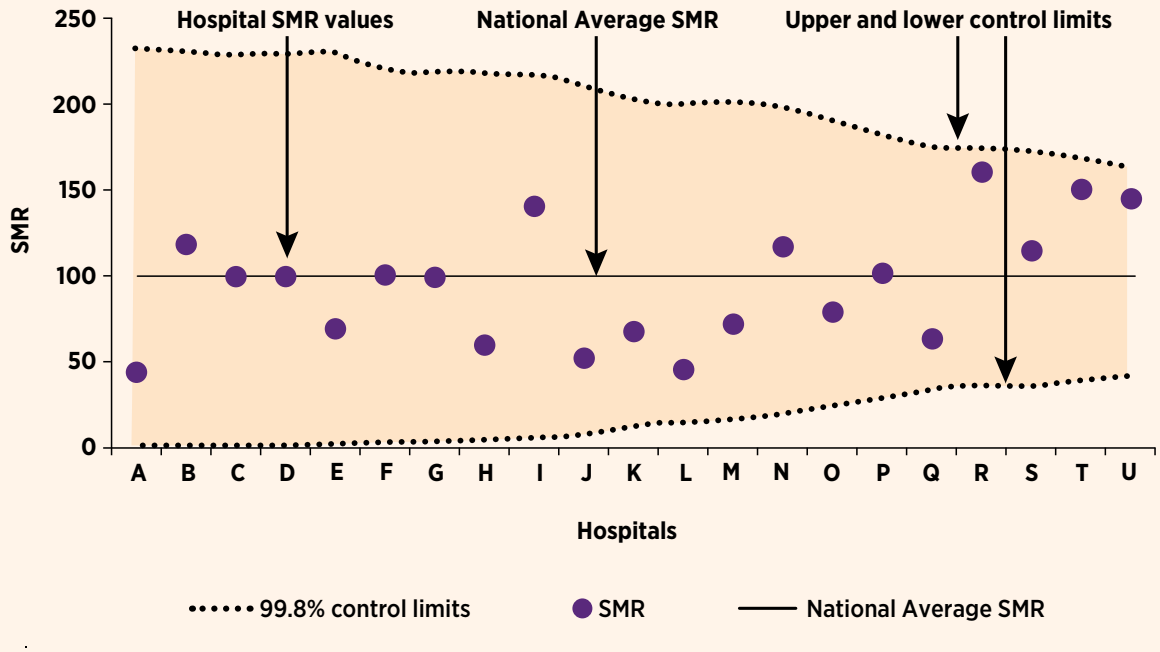


FIGURE 9.3: EXAMPLE OF A FUNNEL PLOT

MONITORING OF STATISTICAL OUTLIERS

As described above, if an SMR appears outside the given control limits, it is very unlikely that this is due to chance. These outlier observations represent variation worthy of further review. An outlier is a result that is statistically significantly further from the expected value of an agreed quality indicator/reference value than would occur by chance alone. The reporting of the SMRs by hospital is supported by a statistical outlier management process in NOCA.

NEXT STEPS

The NOCA data analytical team has applied the risk-adjustment model aligned to the GRACE model.

It is planned that from 2024, quarterly risk-adjusted mortality results will be reported to clinical and hospital management teams in primary PCI centres. In order for this to be achieved, the following steps need to be delivered:

1. The NOCA data analytical team will develop a mortality report for each hospital. This report will be sent to each PCI centre with each centre's own results. The report will include interpretive notes and:
   a. the hospital-level risk-adjusted mortality results for the 12-month rolling period
   b. the data quality of the data points used in the GRACE model calculation and the mortality on discharge from hospital data point.
2 The IHAA Clinical Lead and Audit Manager will prepare an information package for all clinical and hospital management teams outlining the outlier management process.
3 Training on how to interpret the results and how to assess data quality for identified outliers will be provided to clinical teams.

OPPORTUNITIES FOR FUTURE WORK

GRACE SCORE 3.0

The GRACE score was developed and validated in predominantly male patient populations. There is evidence to suggest that the GRACE score underperforms in female populations, and so the GRACE score 3.0 was developed in order to account for the sex differences. The updated model used the supervised tree-based learning algorithm eXtreme Gradient Boosting (XGBoost) in order to predict in-hospital mortality (Wenzl *et al.*, 2022). Although the GRACE score 3.0 calculator is freely available online (Figure 9.4), as with previous models, the application of this model in the Heartbeat dataset in order to estimate the probability of death is complex. The methodology for the development of the GRACE score 3.0 did not apply logistic regression, as with the previous model. NOCA is dedicated to pursuing possibilities for applying the GRACE score 3.0 within the Heartbeat dataset.

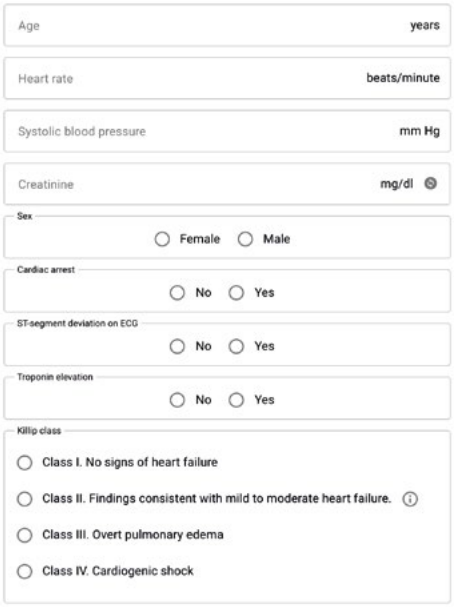


FIGURE 9.4: GLOBAL REGISTRY OF ACUTE CORONARY EVENTS SCORE 3.0 WEB CALCULATOR

The National Audit of Hospital Mortality

NOCA has published the National Audit of Hospital Mortality (NAHM) annually since 2016. The NAHM shows six key clinical conditions: acute myocardial infarction, heart failure, ischaemic stroke, haemorrhagic stroke, chronic obstructive pulmonary disease and pneumonia. The web-based National Quality Assurance Improvement System is an established and validated tool that calculates SMRs for all diagnoses for all in-hospital admissions. The SMR is calculated from the observed number of deaths divided by the expected number of deaths in a hospital for a particular diagnosis and time period, adjusted for the following factors: age, sex, pre-existing conditions, in-hospital palliative care treatment, source of admission, type of admission, previous emergency admissions, and use of a medical card. NOCA is exploring the possibility of collaborating with the NAHM to either apply the NAHM model to the Heartbeat dataset, or to include the GRACE score data points in the NAHM model.

HIPE–HEARTBEAT STEMI DIAGNOSIS RECONCILIATION PROJECT

In 2023, the IHAA core team and representatives from the Healthcare Pricing Office (HPO) undertook a project to assess whether all STEMIs recorded on the Heartbeat portal are coded as STEMIs on HIPE, and if all STEMIs coded on HIPE are recorded on the Heartbeat portal. The aim of this project was to evaluate the possibility of quantifying the coverage of Heartbeat cases against HIPE cases as a data quality measurement.

The group reviewed two groups of cases:

1. cases recorded on the Heartbeat portal as STEMIs but which are not coded as STEMIs on HIPE, in order to determine why differences are occurring between the two datasets
2. cases coded on HIPE as STEMIs but which are not recorded on the Heartbeat portal as STEMIs in order to determine why differences are occurring between the two datasets.

The results indicated that there were coding errors and poor documentation of diagnoses in the medical records, and the following recommendations were made:

- Educate medical teams on the importance of clear documentation.
- Improve the documentation of STEMI diagnoses in medical charts.
- Increase communication between clinical teams and coders in order to agree the final diagnosis if this is unclear.

It was agreed that using HIPE data in order to assess coverage of STEMI within the Heartbeat dataset may not be the most appropriate way to formally assess the coverage of cases for Heartbeat.

EUROHEART REGISTRY PROJECT

EuroHeart is a European Society of Cardiology (ESC) initiative to establish national quality registries on cardiovascular diseases across Europe (ESC, n.d.). The EuroHeart ACS/PCI dataset was developed using a robust, evidence-based approach involving a systematic review of empirical literature, evaluation of national registries and consensus development with 22 ACS/PCI representatives from 11 countries. Currently, 12 countries are actively using EuroHeart. Full participation in EuroHeart would facilitate real-time reporting and annual international benchmarking with other countries. In 2023, the cardiac community in Ireland (via the Irish Cardiac Society) agreed to commence work on a project to implement EuroHeart in Ireland.

The overall aims of the project include:

- a pilot project led by the Coronary Heart Attack Ireland Register (CHAIR) to test the collection and submission of data related to ACS/PCI to the EuroHeart registry in the South/South West Hospital Group
- a comprehensive IHAA impact study to assess the viability and advantages of, and the potential challenges associated with, collecting a dataset for the IHAA via the EuroHeart registry for the national collection of both STEMI and non-ST elevation myocardial infarction (NSTEMI) cases
- work towards achieving comprehensive national data coverage by involving healthcare providers from across Ireland (this includes both public and private healthcare providers)
- gradual expansion over time to include other relevant EuroHeart datasets, such as a heart failure dataset.

IHAA impact study

The EuroHeart ACS/PCI register and the IHAA dataset collect similar STEMI data. There is an opportunity to explore if the EuroHeart register could be used in order to collect STEMI and NSTEMI data for the IHAA as well as other future national audits that are under NOCA's management. This will require NOCA to carry out a detailed impact assessment. The IHAA impact study will aim to develop frameworks for data management, reporting and information governance. It will also seek to clarify the implications for personnel and the technical infrastructure and costs for national implementation. The deliverables of the IHAA impact study will be informed by the learnings from the CHAIR South/South West Hospital Group pilot collection of EuroHeart data.

A project team has been established that will be responsible for the delivery of the agreed scope of work to the required standards, timelines and funding.

Stakeholder engagement thus far has indicated widespread support for the initiative, including from frontline stakeholders, Public and Patient Interest representatives and the Department of Health.

Updates on the project will be presented to the IHAA Governance Committee on a quarterly basis and reported annually in the IHAA national reports.

HIPE CODING OF DIABETES AND HEARTBEAT RECORDING OF DIABETES

Diabetes mellitus is a well-established risk factor for cardiovascular disease. Compared with individuals without diabetes, both those with type 1 or type 2 diabetes have a considerably higher risk of cardiovascular morbidity and mortality, and are disproportionately affected by cardiovascular disease (Martín-Timón *et al*., 2014). Type 1 diabetes is treated with insulin injection therapy, while type 2 diabetes can be treated with lifestyle/dietary intervention, oral tablet therapy, non-insulin injection therapy, and insulin injection therapy if needed.

In previous IHAA national reports (NOCA, 2022a; NOCA, 2023a), type 2 diabetes has been inferred by reporting on those with diabetes (diet control) and diabetes (oral medications) together. In 2021 (NOCA, 2023a), there was a concern that the IHAA may be underestimating the prevalence of type 2 diabetes due to data collection and coding concerns over newly diagnosed type 2 diabetes during the index hospital admission with a STEMI and the emergence of new injection-based drug therapy for type 2 diabetes since 2012, when the Heartbeat dataset was developed.

It was recommended that NOCA should work with the HPO in order to assess the congruence between the Heartbeat and HIPE datasets and the option to report on data from HIPE only. Data from 2023 using both Heartbeat variables and HIPE codes were analysed in order to determine the future of diabetes reporting in the IHAA.

ANALYSIS

In HIPE, diabetes is coded by diabetic type: E10 = type 1 diabetes and E11 = type 2 diabetes. There are also two other codes: E13 = other specified diabetes and E14 = unspecified diabetes. Heartbeat records diabetes differently: not diabetic, diabetes (diet control), diabetes (oral medications), diabetes (insulin), and unknown.

In 2023, out of all patients with a STEMI recorded on Heartbeat (n=1569), 13.7% (n=215) of cases were recorded on HIPE as having type 2 diabetes. An additional 1% (n=16) had type 1 diabetes, and 1 case was coded as unspecified diabetes (Table 9.3).

TABLE 9.3 NUMBER OF HEARTBEAT DIABETIC VARIABLES WITH ASSOCIATED HOSPITAL IN-PATIENT ENQUIRY DIABETES CODES, 2023

2023			
Heartbeat variable	**Heartbeat cases**	**HIPE code**	**HIPE cases**
Not diabetic	1180	E11	17
		E10	1
Diabetes (diet control)	94	E11	21
		E14	1
		E10	0
Diabetes (oral medications)	198	E11	134
		E14	0
		E10	1
Diabetes (insulin)	60	E11	42
		E10	14
Unknown	37	E11	1
Total	1569	E11	215
		E14	1
		E10	16
		No diabetic code	1337

While Heartbeat captured 1,180 cases that were coded as 'not diabetic', this figure was higher for HIPE, at 1,337 cases without a diabetic code, which is a difference of 157 cases. The HPO has requested the sites where a difference was identified to review these cases, and these reviews are in progress.

A smaller review of 18 cases that were recorded on Heartbeat as 'not diabetic' but that had a diabetic code assigned in HIPE has been completed. Each PCI centre (n=7) was asked to review the cases that had a diabetic code assigned in HIPE and where there was no associated Heartbeat record of diabetes. Nine cases were incorrectly recorded on Heartbeat, as they did have diabetes; four were newly diagnosed as diabetic and the audit coordinators recorded them as not diabetic; two cases had results suggestive of diabetes but were discharged home without a diagnosis with a view to follow up with the GP; two cases were confirmed as not diabetic; and no information was available in one case. The Heartbeat data dictionary does specify to code newly diagnosed diabetics as diabetic, and further education and training will be provided to audit coordinators.

In 2023, Heartbeat recorded 292 cases of inferred type 2 diabetes (diet control and oral medications), equating to a rate of 18.6%. This result is similar to the 18% reported in 2021 (NOCA, 2023a). Heartbeat reported an additional 3.8% (n=60) of cases with diabetes who were on insulin; however, only 16 cases were reported on HIPE as having type 1 diabetes, which may suggest that in Heartbeat, some patients may be coded as having type 2 diabetes that is being treated with insulin. Because cases treated with insulin are inferred as having type 1 diabetes, they are not included in the type 2 diabetes total. Finally, diabetic status was unknown in 2.4% (n=37) of cases in Heartbeat.

CONCLUSION

In 2023, Heartbeat captured more cases of type 2 diabetes compared with HIPE (18.6% versus 13.7%). However, it remains likely that Heartbeat is underestimating the rate of type 2 diabetes compared with HIPE, as it does not differentiate those on insulin by diabetic type. HIPE coding relies on documentation of diabetes in the healthcare record. The findings on the differences between Heartbeat and HIPE will inform training and advice on HIPE coding of diabetes.

Three options to improve the reporting of diabetes can be considered:

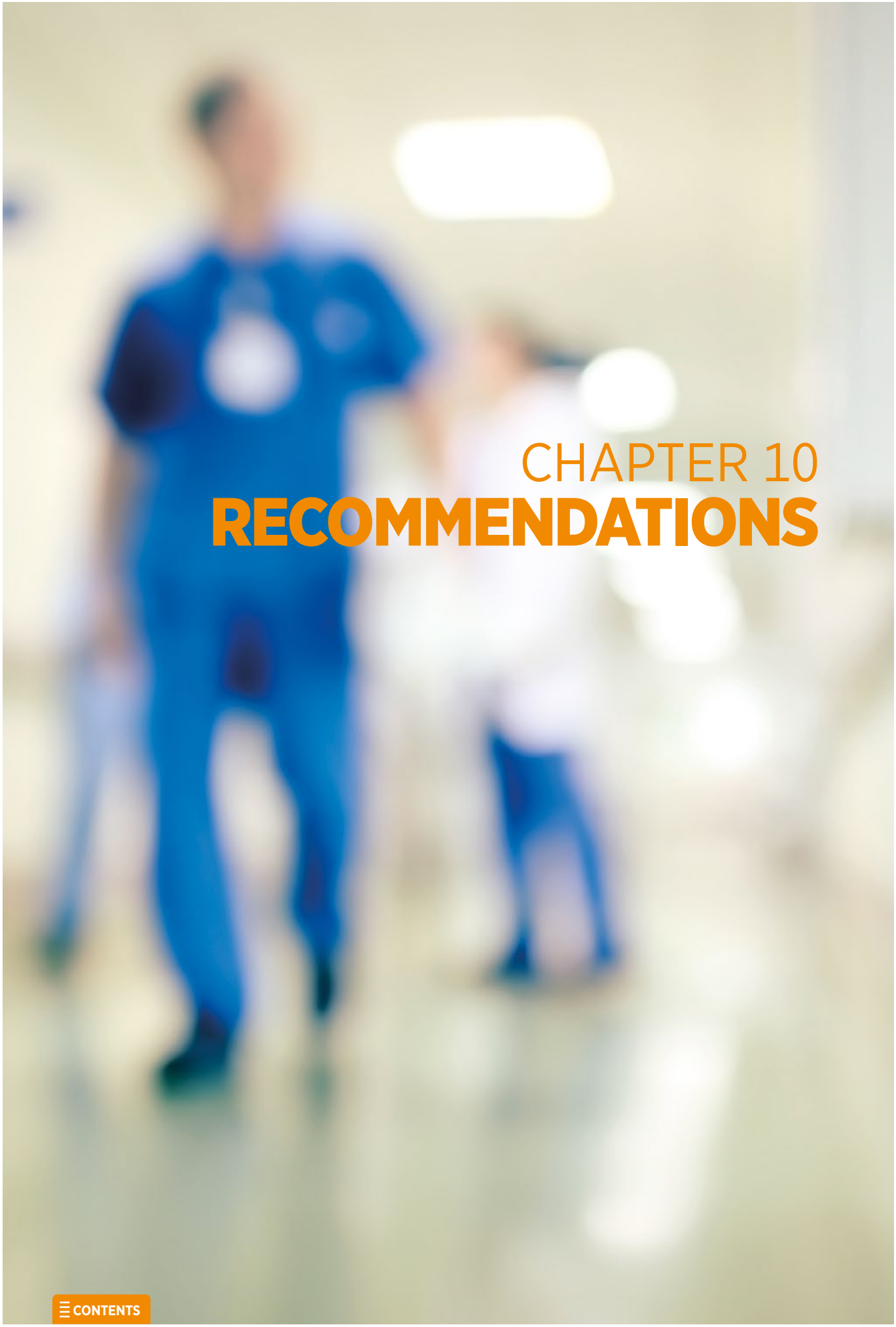
1. Increase the education and training provided to audit coordinators and continue to report using the current Heartbeat diabetes information.
2. Use the HIPE diabetic code to report on diabetes.
3. Revise the Heartbeat dataset to change from identifying cases of diabetes by treatment type to recording the diabetic type.

The IHAA Governance Committee will make a decision based on the results of this project.

AUDIT DEVELOPMENT PLAN

The IHAA continues to develop and mature. The following projects and amendments aim to maximise the value of the audit:

- Continue to facilitate direct access to the IHAA dashboard at hospital level for all users, ensuring access to timely data.
- Add two new data points to the Heartbeat dataset in order to capture the date and time of the first ECG in order to measure against the 2023 ESC ACS guideline (Byrne *et al*., 2023) of providing an ECG within 10 minutes of hospital arrival.
- Consider using the HIPE dataset to measure the incidence of diabetes or revising the Heartbeat dataset to capture diabetes by type rather than by treatment type, in order to align with EuroHeart reporting.
- Complete a review of cases with a diagnosed STEMI who were initially transported to a non-PCI-capable hospital rather than to a PCI centre.
- Continue to refine the risk-adjusted mortality modelling over time in conjunction with the NAHM.
- Complete an IHAA impact study in order to assess the viability and advantages of, and the potential challenges associated with, collecting a dataset for the IHAA via the EuroHeart registry for the national collection of both STEMI and NSTEMI cases.



CHAPTER 10
RECOMMENDATIONS

CONTENTS

CHAPTER 10: **RECOMMENDATIONS**

RECOMMENDATION 1

All percutaneous coronary intervention (PCI) centres, non-PCI-capable hospitals, and ambulance services should participate in the STEMI care pathway quality improvement project.

Rationale

In the *Irish Heart Attack Audit National Report 2021*, it was recommended that there should be a national and regional focus on QI in the STEMI care pathway. Again in 2022 and 2023, national KQI targets were not achieved: the proportion of patients with a STEMI who received reperfusion fell below the target of 95% for the first time since 2016, at 93% (n=1331); the proportion of patients who received timely reperfusion decreased from 69% in 2021 to 65% in 2022 and 66% in 2023, well below the target of 90%; and those transferred from non-PCI-capable hospitals to a PCI centre continue to have delayed primary PCI times (45% received timely reperfusion in 2023) compared with those who are brought directly to a PCI centre (79% received timely reperfusion in 2023).

In order to improve processes for those transferred to a PCI centre, a DIDO time of 30 minutes or less is recommended (Byrne *et al*., 2023); in 2023, only 4% of patients treated in the ED of a non-PCI-capable hospital achieved a DIDO time of 30 minutes or less, and only 37% had the STEMI diagnosed by ECG within 10 minutes.

In 2023, the National Heart Programme and National Ambulance Service, in collaboration with the HSE National Quality and Patient Safety Directorate and the Royal College of Physicians of Ireland, embarked on a QI project focusing on the STEMI care pathway, referred to as the STEMI Care Pathway Quality Improvement Project. This project is assessing the feasibility of many creative solutions, such as using technology to streamline communication between all teams providing STEMI care; considering triangulated communication between ambulance services, non-PCI-capable hospitals and PCI centres via the National Emergency Operations Centre in order to facilitate inter-hospital transfer; changing the priority status of patients with a STEMI requiring emergency transfer to a PCI centre (adjusting protocol 37);[64] and aligning with the PITSTOP (Protocol for Improving Times for STroke patients requiring Onward transfer from Primary stroke centre to thrombectomy centre) protocol. It is essential that all teams providing STEMI care are supported to participate in this collaborative QI project in order to ensure that the STEMI care pathway is streamlined and working effectively in all PCI networks.

[64] Protocol 37 has been developed for emergency inter-hospital transfers for patients who require a clinically time-critical intervention which is not available within their current facility

What actions should be taken?	Who is responsible for implementation?	When should this be implemented?
• The National Heart Programme and National Ambulance Service, in collaboration with the HSE National Quality and Patient Safety Directorate and the Royal College of Physicians of Ireland, should deliver the STEMI Care Pathway Quality Improvement Project. • All PCI networks should participate in the QI project. • All hospital managers should support their teams in the QI project. • NOCA data should be used in order to monitor changes in the delivery of STEMI care.	• National Heart Programme • National Ambulance Service • HSE National Quality and Patient Safety Directorate • Royal College of Physicians of Ireland • NOCA	Commenced in 2024

Evidence that the action will be effective

- Mumma *et al*. (2014) identified 18 key care processes that improved timely reperfusion in STEMI care, including improved communications throughout the patient pathway to reperfusion. Wang *et al*. (2011) found that only 11% of patients with a STEMI who required inter-hospital transfer had a DIDO time of less than 30 minutes; this was due to multiple reasons, including age and sex demographics, transportation delays, and time of presentation. A DIDO time of less than 30 minutes was associated with fewer reperfusion delays and lower in-hospital mortality rates. Fordyce *et al*. (2017) found that QI initiatives that focus on key care processes are associated with small improvements in timeliness to reperfusion.

Who will benefit from the recommendation?

- Patients with a STEMI will benefit from the establishment of PCI networks that work towards identifying areas for improvement and implementing and monitoring the effect of change. Healthcare teams involved in the care of patients with a STEMI will benefit through increased collaboration with colleagues.

RECOMMENDATION 2

The Health Service Executive should increase the proportion of patients arriving at a PCI centre directly by ambulance through the delivery of a public awareness campaign aimed at the appropriate use of the ambulance service.

Rationale

In 2013, the National Clinical Programme for Acute Coronary Syndrome (NCP-ACS) implemented an optimal reperfusion service (ORS) protocol for the care of patients with a STEMI, with the aim of saving lives by standardising care across the country. This protocol states that all patients with a STEMI should be brought directly by ambulance to a PCI centre unless the transport time is greater than 90 minutes. If the journey time is greater than 90 minutes, the patient should be brought to the nearest hospital for reperfusion with thrombolysis and then transported to a PCI centre for rescue PCI. In 2023 (NOCA, 2023a), the IHAA, in conjunction with the HSE Health Intelligence Unit, undertook a mapping exercise, which indicated that 92% of the population aged 55 years and over lived within a 90-minute drive of one of the six 24/7 primary PCI centres in Ireland; this figure was 95% if University Hospital Waterford was included in the analysis. In 2022 and 2023, slightly more than one-half of all patients with a STEMI were brought directly by ambulance to a PCI centre (a decrease from 58% in 2021), and only 47% of those called 112 or 999 within 60 minutes of symptom onset. This is important, as patients who arrive directly by ambulance to a PCI centre are more likely to receive timely primary PCI (as was the case for 79% of patients in 2023) compared with those who are transferred from a non-PCI-capable hospital to a PCI centre (as was the case for 45% of patients in 2023). Timely reperfusion is associated with lower proportions of severely reduced left ventricular function (LVF) (11% of patients who received timely reperfusion had severely reduced LVF (of less than 30%) in 2023) compared with non-timely reperfusion (16% who did not receive timely reperfusion had LVF of less than 30% in 2023). Timely primary PCI is also associated with lower mortality. In 2022, those who received timely primary PCI had an unadjusted in-hospital mortality rate of 2.7% (n=20) compared with 7.8% (n=28) for those who did not receive timely primary PCI (the corresponding figures for 2023 were 4.1% and 5.3%, respectively).

As clearly described by Michael, who generously shared his heart attack story in our patient perspective narrative, there is a lack of awareness of heart attack symptoms and a reluctance to call 112 or 999. Calling 112 or 999 will ensure prompt pre-hospital ECG diagnosis of a STEMI and allows direct transfer of STEMI cases to PCI centres. It is imperative to fund a public health campaign to increase awareness of heart attack symptoms and the importance of calling 112 or 999, and to incorporate the experience of other campaigns into the design of this public health campaign.

What actions should be taken?	Who is responsible for implementation?	When should this be implemented?
• The National Heart Programme, National Ambulance Service and Irish Heart Foundation have collaboratively developed a business case for a targeted public awareness campaign, and the HSE should submit this for funding to the National Service Plan 2025. • A scoping review of the content and impact of previous public awareness campaigns should be undertaken in order to maximise the impact of a public awareness campaign on heart attack symptom recognition and reduction of pre-hospital delay.	• HSE • National Heart Programme • National Ambulance Service	As soon as possible.

Evidence that the action will be effective

- Studies show that increasing public awareness of the signs and symptoms of heart attack is associated with shorter pre-hospital decision-making (Bray *et al*., 2015) and with a reduction in the number of out-of-hospital cardiac arrests (Nehme *et al*., 2017). A warning sign campaign was in place in Australia from 2009 to 2013, and an impact analysis of this campaign indicated that there was no increase in the proportion of ambulance presentations nor earlier hospital presentations among patients with a STEMI during the campaign. However, there was an increase in the proportion of patients for whom English was their first language and for those without a prior cardiac history but who had cardiovascular risk factors, suggesting that the campaign impacted preferentially on certain strata in the community (Redwood *et al*., 2022). In Ireland, following the first stroke public awareness campaign, it was found that awareness can wane when campaigns end (Hickey *et al*., 2018), emphasising the need for regular, recurrent campaigns.

Who will benefit from the recommendation?

- All patients with symptoms of a heart attack will benefit from early detection of a STEMI and direct transfer to a PCI centre, as they will be more likely to receive timely reperfusion, with a positive impact on both individual prognosis and overall healthcare costs.

RECOMMENDATION 3

The Irish Heart Attack Audit should complete a survey of PCI networks.

Rationale

The designation of cardiac networks providing diagnostic and interventional services was recommended in *Changing Cardiovascular Health: National Cardiovascular Health Policy 2010 – 2019* (Department of Health, 2010), and the development of these networks was a core first step in the implementation of this policy. The *Irish Heart Attack Audit National Report 2021* (NOCA, 2023a) recommended the establishment of PCI networks in order to improve the timeliness of reperfusion for patients with a STEMI presenting to non-PCI-capable hospitals.

During 2022 and 2023, one-third (n=1000) of patients with a STEMI were transferred to a PCI centre from a non-PCI-capable hospital. After intervention in a PCI centre, 46% (n=692) of patients with a STEMI were transferred to other hospitals for ongoing STEMI care in 2022 and 41% (n=641) were transferred in 2023. Heartbeat data are collected in the PCI centres only, and follow-up data are accessed from the hospitals patients are referred back to. There have been improvements in the capture of follow-up data since 2021 (e.g. referral to CR is recorded in 91% of cases); however, in all PCI centres, there is still unknown information: for example, in 2023, it was reported that 12% of patients with a STEMI did not have LVF assessed, and the date of the first CR phase 3 appointment is unknown in 48% of cases. It is unclear if this is due to limited availability of services or other factors, such as poor communication between teams providing the services.

There has been a consistent increase in the number of STEMI cases treated per year. This has service planning and resourcing implications for primary PCI centres into the future. The IHAA is reporting data from all hospitals providing care to patients with a STEMI. Monitoring the governance structures, the availability of acute cardiology services, and follow-up care such as CR will help the IHAA understand variations in results and inform the healthcare system of any deficits.

What actions should be taken?	Who is responsible for implementation?	When should this be implemented?
• NOCA should develop a survey in conjunction with the National Heart Programme in order to assess the governance structures of PCI networks and the availability of acute cardiology services and CR services. • The survey should be based on evidence-based guidelines. • This survey should be completed by all hospitals providing STEMI care. • This survey should be completed in 3-year intervals in order to monitor change.	• NOCA • National Heart Programme	2025

Evidence that the action will be effective

- Monitoring the implementation of national policies (such as the HSE's *Acute Coronary Syndromes Programme Model of Care* (HSE, 2012) and *Changing Cardiovascular Health: National Cardiovascular Health Policy 2010 – 2019* (Department of Health, 2010)) and evidence-based guidelines (such as the 2023 ESC ACS guideline (Byrne *et al.*, 2023)) will ensure that patients with a STEMI are provided with the highest standard of care.

Who will benefit from the recommendation?

- All patients with a STEMI will benefit from receiving evidence-based healthcare. All hospital managers and clinical teams will benefit from the regular assessment of service provision in order for them to advocate for enhanced service provision as needed.

RECOMMENDATION 4

The Irish Heart Attack Audit should report on patients who self-present in all hospitals as a separate cohort and align the timeliness targets with the 2023 European Society of Cardiology guideline.

Rationale

The ESC ACS guideline (Byrne *et al*., 2023) recommends the analysis of the cohort of patients who self-present to PCI centres as a distinct group and to increase the 'door to balloon' time to 60 minutes in order to facilitate the initial assessment and diagnosis in the PCI centre's ED. In 2023, some initial analyses of this cohort indicated delayed access to ECG. The ESC ACS guideline (Byrne *et al*., 2023) recommends a 10-minute interval from hospital arrival to first ECG. In 2023, the median time to first positive ECG for patients who self-presented to a PCI centre (n=144) was 17 minutes (interquartile range (IQR): 7–46 minutes) compared with 22 minutes (IQR: 9–65 minutes) for those diagnosed in the ED of a non-PCI-capable hospital. We recommend caution in the interpretation of these time intervals, however, as the time to first positive ECG may not reflect the time to first ECG performance in the ED. Some patients may develop ECG changes in time with ongoing chest pain. Capturing the date and time of the first ECG in order to measure against the ESC ACS guideline of the first ECG being performed within 10 minutes of hospital arrival is recommended.

What actions should be taken?	Who is responsible for implementation?	When should this be implemented?
• Revise the Heartbeat dataset to include the collection of the date and time of the first ECG.	NOCA	2025
• Amend the reporting of the 'door to balloon' time for those who self-present to PCI centres.	NOCA	

Evidence that the action will be effective

- The ESC ACS guideline (Byrne *et al*., 2023) recommends a 10-minute interval from hospital arrival to first ECG. This will ensure prompt diagnosis of, and timely intervention for, patients with a STEMI.

Who will benefit from the recommendation?

- All patients with a STEMI will benefit from receiving evidence-based healthcare. Timely reperfusion is associated with reduced mortality and better heart function for all patients with a STEMI.

LEARNINGS/CONSIDERATIONS

SMOKING

NOCA (2023a) recommended that there should be ongoing public health messaging campaigns on the impact of smoking on heart health. In 2022 and 2023, the proportion of patients with a STEMI who currently smoke was 35%, almost double the national population average for current smoking, which was reported at to be 18% in 2022.

As in the Irish Heart Attack Audit National Report 2021, it was found that smoking caused STEMI at a younger age. On average, smokers present with a STEMI 10 years earlier than people who have never smoked (mean age of current smokers with a STEMI: 57 years; mean age of never smokers with a STEMI: 67 years).

NOCA, together with the HSE Health and Wellbeing Division and with the HSE Tobacco Free Ireland Programme, will continue to advocate in order to ensure that the impact of smoking on heart health is included in health promotional messaging.

CARDIOGENIC SHOCK

In 2022 and 2023, cardiogenic shock was reported in the cath lab in 8% of patients (n=120 in 2022; n=133 in 2023). Cardiogenic shock is associated with high levels of in-hospital mortality: the unadjusted in-hospital mortality rate for those in cardiogenic shock was 43% (n=52) in 2022 and 46% (n=61) in 2023. Ensuring early recognition and treatment of cardiogenic shock is important, and further analysis on the treatment and outcomes of this cohort of patients will be completed in the next IHAA report. Highlighting the excess mortality risk in this cohort of STEMI patients to the National Heart Programme will hopefully lead to a focus within the ACS/PCI subgroup of the National Heart Programme to standardise the treatment protocol/pathway for cardiogenic shock and provide regional access to advanced mechanical circulatory support for these patients.

CHAPTER 11
CONCLUSION

CONTENTS

CHAPTER 11: **CONCLUSION**

The *Irish Heart Attack Audit National Report 2022 and 2023* presents a comprehensive analysis of the pathway to reperfusion for patients with a STEMI. The report notes the improvement in data quality, particularly in some key follow-up data points and in the new data points added in 2022, allowing us to report on new aspects of the pathway, such as the DIDO time and in-hospital risk-adjusted mortality. We would like to thank all of the audit coordinators and clinical teams providing STEMI care for their dedication to and support of the audit.

The report emphasises the critical importance of timely reperfusion therapy in improving outcomes for patients with a STEMI. Despite advancements in cardiac care, the report reveals significant delays in both the initial medical response and the transfer of patients to appropriate care facilities, which can drastically affect survival rates and long-term recovery outcomes.

One of the most concerning findings is the delay in seeking medical help among patients with a STEMI. The IHAA shows that only 55% of patients with a STEMI in 2022 and 47% in 2023 sought medical attention within the crucial first hour of symptom onset, a period often referred to as the 'golden hour' in cardiology. This delay is critical because the sooner reperfusion therapy (such as PCI or thrombolysis) is administered, the better the chances of limiting heart muscle damage and improving survival rates. This is borne out in the findings published in this report, with timely reperfusion associated with lower mortality and less severe heart pump/function damage.

Prompt symptom recognition and early contact with emergency medical services allows pre-hospital ECG diagnosis of a STEMI, which in turn facilitates direct transfer for primary PCI. This report again highlights how patients brought directly to a primary PCI centre continue to have higher rates of timely reperfusion compared with patients transferred from non-PCI-capable hospitals (79% versus 45%, respectively, in 2023). This report also highlights delays in the transfer of patients to primary PCI centres. For patients requiring primary PCI, timely transfer to a hospital equipped with these capabilities is essential. However, this report found that many patients experienced significant delays in being transferred from their initial point of care to a PCI centre.

Early recognition of a STEMI begins with performing an ECG. It is accepted internationally that an ECG should be performed within 10 minutes of a patient arriving in the emergency department with chest pain. This audit shows that in both PCI centres and non-PCI-capable hospitals, this target was missed, with a median time to ECG of 46 minutes and 22 minutes in primary PCI centres and in non-PCI-capable hospitals, respectively.

For the first time in 2023, the DIDO metric is reported for patients who were transferred from a non-PCI-capable hospital to a PCI centre. It is recommended that the DIDO time should be 30 minutes or less. Again, this report highlights that this target was only achieved for 4% of patients who initially presented to a non-PCI-capable hospital, with a national median DIDO time of 97 minutes.

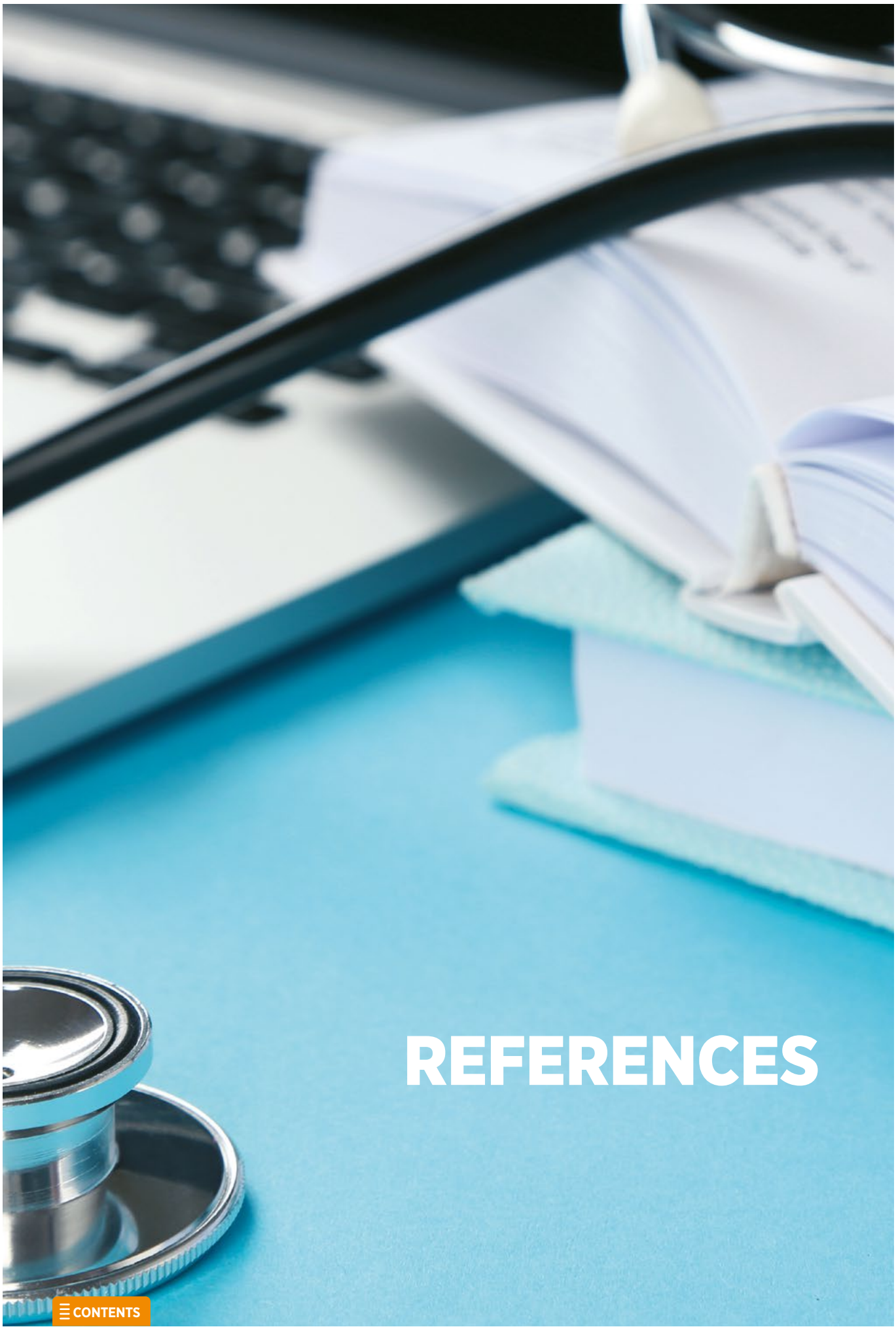
This report has called for systemic improvements in order to address these delays, and it welcomes the initiation of a STEMI Care Pathway Quality Improvement Project with key stakeholders in 2023 in order to address this specific issue. The IHAA advocates for the development of streamlined protocols in order to ensure faster recognition of heart attack symptoms, quicker initial treatment, and more efficient transfer processes to PCI centres.

Moreover, this report underscores the need for public education campaigns to raise awareness about the symptoms of heart attack and the importance of calling emergency services immediately. Public awareness is crucial to ensuring that patients do not delay in seeking help, which is a significant factor contributing to the overall delay in receiving appropriate care.

It is also important to note that there is an increasing number of patients with a STEMI presenting to primary PCI centres year on year, and we look forward to the publication of the National Review of Specialist Cardiac Services, which will address the configuration and resourcing of national adult cardiac services in order to achieve optimal patient outcomes at population level, with a particular emphasis on the safety, quality and sustainability of the services that patients receive.

Having developed an in-hospital risk-adjusted mortality model in order to report on in-hospital mortality by individual PCI centres, it is reassuring to report that no PCI centre is outside of the expected in-hospital mortality rate for its hospital.

In conclusion, the *Irish Heart Attack Audit National Report 2022 and 2023* highlights the urgent need to address delays in both the initial medical response and the transfer of heart attack patients to the right hospital at the right time. By improving the timeliness of reperfusion therapy and ensuring faster patient transfers, the healthcare system can significantly improve outcomes for patients with a heart attack. The findings underscore the importance of not only advancing medical treatments, but also optimising the processes that ensure timely care, ultimately saving lives and reducing the long-term impact of heart attacks on individuals and the healthcare system as a whole.



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ACCESSING REPORT APPENDICES

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Available at: https://a.storyblok.com/f/265949/x/a71195a341/irish-heart-attack-audit-national-report-2022-and-2023-appendices-final.pdf

APPENDIX 1:
AIM AND OBJECTIVES OF THE IRISH HEART ATTACK AUDIT — CLICK HERE

APPENDIX 2:
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