

IRISH HEART ATTACK AUDIT

NATIONAL REPORT 2025



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clinical audit, improvements, if required, should be implemented at an individual, team or organisation level and the care then be re-evaluated to confirm improvements (DOHC, 2008).

Citation for this report:

National Office of Clinical Audit (2026)
Irish Heart Attack Audit National Report 2025
Dublin: National Office of Clinical Audit.

ISSN 2811-5554 Irish Heart Attack Audit (Electronic)

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Website details to access the report:

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This report was published on 16th October 2026

ACKNOWLEDGEMENT OF KEY PARTNERS

This work uses data provided by patients and collected by their healthcare providers as part of their care. NOCA would like to thank all participating hospitals for their valuable contributions, in particular the clinical leads and all Irish Heart Attack Audit (IHAA) audit coordinators. Without their continued support and input, this audit could not continue to produce meaningful analysis of heart attack care in Ireland. NOCA would also like to acknowledge the work of the HSE, particularly the National Heart Programme and the National Ambulance Service, with whom we are developing a collaborative relationship in order to drive improvements in heart attack care in Ireland. NOCA greatly appreciates the ongoing commitment and support received from the HSE. We would especially like to thank Dr Colm Henry, Chief Clinical Officer; Dr Orla Healy, National Clinical Director, National Quality and Patient Safety; and Dr Patricia Kearney, Clinical Lead, National Quality and Patient Safety (Intelligence, Communications & National Centre for Clinical Audit). We would also like to thank Philip Dunne, IT Systems Support, Healthcare Pricing Office, who provides ongoing support for the Heartbeat portal.

ACKNOWLEDGING SIGNIFICANT CONTRIBUTIONS FROM THE FOLLOWING:



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Irish Heart Attack Audit

National Report 2025



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1st October 2026

Dear Professor Margey,

On behalf of the NOCA Governance Board, I wish to formally acknowledge receipt of the *Irish Heart Attack Audit National Report 2025*.

We extend our congratulations to you and the entire team, including Cardiovascular Programme Audit Manager Joan McCormack, Assistant Audit Manager Ursula Kelleher, the Governance Committee, and the Patient and Public Interest Representatives, whose contributions continue to strengthen the relevance and impact of this audit.

This report provides an important national overview of care for patients with ST-elevation myocardial infarction. It is encouraging that 95% of eligible patients received reperfusion therapy. However, the report also identifies persistent challenges in the timeliness of treatment, with only 59% receiving reperfusion within recommended timeframes. The findings reinforce the importance of reducing delays across the entire patient pathway, from symptom recognition and diagnosis through to transport, inter-hospital transfer and definitive treatment.

We also wish to acknowledge the continued commitment of audit coordinators, clinical teams and participating hospitals whose high-quality data enable the audit to identify variation, support quality improvement and inform the development of heart attack services nationally.

This letter serves as the formal endorsement of the NOCA Governance Board for the Irish Heart Attack Audit National Report 2025. We are confident that its findings will support continued collaboration and targeted quality improvement to improve timely and equitable care for patients with STEMI across Ireland.

Yours sincerely,



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PREFACE

Heart attack, and specifically ST elevation myocardial infarction (STEMI) remains one of the most time-critical conditions we encounter in healthcare. Patient outcomes depend on the quality and timeliness of care delivered at multiple points from ambulance emergency call taking, to prehospital care, rapid transport and primary percutaneous coronary intervention (Primary PCI). More than these individual points along the continuum however, outcomes are dependent on how the entire system works together.

The Irish Heart Attack Audit provides us with an essential national view of that system. By bringing together robust, measurable data on the metrics of care and outcomes for patients with STEMI, it allows us to understand the strengths and weaknesses of the system. Moreover, it identifies areas of variation and enables us to focus improvements on those which will have the greatest impact.

For the National Ambulance Service, and our colleagues in Dublin Fire Brigade, this is particularly important. Our clinicians are often the first point of healthcare contact for these patients, and early recognition, acquisition and interpretation of a 12-lead ECG allows appropriate treatment and rapid access to Primary PCI to commence immediately. These acts and decisions can fundamentally alter a patient's outcome. This effective care depends on close collaboration and cooperation between the ambulance services, emergency departments, cardiologists and Primary PCI centres.

This integration is now being strengthened through the establishment of Regional PCI Networks, under the direction of the Chief Clinical Officer. These networks bring together the ambulance service, PCI centres and other hospitals within each health region and represents an important opportunity to increase integration, reduce variation, save time and improve outcomes.

Any audit is about more than simply collecting data; it must act on that data to drive change and improve care. This report is a real example of that and is a big step towards ensuring that every patient in Ireland, regardless of where they suffer a myocardial infarction, will have timely access to high-quality care. There are key recommendations in this year's report with respect to improving public awareness and reducing delays in patient transfer to PCI centres.

I would like to acknowledge the patients, whose experiences are represented in this report, the many clinician colleagues, and the IHAA team in NOCA, particularly Prof Ronan Margey, Ms Joan McCormack, Ms Ursula Kelleher and Ms Ciara McFadden who make the Irish Heart Attack Audit possible. They have delivered a powerful tool to drive change and ultimately, to save lives.

Dr David Menzies
Deputy Clinical Director
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GLOSSARY OF TERMS AND DEFINITIONS

TERM	MEANING
ACEI	angiotensin-converting enzyme inhibitor
ACS	acute coronary syndrome
ARB	angiotensin II receptor blocker
BMI	body mass index
CABG	coronary artery bypass graft
cath lab	catheterisation laboratory
CHD	coronary heart disease
CR	cardiac rehabilitation
denominator	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 that an object is divided into. For example, in '20/100', '100' is the denominator.
DFB	Dublin Fire Brigade
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

TERM	MEANING
LOS	length of stay
LVF	left ventricular function
MI	myocardial infarction
NAS	National Ambulance Service
NCCA	National Centre for Clinical Audit
NCP-ACS	National Clinical Programme for Acute Coronary Syndrome
NHO	National Heart Office
NOCA	National Office of Clinical Audit
NSTEMI	non-ST elevation myocardial infarction
numerator	The number that is derived from the denominator as the subset meeting a specific criterion. It is the number above the fractional bar. For example, in '20/100', '20' is the numerator.
ORS	optimal reperfusion service
PCI	percutaneous coronary intervention
Primary PCI	primary percutaneous coronary intervention
PPI	Public and Patient Interest
QI	quality improvement
SMR	standardised mortality ratio
ST	ST segment, which is a portion of the ECG (electrocardiogram) tracing between the end of the S wave and the beginning of the T wave.
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 report presents a comprehensive analysis of the management of ST elevation myocardial infarction (STEMI) in Ireland during 2025, drawing on data from 1,931 cases submitted to the Heartbeat portal across all participating percutaneous coronary intervention (PCI) centres. Of these, 1,642 patients were confirmed as having a STEMI, representing a continued upward trend in case numbers and a 15% increase since 2017.

While Ireland continues to deliver high rates of reperfusion and maintains mortality outcomes within expected ranges, this report identifies persistent and significant challenges in the timeliness of reperfusion, delays across the patient care pathway, and a sustained high burden of established cardiovascular risk factors in patients presenting with STEMI. These findings emphasise the ongoing need for enhanced public awareness of heart attack symptom recognition; coordinated, system-wide improvements in the timeliness of diagnosis, transport, and delivery of care; and strengthened prevention strategies to optimise patient outcomes.

OVERALL PERFORMANCE AND KEY THEMES

The findings from 2025 reflect a healthcare system that continues to deliver high-quality care in many respects, while simultaneously facing enduring structural and behavioural barriers to optimal timely treatment outcomes.

Encouragingly, 95% of eligible patients with a STEMI received reperfusion therapy, achieving the HSE ACS model of care key quality indicator (KQI) target and demonstrating strong adherence to guideline-recommended care. However, only 59% of patients received this treatment within recommended timeframes, highlighting a critical gap between access to care and timely delivery.

Primary PCI remains the dominant reperfusion strategy, delivered to 78% of all STEMI patients, while thrombolysis continues to play a smaller but essential role, particularly in geographically remote regions. Nevertheless, the effectiveness of both strategies is undermined by delays at multiple points along the care pathway, including delayed symptom recognition, late presentation, delayed diagnosis, and prolonged inter-hospital transfer times.

Mortality outcomes reinforce the importance of timely care. Patients who received timely primary PCI experienced substantially lower in-hospital mortality (4.2%) than those who did not receive timely treatment (9.2%), with similar differences observed at 30 days. These findings underscore the critical relationship between time-to-treatment and survival.

DELAYS IN SYMPTOM RECOGNITION AND PATIENT BEHAVIOUR

Patient delay in seeking care remains a central challenge in STEMI management. In 2025, only 48% of patients who arrived at a PCI centre directly by ambulance contacted emergency services within 60 minutes of symptom onset, with no significant change compared to prior years.

Late presentation continues to have profound clinical consequences. Over three-quarters (77%) of patients who were contraindicated for reperfusion were deemed ineligible due to delays exceeding 12 hours from symptom onset. This highlights the persistent gap in public awareness and symptom recognition, particularly among older patients and women, who are more likely to experience different presentations and delayed help-seeking behaviour.

Despite improvements in pre-hospital systems, the benefits of advanced reperfusion networks cannot be fully realised without earlier patient engagement. A sustained national focus on public education, particularly targeted towards high-risk and underserved populations, is essential to reduce preventable delays.

ACCESS TO CARE AND REFERRAL PATHWAYS

The route by which patients access care continues to significantly influence treatment and outcomes. In 2025, 55% of STEMI patients were diagnosed pre-hospital and brought directly to a PCI centre by ambulance, while one-third were initially diagnosed or assessed in non-PCI capable hospitals and required subsequent transfer to Primary PCI hospitals.

Patients arriving directly to PCI centres were substantially more likely to receive primary PCI (87%) compared with those transferred from non-PCI-capable hospitals (62%). This disparity reflects the continued importance of pre-hospital ECG diagnosis and direct ambulance transport in optimising outcomes.

Geographic variation persists, particularly in regions with longer travel times to PCI centres, where thrombolysis rates are higher. While this reflects appropriate clinical decision-making in certain contexts, variation between regions indicates opportunities to further optimise pre-hospital triage, inter-hospital transfer protocols, and PCI network configuration.

DELAYS ACROSS THE STEMI CARE PATHWAY

Delays remained evident at every stage of the STEMI care pathway in 2025.

DIAGNOSTIC DELAYS

Timely electrocardiogram (ECG) acquisition remains suboptimal. Only 32% of patients who self-presented to PCI centres and 38% of those presenting to non-PCI-capable hospitals received an ECG within 10 minutes of arrival. These findings highlight the need for streamlined triage processes, early recognition of cardiac chest pain, early ECG performance in patients in presenting with cardiac-suspected chest pain, and increased awareness within emergency departments in general.

INTER-HOSPITAL TRANSFER DELAYS

Timely inter-hospital transfer remains a key priority for patients diagnosed or initially presenting to non-PCI capable hospitals. The European Society of Cardiology has established a key quality indicator of 'door- in door-out' (DIDO) time interval, the time from diagnosis in a non-PCI capable hospital to the time the patient leaves to transport to a Primary PCI hospital, as less than 30 minutes. For patients requiring transfer, performance against the DIDO target remains particularly poor. Only 4% of transferred patients achieved the recommended 30-minute DIDO time.

Similarly, only 29% of transferred patients met the current 90-minute target for arrival at a PCI centre, compared with 79% of those diagnosed pre-hospital and transported directly by ambulance. This disparity continues to represent one of the most significant system-level weaknesses in STEMI care.

REPERFUSION DELAYS

Median time from first medical contact to balloon (FMCTB) exceeded recommended targets across all patient groups, particularly for transferred patients, where delays were most pronounced.

In patients diagnosed in geographically remote regions or in non-PCI hospitals where timely inter-hospital transfer is unlikely, an alternative potential reperfusion treatment is administration of thrombolytic (clot-busting) drug therapy provided the patient has no contraindications to this therapy. However, to achieve any benefit above the potential harm of extra bleeding complications, thrombolysis needs to be administered rapidly after confirming the diagnosis and suspected transport delay. Timely thrombolysis also remains a concern, with only 27% of eligible patients receiving treatment within the recommended timeframe. This underutilisation further contributes to suboptimal outcomes, particularly in regions where primary PCI cannot be delivered rapidly.

OUTCOMES AND CLINICAL EFFECTIVENESS

Despite ongoing challenges, mortality (death) outcomes for patients with STEMI in Ireland remain broadly consistent with international standards. Risk-adjusted mortality remains within expected ranges across all PCI centres, reflecting overall safe and effective care delivery.

However, disparities in outcomes persist:

- Overall, in-hospital mortality was 7.4%, with higher rates observed among female (9.0%) and older patients (over 80 years old – 20.3%).
- Thirty-day mortality reached 9.4%, again higher among women (11.6%) compared with men (8.8%). Patients aged 80 years and over experienced higher mortality rates, exceeding 25%.
- Timely reperfusion was associated not only with improved survival but also with better cardiac function. Patients receiving timely treatment were more likely to have preserved left ventricular function (heart pump function) and less likely to experience severe impairment of cardiac function.

These findings reinforce the central importance of reducing delays in order to improve both survival and long-term health outcomes, particularly in potentially reducing long-term post-STEMI-related heart failure.

CARDIOVASCULAR RISK PROFILE AND PREVENTION

The burden of established recognised cardiovascular risk factors among patients with STEMI in 2025 remains high. Overall, 87% of patients had at least one risk factor, and 35% had three or more modifiable risk factors.

The most prevalent risk factors included:

- Hypertension (50%)
- Hypercholesterolaemia (44%)
- Smoking (37%)
- Diabetes (19%)
- Obesity (30%)
- Prior cardiovascular disease (25%)

Smoking continues to have a disproportionate impact, particularly among younger patients. Smokers present with STEMI approximately 10 years earlier than non-smokers, and nearly two-thirds of STEMI 'young' patients, under 40 years of age, were active current smokers at the time of their heart attack.

This risk factor burden has been consistently demonstrated in previous years and highlights an ongoing public health challenge. While 95% of smokers received cessation advice, meeting the relevant quality indicator, the persistently high prevalence of smoking indicates that prevention efforts must extend beyond the hospital setting.

The high prevalence of multiple modifiable risk factors represents a significant opportunity for strengthened primary prevention and chronic disease management initiatives across the healthcare system.

SECONDARY PREVENTION AND REHABILITATION

Performance in secondary prevention measures remains strong. The majority of patients were discharged with appropriate secondary prevention medication therapy (92%), and smoking cessation advice was consistently delivered.

Referral rates to cardiac rehabilitation programmes were also high, with 98% of eligible patients referred, meeting national targets. However, data completeness for rehabilitation attendance remains suboptimal, limiting the ability to fully evaluate whether patients access cardiac rehab programmes in a timely fashion after their acute event, and patients' long-term engagement and outcomes.

Ensuring that patients not only receive referrals but also attend and complete rehabilitation programmes should remain a priority for quality improvement (QI).

DATA QUALITY AND AUDIT DEVELOPMENT

The quality and completeness of audit data continue to improve. In 2025, 91% of STEMI cases recorded in HIPE were matched with Heartbeat data, and most data fields demonstrated high completeness.

The ongoing development of the IHAA dataset, including enhancements to the dashboard and incorporation of updated quality indicators, will further strengthen the audit's capacity to drive improvement. The introduction of revised indicators focusing on timeliness and pathway metrics is particularly welcome, given the importance of these factors in determining outcomes.

OPPORTUNITIES FOR IMPROVEMENT

The findings of this report highlight several key areas for action, as follows:

Improving public awareness and early presentation and ECG diagnosis

Increased public education is required to improve recognition of heart attack symptoms and encourage early activation of emergency services, and rapid performance of ECGs to confirm the diagnosis.

Enhancing pre-hospital care and ambulance pathways

Greater integration of pre-hospital diagnosis and direct transport to PCI centres is essential to reduce delays.

Addressing inter-hospital transfer delays

Significant improvements in DIDO times and transfer processes are required to ensure equitable access to timely reperfusion.

Improving timeliness of reperfusion therapy

Both primary PCI and thrombolysis pathways require targeted QI initiatives to achieve recommended time targets.

Strengthening prevention and risk factor management

A sustained national focus on smoking prevention, cardiovascular risk management, and chronic disease care is essential to reduce STEMI incidence.

Reducing disparities in outcomes

Targeted interventions are needed to address higher mortality among older patients, and those experiencing delayed presentation.

CONCLUSION

The Irish Heart Attack Audit National Report 2025 demonstrates that Ireland continues to deliver high levels of reperfusion and effective acute care for patients with STEMI. However, the persistent gap between treatment availability and treatment timeliness remains the defining challenge in the system.

Delays in symptom recognition, ECG performance, diagnosis, and inter-hospital transfer continue to limit the effectiveness of established care pathways. At the same time, the ongoing burden of modifiable cardiovascular risk factors, particularly smoking, reinforces the need for strengthened prevention strategies.

This report provides clear evidence that improving timeliness across the STEMI pathway, supported by enhanced public awareness and system-level coordination, has the potential to significantly improve outcomes. The continued evolution of the Irish Heart Attack Audit, coupled with targeted QI initiatives, will be central to achieving this goal.

KEY FINDINGS

•	A total of 1,931 cases were submitted to the Heartbeat portal during the 2025 reporting period, reflecting a continuing upward trend, from 1,742 cases in 2021.
•	Overall, 1,642 patients with a STEMI were recorded on the Heartbeat portal in 2025, indicating a 15% increase since 2017 (n=1,427) while the general population increased 17% during the same period.
•	Males accounted for 78% (n=1,277) of all patients with a STEMI and had a median age of 62 years (interquartile range (IQR): 53–71 years). Female patients with a STEMI were generally older, with a median age of 69 years (IQR: 58–78 years).
•	Eighty-seven per cent (n=1,435) of patients with a STEMI in 2025 had at least one cardiovascular risk factor. The most prevalent risk factors were hypertension (50%; n=825) and hypercholesterolaemia (44%; n=729). Thirty-five per cent (n=572) of patients had three or more potentially modifiable cardiovascular risk factors.
•	Smoking causes STEMI at a younger age. On average, smokers present with a STEMI 10 years earlier than people who have never smoked. Among females, current smokers presenting with a STEMI had a median age of 61 years (IQR: 52–69 years) compared with a median age of 74 years (IQR: 66–82 years) for females with a STEMI who have never smoked.
•	Only 55% of patients with a STEMI arrived directly by ambulance to a PCI centre.
•	Only 48% of patients who arrived directly by ambulance to a PCI centre called for help within 60 minutes of symptom onset in 2025, similar to 45% (n=402) in 2024.
•	Seventy-seven per cent (n=1,036) of patients with a STEMI who arrived at a Primary PCI centre by ambulance, either directly or transferred, were brought directly to the catheterisation laboratory (cath lab), bypassing the emergency department of the Primary PCI hospital.
•	Primary PCI was performed in 87% of patients who presented directly to a PCI centre, compared with 62% of those who initially presented to a non-PCI-capable hospital.
•	Seventy-nine per cent of patients who arrived directly by ambulance to a PCI centre met the 90-minute FMCTD target, compared with only 29% of those who were transferred from another hospital.
•	The proportion of patients receiving an ECG within 10 minutes of arrival at hospital is suboptimal. Only 32% of patients who self-presented to a PCI centre met this target, and 38% for those who self-presented to a non-PCI-capable hospital.
•	The DIDO time of 30 minutes or less, which is the recommended goal for patients who initially present to a non-PCI-capable hospital, was achieved in only 4% of cases.
•	The door to balloon (DTB) target of 30 minutes was achieved in 54% of patients who presented directly to a PCI centre and in 62% of patients who were transferred to a PCI centre.
•	The proportion of patients who received timely primary PCI has seen a steady decline, from 68% in 2017 to 62% in 2025.
•	No PCI centre had a mortality rate higher than the expected range in 2025.
•	Timely primary PCI is associated with reduced mortality. In 2025, those who received timely primary PCI had an unadjusted mortality rate of 4.2% (n=37), compared with 9.2% (n=46) for those who did not receive timely primary PCI.
•	The proportion of patients with a STEMI who were current smokers and were recorded as receiving smoking cessation advice was 95%.
•	One-half (n=786, 48%) of patients with a STEMI were discharged directly home from a PCI centre in 2025, similar to the 50% reported in 2024; 43% (n=706) were transferred to another acute hospital for ongoing STEMI care, which is unchanged from 2024.

RECOMMENDATIONS

RECOMMENDATION 1	
Increase the proportion of patients with a STEMI receiving primary PCI by implementing a national, targeted public awareness campaign that encourages individuals to seek immediate medical attention when experiencing symptoms of a heart attack.	
RECOMMENDATION 2	
Improve the timeliness of primary PCI in patients with a STEMI where primary PCI is identified as the optimal reperfusion therapy.	
RECOMMENDATION 3	
Improve the timeliness of thrombolysis in patients with a STEMI where thrombolysis is identified as the optimal reperfusion therapy.	
RECOMMENDATION 4	
NOCA should collaborate with the National Ambulance Service (NAS) and Dublin Fire Brigade (DFB) to develop and implement a standardised national reporting framework for pre-hospital STEMI care.	

UPDATE ON PREVIOUS RECOMMENDATIONS

Chapter 10 outlines progress on the 11 recommendations made across previous IHAA National Reports (NOCA, 2021, 2023, 2024b, 2026).

In 2025, the Office of the Chief Clinical Officer and the HSE National Heart Office (NHO) directed the establishment of Regional Primary PCI Networks. These networks are currently being established and are expected to bring together emergency medicine, cardiology, and the NAS/DFB, alongside primary PCI centres and non-PCI-capable hospitals within each region, to support QI initiatives.

Four of the 11 recommendations relate to QI projects aimed at increasing the rate and timeliness of reperfusion therapy. The Regional Primary PCI Networks are well placed to lead and support the implementation of these recommendations.

The IHAA has consistently recommended the development of a targeted public awareness campaign to improve recognition of heart attack symptoms and encourage prompt help-seeking behaviour. Development of this campaign has now been agreed, and the focus of the 2025 recommendation is on its implementation.

Of the 11 recommendations, 3 have been completed, 1 has been closed as responsibility has transferred to the Regional Primary PCI Networks, 1 remains on hold and others are in progress.

The recommendation to use IHAA data to support smoking cessation initiatives remains ongoing. The IHAA continues to highlight the impact of smoking on STEMI incidence and outcomes in its national reports and other publications.

KEY FINDINGS 2025



1,642
confirmed
STEMIs
in 2025



78%
Male with
median
age **62** years.



22%
Female
with median
age **69** years.



ARE YOU AT RISK OF A HEART ATTACK?

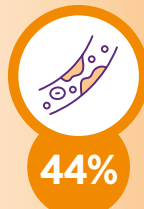


Smoking damages the heart and blood vessels. 37% of patients were smokers at the time of their heart attack, more than double the rate of smoking nationally (17%). Current smokers present with heart attack on average 10 years younger than those who have never smoked.



37%

Too much cholesterol in your blood, known as hypercholesterolaemia, increases your risk. 44% of patients had a previous history of hypercholesterolaemia.



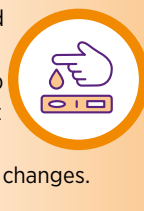
44%

High blood pressure, known as hypertension, increases your risk. 50% of patients had a previous history of hypertension.



50%

A large proportion of patients with heart attack had more than three risk factors for heart disease – treating cholesterol, lowering blood pressure, treating diabetes and stopping smoking help to reduce your risk of heart attack. It is never too early or too late to start to make changes.



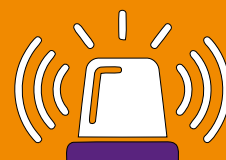
GETTING TO THE RIGHT HOSPITAL AT THE RIGHT TIME

**IF YOU THINK SOMEONE
IS HAVING A HEART
ATTACK, CALL 112 OR 999
STRAIGHT AWAY.**



**112
999**

Paramedics can do an ECG on the spot. If it shows a STEMI, they will take the person directly to a specialist hospital (PCI centre) for urgent treatment. Patients diagnosed before hospital are brought directly for treatment, bypassing any delays and improving their chance of survival.



If the person goes to a non-specialist hospital themselves, it can cause delays as they need to be transferred to the specialist hospital. That's why calling an ambulance is the fastest and safest option.



Only **48%** of patients who arrived at a PCI centre directly by ambulance called for help within 60 minutes of onset of symptoms.

48%



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

55%



33% of patients were transferred by ambulance from a non-specialist hospital to the PCI centre.

33%



38% of patients who were transferred from a non-specialist hospital to the PCI centre had the ECG completed within 10 minutes.

38%

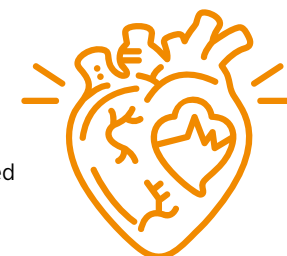


4% of patients with a STEMI achieved the 30-minute 'door in door out' (DIDO) target.

4%

DIDO time is the total time a heart attack patient 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.

HOW IS A HEART ATTACK TREATED?



PRIMARY PCI

Primary PCI is an emergency procedure performed in specialist hospitals to quickly open a blocked heart artery during a heart attack. To be most effective, this procedure needs to be done within 2 hours after a heart attack is diagnosed. Doing it within this time is called timely primary PCI.

PROPORTION WHO RECEIVED TIMELY PRIMARY PCI



**ARRIVED DIRECTLY
TO A PCI CENTRE**

77%



**PRESENT TO A
NON-PCI CENTRE AND
THEN TRANSFER BY
AMBULANCE TO A PCI
CENTRE**

37%



**SELF-PRESENT TO
A PCI CENTRE**

28%

**Patients who receive timely primary
PCI have lower mortality rates
compared with those who do not:**

**TIMELY PRIMARY PCI
4.2% mortality rate**



**NOT TIMELY PRIMARY PCI
9.2% mortality rate**

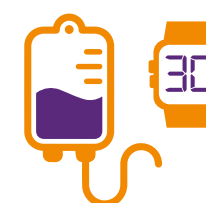


THROMBOLYSIS

If a patient is unable to get to a specialist centre within 90 minutes, treatment with thrombolysis, a medication that dissolves blood clots, can be given. To be effective, this medication needs to be given within 30 minutes of diagnosis; this is called timely thrombolysis.

In 2025, 6% of patients with a STEMI received treatment with thrombolysis; 27% of these patients received timely thrombolysis.

27%



PREVENTING ANOTHER HEART ATTACK



92%

92% of patients with a STEMI had an appropriate secondary prevention medication prescribed: an increase from 91% in 2024 and achieving the target of 90%.



98%

98% of patients were referred to cardiac rehabilitation, which provides an exercise programme and educational classes: an increase from 97% in 2024 and achieving the target of 90%.

THE PATIENT PERSPECTIVE: PETER'S STORY

The National Office of Clinical Audit is committed to putting the voice of the patient at the centre of national clinical audit, providing a broader picture of quality and safety and patients' experience of healthcare. Here is Peter's story, as told in his own words.

PETER'S STORY

"I didn't think I was a candidate ... and I got one."

RECOGNISING SYMPTOMS AND ACTING

My name is Peter Byrne. I'm a 57-year-old Kildare man, living in Donegal now over 30 years. I'm married with four children, from 27 down to 15, so there's always something happening in the house. It's busy, but it's a good busy. I work in Letterkenny University Hospital and I've quite a full-on role there, and outside of that I am heavily involved in the GAA and the local community.

Looking back now, I was always on the go. I liked being busy. I would squeeze things in between work, matches and everything else. I probably wasn't looking after myself as well as I could have, "just wasn't respecting myself" is how I'd describe it now.

It all started on what I'd call a completely normal rainy Saturday morning in February 2024. I'd ordered a skip and was clearing out the garage. Then I headed down



to watch my son play a football match. I was standing on the terrace, chatting away, and I kind of got pain in my chest. A nigggle. What felt like a muscular pain and I just put it down to lifting earlier. Never, never did I think about the heart attack bit. It didn't go away. It slowly got worse, and then I started to feel this overwhelming heat come over me., like somebody had turned on an oven inside my wet gear. I made an excuse and left. Even then, I still wasn't thinking heart attack. I drove home, rang my wife to come back from the match and told her I just needed to get in and take a painkiller. Within minutes, things changed. The pain got stronger and then it started going down my arm. That was the moment I remember saying, "you better ring an ambulance. This is going down my arm."

When the ambulance arrived, everything moved very quickly. They brought me into the ambulance, put the leads on and within a few minutes one of them said to me: "you're having a heart attack." I'll never forget that. It wasn't just what he said, it was the word **having**. I remember the word 'having' threw me, because I always thought you had a heart attack and that was it. Done. I didn't realise it was something that was actively happening. I was a bit overweight, had no medical history and the only relative I knew who had heart problems was my mother's father, who had died of a heart attack. Looking back now, I realise that I had signs I didn't understand at the time. For over a year, I had experienced episodes of severe jaw pain.

"I kind of got pain in my chest. A nigggle. What felt like a muscular pain and I just put it down to lifting earlier. Never, never did I think about the heart attack bit."

EMERGENCY CARE AND TREATMENT EXPERIENCE

From there, everything was fast. I was given aspirin and told I was going straight for treatment and they were waiting for me. I didn't fully understand what that meant at the time. Next thing I knew, I was in the lab in Altnagelvin hospital. What stands out to me now is how calm it all felt. The doctor started chatting to me about music. He said, "Do you like Prince?" and then asked Alexa to play Mark Knopfler when I said I preferred him.

“I remember the word ‘having’ threw me, because I always thought you had a heart attack and that was it. Done.”

All the time, he was working away. I didn’t realise he was actually in my wrist and into my heart. I felt nothing. It was like an “out-of-body thing”. Within a short time, the stent was in. That was it. When I came out, my wife and daughter were only arriving. They thought I’d just landed into the hospital. I told them I’d already been stented and they couldn’t believe the speed of it.

The next day, on the way back to Letterkenny, something happened that has stayed with me. The ambulance crew asked, “do you mind if we stop? There’s a fella after coming off a bicycle. He’s had a cardiac arrest.” We stopped, but unfortunately, he died on the side of the road. That really hit me. He had a cardiac arrest; I had a heart attack. Two sides of the same story. It made me realise how fine the margins are. What also never struck me before was how lucky we are in Donegal to be so close to a PCI centre. It’s the difference in where you live as to what you have access to and I’d say the amount of people that saves is countless.

A few weeks later, I had to go to Galway for a second elective stent. That was a different experience. A long early morning ambulance journey, very uncomfortable, and a very busy unit. It was like a bus stop. People in and out being stented. There were a few complications afterwards, including bleeding in my groin, as they couldn’t get access in my wrist, but I’d describe them as part of the journey rather than anything else. The care was still excellent.

RECOVERY, REFLECTION AND LIVING DIFFERENTLY

After a few days in hospital, I genuinely thought I was back to normal. I said to everyone I’d be back at work the following week. I felt as if I was right as rain. But that didn’t last. They kept saying it will crash you, and that’s exactly what happened. When I got home, the fatigue hit me. I could just about go to bed and just about get out of bed. For someone who was always busy, that was probably the hardest part. You suddenly realise you’re not in control the way you thought you were. That’s where I learned one of the biggest lessons: “You need to respect your body, even when you think you don’t.”

Recovery became very simple. Five minutes walking. Then 10. Then 15. That was my focus. Cardiac rehabilitation was a big turning point for me. They were asking the right questions. You felt they were interested in you. That gave me confidence again, knowing what I could do, how far to push, and how to build back up. Now, my routine is completely different. I get up at 5.00

and I walk for an hour. I’m exercising every single day. It also changed how I eat and how I think about food. And to be honest, I feel 1,000 times better. Probably better than I ever have.

Medication was something I struggled with at the start. When they handed me a box full of tablets, I wasn’t at all happy. I particularly struggled with the beta blocker. I hated it, as it gave me brain fog. But over time, I accepted the medications. Now I just see them as part of staying well. I’m quite happy to take them for the rest of my life to keep me right.

The part that really affected me emotionally came later. I was giving a talk locally and in the middle of it I got emotional. I don’t know why. That evening, talking at home, I realised what had been happening around me. I didn’t know that there had been a big meeting in the house about “what’s going to happen if this happens?”, and that kind of thing. That’s when it hit me. It’s not just about what had happened to me, but what it meant for my family. It just reminds you how, in the blink of an eye, the whole thing can stop. It wasn’t just about me; it was about everyone around me.

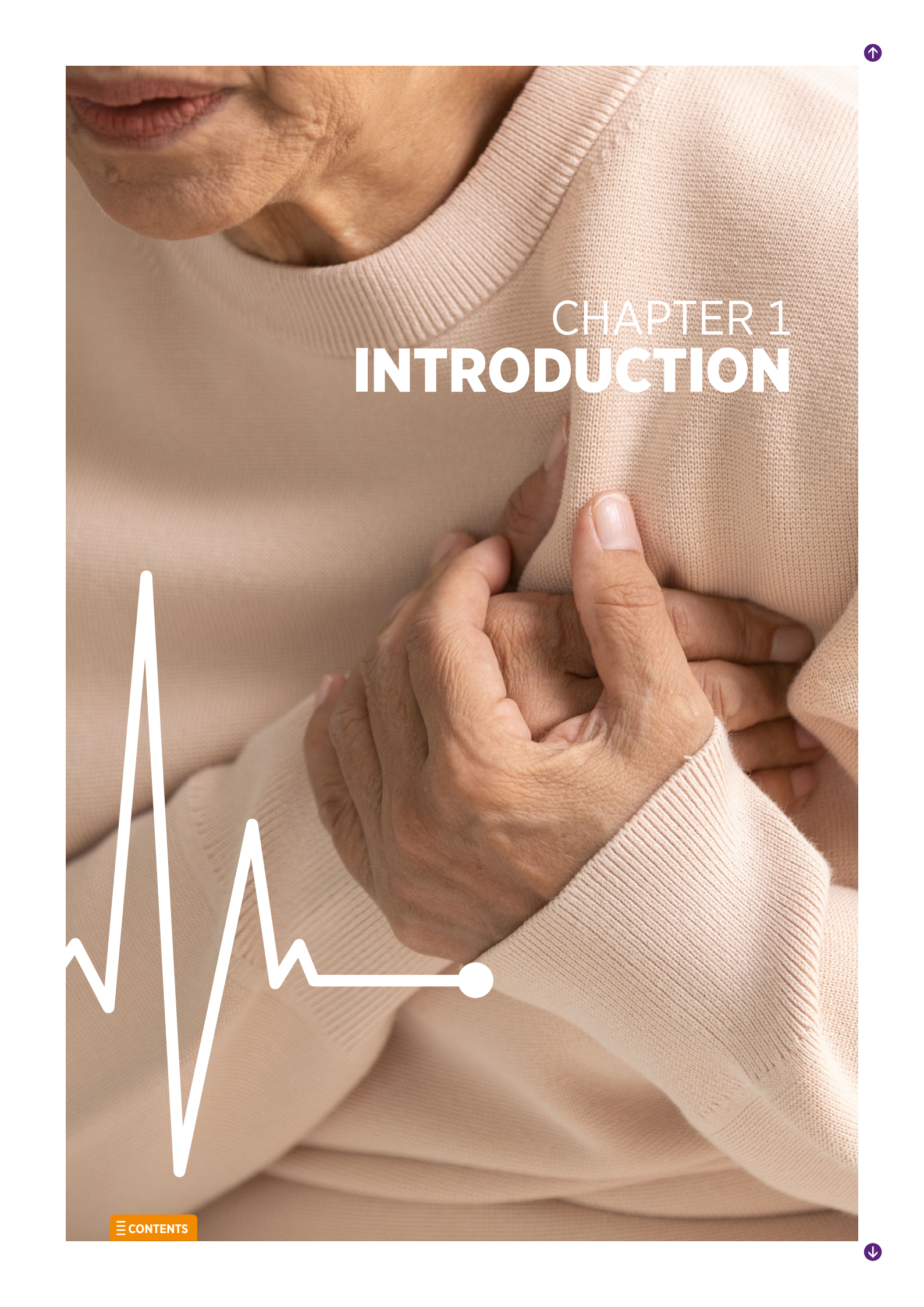
One of the most important things about sharing my story is what happened next in my own family. About six weeks later, my brother didn’t feel right. Because of what had happened to me, he went to his GP. They sent him on for further tests as they could find nothing on the ECG, and he had five grafts put in his heart. That’s the power of telling your story. It made him act.

If I was to say anything to anyone reading this, it’s simple. I didn’t think I was a candidate for a heart attack and I got one. So, listen to your body. Don’t ignore things. Just go to your doctor. And if you do have a heart attack, take your time. Allow your body to recover.

When I look back on the whole experience, I can honestly say the care I received was excellent. From the ambulance to the hospital teams and cardiac rehab, everything worked. The one thing I would say is not to assume patients understand everything. Healthcare workers speak a language full of acronyms. Even working in a hospital, there were times I didn’t understand what was being said. But overall, I genuinely couldn’t say any part of my care was substandard.

This experience has been a wake-up call. A refocus. It shows how quickly things can change, but also how much can be gained from stopping, listening, and taking care of yourself. And if telling my story helps even one person recognise the signs, go to their GP, or act sooner, then it’s worth telling.

“You need to respect your body, even when you think you don’t.”



CHAPTER 1 **INTRODUCTION**

CHAPTER 1: INTRODUCTION

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. The abrupt lack of blood supply to the heart can seriously damage the heart muscle. 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). Approximately 6,000 people have a heart attack in Ireland every year (NOCA, 2022). This report focuses on the care provided to patients with a STEMI.

SYMPTOMS OF A HEART ATTACK

Symptoms of a heart attack can include (Figure 1.1):

- new, persistent chest pain; this can feel like the chest 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).

SYMPTOMS OF A HEART ATTACK

INCLUDE PAIN, DISCOMFORT, PRESSURE, TIGHTNESS OR HEAVINESS IN ANY OF THESE AREAS

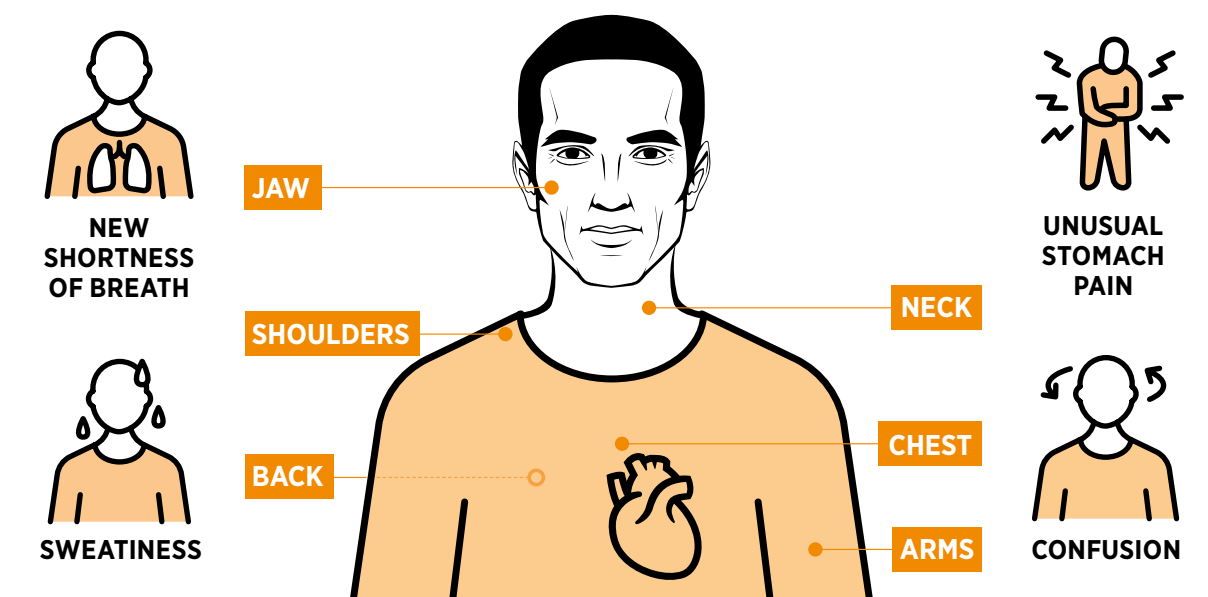


FIGURE 1.1: SYMPTOMS OF A HEART ATTACK

Risk factors for coronary heart disease (CHD), which can lead to heart attack, include smoking, elevated cholesterol levels, diabetes, family history of CHD, high blood pressure, and being overweight or obese (Figure 1.2).

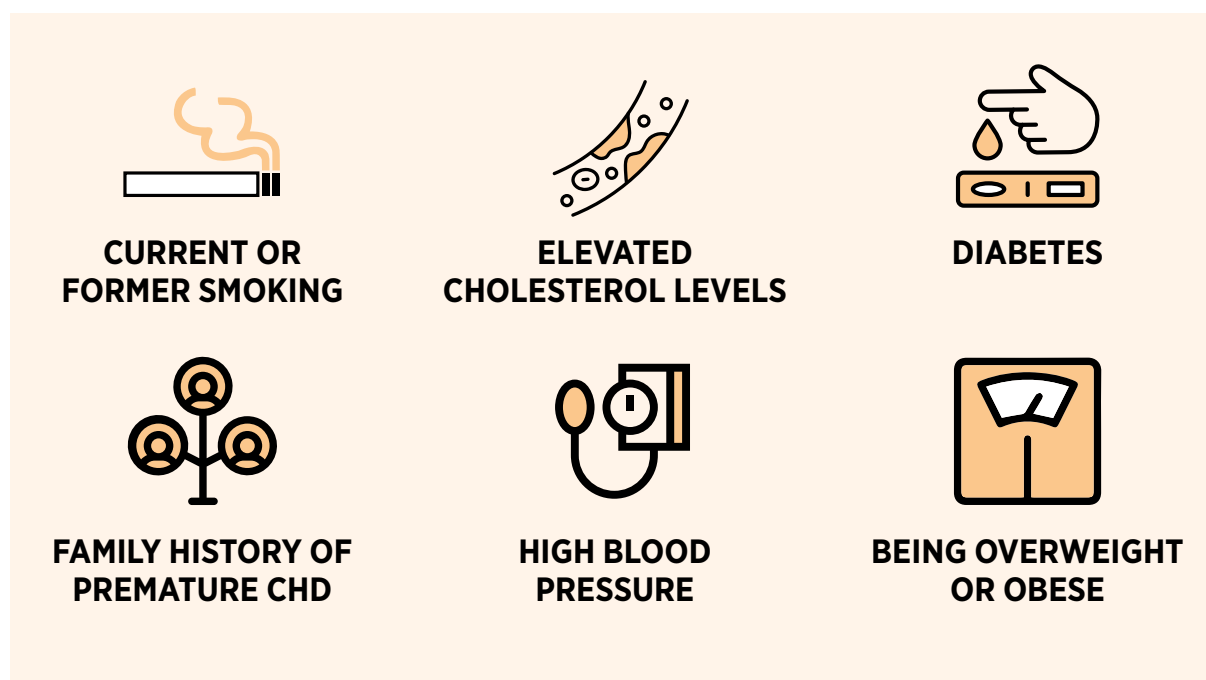


FIGURE 1.2: RISK FACTORS FOR HEART ATTACK

HOW ARE PEOPLE WHO HAVE A STEMI TREATED IN IRELAND?

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)). 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. 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, 2022).

Currently, seven primary PCI centres are designated to receive patients with a STEMI who are brought directly by emergency ambulance. Six provide 24/7 access and one provides access from 8.00am to 8.00pm, seven days per week. For parts of Donegal, Altnagelvin Area Hospital in Derry provides 24/7 coverage as part of a cross-border care arrangement between the Health Service Executive (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: PCI 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, seven days per week [†]	

* 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 daily in March 2025.¹ Prior to this, since 2022, 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

The purpose of this report is to audit the clinical care provided to patients presenting with STEMI in hospitals delivering primary PCI services, against the recommendations outlined in the Acute Coronary Syndromes Programme Model of Care (HSE, 2012) and the 2023 European Society of Cardiology Guidelines for the Management of Acute Coronary Syndromes (Byrne *et al.*, 2023).

Using Heartbeat data, the report describes the quality of care delivered to patients with STEMI during 2025 across all 10 hospitals providing a primary PCI service in Ireland. It also evaluates performance against established best-practice standards and key quality indicators (KQIs), with the aim of identifying opportunities for improvement and informing recommendations to enhance patient care.

The report was prepared by a multidisciplinary writing group and overseen by the Irish Heart Attack Audit (IHAA) Governance Committee.

¹ University Hospital Waterford further expanded its primary PCI service to 24/7 in July 2026 and the impact of this will be reported in the next IHAA annual report.



CHAPTER 2

METHODOLOGY



CHAPTER 2: METHODOLOGY

THE IRISH HEART ATTACK AUDIT

The IHAA is a clinically led audit that uses the Heartbeat dataset, which the ACS programme developed in 2012 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, 2022). [Appendix 1](#) outlines the aim and objectives of the IHAA.

The IHAA Governance Committee oversees the IHAA, and its membership comprises clinical experts, patient and public 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 [Irish Heart Attack Audit Data Dictionary Version 1.0](#) (National Office of Clinical Audit, 2024a), was collected on all cases admitted to a PCI centre following activation of the optimal reperfusion service protocol (HSE, 2012) 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 17 years and over. The HIPE data and the Heartbeat data were merged within HIPE to form an anonymised dataset before being sent to the National Office of Clinical Audit (NOCA).



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 related to 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 records.



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; these patients 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 ANALYSIS

NOCA received the Heartbeat data from the HPO for the 2025 reporting period on 12 May 2026. The NOCA Data Analyst completed the analysis following data checks with the HPO. Prior to analysis, the dataset underwent data cleaning and pre-processing using R, including validation, recoding, and consistency checks. 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. The Global Registry of Acute Coronary Events (GRACE) model was used in order to estimate expected mortality; this was then 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 in the *Irish Heart Attack Audit National Report 2022 and 2023* (NOCA, 2024b).



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 and 31 December 2025, 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

The NOCA dashboard is available in each PCI centre, and the KQI results for 2025 are highlighted throughout this report. The metadata for each KQI are available in [Appendix 3](#), and the result of each KQI for 2025 is reported within the findings. Frequency tables for each figure are available in [Appendix 4](#).

In 2023, the European Society of Cardiology updated its acute coronary syndrome (ACS) guidelines (Byrne *et al.*, 2023), further refining the patient pathway to reperfusion (Figure 2.1). The guideline emphasises total ischaemic time and defines key time-based targets across each stage of the patient journey. The IHAA has incorporated some of these targets into its reporting, such as time to first ECG and timeliness of Primary PCI for patients who self-present to a PCI centre. However, targets that conflict with those outlined in the current ACS Model of Care (HSE, 2012) have not yet been adopted, pending the outcome of an ongoing review of the HSE ACS Model of Care led by the National Heart Office.



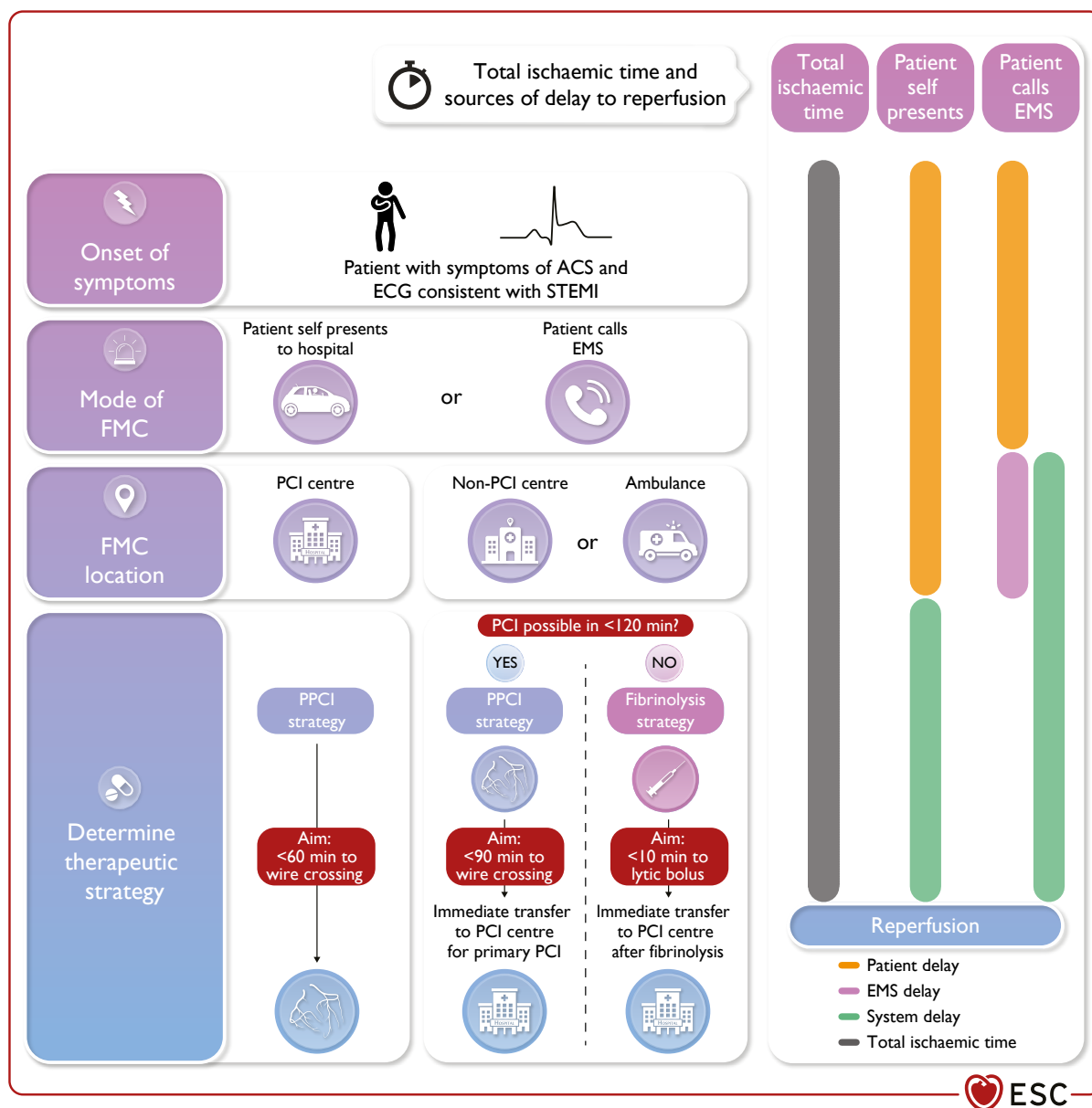


FIGURE 2.1: EUROPEAN SOCIETY OF CARDIOLOGY STEMI PATHWAY

CHAPTER 3

DATA QUALITY STATEMENT



**Coverage of
Data Release**



**Completeness of
Data Release**



**Accuracy of
Data Release**

CHAPTER 3: DATA QUALITY STATEMENT FOR THE IRISH HEART ATTACK NATIONAL REPORT 2025

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 3.4 provides an overall assessment of the quality of the data in this report. This can be used in conjunction with an assessment of the characteristics of the IHAA dataset available at [Assessment of IHAA Data Quality](#).

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 2025. 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 and 31 December 2025.
TYPE OF DATA	Final

TABLE 3.2: CHARACTERISTICS OF DATA QUALITY

Coverage of data release

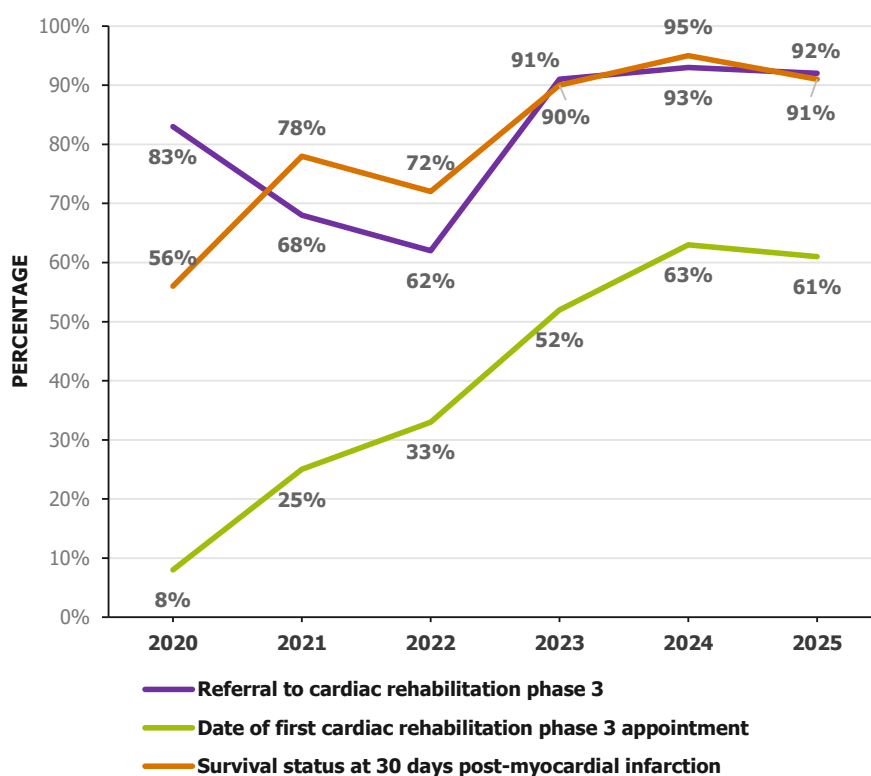
For this report, data are included from all PCI centres (both designated primary PCI and non-designated, 9.00am to 5.00pm weekday PCI centres) (see Table 1.1).

The number of patients with a STEMI recorded on Heartbeat compared with the number of patients with a STEMI recorded on HIPE gives an indication of coverage. Not all HIPE cases with STEMI should be included in Heartbeat as HIPE records episodes of care and a patient may have one or more episodes of care for one STEMI event. In 2025, 91% of STEMI cases recorded on HIPE had additional clinical data recorded on Heartbeat (Appendix 8). The discrepancy does not mean actual STEMI offered reperfusion are not recorded in heartbeat; the difference relates to patients with STEMI who have a second episode of care within a specific time period after their event.

Completeness of data release

Completeness of all data points is presented in Appendix 5. In 2025, almost all (97%) of the data points had over 90% completeness.

The capture of follow-up data requires the audit coordinators to gather data from other hospitals. Without adequate resources for data collection and good networks between hospitals to collect the data, follow-up data can be missing (Figure 3.1).

**FIGURE 3.1:** DATA COMPLETENESS IN FOLLOW-UP DATA, 2020–2025

Completeness
of data release

Table 3.3 displays the number and proportion of cases that were included in the calculation of each of the KQIs in 2025. Each KQI uses multiple variables for its calculation. The table displays the overall number and proportion of cases with each required variable recorded. For instance, KQI 1 (percentage of eligible patients with a STEMI who received reperfusion) requires two variables to calculate: contraindication to reperfusion and reperfusion type. Overall, 99.9% of cases had both variables recorded.

TABLE 3.3: COMPLETENESS OF VARIABLES REQUIRED FOR KEY QUALITY INDICATOR CALCULATION, 2025

	n	%
KQI 1: Percentage of eligible patients with a STEMI who received reperfusion	1641	99.9%
KQI 2: Percentage of patients with a STEMI who were brought directly to a primary PCI centre who had timely primary PCI	1639	99.8%
KQI 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	1636	99.6%
KQI 4: Percentage of patients with a STEMI who had radial access for primary PCI	1641	99.9%
KQI 5: Percentage of patients with a STEMI who were discharged with an appropriate secondary prevention medication discharge bundle	1467	96.4%
KQI 6: Percentage of patients with a STEMI who actively smoke who were offered smoking cessation advice	1551	94.5%
KQI 7: Percentage of eligible patients with a STEMI who were referred for cardiac rehabilitation phase 3	1505	91.7%
KQI 8: Percentage completeness of the 'survival status at 30 days' data point recorded in Heartbeat	1336	89.9%
KQI 9: Percentage of patients who have a cardiac rehabilitation phase 3 date recorded	612	59.8%

Accuracy of
data release

All data were reported, including missing or unknown data.

TABLE 3.4: 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.
Limitations of data in this report	Completion of the date of cardiac rehabilitation phase 3 remains low at 61% and therefore calculating the time to cardiac rehabilitation cannot be reported in this report. Patient-level data linkage between Heartbeat and ambulance records is not currently available. As a result, the time of the first positive ECG is used as a proxy for the first medical contact (FMC). When comparing the timeliness of primary PCI with other jurisdictions, this limitation should be taken into account. 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 number of data for this implementation. The IHAA governance committee have agreed that the NOCA outlier management policy will not commence until the model has been refined and supported by larger quantities of data.



CHAPTER 4

DEMOGRAPHIC AND CARDIOVASCULAR RISK FACTOR PROFILE



CHAPTER 4: DEMOGRAPHIC AND CARDIOVASCULAR RISK FACTOR PROFILE

Chapter 4 presents data on the demographic and cardiovascular risk factor profile of all cases submitted to the Heartbeat portal in 2025. The data include only cases that triggered the ORS protocol (HSE, 2012) and their subsequent admission to a PCI centre. Comparisons with the *Irish Heart Attack Audit National Report 2024* (NOCA, 2026) and other international reports are made where applicable. Emerging trends in age and sex demographics, comorbidities, and cardiovascular risk factors (including smoking) are outlined and discussed.

HEARTBEAT CASE SUBMISSIONS, 2025

A total of 1,931 cases were submitted to the Heartbeat portal during the 2025 reporting period, reflecting a continuing upward trend. Submissions have steadily increased, from 1,742 cases in 2021 to 1,931 in 2025. There has been a 15% increase in STEMI submissions since 2017 (n=1,427), the population increase during the same period was 17% (CSO,2025).

Figure 4.1 displays the proportion of all cases submitted by each participating hospital. St James’s Hospital and the Mater Misericordiae University Hospital together continue to receive almost one-half (47%) of all admissions to PCI centres. University Hospital Waterford expanded its primary PCI service in March 2025, increasing operating hours from 8.00am–5.00pm, Monday to Friday, to 8.00am–8.00pm, seven days per week. Following this expansion, the proportion of submissions from University Hospital Waterford increased from 6% (n=119) in 2024 to 8% (n=148) in 2025. Conversely, submissions from Cork University Hospital decreased from 14% (n=259) in 2024 to 11% (n=220) in 2025, which may reflect a shift in activity associated with the enhanced service provision in Waterford.

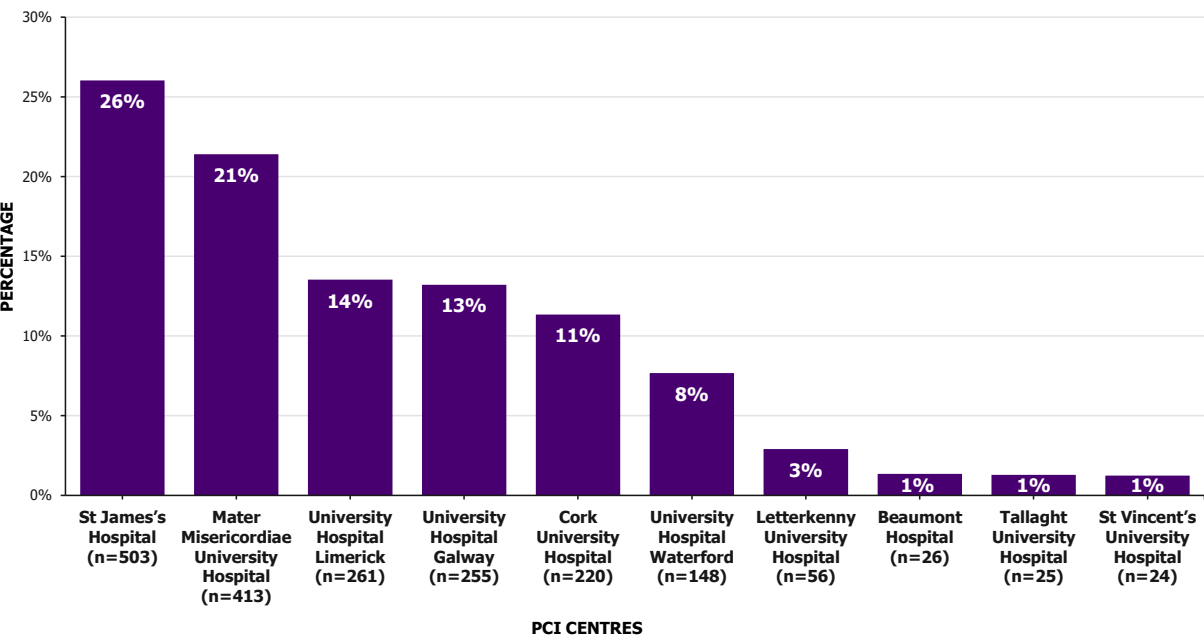


FIGURE 4.1: PROPORTION OF HEARTBEAT CASE SUBMISSIONS BY PCI CENTRE (N=1,931)

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 2025, 85% (n=1,642) of cases had a confirmed diagnosis of a STEMI, 11% (n=212) had an alternative diagnosis, and 4% (n=77) were reported as 'other/unknown' (Figure 4.2). The distribution of diagnoses remains consistent with the 2024 figures.

The most common alternative diagnosis (n=212) was non-cardiac chest pain (n=74; 35%), followed by NSTEMI (n=67; 32%) and pericarditis (n=32; 15%). The breakdown of alternative discharge diagnoses is available by hospital in the supplementary frequency tables in [Appendix 4](#).

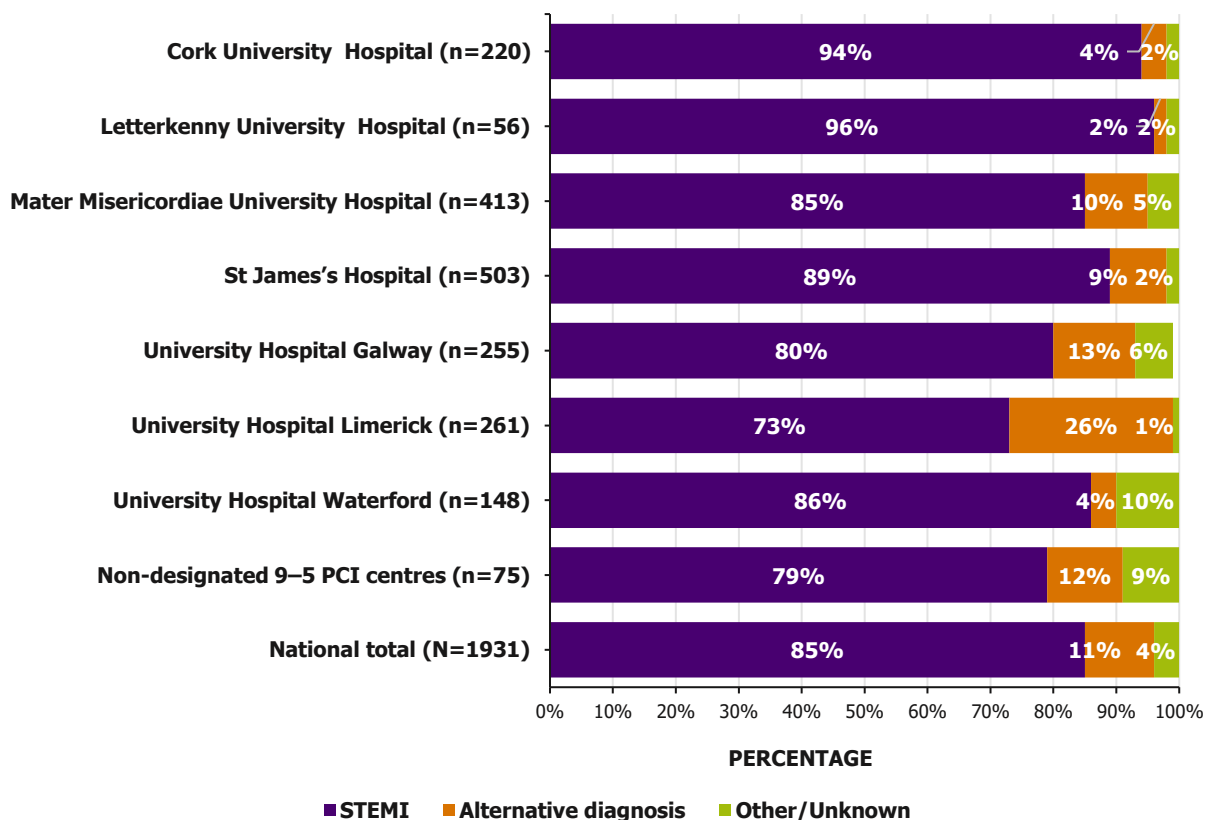


FIGURE 4.2: DISCHARGE DIAGNOSIS BY PCI CENTRE (N=1,931)

STEMI, SEX AND AGE

Of the 1,642 patients with a confirmed diagnosis of a STEMI treated in PCI centres (Figure 4.3), the majority were male (n=1,277; 78%); this is consistent with previous years.

The mean and median age of patients with a STEMI was 63 years (interquartile range (IQR): 54–72 years). For males, the median age was 62 years (IQR: 53–71 years). Female patients with a STEMI were typically older, with a median age of 69 years (IQR: 58–78 years). There were a larger proportion of females aged 65 years and over (n=224, 61%) compared with males (n=539, 42%).



For males, the median age was 62 years. For female patients, the median age was 69 years.

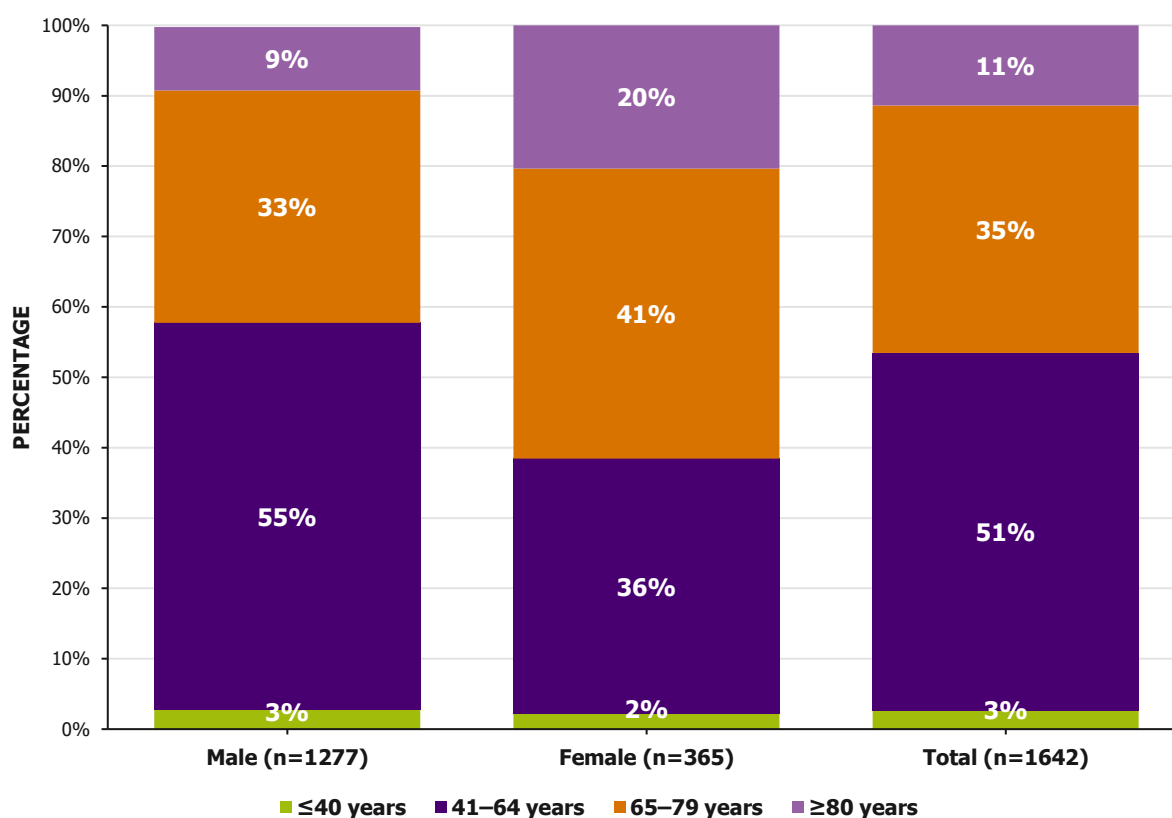


FIGURE 4.3: PERCENTAGE OF STEMI CASES BY SEX AND AGE GROUP (N=1,642)

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

In 2025, 32% (n=527) 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 most frequently reported conditions were previous PCI (n=207; 13%), previous MI (n=193, 12%), and previous angina (n=185; 11%). Sixty-seven per cent (n=1,106) of patients had no known comorbidities recorded. Additional cardiovascular risk factors are presented in Table 4.1, indicating that 87% (n=1435) of patients with a STEMI had at least one cardiovascular risk factor (Figure 4.8).

Figure 4.4 demonstrates sex-related differences in prior cardiovascular disease and comorbidity rates.

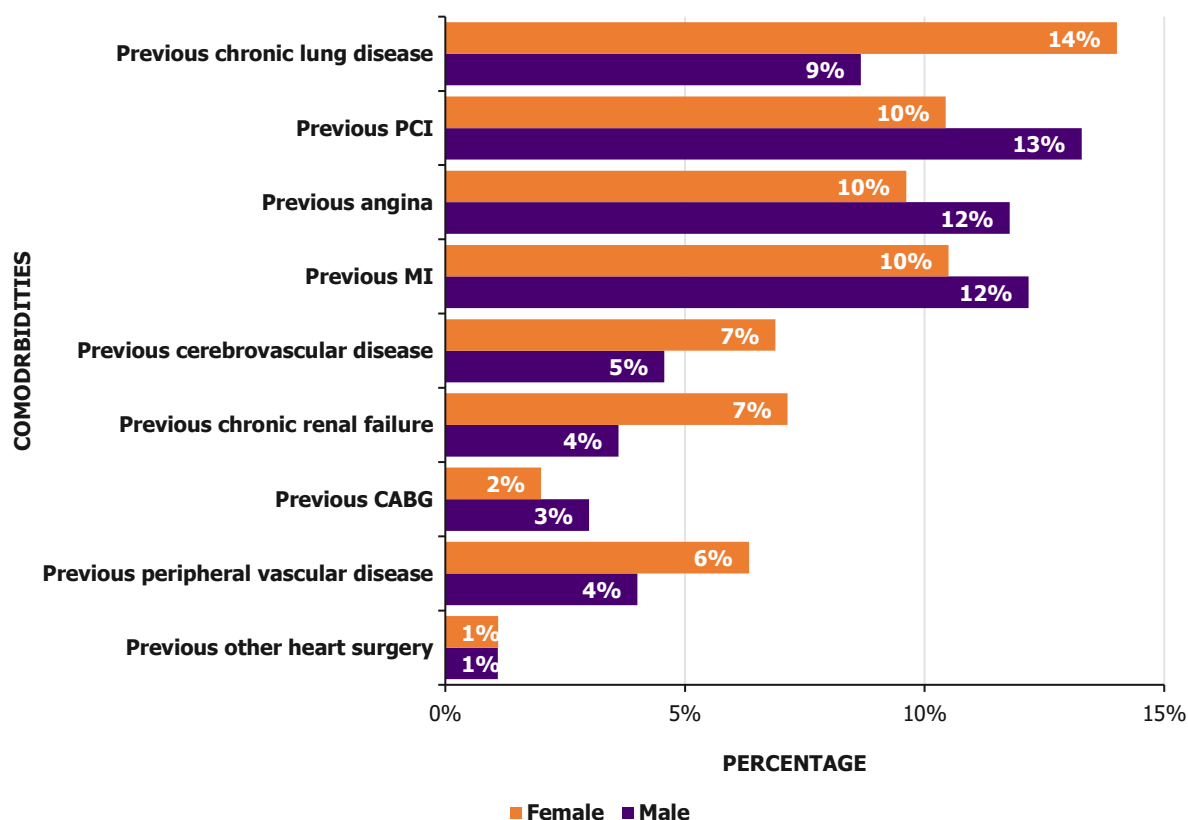


FIGURE 4.4: PRIOR CARDIOVASCULAR DISEASE AND MAJOR COMORBIDITIES IN PATIENTS WITH A STEMI, BY SEX²

² 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 2025, the proportion of patients with a STEMI who had a pre-existing diagnosis of coronary heart disease (CHD) (prior MI, prior angina, prior PCI, and/or prior coronary artery bypass graft (CABG)) was 19% (n=305). Figure 4.5 displays the proportion of patients with a STEMI who were admitted with prior CHD, by sex and age group.

In total, there was little variation between male and female patients with a STEMI (19% of males versus 18% of females) who had at least one pre-existing CHD diagnosis.

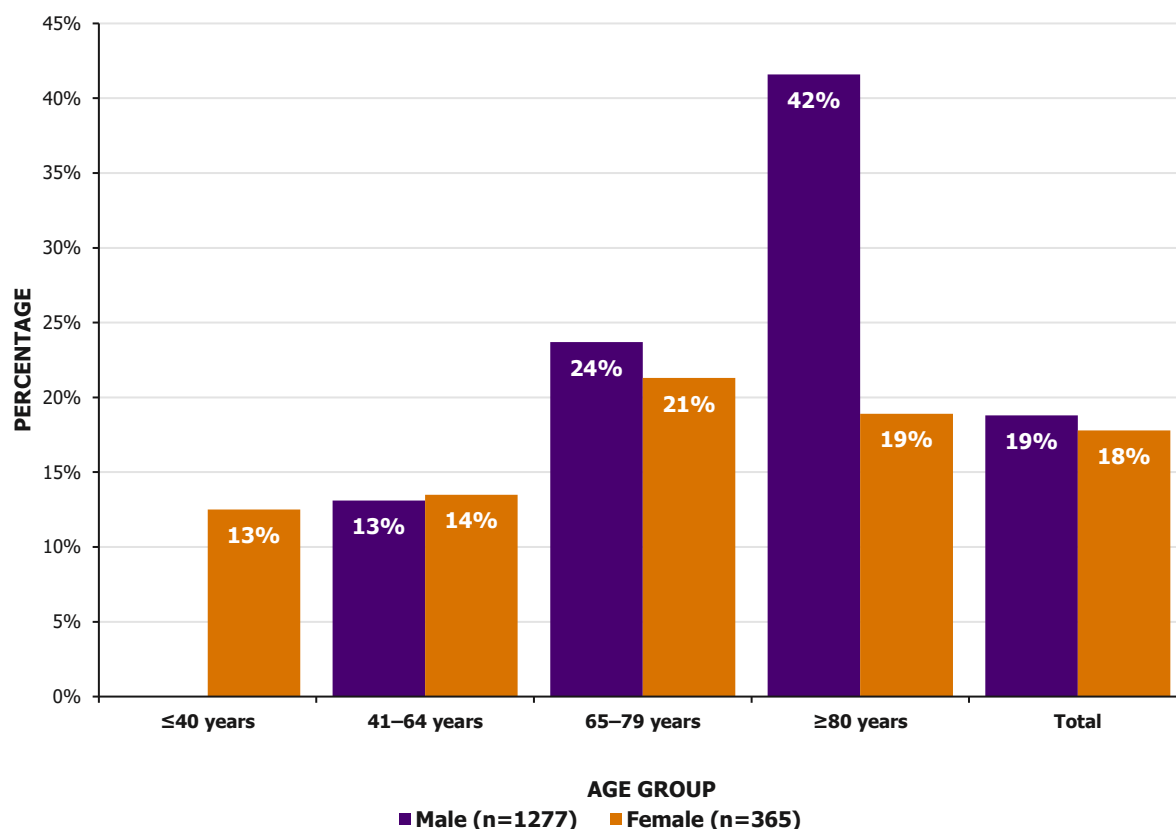


FIGURE 4.5: PROPORTION OF PATIENTS WITH A STEMI WITH PRIOR CORONARY HEART DISEASE, BY SEX AND AGE GROUP (N=1,642)

DIABETES PROFILE IN PATIENTS WITH A STEMI

The Heartbeat dataset will update the diabetes variable in 2026 to include the following categories: Not diabetic; Diabetes mellitus Type 1; Diabetes mellitus Type 2; Diabetes mellitus other/unspecified type; and Unknown. As a result, some cases, if submitted in 2026, have used the revised variable in the 2025 dataset. Since the updated categories are not directly comparable with the 2025 definitions, a decision was made to group Diabetes mellitus Type 1, Diabetes mellitus Type 2 and Diabetes mellitus other/unspecified type into a new category: Diabetes (medication unknown). This alteration in methodology renders comparisons with previous years, for this variable, invalid.

While most patients with a STEMI in 2025 did not have diabetes (n=1,312, 80%), 19% (n=312) had a diagnosis of diabetes before or during admission. Figure 4.6 shows the distribution of patients with a STEMI who were diagnosed with diabetes, by sex and age group. Male patients with a STEMI were less likely to be diagnosed with diabetes (18%) compared to female patients (22%).

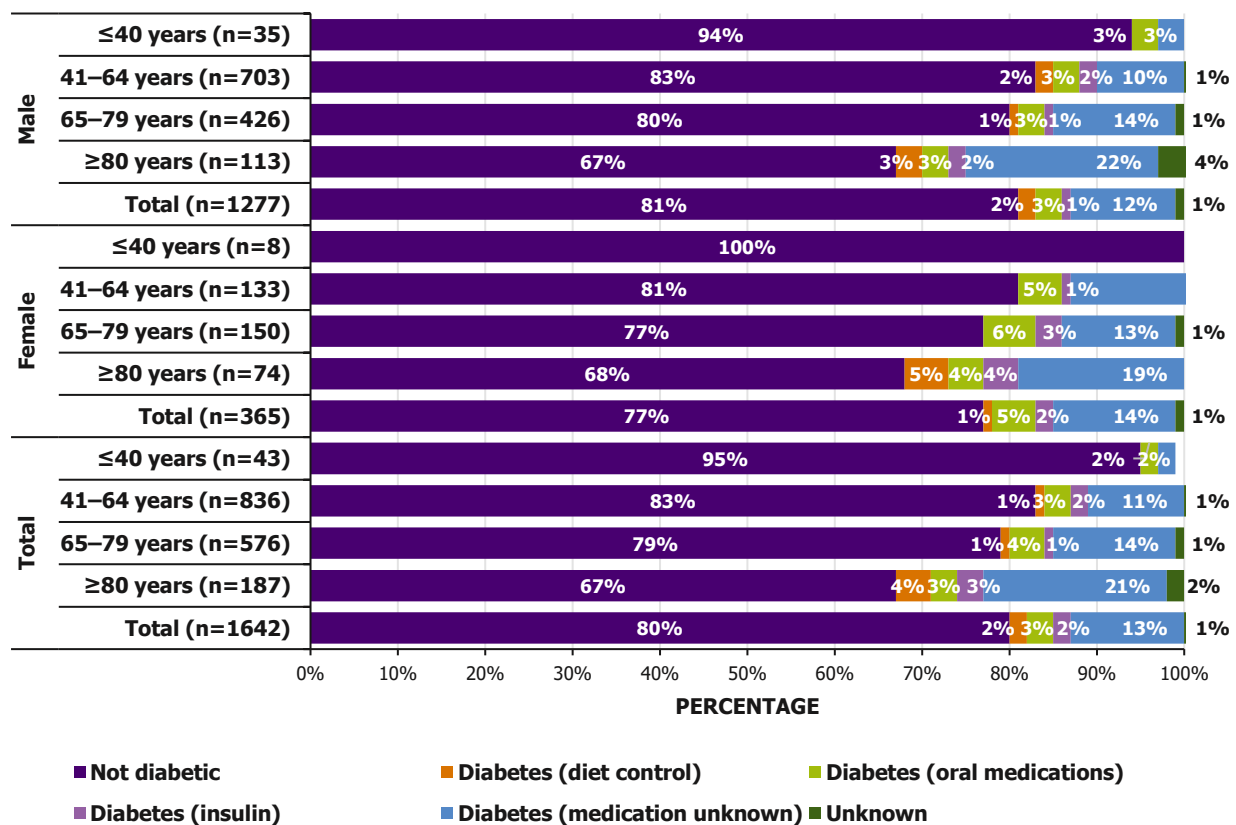


FIGURE 4.6: DIABETES PROFILE OF PATIENTS WITH A STEMI, BY SEX AND AGE GROUP (N=1,642)

SMOKING AND AGE PROFILE OF PATIENTS WITH A STEMI

In 2025, 37% (n=604) of patients with a STEMI were current smokers, which was consistent with the 2024 result (36%). The proportion of patients with a STEMI who currently smoke remains substantially higher than the national population average, which was reported to be 17% in 2025 (Department of Health, 2025). The proportion of patients with a STEMI who have given up smoking (n=451; 28%) was slightly less than the national average (30%). Data on the use of electronic vaping products are 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 smoked: 67 years).

This premature STEMI risk continues to be more pronounced in female smokers. Among males, current smokers presenting with a STEMI had a median age of 56 years (IQR: 49–64 years) compared with a median age of 65 years (IQR: 56–73 years) for males with a STEMI who have never smoked. Among females, current smokers presenting with a STEMI had a median age of 61 years (IQR: 52–69 years) compared with a median age of 74 years (IQR: 66–82 years) for females with a STEMI who have never smoked.

Figure 4.7 shows the smoking profile of patients with a STEMI by sex and age group. The majority of patients with a STEMI aged under 40 years were current smokers (n=27; 63%). As age increased, the proportion of current smokers decreased. This trend highlights the degree to which smoking can cause premature CHD events.

Of the 305 patients with a STEMI who had prior CHD, 32% (n=98) were current smokers, which is an increase from 2024 results (26%). The proportion of former smokers who had prior CHD in 2025 was 35% (n=108). These data highlight the importance of providing continuing support for smokers who have experienced a STEMI in order to reinforce quitting and maintaining abstinence from smoking.

Of the 604 patients with a STEMI who were reported as current smokers, 95% (n=572) received smoking cessation advice, consistent with 2024 results (95%).

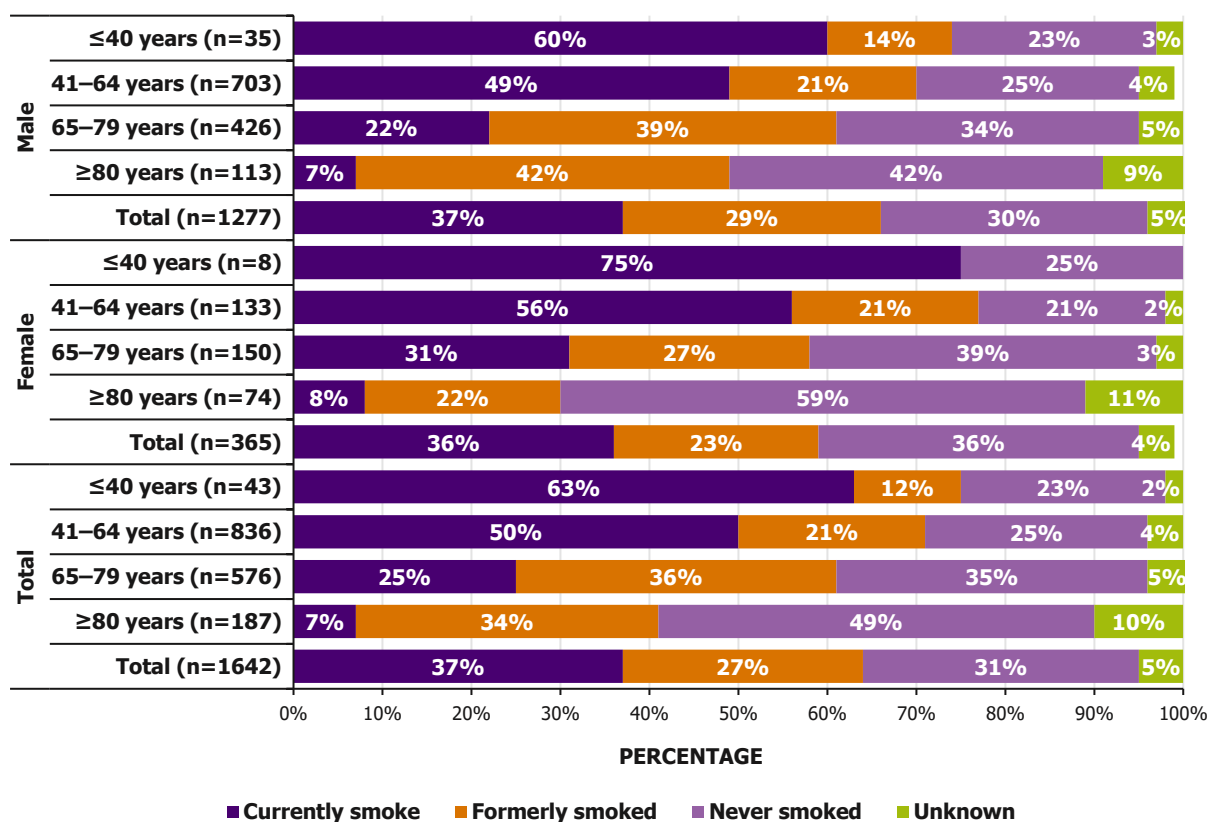


FIGURE 4.7: SMOKING PROFILE OF PATIENTS WITH A STEMI, BY SEX AND AGE GROUP (N=1,642)

CARDIOVASCULAR RISK FACTOR PROFILE OF PATIENTS WITH A STEMI

In 2025, 87% (n=1435) of patients with a STEMI had at least one cardiovascular risk factor (Figure 4.8). This percentage represented a decrease from 90% (n=1,460) in 2024.

Table 4.1 shows the proportion of cardiovascular risk factors by sex. The most prevalent risk factors were hypertension (n=825; 50%) and hypercholesterolaemia (n=729, 44%).

More than one-quarter (30%) of patients with a STEMI had a body mass index (BMI) of 30 or higher, similar to 28% reported in 2024 but higher than the general population, which is reported as 21% (Department of Health, 2025).



87% (n=1435) of patients with a STEMI had at least one cardiovascular risk factor

TABLE 4.1: CARDIOVASCULAR RISK FACTOR PROFILE OF PATIENTS WITH A STEMI

	MALE		FEMALE		TOTAL	
	n	%	n	%	n	%
Previous hypertension	605	47%	220	60%	825	50%
Previous hypercholesterolaemia	554	43%	175	48%	729	44%
Smoking	471	37%	133	36%	604	37%
Diabetes	230	18%	82	23%	312	19%
Prior cardiovascular disease	305	24%	98	27%	403	25%
BMI ≥ 30	385	30%	100	27%	485	30%

Figure 4.8 shows the proportion of patients with a STEMI who had one to six cardiovascular risk factors. More than one-half of patients with a STEMI (n=863, 53%) had one or two cardiovascular risk factors, and 87% (n=1,435) had at least one risk factor.

A substantial proportion of patients had three or more potentially modifiable cardiovascular risk factors on presentation (n=572; 35%). A very small number of patients (n=8; 0.5%) had six risk factors.



A substantial proportion of patients had three or more potentially modifiable cardiovascular risk factors

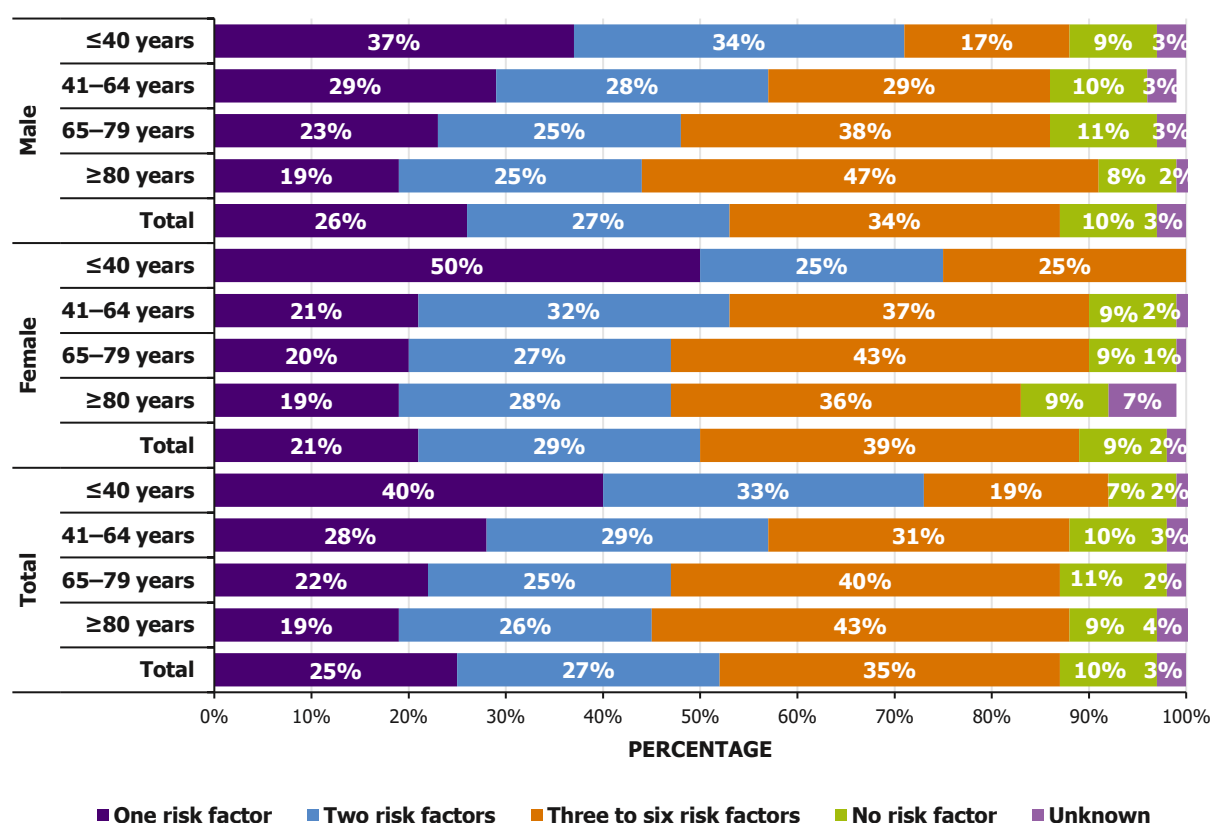


FIGURE 4.8: PREVALENCE OF RISK FACTORS FOR PATIENTS WITH A STEMI, BY SEX AND AGE GROUP (N=1,642)

KEY FINDINGS FROM CHAPTER 4

- A total of 1,931 cases were submitted to the Heartbeat portal during the 2025 reporting period, reflecting a continuing upward trend, from 1,742 cases in 2021.
- Overall, 1,642 patients with a STEMI were recorded on the Heartbeat portal in 2025, indicating a 15% increase since 2017 (n=1427) (Figure 5.4); the population increase during the same period was 17%.
- Males accounted for 78% (n=1,277) of all patients with a STEMI and had a median age of 62 years (IQR: 53–71 years). Female patients with a STEMI were generally older, with a median age of 69 years (IQR: 58–78 years).
- Eighty-seven per cent (n=1,435) of patients with a STEMI in 2025 had at least one cardiovascular risk factor. The most prevalent risk factors were hypertension (50%; n=825) and hypercholesterolaemia (44%; n=729). Thirty-five per cent (n=572) of patients had three or more potentially modifiable cardiovascular risk factors.
- Smoking causes STEMI at a younger age. On average, smokers present with a STEMI 10 years earlier than people who have never smoked. Among females, current smokers presenting with a STEMI had a median age of 61 years (IQR: 52–69 years) compared with a median age of 74 years (IQR: 66–82 years) for females with a STEMI who have never smoked.



CHAPTER 5 **ACCESS TO REPERFUSION THERAPY**



CHAPTER 5: ACCESS TO REPERFUSION THERAPY

Chapter 5 presents data on how patients with a STEMI access care from the first call for help to arrival at the PCI centre and how this can impact the treatment provided.

SOURCE OF REFERRAL TO A PCI CENTRE

The way in which a patient initially accesses care, which is known as the source of referral, 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 2025. More than one-half (n=906; 55%) of patients with a STEMI arrived directly by ambulance to a PCI centre, the same as in 2024. One-third (n=544; 33%) of patients with a STEMI presented initially to a non-PCI-capable hospital and were subsequently transferred by ambulance to a PCI centre, which was consistent with 2024 (32%). This includes patients who self-presented to a non-PCI-capable hospital, those who had the STEMI diagnosed while already an inpatient in a non-PCI-capable hospital, and those who may have been brought by ambulance to a non-PCI-capable hospital for stabilisation prior to transfer to a PCI centre.³

The location of primary PCI centres and the number of non-PCI-capable hospitals with an emergency department (ED) service nearby may have an impact on the proportion of patients who are able to access a PCI centre directly.

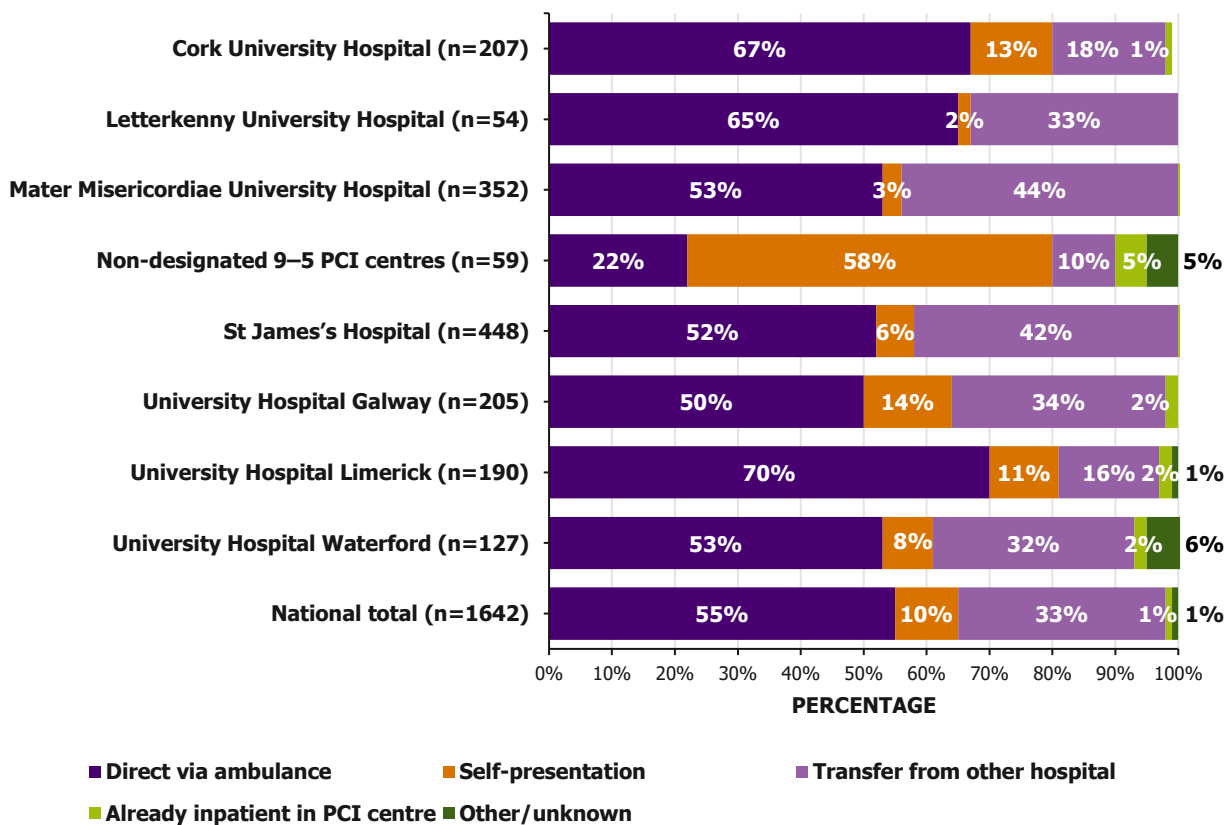


FIGURE 5.1: REFERRAL SOURCE TO A PCI CENTRE FOR ALL PATIENTS WITH A STEMI, BY HOSPITAL (N=1,642) ^{4,5}

³ Altnagelvin Area Hospital PCI centre provides the primary PCI service for Letterkenny University Hospital. In Figure 5.1, the results refer to how the patient accesses care in Altnagelvin Area Hospital.

⁴ Non-designated 9.00am to 5.00pm weekday PCI centres include Beaumont Hospital (n=21), St Vincent's University Hospital (n=19) and Tallaght University Hospital (n=19).

⁵ The 'transfer from other hospital' category includes transfer from other hospital and inpatient transfer from other hospital.

TIME INTERVAL FROM ONSET OF SYMPTOMS TO CALL FOR HELP FOR PATIENTS WHO ARRIVED AT A PCI CENTRE DIRECTLY BY AMBULANCE

The quicker that 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 whose interval between the time of symptom onset and the time of the call for help was within 60 minutes, by sex.

In 2025, for 48% (n=435) of STEMI patients who arrived at a PCI centre directly by ambulance, the time interval between symptom onset and call for help was ≤ 60 minutes: not substantially different from 45% (n=402) in 2024. As in previous years, a larger proportion of male patients sought help within 60 minutes of symptom onset (51%) in 2025 compared with female patients (39%). There is a gradual shift towards the ≥ 61 -minute time interval with increasing age. Differences between sexes are modest in most age groups but become more pronounced in the oldest group, where females are more likely to fall into the ≥ 61 minutes category.



In 2025, only 48% of patients called for help within 60 minutes

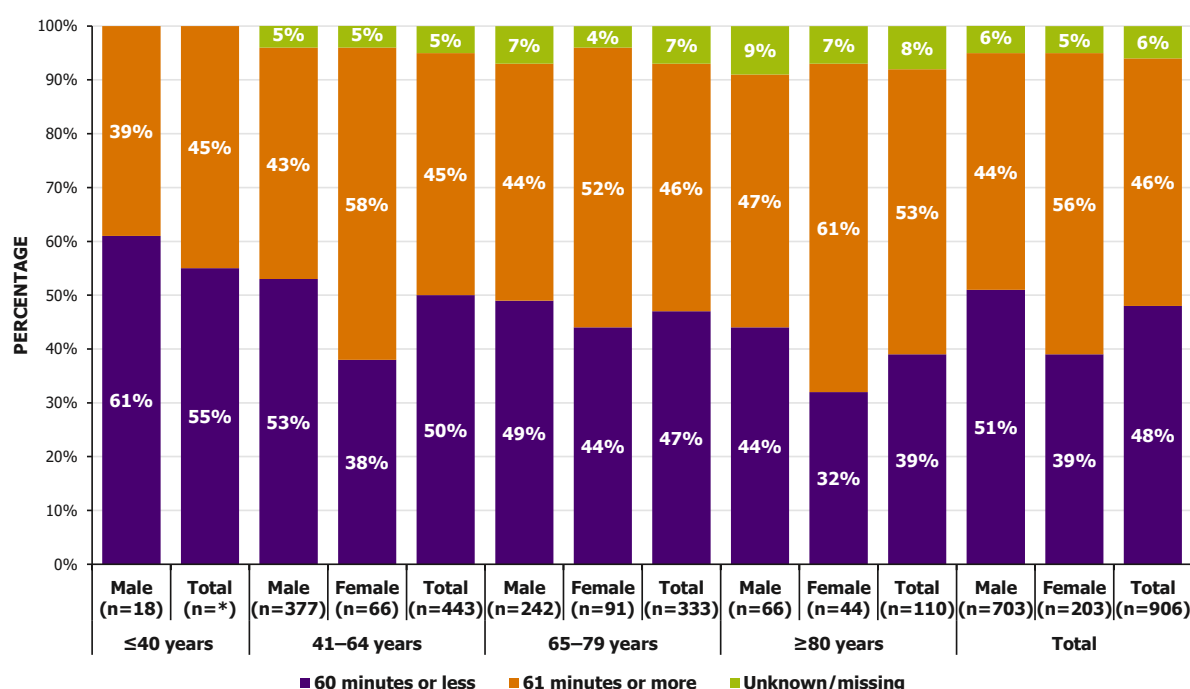


FIGURE 5.2: PROPORTION OF PATIENTS WITH A STEMI WITH A SYMPTOM ONSET TO CALL FOR HELP INTERVAL WITHIN 60 MINUTES, BY SEX (n=906)⁶

⁶ Figure 5.2 only includes patients who arrived at a PCI centre directly by ambulance.

AMBULANCE OFFLOAD LOCATION FOR PATIENTS BROUGHT TO A PCI CENTRE FOR PRIMARY PCI

For patients with a STEMI, the European Society of Cardiology (ESC) recommends an ED bypass direct to the cath lab in at least 80% of cases (Ibanez *et al.*, 2018). In 2025, 77% (n=1,036) of patients with a STEMI who arrived at a Primary PCI centre by ambulance, either directly or transferred, were brought directly to the cath lab. Figure 5.3 shows the ambulance offload location for patients who arrived at a PCI centre directly by ambulance and for patients who were transferred from another hospital to a PCI centre. In 2025, among those who arrived at a PCI centre directly by ambulance, 70% (n=632) were brought directly to the cath lab, bypassing the ED, similar to the 71% (n=632) recorded in 2024. The proportion of patients who were transferred from a non-PCI-capable hospital to a PCI centre and brought directly to the cath lab increased from 87% (n=353) in 2024 to 90% (n=404) in 2025, although this is still lower than 95% (n=393) in 2022.

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 than 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.



77% of those brought by ambulance, either directly or transferred to the PCI centre, bypassed the ED and went straight to the cath lab.

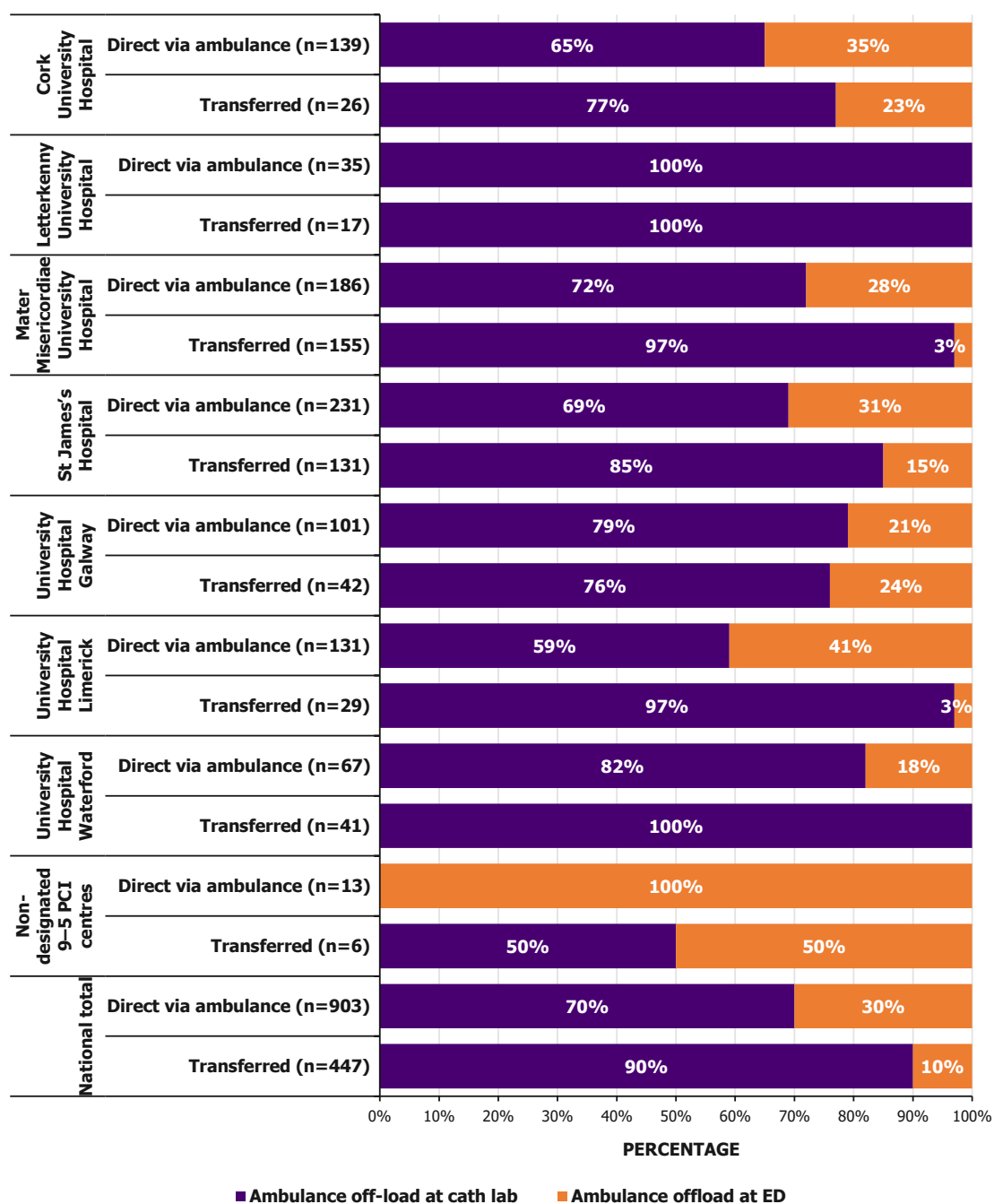


FIGURE 5.3: LOCATION OF AMBULANCE OFFLOAD AT THE PCI CENTRE FOR PATIENTS WHO ARRIVED DIRECTLY BY AMBULANCE TO A PCI CENTRE OR WERE TRANSFERRED FROM A NON-PCI-CAPABLE HOSPITAL, BY PCI CENTRE (n=1,350)^{7,8,9}

In 2025, the majority of patients who arrived directly or were transferred to a PCI centre (83%; n=1,116) were stable on admission to the PCI centre, compared with 81% in 2024. However, a small proportion of patients (n=73; 5%) were in cardiogenic shock on admission to the PCI centre, and 9% (n=127) had a resuscitated arrest on arrival.¹⁰ For more detailed information on patients' clinical status on arrival at the PCI centre, by hospital, see [Appendix 6](#).

⁷ Patients who had thrombolysis were excluded from this analysis.

⁸ 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 5.3 due to the small number of admissions. However, they are included in the totals for this figure.

⁹ Letterkenny University Hospital refers to the Altnagelvin Area Hospital PCI centre, which provides the primary PCI service for Letterkenny University Hospital.

¹⁰ 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=1,347).

REPERFUSION THERAPY FOR PATIENTS WITH A STEMI

The provision of reperfusion to eligible patients is a key quality indicator (KQI), with a target of 95%, reported quarterly within the IHAA. Timely primary PCI is recognised internationally as the preferred treatment for a 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). In 2025, 95% of eligible patients received reperfusion, either primary PCI or thrombolysis, achieving the 95% target.



The proportion of patients who received a primary PCI decreased from 86% in 2017 to 78% in 2025

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

TARGET: 95% 2025 RESULT: 95%



The proportion of patients who received a primary PCI decreased from 86% (n=1,232) in 2017 to 78% (n=1,287) in 2025 (Figure 5.4), and the proportion of patients who received thrombolysis increased from 3% in 2017 to 6% in 2025. There is notable variation in thrombolysis rates across PCI centres.¹¹ In St James's Hospital, the thrombolysis rate increased from 9% in 2017 to 12% (n=55) in 2025 (NOCA, 2022). This contrasts with the Mater Misericordiae University Hospital, where fewer than five patients received thrombolysis in both 2017 and 2025, indicating no significant change over time (NOCA, 2022). University Hospital Galway consistently reports higher than average thrombolysis rates, with some fluctuation observed: 11% in 2017, 8% in 2018, and 14% in 2025. These differences can be partly explained by geographic factors; for example, University Hospital Galway serves a large, predominantly rural catchment area, where thrombolysis remains the more practical reperfusion strategy in many cases. In contrast, St James's Hospital serves a more urban population located closer to the PCI centre, making primary PCI more accessible. The increasing use of thrombolysis in this more urban region suggests evolving referral practices.

Eleven per cent (n=179) of patients with a STEMI in 2025 had a contraindication to reperfusion, and 5% (n=74) did not require reperfusion after angiography. The distribution of reperfusion types was similar between sexes (Table 5.1). The proportion of patients who had a contraindication to reperfusion has fluctuated over the years, from 7% in 2020 to 11% (n=179) in 2025. As in previous years, the most common contraindication in 2025 was late (after more than 12 hours) presentation to the hospital (2025: 77% (n=138); 2024: 86% (n=152); 2023: 91%; 2022: 90%). The contraindications recorded for the remaining 23% (n=41) of patients were multifactorial and included resolving symptoms and cases where the patient was too unwell to proceed with reperfusion. A higher proportion of male patients with a STEMI (81%; n=105) were contraindicated as a result of delayed presentation compared with female patients (66%; n=33) ([Appendix 4](#)).

¹¹ Thrombolysis is administered in non-PCI-capable hospitals prior to transfer to the PCI centre.

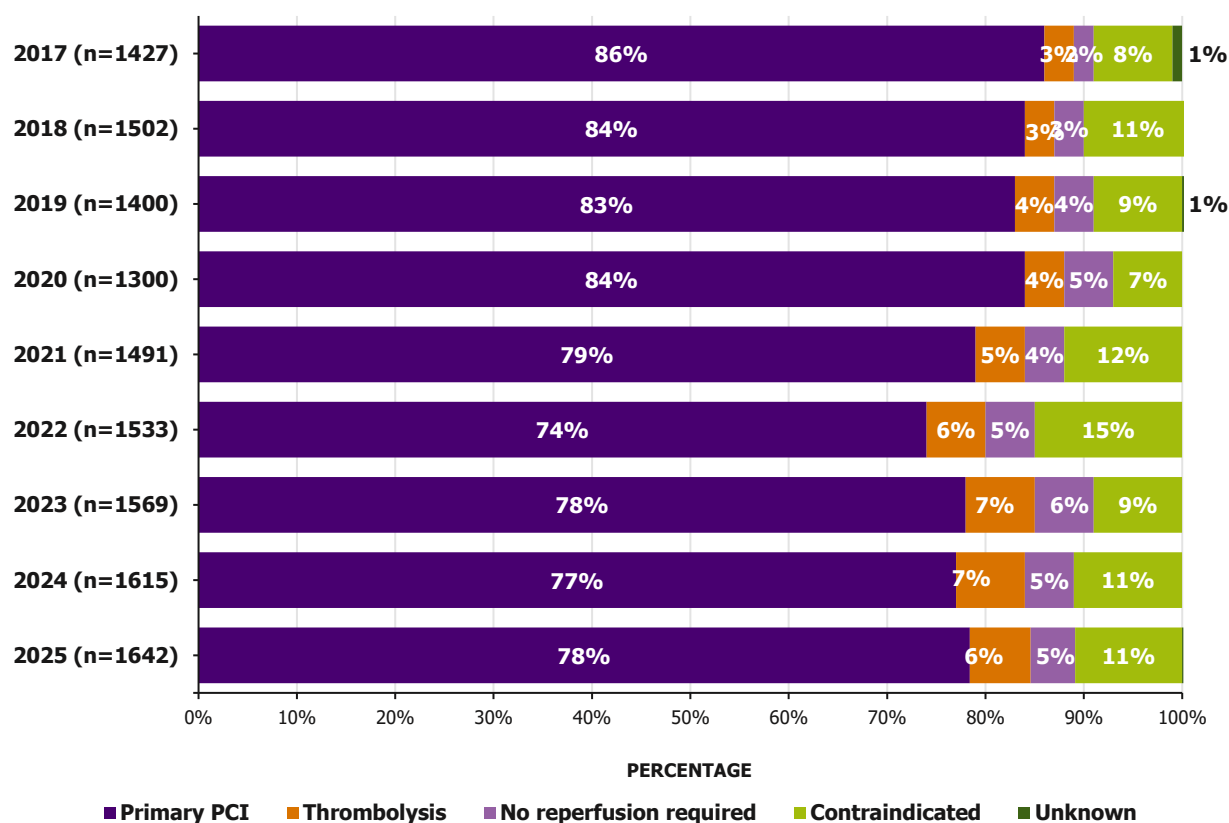


FIGURE 5.4: FIRST REPERFUSION THERAPY TYPE FOR PATIENTS ADMITTED TO A PCI CENTRE WITH A CONFIRMED STEMI, BY YEAR, 2017–2025 (N=13,479)

TABLE 5.1: FIRST REPERFUSION THERAPY TYPE FOR PATIENTS ADMITTED TO A PCI CENTRE WITH A CONFIRMED STEMI, BY HOSPITAL (N=1,642)

		Total	
		N	%
St James's Hospital	Thrombolysis	55	12%
	Primary PCI	344	77%
	No reperfusion required	*	*
	Contraindicated	30	7%
	Unknown	-	*
	Total	448	100%
Mater Misericordiae University Hospital	Thrombolysis	0	0%
	Primary PCI	285	81%
	No reperfusion required	17	5%
	Contraindicated	50	14%
	Unknown	0	0%
	Total	352	100%
Cork University Hospital	Thrombolysis	12	6%
	Primary PCI	151	73%
	No reperfusion required	8	4%
	Contraindicated	36	17%
	Unknown	0	0%
	Total	207	100%
University Hospital Limerick	Thrombolysis	-	*
	Primary PCI	166	87%
	No reperfusion required	-	*
	Contraindicated	19	10%
	Unknown	0	0%
	Total	190	100%
University Hospital Galway	Thrombolysis	28	14%
	Primary PCI	130	63%
	No reperfusion required	19	9%
	Contraindicated	28	14%
	Unknown	0	0%
	Total	205	100%
University Hospital Waterford	Thrombolysis	-	*
	Primary PCI	115	91%
	No reperfusion required	9	7%
	Contraindicated	-	*
	Unknown	0	0%
	Total	127	100%
Letterkenny University Hospital	Thrombolysis	-	*
	Primary PCI	*	*
	No reperfusion required	0	0%
	Contraindicated	-	*
	Unknown	0	0%
	Total	54	100%
Beaumont Hospital†	Thrombolysis	0	0%
	Primary PCI	*	*
	No reperfusion required	-	*
	Contraindicated	0	0%
	Unknown	0	0%
	Total	21	100%
Tallaght University Hospital†	Thrombolysis	-	*
	Primary PCI	*	*
	No reperfusion required	0	0%
	Contraindicated	12	63%
	Unknown	0	0%
	Total	19	100%
St Vincent's University Hospital†	Thrombolysis	0	0%
	Primary PCI	19	100%
	No reperfusion required	0	0%
	Contraindicated	0	0%
	Unknown	0	0%
	Total	19	100%
Total	Thrombolysis	101	6%
	Primary PCI	1287	78%
	No reperfusion required	*	*
	Contraindicated	179	11%
	Unknown	-	*
	Total	1642	100%

† Non-designated 9.00am to 5.00pm, Monday to Friday PCI centre.

- Denotes five cases or fewer.

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

REPERFUSION THERAPY TYPE BY REFERRAL SOURCE

How patients access care initially may influence the type of reperfusion therapy they receive. If a patient self-presents with a STEMI to a non-PCI-capable 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).

The type of reperfusion therapy by referral source is displayed in Figure 5.5. Among patients with a STEMI who arrived directly at a PCI centre in 2025, the vast majority (n=939; 87%) had a primary PCI; this is unchanged from 2024 (87%). Among patients who initially presented to non-PCI-capable hospitals, 62% (n=338) were transferred to a PCI centre for primary PCI, while 18% (n=95) of patients had thrombolysis as their initial reperfusion strategy.

Similarly to previous years, Cork University Hospital, St James's Hospital and University Hospital Galway had 30% or more patients thrombolysed prior to transfer, compared with less than 6% in the other PCI centres. This could reflect longer travel distance or improved adherence to the ORS protocol, and greater clinician experience and comfort in administering thrombolysis in non-PCI-capable hospital EDs.



FIGURE 5.5: REPERFUSION THERAPY TYPE, BY REFERRAL SOURCE AND PCI CENTRE (n=1,629)¹²

¹² Directly admitted to a PCI centre' includes patients who arrived at the PCI centre directly via ambulance, those who were already 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, and Tallaght University Hospital. Data on reperfusion therapy type for these hospitals are included in the corresponding frequency table in [Appendix 4](#).

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 5.6 displays the proportion of patients who received each type of arterial access in each PCI centre in 2025. The majority of patients (n=1,214; 94%) received Primary PCI through radial access. Although the 2025 results remain consistent with 2024 (93%), nationally they remain slightly below the 95% KQI 4 target. The type of arterial access varied slightly between hospitals, with five Primary PCI centres (Cork University Hospital, Letterkenny University Hospital, University Hospital Galway, University Hospital Limerick, and University Hospital Waterford) and one non-designated 9.00am to 5.00pm PCI centre (Tallaght University Hospital) reaching the 95% KQI 4 target in 2025.

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

TARGET: 95% 2025 RESULT: 94%

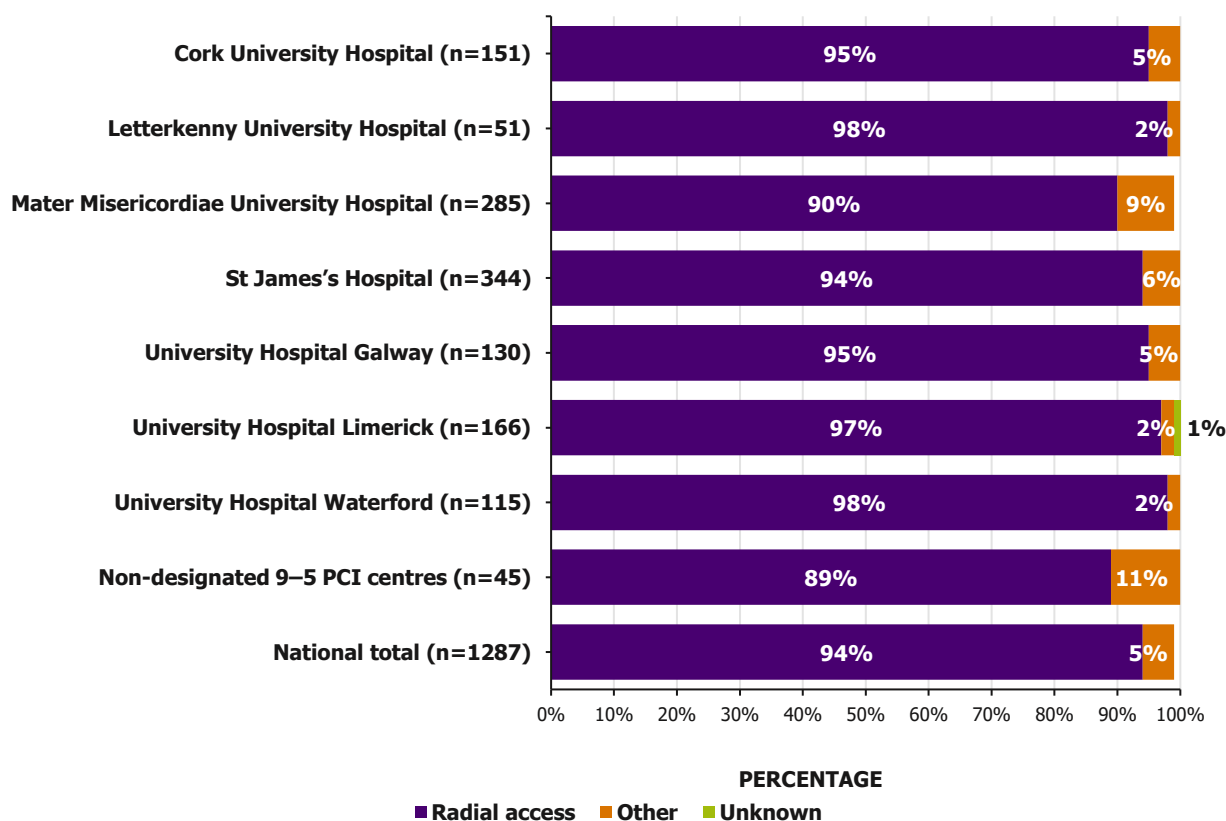


FIGURE 5.6: TYPE OF ARTERIAL ACCESS BY PCI CENTRE (n=1,287) ^{13,14}

¹³ Figure 5.6 includes only patients who were not contraindicated and had a primary PCI performed.

¹⁴ Non-designated 9.00am to 5.00pm weekday PCI centres include Beaumont Hospital, St Vincent's University Hospital, and Tallaght University Hospital.

KEY FINDINGS FROM CHAPTER 5

- Only 55% of patients with a STEMI arrived directly by ambulance to a PCI centre.
- Only 48% of patients who arrived directly by ambulance to a PCI centre called for help within 60 minutes of symptom onset in 2025, similar to 45% (n=402) in 2024.
- 77% (n=1,036) of patients with a STEMI who arrived at a Primary PCI centre by ambulance, either directly or transferred, were brought directly to the cath lab.
- Primary PCI was performed in 87% of patients who presented directly to a PCI centre, compared with 62% of those who initially presented to a non-PCI-capable hospital.

CHAPTER 6

PATHWAY TO TIMELY REPERFUSION



CHAPTER 6: PATHWAY TO TIMELY REPERFUSION

Reporting on the patient pathway to timely reperfusion is complex and varies according to treatment location and the way patients initially access STEMI care. This chapter presents the key time intervals to reperfusion for all patients with STEMI and further evaluates three patient cohorts, stratified by source of referral to the PCI centre:

1. patients with a STEMI who arrived directly by ambulance to a primary PCI centre
2. patients with a STEMI who presented initially to a non-PCI-capable hospital and were transferred by ambulance to a PCI centre
3. patients with a STEMI who self-presented to a PCI centre.

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 optimal reperfusion service protocol does not recommend transfer to these sites for primary PCI. Due to the small number of patients in individual hospitals, caution should be applied when interpreting these results. [Appendix 7](#) provides detailed definitions of each data point used to calculate the time intervals described in this chapter.

DEFINING TIMELY REPERFUSION

Timely primary PCI is recognised internationally as the preferred treatment for a 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 6.1 displays definitions for timely primary PCI and timely thrombolysis. 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. The ESC acute coronary syndromes 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 DTB time to 60 minutes in order to facilitate the initial assessment and diagnosis in the ED.

TABLE 6.1: DEFINITION OF TIMELY PRIMARY PCI AND TIMELY THROMBOLYSIS

Timely primary PCI	Timely primary PCI is defined as an interval between the FMC and balloon/wire cross of 120 minutes or less (Byrne <i>et al.</i>, 2023; HSE, 2012). The FMC is defined as the time of the first diagnostic ECG. For all patients with STEMI who arrive at a PCI centre by ambulance (either directly or by inter-hospital transfer), three key time intervals are measured to evaluate the pathway to timely reperfusion with primary): 1. FMC to door within 90 minutes: In order to meet the timely primary PCI target of 120 minutes or less, the time from FMC to arrival at the PCI centre, known as FMC to door (FMCTD), should be within 90 minutes. 2. DTB within 30 minutes: In order to meet the timely primary PCI target of 120 minutes or less, the time between arrival at the PCI centre (door) and the time of reperfusion (balloon/wire cross) should be within 30 minutes. This is referred to as the DTB time. 3. FMC to balloon within 120 minutes: Timely primary PCI is considered to have been achieved when the time between FMC and balloon/wire cross is 120 minutes or less (Byrne <i>et al.</i>, 2023; HSE, 2012). This is known as FMC to balloon (FMCTB). For those who self-present to PCI centres, timely primary PCI is defined as the time between arrival at the PCI centre and balloon/wire cross being 60 minutes or less (Byrne <i>et al.</i>, 2023).
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 <i>et al.</i>, 2011). 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 time of the first diagnostic electrocardiogram (ECG).

TIMELINESS OF REPERFUSION FOR ALL PATIENTS WITH A STEMI

In 2025, 59% of patients received timely reperfusion, primary PCI and thrombolysis combined, similar to 58% in 2024 but well below the national target of 90%. Timely primary PCI was achieved in 62% of patients, similar to 61% in 2024. Table 6.2 shows the timeliness of primary PCI by source of referral to the PCI centre. Each of these cohorts is presented in further detail within this chapter.

Timeliness of thrombolysis remains low at 27% but has increased from 22% in 2024. While these findings have shown an increase in timeliness of reperfusion compared to 2024, there has been a decrease in timely reperfusion since 2017 (Figure 6.1), highlighting the need for continued focus on QI to reverse this pattern.

TABLE 6.2: TIMELY REPERFUSION, MEDIAN AND INTERQUARTILE RANGE, BY REPERFUSION TYPE AND REFERRAL SOURCE

		Number of patients	Proportion receiving timely reperfusion	Median (h:mm)	IQR 1 (h:mm)	IQR 3 (h:mm)
Total	All timely reperfusion	1357	59%			
	Timely primary PCI	1257	62%	1:43	1:17	2:19
	Timely primary PCI: directly admitted	796	77%	1:35	1:13	1:58
	Timely primary PCI: self-presented	123	28%	1:32	0:57	2:29
	Timely primary PCI: transferred to a PCI centre	338	37%	2:19	1:44	3:17
	Thrombolysis	100	27%	0:51	0:30	1:14

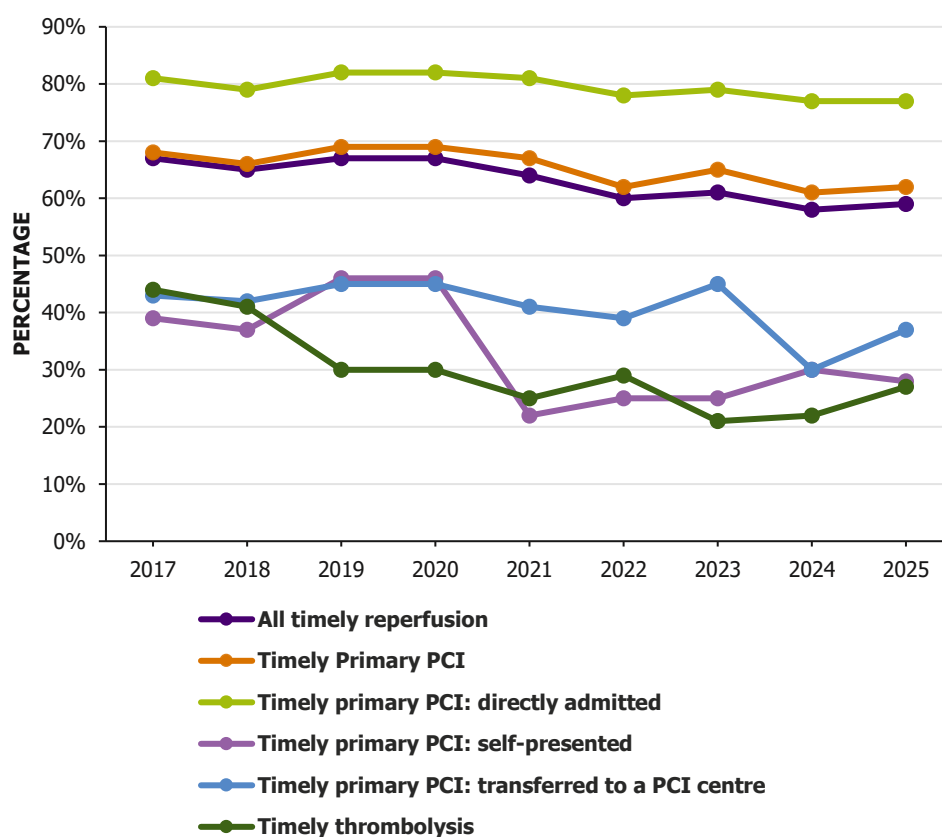


FIGURE 6.1: PROPORTION OF TIMELY REPERFUSION BY REPERFUSION TYPE AND REFERRAL SOURCE, 2017-2025

FIRST MEDICAL CONTACT TO DOOR

As described in Table 6.1, evaluation of both the FMCTD time interval and the DTB time interval may help to identify where there might be modifiable systemic delays. For the overall population with a STEMI, the median FMCTD time was 77 minutes (IQR: 49–113 minutes), increased from 73 minutes (IQR: 46–106 minutes) in 2023 (NOCA, 2024b). Table 6.3 shows that the FMCTD target of 90 minutes was achieved in 61% of cases. This target was achieved in 79% of those who were brought directly by ambulance to the PCI compared to 29% of those who initially presented in a non-PCI capable hospital and were then transferred to the PCI centre. This result will be further evaluated by PCI centre later in this chapter.

TABLE 6.3: FIRST MEDICAL CONTACT TO DOOR WITHIN 90 MINUTES

	n	%	Median (IQR 1–IQR 3) minutes
Direct via ambulance	763	79	60 (42–84)
Transfer from other hospital	447	29	119 (85–185)
Total	1210	61	77 (49–113)

DOOR TO BALLOON

The time of arrival at the PCI centre is an essential variable for reporting metrics such as the time from door to balloon. The IHAA data dictionary defines the time of arrival as the time the ambulance arrives at the hospital. However, this is sometimes missing from the medical record and the time of arrival at the cath lab is used as a surrogate. The IHAA plans to review how much variation exists among PCI centres and will work with the National Ambulance Service to ensure ease of access to this information.

As defined in Table 6.1, the DTB target, for those who are brought directly by ambulance to the PCI centre and for those who initially present in a non-PCI capable hospital and are then transferred to the PCI centre, is 30 minutes. For those who self-present to a PCI centre the DTB target is 60 minutes. For the overall population with a STEMI, Table 6.4 shows that the DTB targets were achieved in 54% of cases, consistent with 54% in 2024. The target of 30 minutes was achieved in 54% of those who were brought directly by ambulance to the PCI compared to 62% of those who initially presented in a non-PCI capable hospital and were then transferred to the PCI centre. These results will be further evaluated by PCI centre later within this chapter.

TABLE 6.4: DOOR TO BALLOON WITHIN TARGET

	n	%	Median (IQR 1–IQR 3) minutes
Directly admitted to a PCI centre (target: 30 mins)	796	54	29 (20–45)
Self-presented to a PCI centre (target: 60 mins)	123	29	92 (57–149)
Transferred to PCI centre (target: 30 mins)	338	62	25.5 (20–37)
Total	1257	54	30 (20–51)

TIMELINESS OF PRIMARY PCI FOR PATIENTS WHO ARRIVED DIRECTLY BY AMBULANCE TO A PCI CENTRE

For patients with a STEMI who arrive at a PCI centre directly by ambulance, timely primary PCI is considered to have been achieved when the time between FMC and balloon/wire cross is 120 minutes or less (Byrne *et al.*, 2023; HSE, 2012). This is known as FMC to balloon (FMCTB). There are two additional key time intervals to timely reperfusion with primary PCI (Figure 6.2):

- 1. FMC to door within 90 minutes:** In order to meet the timely primary PCI target of 120 minutes or less, the time from FMC to arrival at the PCI centre, known as FMC to door (FMCTD), should be within 90 minutes.
- 2. DTB within 30 minutes:** In order to meet the timely primary PCI target of 120 minutes or less, the time between arrival at the PCI centre (door) and the time of reperfusion (balloon/wire cross) should be within 30 minutes. This is referred to as the DTB time.

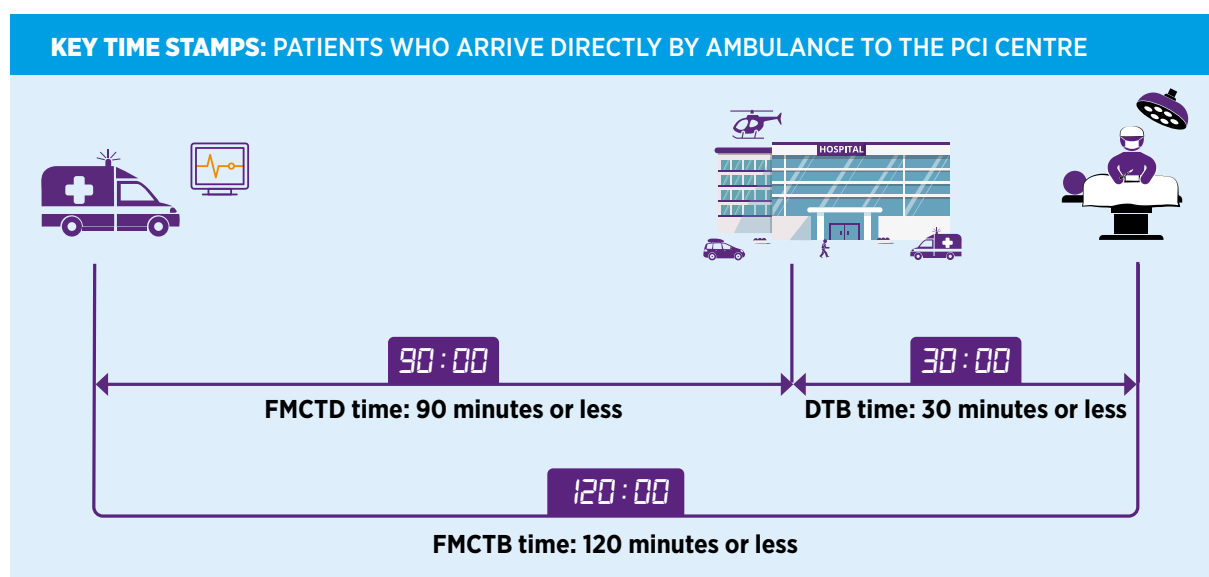


FIGURE 6.2: KEY TIME INTERVALS TO TIMELY PRIMARY PCI FOR THOSE WHO ARRIVED DIRECTLY BY AMBULANCE TO A PCI CENTRE

TIMELY REPERFUSION BY PRIMARY PCI: DIRECT BY AMBULANCE

Seventy-seven per cent (n=615) of patients with a STEMI who were admitted directly to a PCI centre in 2025 had timely reperfusion, which is unchanged from 77% in 2024 (Figure 6.3). As seen in Figure 6.4, the median FMCTB time for patients admitted directly by ambulance to a PCI centre in 2025 was 95 minutes (IQR: 73–118 minutes). The boxplot shows the distribution of time to primary PCI. The ‘whiskers’ highlight the minimum and maximum values (excluding any statistical outliers). The box highlights the interquartile range, meaning that 50% of the data fall within this range (Figure 6.4). The median is the darker line in the middle of this box. The bottom box is the lower quartile (IQR1) and the top box is the upper quartile (IQR3). More boxplots are provided for patients who were transferred and who self-presented to PCI centres in Figures 6.9 and 6.16.

In the IHAA dashboard, KQI 2 refers to all of those who arrived at a PCI centre directly and received timely primary PCI. Patients who self-presented to the PCI centre are included in the calculation but in this report, they are reported separately. In 2026, the IHAA dashboard will be amended to reflect the patients who self-present as a separate group; please see Chapter 9 for further information.

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

TARGET: 90% 2025 RESULT: 77%

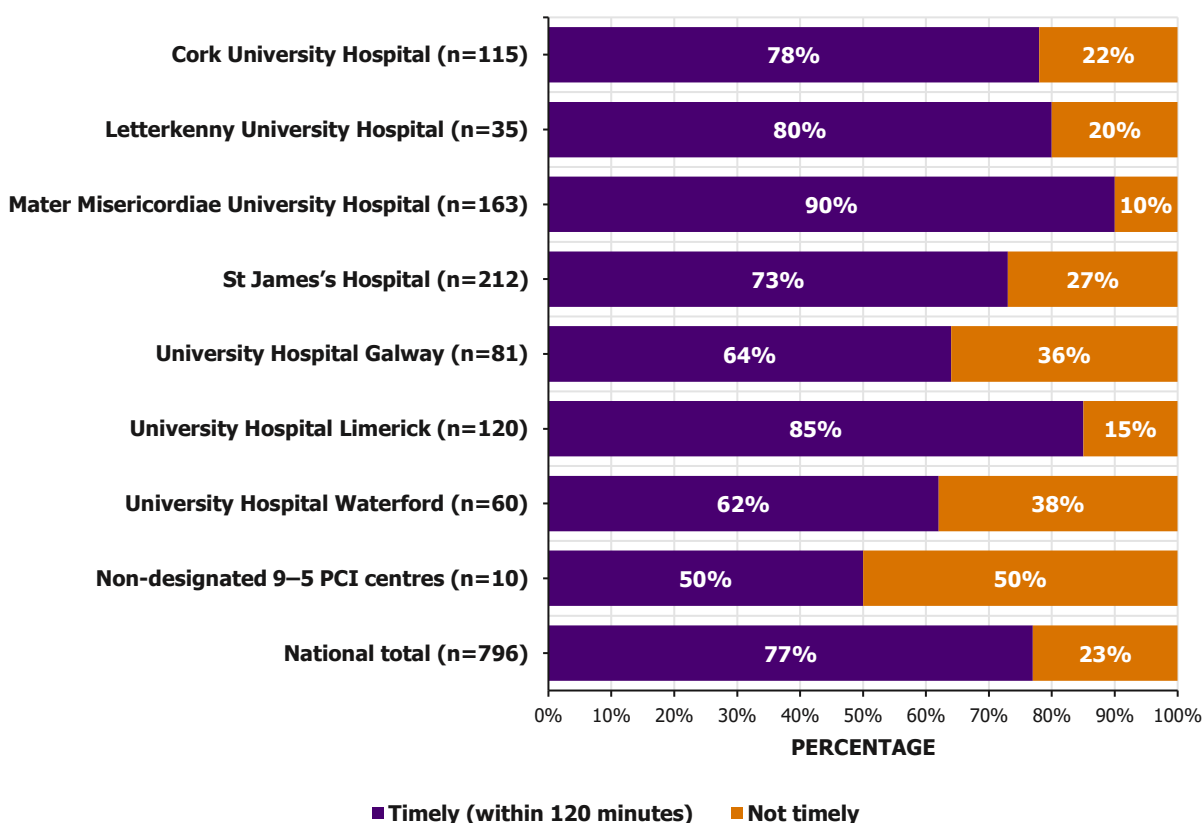


FIGURE 6.3: PROPORTION OF PATIENTS WHO RECEIVED TIMELY PRIMARY PCI FOR THOSE ADMITTED DIRECTLY TO A PCI CENTRE, BY PCI CENTRE (n=796)¹⁵

¹⁵ Non-designated 9.00am to 5.00pm weekday PCI centres include Beaumont Hospital, St Vincent's University Hospital, and Tallaght University Hospital. Data on timeliness for these hospitals are included in the corresponding frequency table in [Appendix 4](#).

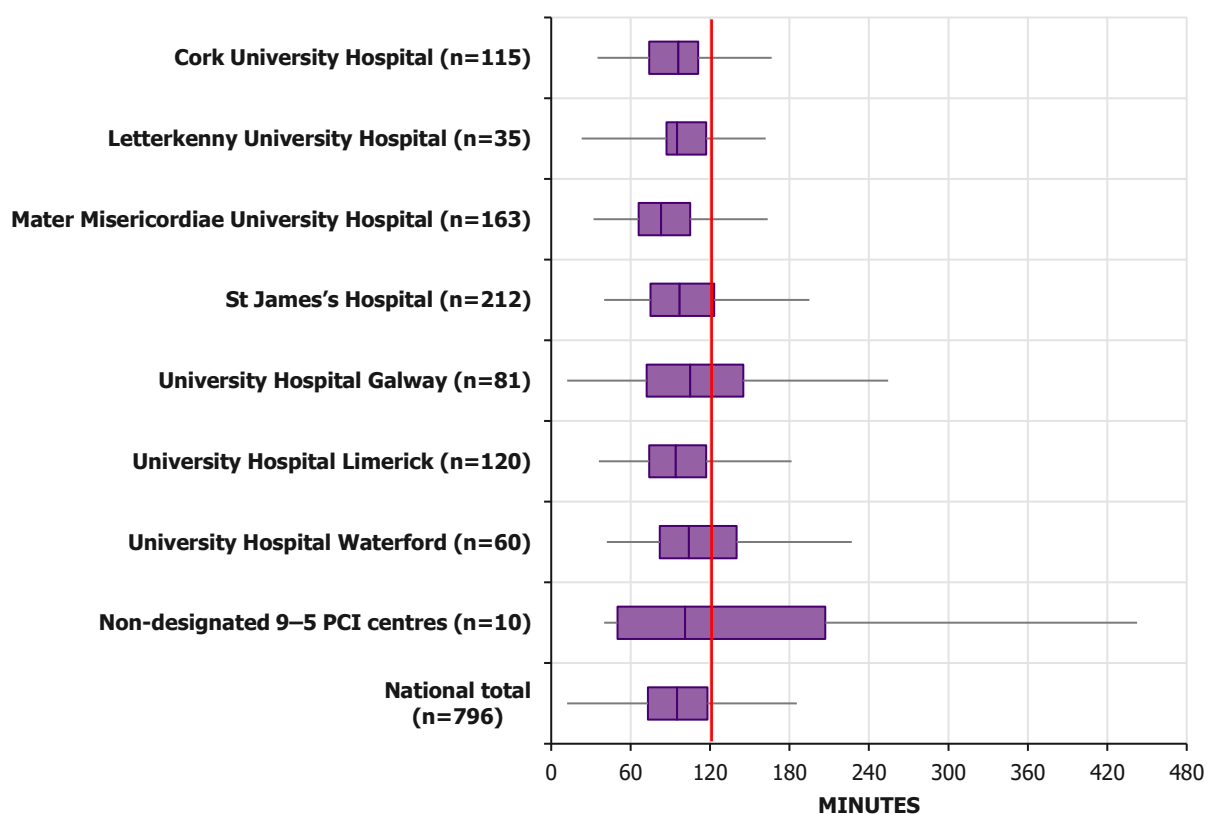


FIGURE 6.4: TIME (MINUTES) TO PRIMARY PCI FOR THOSE DIRECTLY ADMITTED TO A PCI CENTRE, BY PCI CENTRE (n=796)^{16,17}

¹⁶ Hospitals with fewer than five cases are removed from the figure, but are included in the overall total.

¹⁷ Statistical outliers are not included in the figure. Outliers were determined by calculating upper and lower thresholds. Lower threshold: $IQR1 - (1.5 \times IQR)$. Upper threshold: $IQR3 + (1.5 \times IQR)$.

FIRST MEDICAL CONTACT TO DOOR

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 6.5 shows the proportion of patients with a STEMI in 2025 who arrived at the PCI centre within the target of 90 minutes or less, by PCI centre. In 2025, 79% (n=599) of patients achieved a timely FMCTD time; this was an improvement from 76% in 2024. The median FMCTD time for all patients who arrived at a PCI centre directly by ambulance in 2025 was 59 minutes (interquartile range (IQR): 42–84 minutes), an improvement from 62 minutes (IQR: 41–88 minutes) in 2024.

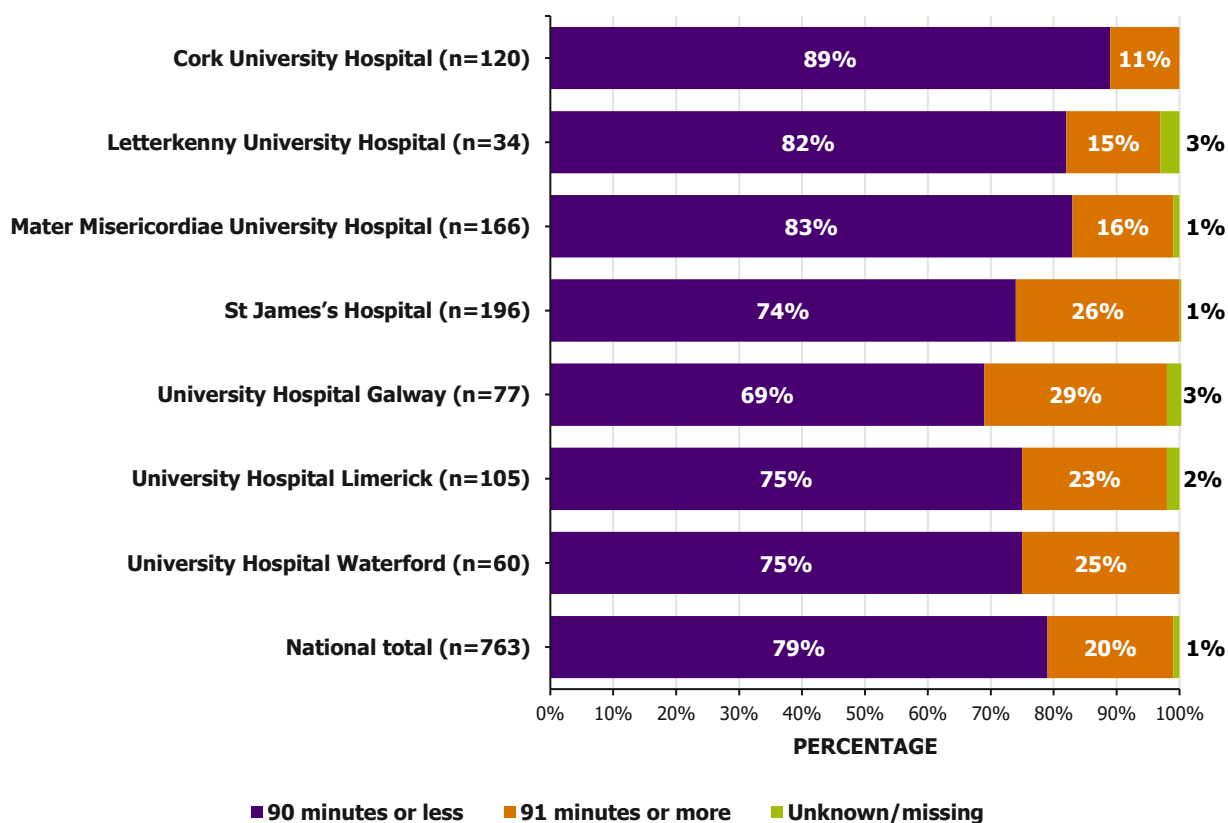


FIGURE 6.5: PROPORTION OF PATIENTS WITH A STEMI WHO ARRIVED AT A PCI CENTRE DIRECTLY BY AMBULANCE WITHIN THE TARGET TIME OF 90 MINUTES, BY PCI CENTRE (n=763)^{18,19}

¹⁸ Beaumont Hospital, St Vincent's University Hospital, and Tallaght University Hospital are not presented individually in Figure 5.8, as they had fewer than five patients each, but they are included in the national figure.

¹⁹ Patients who had hospital or pre-hospital thrombolysis were excluded from Figure 5.8. Only patients who had their first 12-lead ECG performed by an ambulance practitioner were included in the analysis.

DOOR TO BALLOON

In 2025, of those patients who arrived directly by ambulance to a PCI centre, 54% (n=433) achieved a DTB time of 30 minutes or less, a marginal decrease from 2024 (55%). However, the DTB results for those who were admitted directly to a PCI centre in 2025 are not directly comparable to 2024, because in 2024 the directly admitted cohort also included in-patients in the PCI centre. These cases are now excluded from this group in order to align with the proposed IHAA dashboard changes in 2026 as outlined in Chapter 9. There was variation between PCI centres in achieving a DTB time of 30 minutes or less, ranging from 69% (n=113) in the Mater Misericordiae University Hospital to 41% (n=47) in Cork University Hospital (Figure 6.6).

This variation warrants further investigation within each PCI centre to understand, and correct where possible, delays/ local factors contributing to the variation. Non-designated 9.00am to 5.00pm weekday PCI centres had a very low number of patients achieving a DTB time of 30 minutes or less in 2025.

The median DTB time for patients admitted directly to a PCI centre was 29 minutes (IQR: 20–45 minutes) in 2025. Frequency tables in Appendix 4 display the median DTB times and IQRs for each of the PCI centres.

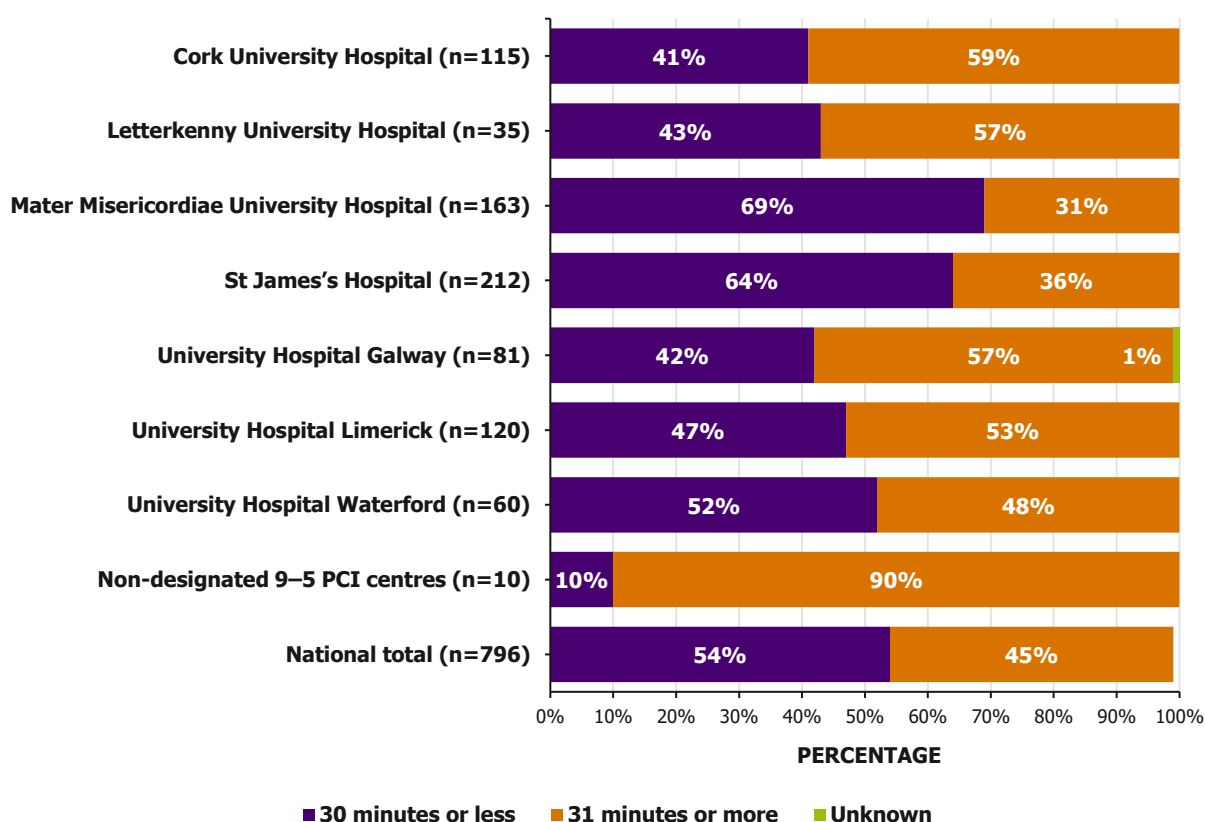


FIGURE 6.6: DOOR TO BALLOON TIME FOR PATIENTS WHO ARRIVED DIRECTLY BY AMBULANCE TO A PCI CENTRE, BY PCI CENTRE (n=796)^{20,21}

²⁰ Non-designated 9.00am to 5.00pm weekday PCI centres include Beaumont Hospital, St Vincent's University Hospital, and Tallaght University Hospital. DTB times for these hospitals are included in the corresponding frequency table in Appendix 4.

²¹ 'Directly admitted to a PCI centre' includes patients who arrived at a PCI centre directly via ambulance and those who were inpatients in a PCI centre.

TIMELINESS OF PRIMARY PCI FOR PATIENTS WHO INITIALLY PRESENTED TO A NON-PCI-CAPABLE HOSPITAL AND TRANSFERRED BY AMBULANCE TO A PCI CENTRE

For those who initially present to a non-PCI-capable hospital and are transferred by ambulance to a PCI centre, timely primary PCI is considered to have been achieved when the FMCTB is 120 minutes or less (Byrne *et al.*, 2023; HSE, 2012).

There are four additional key time intervals to timely reperfusion with primary PCI (Figure 6.7):

- 1. Door to ECG within 10 minutes²²:** All patients with symptoms of a STEMI should have an ECG within 10 minutes of arrival at hospital.
- 2. Door In Door Out (DIDO) within 30 minutes:** All patients with a STEMI who require urgent transfer from a non-PCI-capable hospital to a PCI centre should achieve a DIDO²³ time of 30 minutes or less.
- 3. FMC to door of PCI centre within 90 minutes:** In order to meet the timely primary PCI target of 120 minutes or less, the time from FMC to arrival at the PCI centre (known as FMCTD) should be within 90 minutes.
- 4. Door of PCI centre to balloon within 30 minutes:** In order to meet the timely primary PCI target of 120 minutes or less, the time between arrival at the PCI centre (door) and the time of reperfusion (balloon/wire cross) should be within 30 minutes. This is referred to as the DTB time.

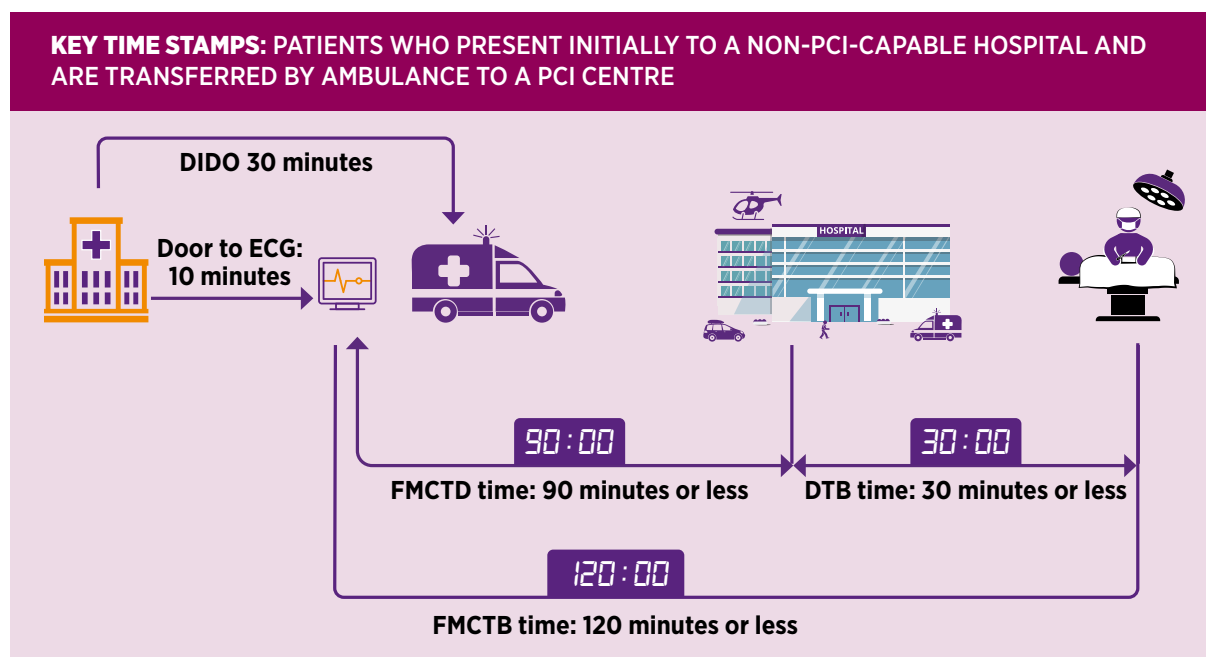


FIGURE 6.7: KEY TIME INTERVALS TO TIMELY PRIMARY PCI FOR PATIENTS WHO INITIALLY PRESENTED TO A NON-PCI-CAPABLE HOSPITAL AND TRANSFERRED BY AMBULANCE TO A PCI CENTRE

²² This is the 'first' ECG performed and different to the 'first positive/diagnostic' ECG reported on in 2024 (NOCA, 2026).

²³ This is the interval between the time of arrival at the first hospital and the time of leaving the first hospital.

TIMELY REPERFUSION BY PRIMARY PCI: TRANSFERRED

Patients who were transferred to a PCI centre from another hospital in 2025 achieved timely primary PCI in 37% of cases (n=125), which is a notable improvement from 30% in 2024. The median FMCTB time for transferred patients was 139 minutes (IQR: 104–197 minutes), improved from 146 minutes in 2024 (Figure 6.9). Figure 6.8 displays the timeliness of primary PCI, by PCI centre and referring hospital, for 2025.

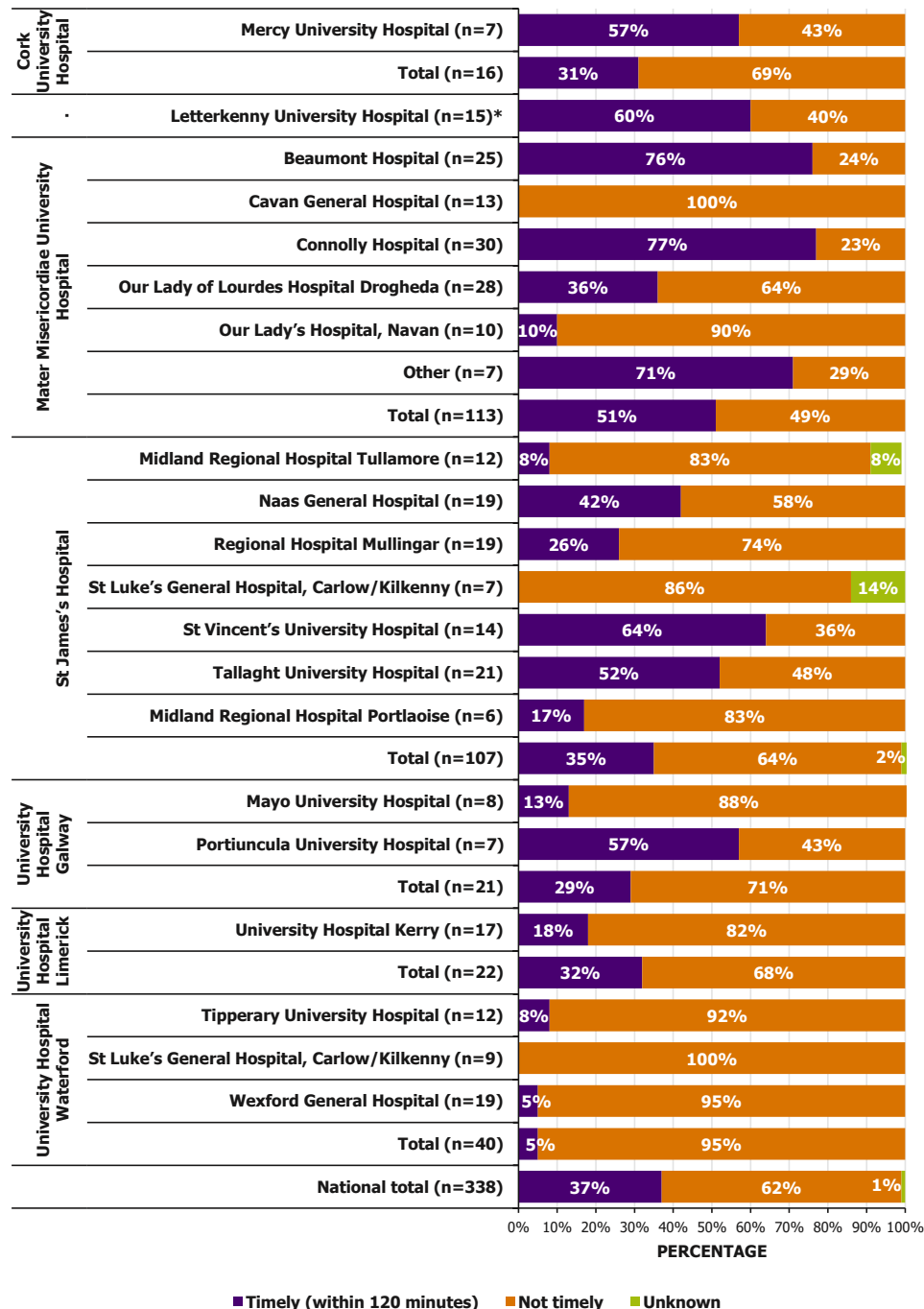


FIGURE 6.8: PROPORTION OF PATIENTS WHO WERE TRANSFERRED TO A PCI CENTRE WHO RECEIVED TIMELY PRIMARY PCI, BY REFERRING HOSPITAL (n=338)^{24,25}

²⁴ The cases reported for Letterkenny University Hospital (*) are cases where the patient initially presented to Letterkenny University Hospital (self-presented, already an in-patient or brought by ambulance for stabilisation prior to transfer) and were then transferred to Altnagelvin General Hospital for primary PCI.

²⁵ Data on timeliness for these hospitals are included in the corresponding frequency table in Appendix 4. Data on timeliness for hospitals that had five cases or fewer are not presented in Figure 6.8 but are included in the total.

KQ1 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

TARGET: 90% 2025 RESULT: 37%



FIGURE 6.9: TIME (MINUTES) TO PRIMARY PCI FOR THOSE WHO WERE TRANSFERRED TO A PCI CENTRE, BY REFERRING HOSPITAL (n=338)^{26,27,28}

²⁶ Hospitals with fewer than five cases are removed from the figure, but not the overall total.

²⁷ Statistical outliers are not included in the figure. Outliers were determined by calculating upper and lower thresholds.

Lower threshold: $IQR1 - (1.5 \times IQR)$. Upper threshold: $IQR3 + (1.5 \times IQR)$.

²⁸ The cases reported for Letterkenny University Hospital (*) are cases where the patient initially presented to Letterkenny University Hospital (self-presented, already an in-patient or brought by ambulance for stabilisation prior to transfer) and were then transferred to Altnagelvin General Hospital for primary PCI.

TIME FROM HOSPITAL ARRIVAL TO FIRST ECG

Heartbeat has previously recorded and reported the time of the first positive ECG. Following a recommendation made in the Irish Heart Attack Audit National Report 2022 and 2023 (NOCA, 2024b), Heartbeat now records the date and time of the first ECG and the date and time of the first positive ECG. Figure 6.10 presents the time from hospital arrival to the first ECG for all patients who presented to a non-PCI-capable hospital and had the ECG performed in the ED. This result is not comparable to previous IHAA reports as they reported on the time to the first positive ECG.

In 2025, 403 cases who had a STEMI diagnosed in the ED of a non-PCI-capable hospital. Of those, 38% (n=154) had the first ECG completed within 10 minutes.

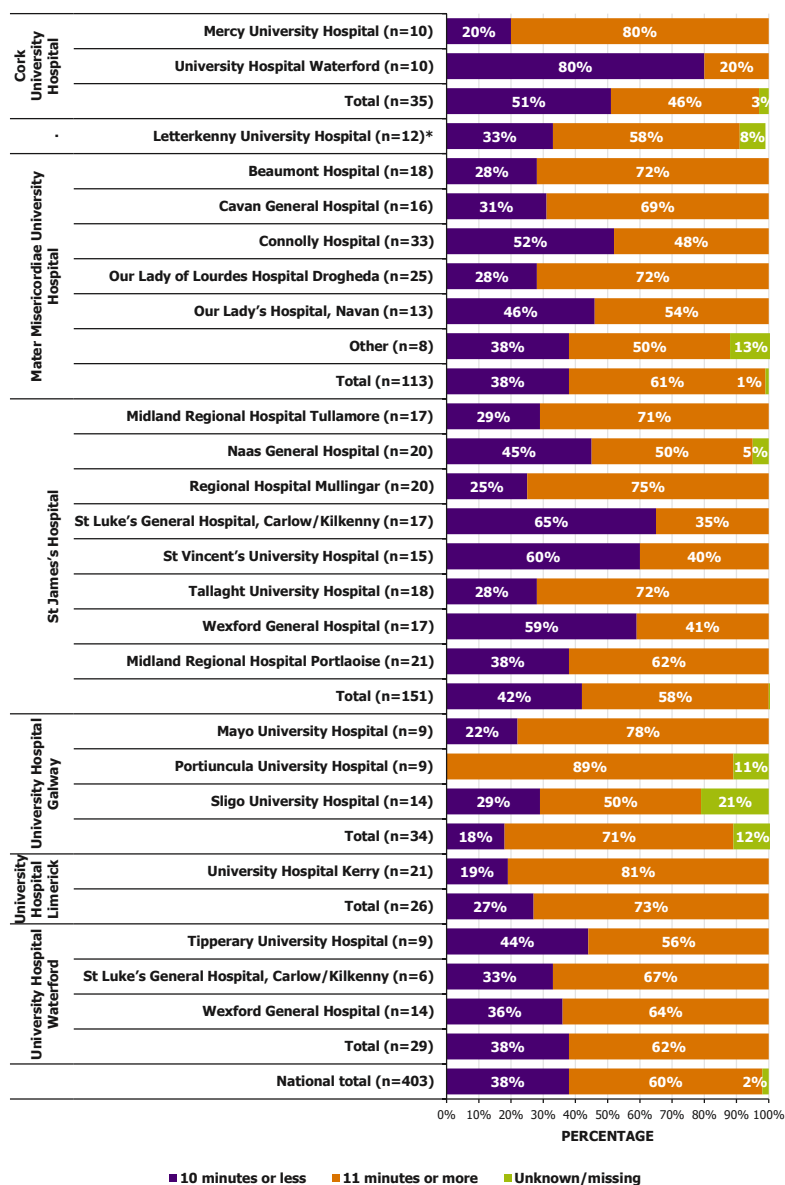


FIGURE 6.10: PROPORTION OF PATIENTS WITH A STEMI WHO WERE TRANSFERRED TO A PCI CENTRE AND WHO RECEIVED AN ELECTROCARDIOGRAM WITHIN 10 MINUTES, BY PCI CENTRE AND REFERRING HOSPITAL (n=403)^{29,30,31}

²⁹ These cases represent all those who had the first ECG in the ED, for cases who had primary PCI or thrombolysis.

³⁰ Hospitals that had fewer than five patients were excluded individually from Figure 5.13; however, they are included in the total figures, and in the corresponding frequency table (Appendix 4).

³¹ The cases reported for Letterkenny University Hospital (*) are cases where the patient initially presented to Letterkenny University Hospital (self-presented, already an in-patient or brought by ambulance for stabilisation prior to transfer) and were then transferred to Altnagelvin General Hospital for primary PCI.

DOOR IN DOOR OUT TIME

The interval between the time of hospital arrival and the first ECG is the first step in the pathway to timely primary PCI. The second recommendation for patients with a STEMI who present to a non-PCI-capable hospital, and who require urgent transfer to a PCI centre for primary PCI, is that they should achieve a DIDO time of 30 minutes or less.

In 2025, 447 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 for cases transferred from the ED (n=414) in the first hospital. This includes cases where the first positive ECG was diagnosed in the ED (n=362) and those diagnosed before arrival at the first hospital, either in the ambulance (n=41) or in a general practitioner (GP) surgery (n=11). Of the remaining cases, 33 patients had the first positive ECG in a hospital ward or coronary care unit or were already an inpatient in the hospital (in either a general ward or a coronary care unit/high dependency unit); these cases are excluded from this analysis.

The median DIDO time was 96 minutes (IQR: 60–186 minutes) in 2025. Figure 6.11 shows that only 4% (n=16) of patients with a STEMI achieved the DIDO target of 30 minutes or less. While this has marginally increased from 3% in 2024, the vast majority of patients do not meet the DIDO target. The median DIDO time for those who were diagnosed with a STEMI before arrival at the first hospital was 69 minutes (n=46; IQR: 50–103 minutes), and for those diagnosed in the ED, it was 100 minutes (n=335; IQR: 64–194 minutes).

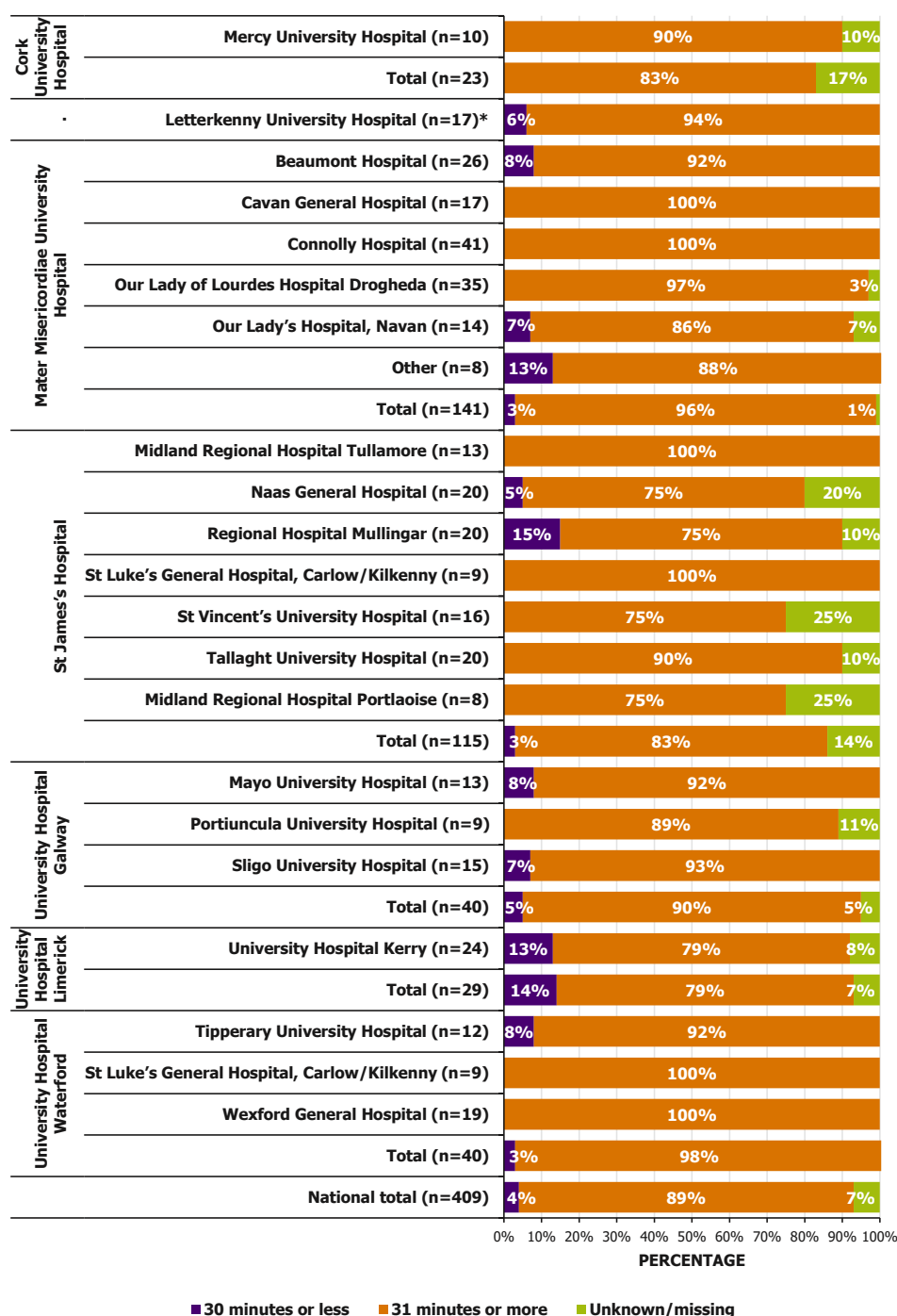


FIGURE 6.11: PROPORTION OF PATIENTS WITH A STEMI WHO WERE TRANSFERRED TO A PCI CENTRE AND WHO ACHIEVED THE 'DOOR IN DOOR OUT' TARGET OF 30 MINUTES OR LESS, BY PCI CENTRE AND REFERRING HOSPITAL (n=409)^{32,33}

³² Hospitals that had fewer than five patients were excluded individually from Figure 5.15.

³³ The cases reported for Letterkenny University Hospital (*) are cases where the patient initially presented to Letterkenny University Hospital (self-presented, already an in-patient or brought by ambulance for stabilisation prior to transfer) and were then transferred to Altnagelvin General Hospital for primary PCI.

FIRST MEDICAL CONTACT TO DOOR – TRANSFERRED

In 2025, 29% (n=130) of patients with a STEMI were transferred from the first hospital of arrival to a PCI centre within 90 minutes (Figure 6.12); this was an improvement from 26% in 2024. The median FMCTD time for patients with a STEMI who were transferred to a PCI centre for primary PCI was 117 minutes (IQR: 84–176 minutes) in 2025, an improvement from 126 minutes in 2024.

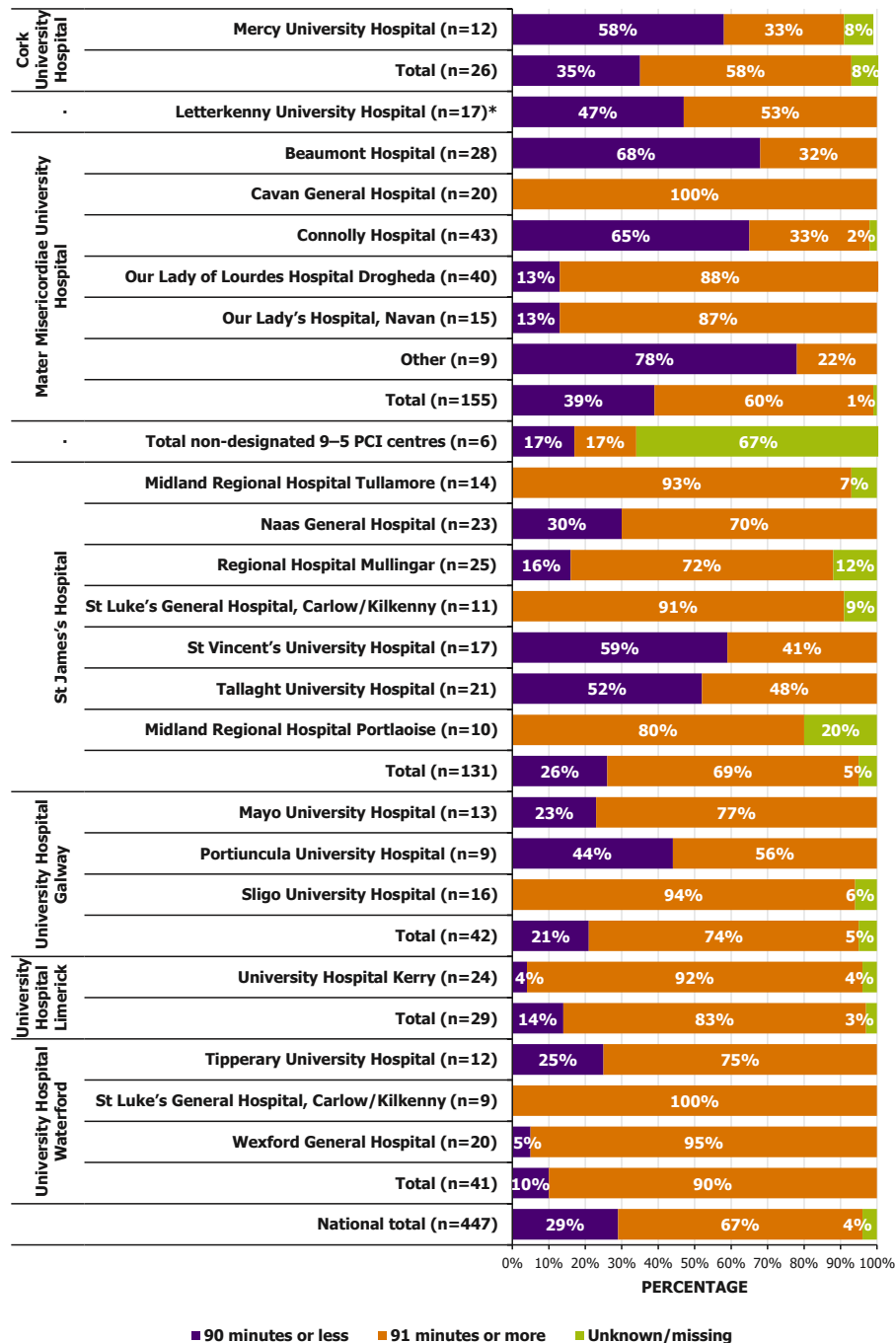


FIGURE 6.12: PROPORTION OF PATIENTS WITH A STEMI WHO WERE TRANSFERRED TO A PCI CENTRE AND WHO ARRIVED WITHIN THE TARGET TIME OF 90 MINUTES, BY PCI CENTRE (n=447)^{34,35}

³⁴ Non-designated 9.00am to 5.00pm PCI centres and hospitals that had five cases or fewer were excluded individually from Figure 6.12.

³⁵ The cases reported for Letterkenny University Hospital (*) are cases where the patient initially presented to Letterkenny University Hospital (self-presented, already an in-patient or brought by ambulance for stabilisation prior to transfer) and were then transferred to Altnagelvin General Hospital for primary PCI.

DOOR TO BALLOON TIME – TRANSFERRED

In 2025, of patients who were transferred to a PCI centre, 62% (n=210) achieved a DTB time of 30 minutes or less (Figure 6.13); this represented a slight decline from 63% in 2024. The median DTB time for those who were transferred to a PCI centre was 26 minutes (IQR: 20–37 minutes), unchanged from 2024. There was variation among PCI centres in achieving a DTB time of 30 minutes or less, ranging from 19% in University Hospital Galway to 82% in Mater Misericordiae University Hospital (Figure 6.10). This warrants further investigation within each PCI centre to understand and potentially correct delays/local factors contributing to the variation.

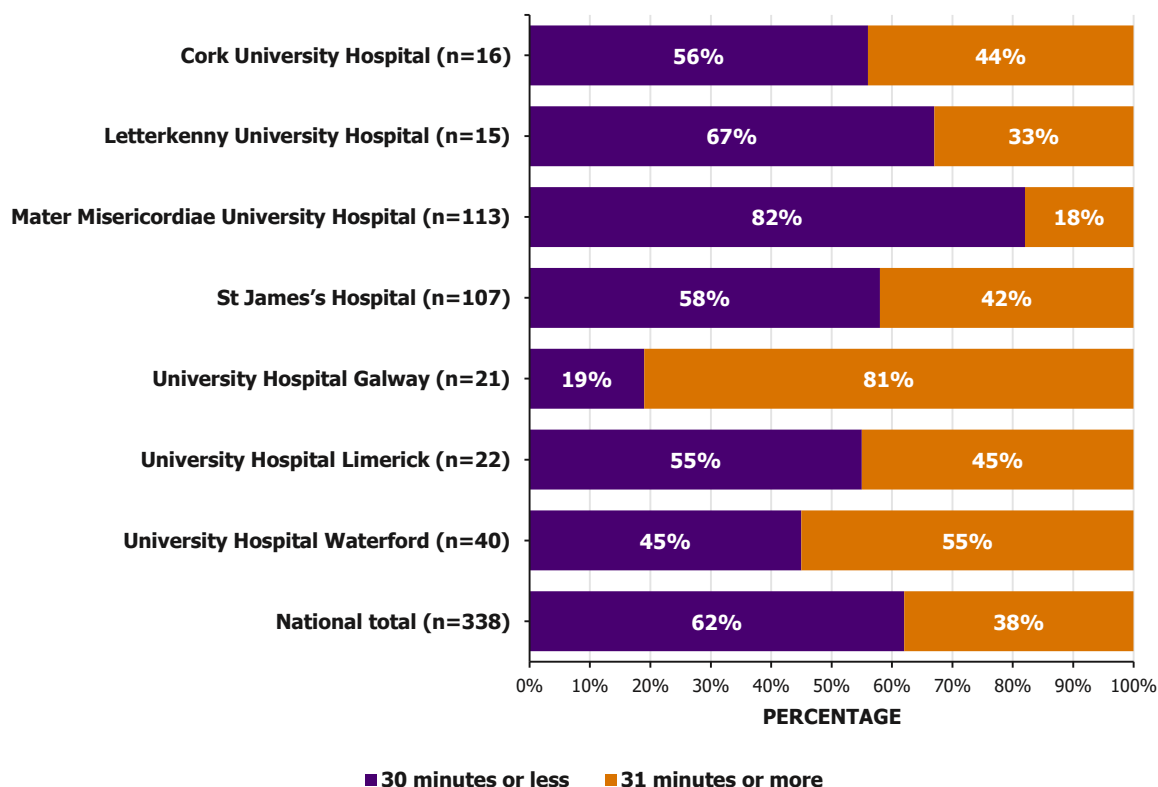


FIGURE 6.13: DOOR TO BALLOON TIME FOR PATIENTS WHO WERE TRANSFERRED TO A PCI CENTRE, BY PCI CENTRE (n=338)^{36,37}

³⁶ Non-designated 9.00am to 5.00pm weekday PCI centres include Beaumont Hospital, St Vincent's University Hospital, and Tallaght University Hospital. DTB times for these hospitals are included in the corresponding frequency table in [Appendix 4](#).

³⁷ Hospitals that had five patients or fewer were excluded individually from Figure 6.10.

TIMELINESS OF PRIMARY PCI FOR PATIENTS WHO SELF-PRESENTED TO A PCI CENTRE

For patients with a STEMI who self-present to a PCI centre, timely primary PCI is considered to have been achieved when the time between FMC and balloon/wire cross is 60 minutes or less (Byrne *et al.*, 2023).

There is one other key time interval to timely reperfusion with primary PCI:

1. **Door to ECG within 10 minutes:** All patients with symptoms of a STEMI should have an ECG within 10 minutes of arrival at hospital.

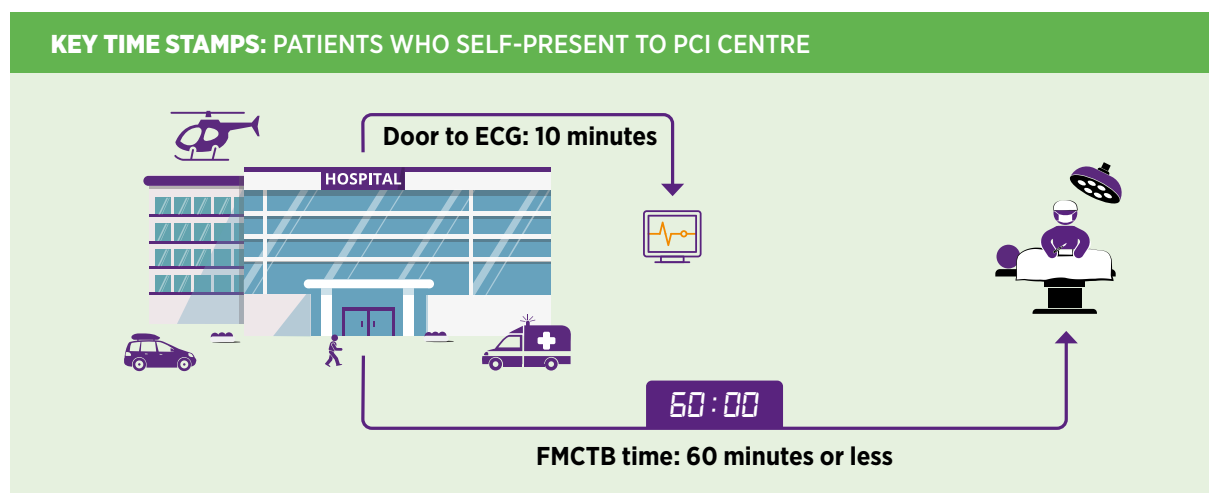


FIGURE 6.14: KEY TIME INTERVALS TO TIMELY PRIMARY PCI FOR PATIENTS WHO SELF-PRESENTED TO A PCI CENTRE

TIMELY REPERFUSION BY PRIMARY PCI FOR THOSE WHO SELF-PRESENTED TO A PCI CENTRE

Twenty-nine per cent (n=35) of patients with a STEMI who self-presented to a PCI centre in 2025 had timely primary PCI (Figure 6.15). The median FMCTB time for this cohort was 92 minutes (IQR: 57–149 minutes) (Figure 6.16).

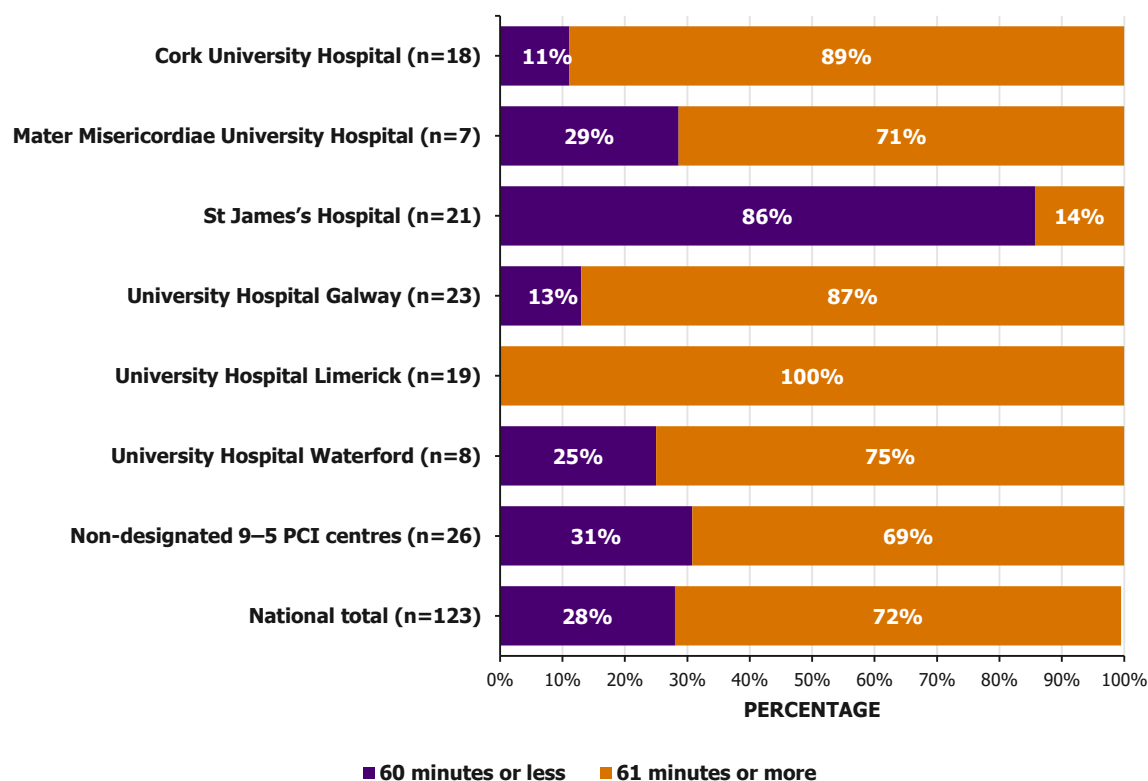


FIGURE 6.15: PROPORTION OF TIMELY PRIMARY PCI FOR PATIENTS WHO SELF-PRESENTED TO A PCI CENTRE, BY PCI CENTRE (n=123)^{38,39}

³⁸ Non-designated 9.00am to 5.00pm weekday PCI centres include Beaumont Hospital, St Vincent's University Hospital, and Tallaght University Hospital. Data on timeliness for these hospitals are included in the corresponding frequency table in [Appendix 4](#).

³⁹ Letterkenny University Hospital is excluded from the figure due to having less than 5 cases, but is included in the national total.

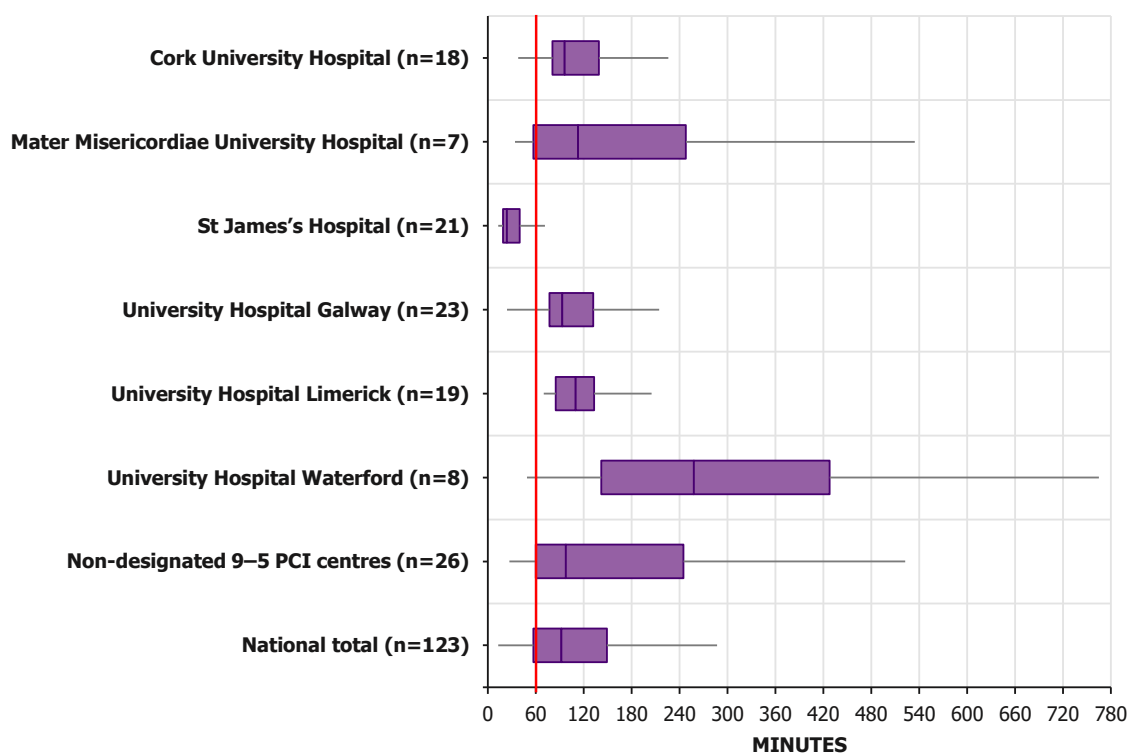


FIGURE 6.16: TIME (MINUTES) TO PRIMARY PCI FOR PATIENTS WHO SELF-PRESENTED TO A PCI CENTRE, BY PCI CENTRE (n=123)^{40,41}

⁴⁰ Hospitals with less than 5 cases are removed from the figure, but are included in the overall total.

⁴¹ Statistical outliers are not included in the figure. Outliers were determined by calculating upper and lower thresholds. Lower threshold: $IQR1 - (1.5 \times IQR)$. Upper threshold: $IQR3 + (1.5 \times IQR)$.

HOSPITAL ARRIVAL TO FIRST ECG

Reducing the time to ECG is a key opportunity to improve the speed of reperfusion delivery. Figure 6.17 presents the interval between the time of hospital arrival to the first ECG for patients who self-presented to a PCI centre and had their first ECG performed in the ED. This is important, as some patients may develop ECG changes over time with ongoing chest pain after arrival at hospital.

In 2025, 146 patients with a STEMI self-presented to a PCI centre and had the first ECG in the ED. Of those, 32% (n=47) had their first ECG within 10 minutes of arrival. The median time to first ECG for this cohort was 16 minutes (IQR: 9–35 minutes).

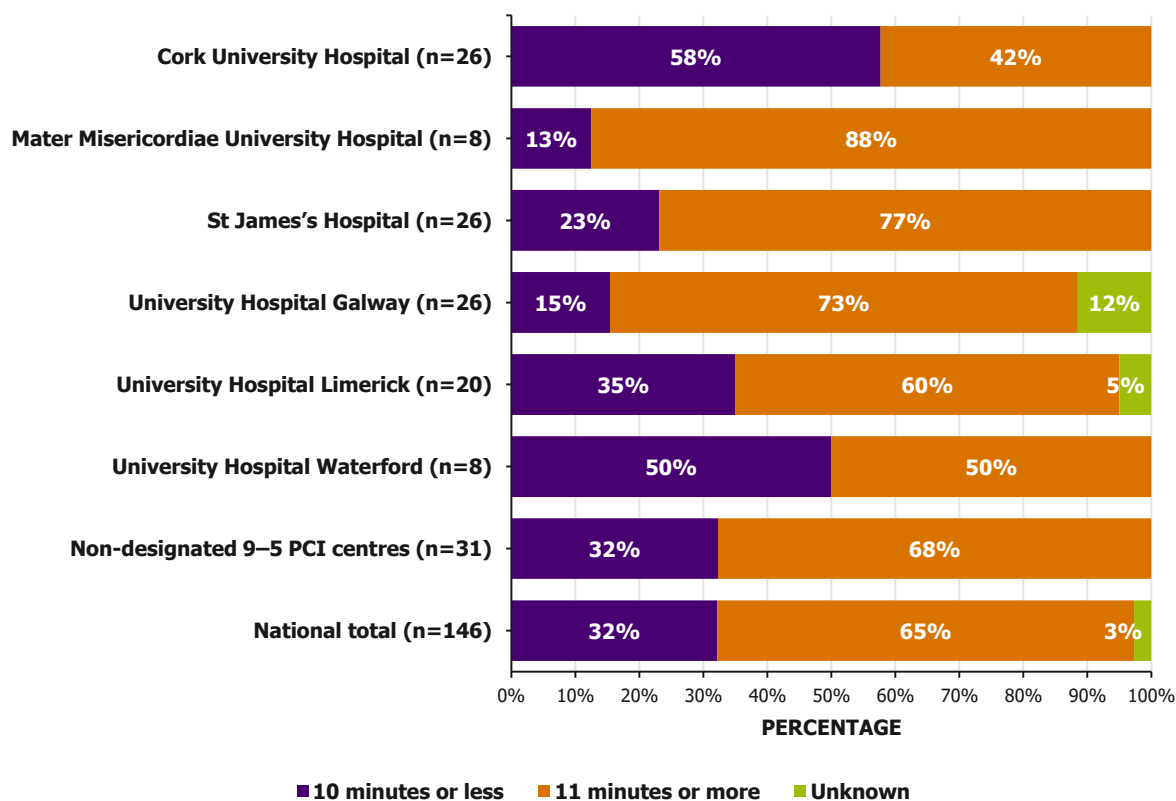


FIGURE 6.17: PROPORTION OF PATIENTS WITH A STEMI WHO SELF-PRESENTED TO A PCI CENTRE AND WHO RECEIVED AN ELECTROCARDIOGRAM WITHIN 10 MINUTES, BY PCI CENTRE (n=146)⁴²

⁴² Letterkenny University Hospital is excluded from the figure due to having less than 5 cases but is included in the national total.

TIMELINESS OF REPERFUSION BY THROMBOLYSIS

TIMELY THROMBOLYSIS

There are two key time intervals to timely reperfusion with thrombolysis:

- 1. Door to ECG within 10 minutes:** In order to achieve timely reperfusion with thrombolysis, the ESC acute coronary syndromes guideline (Byrne *et al.*, 2023) recommends that all patients with symptoms of a STEMI should have an ECG within 10 minutes of arrival at hospital.
- 2. Door to needle within 30 minutes:** Timely reperfusion with thrombolysis is considered to have been achieved when the interval between the time of arrival at the hospital and the time of initiation of thrombolysis is 30 minutes or less.

TIME FROM HOSPITAL ARRIVAL TO FIRST POSITIVE ECG

In 2025, there were 75 cases who had a STEMI diagnosed in the ED and received thrombolysis. Of those, 43% (n=32) had the ECG completed within 10 minutes.

TIMELINESS OF THROMBOLYSIS THERAPY

The number of patients with a STEMI who were treated with thrombolysis had shown a consistent annual increase, from 81 cases in 2021 to 85 in 2022, 108 in 2023, and 111 in 2024. However, in 2025 the number of patients with a STEMI treated with thrombolysis dropped to 101. This may reflect a greater focus on the delivery of thrombolysis for patients who cannot be transferred for Primary PCI in a timely manner.

Of all patients who received thrombolysis as their first reperfusion strategy, only 27% (n=27) received timely thrombolysis (Figure 6.18). However, this is an improvement from 22% (n=24) in 2024.

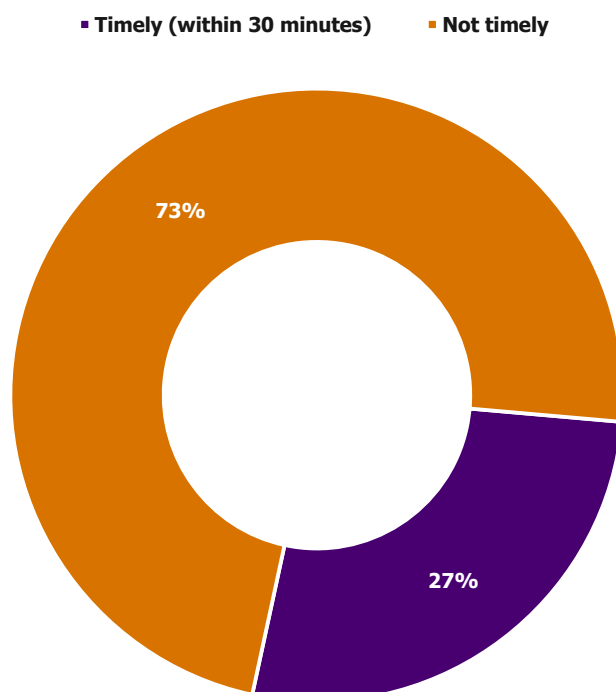


FIGURE 6.18: PROPORTION OF PATIENTS WHO RECEIVED TIMELY REPERFUSION WITH THROMBOLYSIS (n=101)

TIMELINESS OF THROMBOLYSIS AND PRIMARY PCI FOR THOSE TRANSFERRED TO A PCI CENTRE

Figure 6.19 displays the proportion of patients who were transferred to a PCI centre who received timely reperfusion with either primary PCI or thrombolysis in 2025. In total, 35% (n=152) received a timely reperfusion.

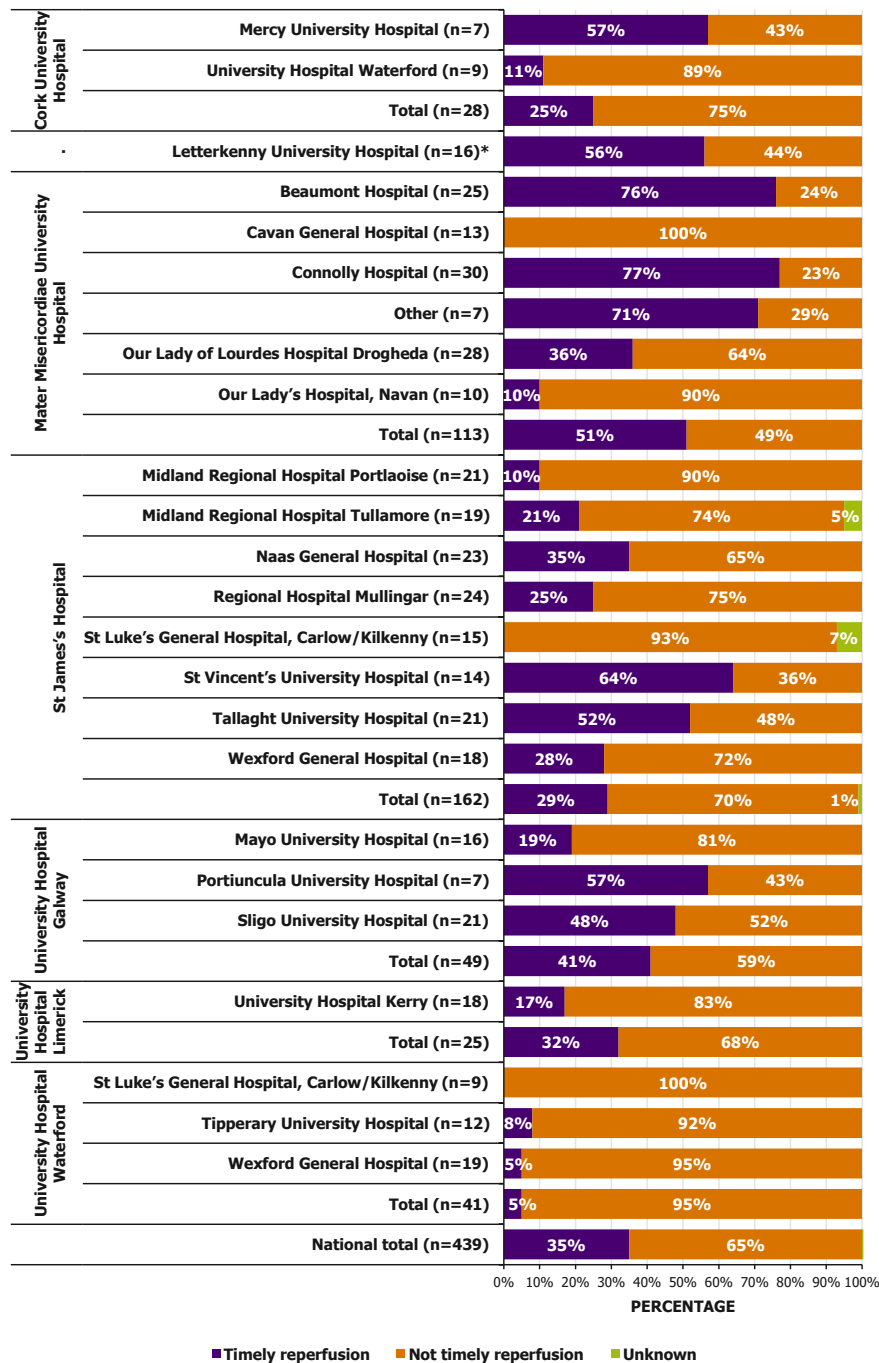


FIGURE 6.19: PROPORTION OF PATIENTS WHO WERE TRANSFERRED TO A PCI CENTRE AND RECEIVED TIMELY REPERFUSION, BY REFERRING HOSPITAL (n=439)^{43,44,45}

⁴³ Hospitals that had fewer than five patients were excluded individually from Figure 6.19; however, they are included in the total figures, and in the corresponding frequency tables.

⁴⁴ Reperfusion timeliness includes both patients who received thrombolysis (with a target timeliness of 30 minutes) and those who received primary PCI (with a target timeliness of 120 minutes).

⁴⁵ The cases reported for Letterkenny University Hospital (*) are cases where the patient initially presented to Letterkenny University Hospital (self-presented, already an in-patient or brought by ambulance for stabilisation prior to transfer) and were then transferred to Altnagelvin General Hospital for primary PCI.

SUMMARY OF TIMELY REPERFUSION TRENDS

TIMELINESS OF ALL REPERFUSION

The proportion of patients who received timely reperfusion, either primary PCI or thrombolysis, has seen a steady decline, from 67% in 2017 to 59% in 2025.

TIMELINESS OF PRIMARY PCI

The proportion of patients who received timely primary PCI has seen a steady decline, from 68% in 2017 to 62% in 2025 (Table 6.5), which is associated with delays in the FMCTB from 96 minutes (IQR: 67–126 minutes) in 2017 to 100 minutes (IQR: 73–137 minutes) in 2025 (Table 6.6).

The method by which a patient accesses the PCI centre continues to affect their likelihood of receiving timely primary PCI. For patients who arrived directly at a PCI centre (including those who arrived directly via ambulance and those who were already inpatients in the PCI centre), the proportion who received timely primary PCI was 77% in 2025, with a median FMCTB time of 95 minutes (IQR: 73–118 minutes), which is within the 120-minute KQI target. For those who self-presented to a PCI centre, the proportion who received timely primary PCI was 28%, with a median FMCTB time of 92 minutes (IQR: 57–149 minutes), which is above the 60-minute KQI target; for patients who were transferred to a PCI centre, the proportion who received timely primary PCI was also 37%, with a median FMCTB time of 139 minutes (IQR: 104–197 minutes). Figure 6.1 shows the downward trend in timeliness of primary PCI for all methods of arrival to a PCI centre from 2017 to 2025.

TIMELINESS OF THROMBOLYSIS

The proportion of patients who received timely thrombolysis has also seen a steady decline, from 44% in 2017 to 27% in 2025 (Table 6.5). This is associated with delays in the median door to needle time for patients who had thrombolysis from 40 minutes (IQR: 23–84 minutes) in 2017 to 51 minutes (IQR: 30–74 minutes) in 2025, which is above the recommended 30-minute target.

TABLE 6.5: PROPORTION OF PATIENTS WHO RECEIVED TIMELY REPERFUSION, BY REPERFUSION TYPE AND REFERRAL SOURCE, 2017–2025

	All timely reperfusion	All primary PCI admitted to a PCI centre	Primary PCI directly admitted to a PCI centre	Primary PCI self-presented to a PCI centre	Primary PCI transferred to a PCI centre	Thrombolysis
2017	67% (833/1240)	68%	81%	39%	43%	44%
2018	65% (825/1272)	66%	79%	37%	42%	41%
2019	67% (789/1174)	69%	82%	46%	45%	30%
2020	69% (766/1117)	70%	80%	38%	49%	40%
2021	64% (783/1228)	67%	81%	22%	41%	25%
2022	60% (721/1199)	62%	78%	25%	39%	29%
2023	61% (799/1305)	65%	79%	25%	45%	21%
2024	58% (773/1339)	61%	77%	30%	30%	22%
2025	59% (802/1357)	62%	77%	28%	37%	27%

TABLE 6.6: MEDIAN TIME TO REPERFUSION, BY REPERFUSION TYPE AND REFERRAL SOURCE, 2017–2025

	All timely reperfusion	All primary PCI admitted to a PCI centre minutes (IQR)	Primary PCI directly admitted to a PCI centre minutes (IQR)	Primary PCI self-presented to a PCI centre minutes (IQR)	Primary PCI transferred to a PCI centre minutes (IQR)	Thrombolysis minutes (IQR)
2017	96 (67–126)	97 (68–126)	87 (64–114)	79 (30–131)	126 (99–175)	40 (23–84)
2018	94 (66–129)	96 (69–129)	85 (64–116)	79 (34–120)	129 (103–181)	39 (24–64)
2019	93 (67–122)	95 (68–124)	85 (67–112)	68 (32–108)	127 (100–170)	47 (29–89)
2020	92 (67–122)	95 (69–124)	88 (67–114)	75 (32–125)	121 (94–174)	38.5 (21–60)
2021	96 (69–126)	97 (72–127)	90 (68–114)	86 (63–123)	135 (103–185)	55 (31–93)
2022	98 (71–135)	102 (75–138)	90 (70–117)	96 (61–164.5)	138 (106–193)	50 (25–77)
2023	97 (70–129)	100 (74–132)	88 (69–114)	100 (64–147)	129 (103–196)	52 (32–89)
2024	101 (72–136)	104 (76–138)	95 (72–120)	84 (54–144)	146 (113–202)	53 (32–89)
2025	100 (73–137)	103 (77–139)	95 (73–118)	92 (57–149)	139 (104–197)	51 (30–74)



OPPORTUNITIES FOR IMPROVEMENT

Three modifiable time stamps identified in this chapter highlight clear opportunities for improvement.

The first of these relates to delays in obtaining a prompt ECG. As shown in Figures 6.10 and 6.17, the proportion of patients who received an ECG within 10 minutes is suboptimal. Only 32% of patients who self-presented to a PCI centre met this target, and just 38%, for those who self-presented to a non-PCI-capable hospital.

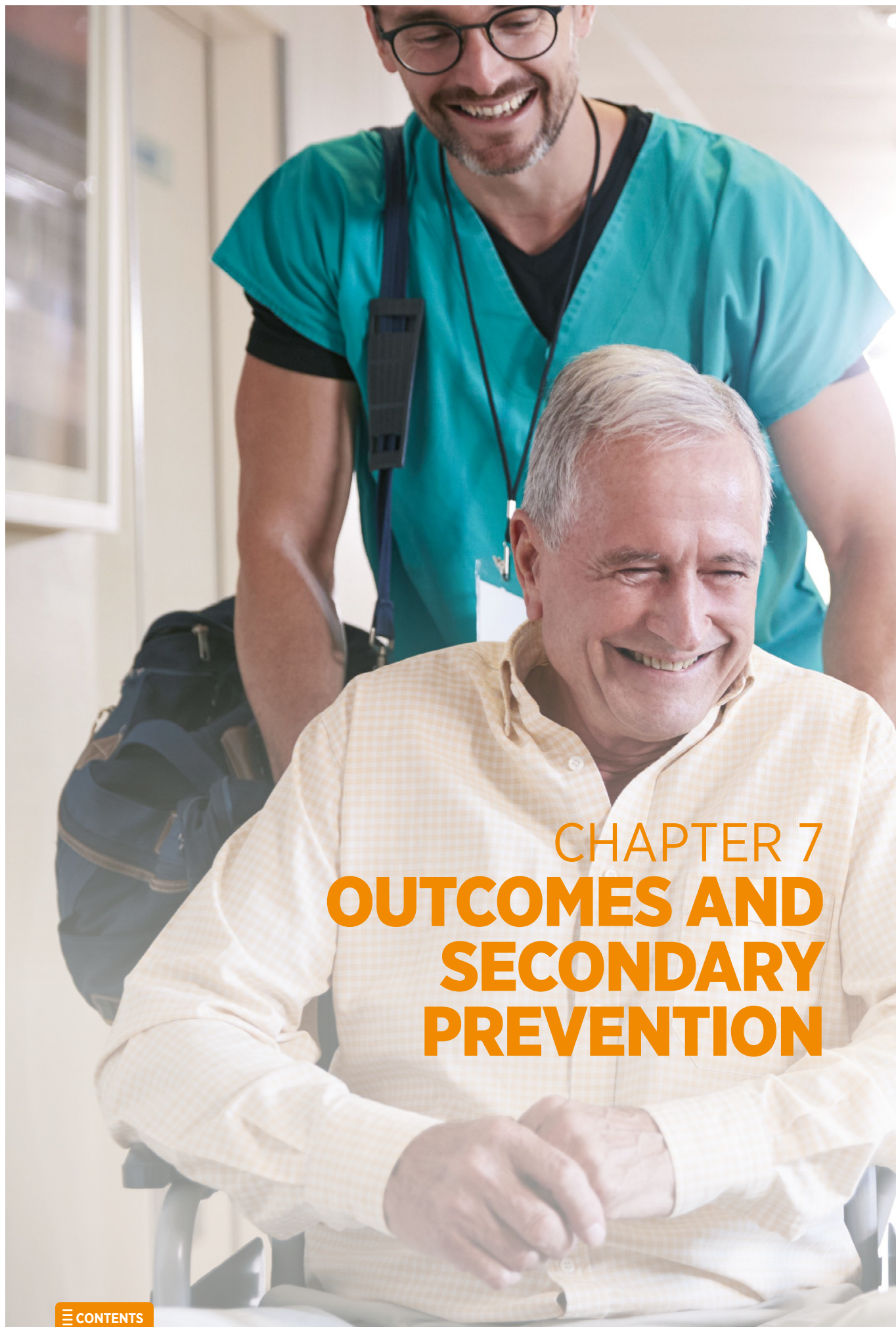
The second time stamp relates to delays in achieving a DIDO time of 30 minutes or less for those who initially present to a non-PCI-capable hospital and are transferred by ambulance to a PCI centre. Figure 6.11 indicates that the 30-minute DIDO target was achieved in only 4% of cases: while this is a marginal improvement from 3% in 2024, it remains an important opportunity for improvement.

With regard to the third time stamp, the recommended DTB target of 30 minutes to achieve timely primary PCI once the patient has arrived at a PCI centre was achieved for only 54% of patients who presented directly to a PCI centre (Figure 6.6) and for 62% of patients who were transferred to a PCI centre (Figure 6.13) in 2025.

All PCI centres and referring hospitals should work together as PCI networks as recommended in the *Acute Coronary Syndromes Programme Model of Care* (HSE, 2012), monitor their results, and implement QI strategies in order to ensure that patients receive optimal care.

KEY FINDINGS FROM CHAPTER 6

- Seventy-nine per cent of patients who arrived directly by ambulance to a PCI centre met the 90-minute FMCTD target, compared with only 29% of those who were transferred from another hospital.
- The proportion of patients receiving an ECG within 10 minutes of arrival at hospital is suboptimal. Only 32% of patients who self-presented to a PCI centre met this target, and 38% for those who were transferred after they initially self-presented to a non-PCI-capable hospital.
- The DIDO time of 30 minutes or less, which is the recommended goal for patients who initially present to a non-PCI-capable hospital, was achieved in only 4% of cases.
- The DTB target of 30 minutes was achieved in 54% of patients who presented directly to a PCI centre and in 62% of patients who were transferred to a PCI centre.
- The proportion of patients who received timely primary PCI has seen a steady decline, from 68% in 2017 to 62% in 2025.



CHAPTER 7 **OUTCOMES AND SECONDARY PREVENTION**



CHAPTER 7: OUTCOMES AND SECONDARY PREVENTION

Chapter 7 presents the outcomes of care and key treatments aimed at the secondary prevention of further cardiovascular events for patients with a STEMI recorded on Heartbeat in 2025.

OUTCOMES

LEFT VENTRICULAR FUNCTION OUTCOMES

The majority of patients with a STEMI in 2025 had a non-anterior infarction (n=931, 57%), similar to 2024 (56%). Anterior infarctions were reported in 42% (n=690) of patients with a STEMI.⁴⁶

Left ventricular function (LVF) was assessed in 88% (n=1448) of cases, which is comparable to the 89% reported in 2024. Of those patients who had an anterior infarction, 89% (n=613) had LVF assessed. Of those patients with a non-anterior infarction, 88% (n=817) had LVF assessed. With regard to patients who did not have LVF assessed, the majority (79%) were transferred to another hospital for ongoing care and may have had an 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 (n=1433, 99%), with a small proportion assessed by left ventricular angiography (1%, n=11).

Figure 7.1 displays LVF results, by infarct type and timeliness of reperfusion. In total, of those who had timely reperfusion, 39% (n=301) had normal LVF, compared to 29% (n=125) who did not have timely reperfusion. A larger proportion of patients who did not have timely reperfusion had severely reduced LVF (n=79, 18%) compared to those who had timely reperfusion (n=76, 10%).

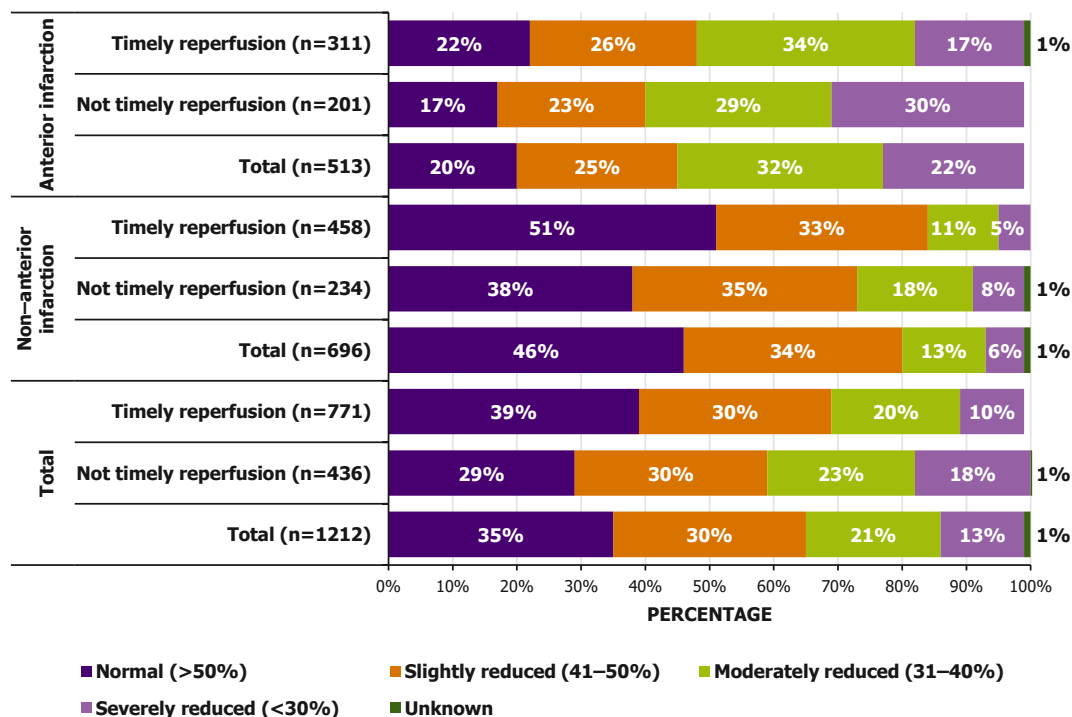


FIGURE 7.1: LEFT VENTRICULAR FUNCTION RESULTS, BY INFARCT TYPE AND TIMELINESS OF REPERFUSION (n=1,212)^{47,48}

⁴⁶ Infarction type was unknown in 21 cases.

⁴⁷ Patients for whom the source of referral was not recorded or was recorded as 'other', and cases who did not have timeliness of reperfusion recorded, are excluded from Figure 7.1.

⁴⁸ Percentages may not add up to 100% due to rounding.

CONGESTIVE HEART FAILURE OUTCOMES

The majority of patients with a STEMI, 79% (n=1295), did not show signs of congestive heart failure in the cath lab: a decrease from 82% in 2024. Cardiogenic shock was reported in 10% (n=165) of patients,⁴⁹ consistent with 2024. Figure 7.2 shows congestive heart failure by infarct type.

Among patients who had cardiogenic shock, the unadjusted in-hospital mortality rate was 50% (n=82) in 2025, a slight increase from the 2024 result (46%).

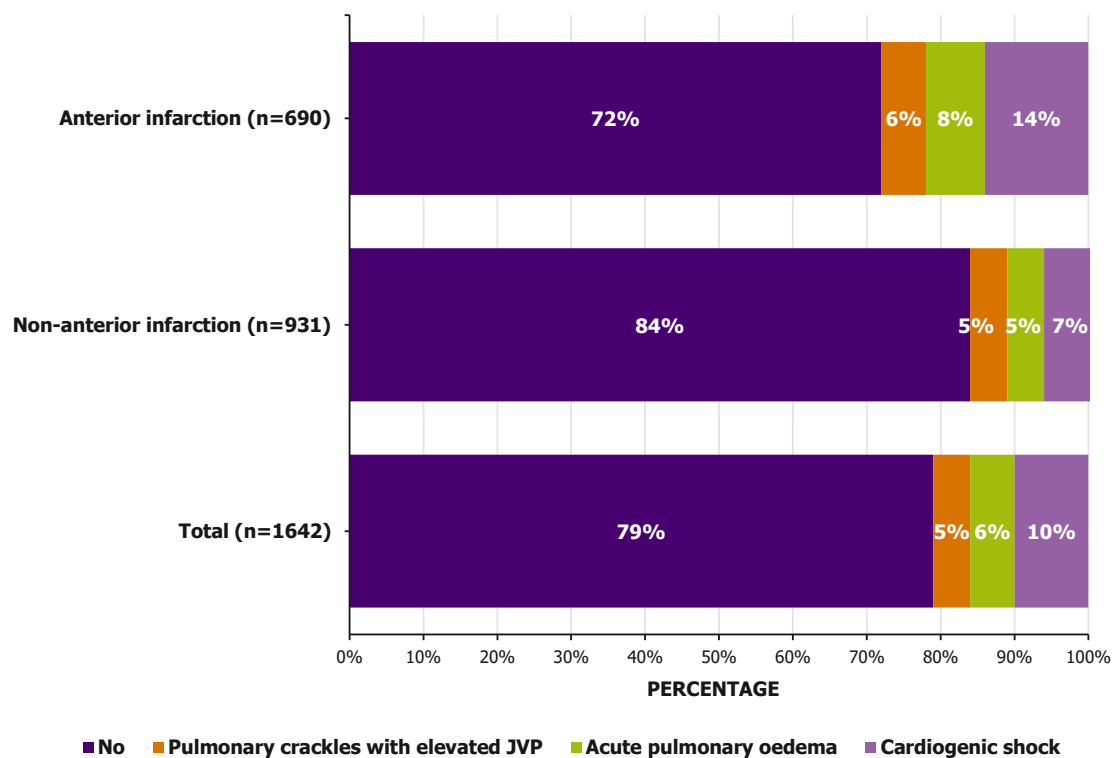


FIGURE 7.2: CONGESTIVE HEART FAILURE, BY INFARCT TYPE (N=1,642)^{50,51}

⁴⁹ Calculated based on the whole population with a STEMI (N=1,642).

⁵⁰ Cases where infarct type was unknown (n=21) are not presented in Figure 7.2.

⁵¹ Percentages may not add up to 100% due to rounding.

UNADJUSTED IN-HOSPITAL MORTALITY

Data gathered by the IHAA include the survival status of patients 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.

In 2025, 7.4% (n=121) of patients with a STEMI died during their stay in hospital, this represents a marginal increase in mortality from 6.6% (n=106) in 2024.

The unadjusted in-hospital mortality rate was higher in older age groups (see Table 7.1). In those aged 80 years and over, the mortality rate was 20.3% (n=38) in 2025, compared with 9.2% (n=53) for those aged 65–79 years. The unadjusted mortality rate for those aged 64 years and under was 3.4% (n=30).

Higher mortality rates for female patients with a STEMI (9%) compared to male patients (7%) may be reflective of the older age profile of female patients. Twenty per cent (n=74) of the total female population with a STEMI were over 80 years old, compared to 9% (n=113) of male patients (see Figure 4.3 for age breakdown).

Within age groups, mortality rates were similar between male and female patients.

TABLE 7.1 UNADJUSTED MORTALITY RATE FOR PATIENTS BY AGE AND SEX

Year	Male (%)	Female (%)	Total (%)
≤64 years	3.4	3.5	3.4
65–79 years	9.6	8.0	9.2
80+ years	19.5	21.6	20.3
Total	6.9	9.0	7.4

Table 7.2 shows the unadjusted in-hospital mortality rate of those who received timely primary PCI versus non-timely primary PCI by sex. In 2025, those who received primary PCI had a 6.0% (n=77) mortality rate, a slight increase from the 5.3% (n=66) reported in 2024. The unadjusted mortality was higher for female patients (n=20; 7.2%) than for male patients (n=57; 5.6%).

Timely primary PCI was associated with reduced mortality. In 2025, those who received timely primary PCI had an unadjusted mortality rate of 4.2% (n=37), compared with 9.2% (n=46) for those who did not receive timely primary PCI.

TABLE 7.2 UNADJUSTED MORTALITY RATE FOR PATIENTS WITH A STEMI WHO RECEIVED PRIMARY PCI, AND WHO RECEIVED TIMELY VERSUS NON-TIMELY PRIMARY PCI, BY SEX

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
Male	5.6% (n=57)	4.2% (n=29)	8.0% (n=31)
Female	7.2% (n=20)	4.4% (n=8)	13.6% (n=15)
Total	6.0% (n=77)	4.2% (n=37)	9.2% (n=46)

In 2025, the unadjusted in-hospital mortality rate in patients who received thrombolysis as the initial reperfusion strategy was 6.9% (n=7); it was 5.4% (n=6) in 2024. The number of cases was too small to provide meaningful analysis on mortality based on the timeliness of thrombolysis. In 2025, the unadjusted in-hospital mortality rate for those who received no reperfusion therapy was 18.9% (n=14), an increase from 13.3% (n=10) in 2024.



RISK-ADJUSTED IN-HOSPITAL MORTALITY

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. Further information on the development of the risk-adjustment model, together with the list of data points used in the GRACE model, is presented in Chapter 9 of the *Irish Heart Attack Audit National Report 2022 and 2023* (NOCA, 2024b).

IHAA RISK-ADJUSTED IN-HOSPITAL MORTALITY

The data quality of all data points required in order to inform the GRACE model decreased from 94% in 2024 to 93% in 2025 nationally.

Figure 7.3 presents the survival status (alive or dead) on discharge from hospital among patients with a STEMI in 2025 who were treated in each PCI centre by GRACE risk score of predicted mortality (low, intermediate, or high risk of mortality).

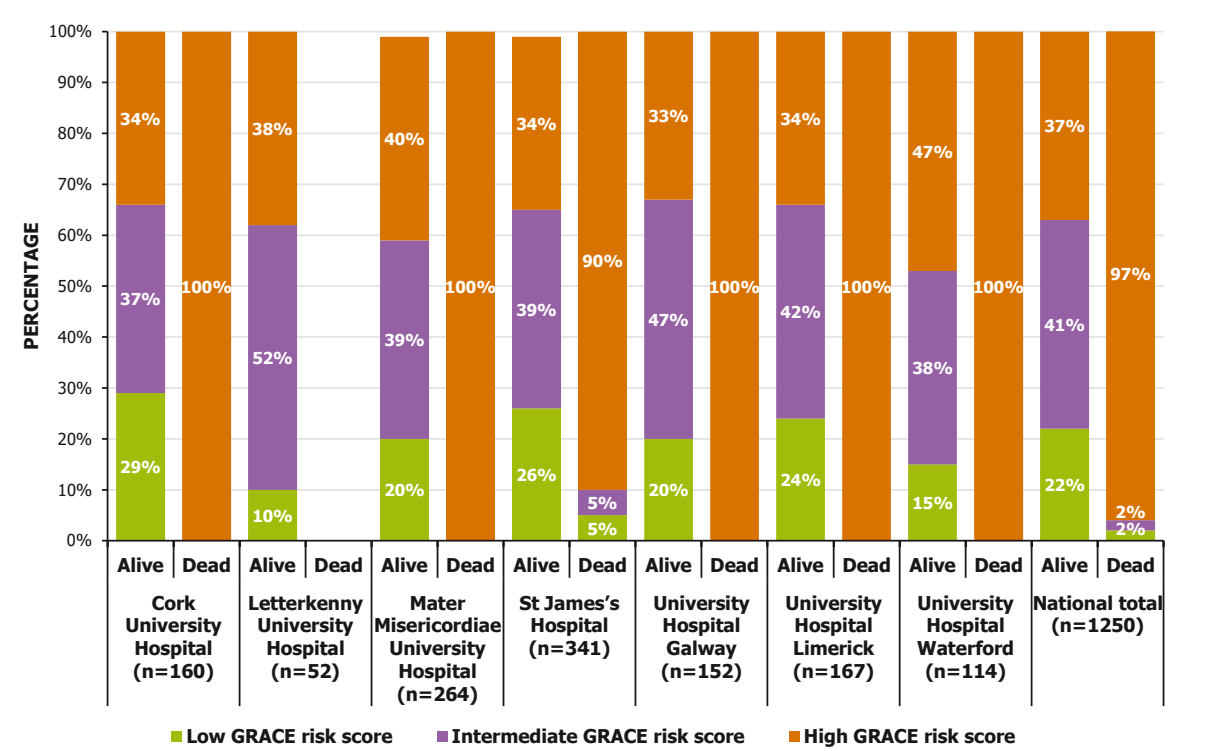


FIGURE 7.3: SURVIVAL AT DISCHARGE BY GLOBAL REGISTRY OF ACUTE CORONARY EVENTS STRATIFICATION, BY PCI CENTRE (n=1,250)



STANDARDISED MORTALITY RATIO FUNNEL PLOT

Standardised mortality ratio (SMR) funnel plots (Figure 7.4) are scatter plots of individual hospitals' SMRs, highlighting the difference between expected and observed mortality. The black dashed line in Figure 7.4 represents an SMR of 1. An SMR of 1 means that the number of observed deaths is the same as the expected number of deaths. The upper and lower borders of the funnel are represented by 99.8% and 95.0% confidence levels. These borders represent the upper and lower limits of what is referred to as 'expected variation'. The size of each orange circle indicates the number of patients with a STEMI.

Funnel plots make it very easy to identify observations worthy of further review, if they fall outside expected variation. 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 7.4 presents the SMRs in 2025 for five PCI centres in a funnel plot. Hospitals that had fewer than five observed deaths are removed from the analysis. Figure 7.4 shows that five PCI centres had an SMR within the 99.8% control limits, and no PCI centre had an SMR of more than 1, meaning that the number of observed deaths was less than expected.

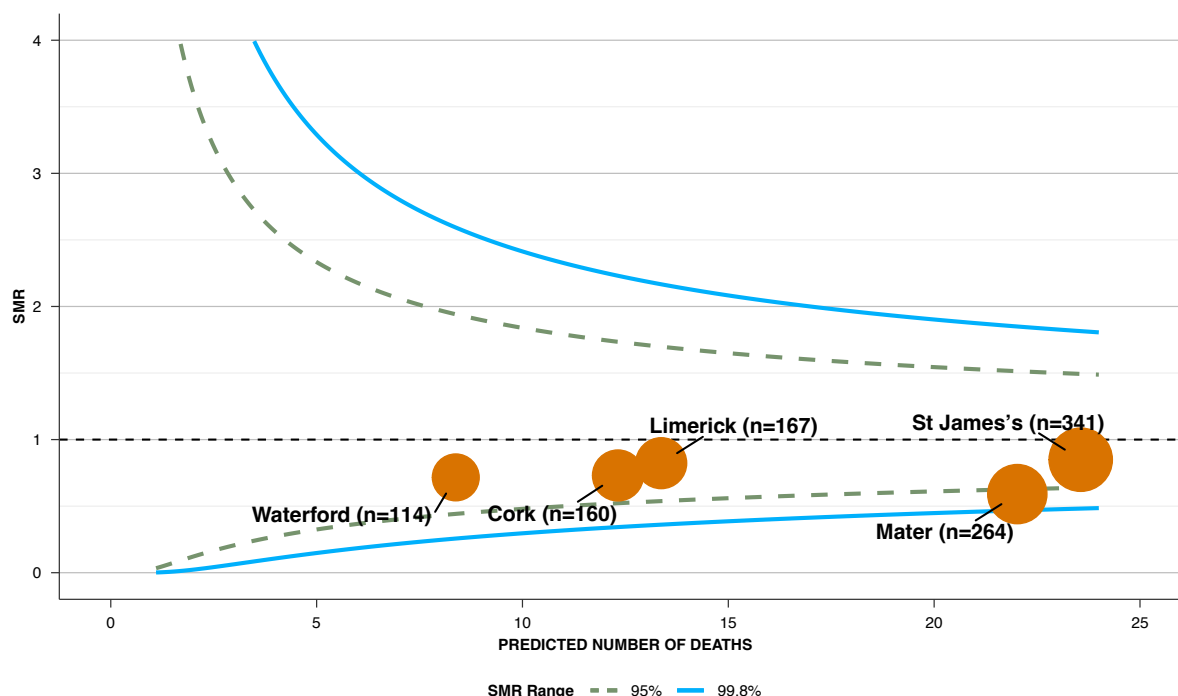


FIGURE 7.4: IN-HOSPITAL STANDARDISED MORTALITY RATIO⁵²

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 number of data for this implementation. The IHAA Governance Committee has agreed that the NOCA outlier management policy will not be implemented until the model is supported with more data.

⁵² Hospitals that had five deaths or fewer (Beaumont Hospital, St Vincent's University Hospital, Tallaght University Hospital, Letterkenny University Hospital, and University Hospital Galway) are not included in Figure 7.4.

30-DAY MORTALITY

The European Society of Cardiology (ESC) acute coronary syndromes 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 91% in 2025⁵³. In 2025, the data show that the national unadjusted 30-day mortality rate was 9.4%. The crude mortality rate was higher for female patients with a STEMI (11.6%) compared with the male cohort (8.8%) (Table 7.3). Table 7.4 shows that patients who did not receive timely primary PCI had approximately double the 30-day mortality rate (11.5%) compared to those who received timely primary PCI (5.5%).

TABLE 7.3 UNADJUSTED MORTALITY RATE AT 30 DAYS FOR PATIENTS BY AGE AND SEX

Year	Male (%)	Female (%)	Total (%)
≤64 years	4.0	4.7	4.2
65–79 years	11.9	11.6	11.9
80+ years	26.5	23.6	25.3
Total	8.8	11.6	9.4

TABLE 7.4 UNADJUSTED MORTALITY RATE AT 30 DAYS FOR PATIENTS WITH A STEMI WHO RECEIVED PRIMARY PCI, AND WHO RECEIVED TIMELY VERSUS NON-TIMELY PRIMARY PCI, BY SEX

	Received primary PCI (%)	Received timely primary PCI (%)	Did not receive timely primary PCI (%)
Male	7.0% (n=62)	5.4% (n=32)	10.2% (n=30)
Female	9.2% (n=23)	5.7% (n=9)	15.6% (n=14)
Total	8.5% (n=85)	5.5% (n=41)	11.5% (n=44)

⁵³ Completeness of the 30-day mortality variable in CUH was 45% in 2025 due to unexpected unavailability of the audit coordinator.

Figure 7.5 presents the 30-day survival status (alive or dead) on discharge from hospital among patients with a STEMI in 2025 who were treated in each PCI centre by GRACE risk score of predicted mortality (low, intermediate, or high risk of mortality). Cork University Hospital is not included in Figure 7.5 due to low data quality (45%).

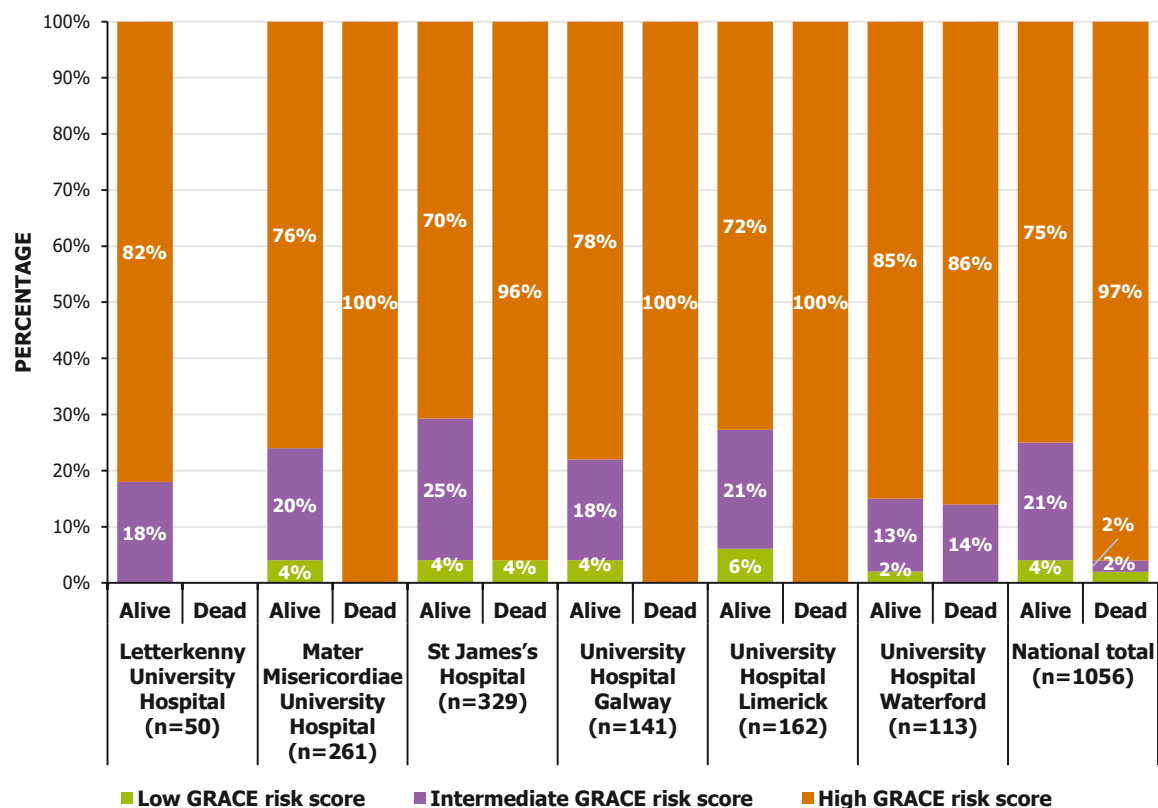


FIGURE 7.5: SURVIVAL STATUS AT 30 DAYS BY GLOBAL REGISTRY OF ACUTE CORONARY EVENTS STRATIFICATION, BY PCI CENTRE (n=1,056)⁵⁴

KQI 8: Percentage completeness of the 'survival status at 30 days' data point recorded in heartbeat

TARGET: 90% 2025 RESULT: 87%



⁵⁴ Those who died while in hospital were categorised as complete. Patients who were not resident in Ireland were not included in the analysis for Figure 7.5.

BLEEDING AND STROKE COMPLICATIONS

In 2025, 1,388 patients with a STEMI received reperfusion therapy, of whom 52 (4%) experienced a bleeding complication. In the group treated with thrombolysis, 4% (n=4) had a bleeding complication. In the group that underwent primary PCI, 4% (n=48) had a bleeding complication. Overall, this represents a marginal increase from 2024 (3%). Bleeding complications were defined as intracranial haemorrhage, retroperitoneal haemorrhage, or other bleeding event (this last category was subdivided into three categories based on the recorded drop in haemoglobin: ≥ 5 grams per decilitre (g/dL); ≥ 3 g/dL to < 5 g/dL; and < 3 g/dL). The incidence of bleeding by reperfusion type is presented in [Appendix 6](#).

Two per cent (n=30) of patients who had reperfusion (n=1388) sustained a stroke. Among those who received thrombolysis, 3% (n=3) had a haemorrhagic stroke. Among those who received a primary PCI, 2% (n=27) had a stroke; 1% (n=14) were classified as an ischaemic stroke and 1% (n=13) as a haemorrhagic stroke. The incidence of stroke has marginally increased from 1.3% in 2023, to 1.7% in 2024 and 2.2% in 2025. The incidence of stroke by reperfusion type and hospital is presented in [Appendix 6](#).

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 2025 was 3 days (IQR: 1–6 days), which is unchanged from 2024 (median: 3 days; IQR: 1–6 days). For patients who completed their inpatient stay at the PCI centre, the median LOS was 4 days (IQR: 3–8 days), which is less than the 5 days (IQR: 3–8 days) reported in 2024. This compares to the relevant KPI in the *Acute Coronary Syndromes Programme Model of Care* (HSE, 2012) of a median LOS of 4 days. The LOS varied between PCI centres, ranging from 4 days to 7 days.

For patients who were transferred to another acute hospital for ongoing STEMI care the median LOS in the PCI centre was 1 day (IQR: 1–2 days), which is unchanged from 2024 (median: 1 day; IQR: 1–2 days) (Table 7.5).

TABLE 7.5: LENGTH OF HOSPITAL STAY IN THE PCI CENTRE, BY PCI CENTRE (NUMBER OF PATIENTS: 1,531; NUMBER OF DAYS: 9,164)⁵⁵

		Transferred to another hospital for ongoing STEMI care	Completed STEMI care in the PCI centre	Total
Cork University Hospital	Number of patients	28	163	191
	Number of days	154	978	1132
	Median LOS (days)	2	4	4
	IQR 1 (days)	1	3	3
	IQR 3 (days)	3	6	6
Letterkenny University Hospital	Number of patients	-	*	54
	Number of days	26	323	349
	Median LOS (days)	6	5	5
	IQR 1 (days)	5	3	3
	IQR 3 (days)	8	7	7
Mater Misericordiae University Hospital	Number of patients	243	87	330
	Number of days	453	891	1344
	Median LOS (days)	1	7	1
	IQR 1 (days)	1	4	1
	IQR 3 (days)	1	12	3
St James's Hospital	Number of patients	276	142	418
	Number of days	741	1617	2358
	Median LOS (days)	1	6	3
	IQR 1 (days)	1	4	1
	IQR 3 (days)	3	12	5
University Hospital Galway	Number of patients	69	118	187
	Number of days	216	839	1055
	Median LOS (days)	2	5	4
	IQR 1 (days)	1	3	2
	IQR 3 (days)	3	7	6
University Hospital Limerick	Number of patients	32	143	175
	Number of days	170	882	1052
	Median LOS (days)	3	4	3
	IQR 1 (days)	2	3	3
	IQR 3 (days)	7	7	7
University Hospital Waterford	Number of patients	48	72	120
	Number of days	259	753	1012
	Median LOS (days)	3	4	4
	IQR 1 (days)	2	3	3
	IQR 3 (days)	9	7	7
Non-designated 9-5 PCI centres	Number of patients	6	50	56
	Number of days	118	744	862
	Median LOS (days)	21	4	5
	IQR 1 (days)	9	3	3
	IQR 3 (days)	29	9	14
Total	Number of patients	706	825	1531
	Number of days	2137	7027	9164
	Median LOS (days)	1	4	3
	IQR 1 (days)	1	3	1
	IQR 3 (days)	2	8	6

- Denotes five cases or fewer.

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

⁵⁵ Only includes patients who were alive on discharge.

DISCHARGE DESTINATION FROM THE PCI CENTRE

Almost one-half (n=786; 48%) of patients with a STEMI were discharged directly home from a PCI centre; this is less than the 52% reported in 2023 and 50% reported in 2024. Forty-three per cent (n=706) were transferred to another acute hospital for ongoing STEMI care, a slight increase from the 41% reported in 2024. The 'other' destination category represents discharge to an alternative destination: nursing home, died, and other (n=150; 9%). Figure 7.6 displays the discharge destination by PCI centre.

A larger proportion (n=620; 49%) of male patients with a STEMI were discharged directly home from a PCI centre compared with female patients (n=166; 46%) ([Appendix 4](#)). 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-capable hospitals and therefore repatriate/transfer patients at a higher rate.

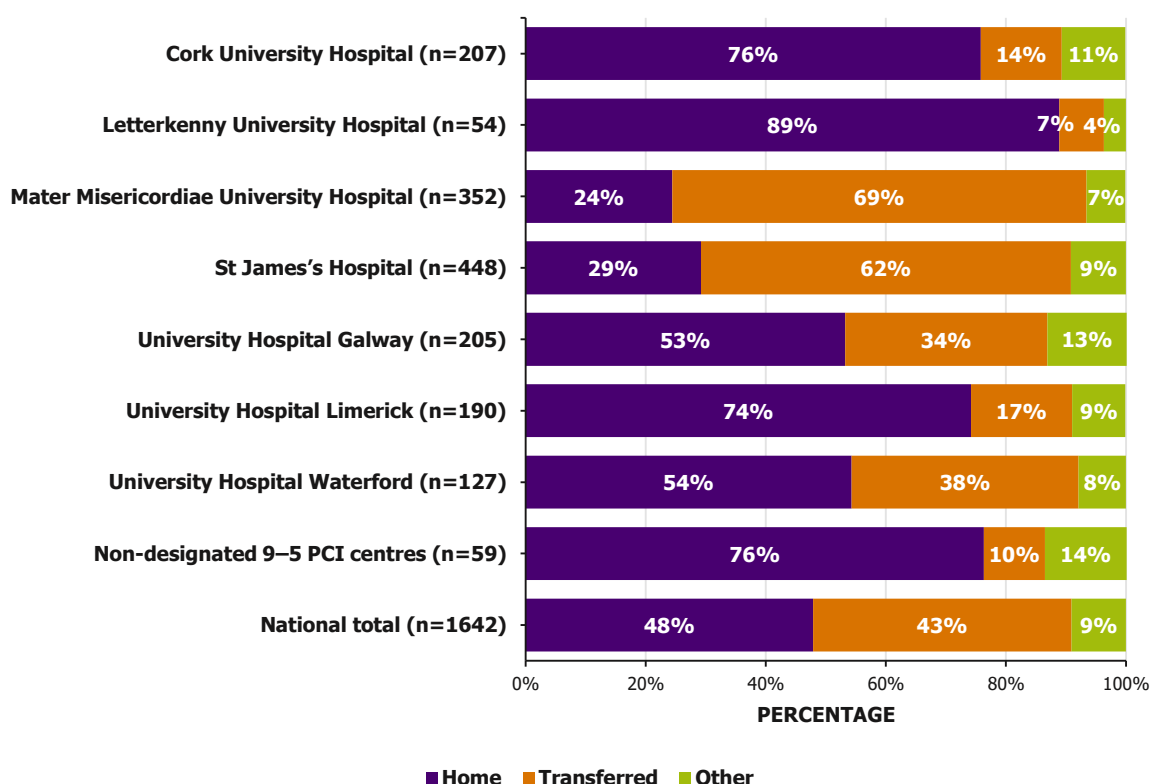


FIGURE 7.6: DISCHARGE DESTINATION FROM PCI CENTRES, BY PCI CENTRE (N=1,642)⁵⁶

⁵⁶ Non-designated 9.00am to 5.00pm weekday PCI centres include Beaumont Hospital, St Vincent's University Hospital and Tallaght University Hospital. Discharge destination data for these hospitals are included in the corresponding frequency table in [Appendix 4](#).

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 on discharge, and (3) cardiac rehabilitation. Each is reported as a KQI in the IHAA dashboard.

SMOKING CESSATION

As described in Chapter 4, 37% (n=604) of patients with a STEMI were classified as current smokers (Figure 4.7). Figure 7.7 displays the proportion of patients with a STEMI who were smokers and who received smoking cessation advice, by sex and age group. The proportion of patients with a STEMI who were current smokers and were recorded as receiving smoking cessation advice has gradually increased, from 80% in 2022 to 91% in 2023, 95% in 2024, and 95% (n=572) again in 2025, meeting the associated KQI target of 90% (HSE, 2012).

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

TARGET: 90% 2025 RESULT: 95%

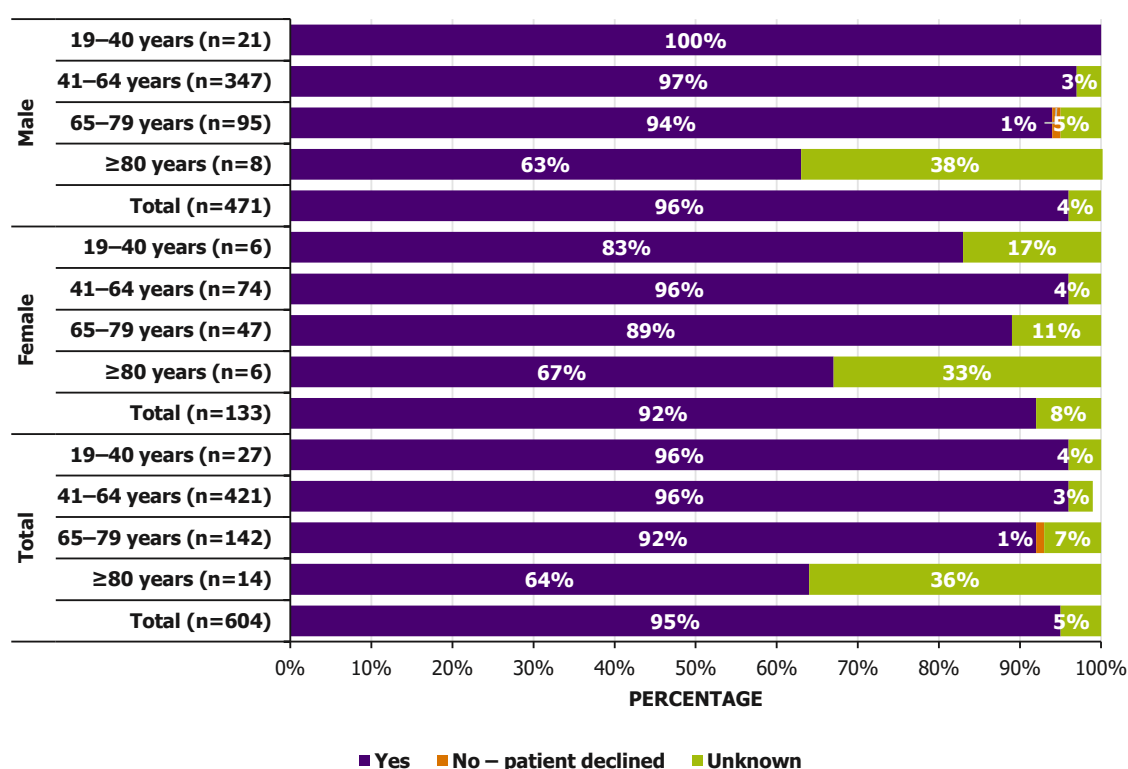


FIGURE 7.7: SMOKING CESSATION ADVICE PROVIDED, BY SEX AND AGE GROUP (n=604)⁵⁷

⁵⁷ Figure 7.7 includes patients who were 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, 86% in 2023, 91% in 2024, and 92% in 2025, reaching the target of 90% (HSE, 2012) in 2025. [Appendix 6](#) presents these data by PCI centre.

Figure 7.8 shows the proportion of each of the secondary prevention medications prescribed on discharge (excluding cases for which no information was recorded) for each of the medications. In 2025, as in 2024, statins (n=1,496; 99%) were the most prescribed secondary prevention medications. A second antiplatelet agent was prescribed in 98% (n=1,481) of cases, followed by aspirin (n=1,476; 97%), beta-blockers (n=1,305; 88%) and angiotensin-converting enzyme inhibitors (ACEIs) or angiotensin II receptor blockers (ARBs) (n=1,237; 84%).

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

TARGET: 90% 2024 RESULT: 92%

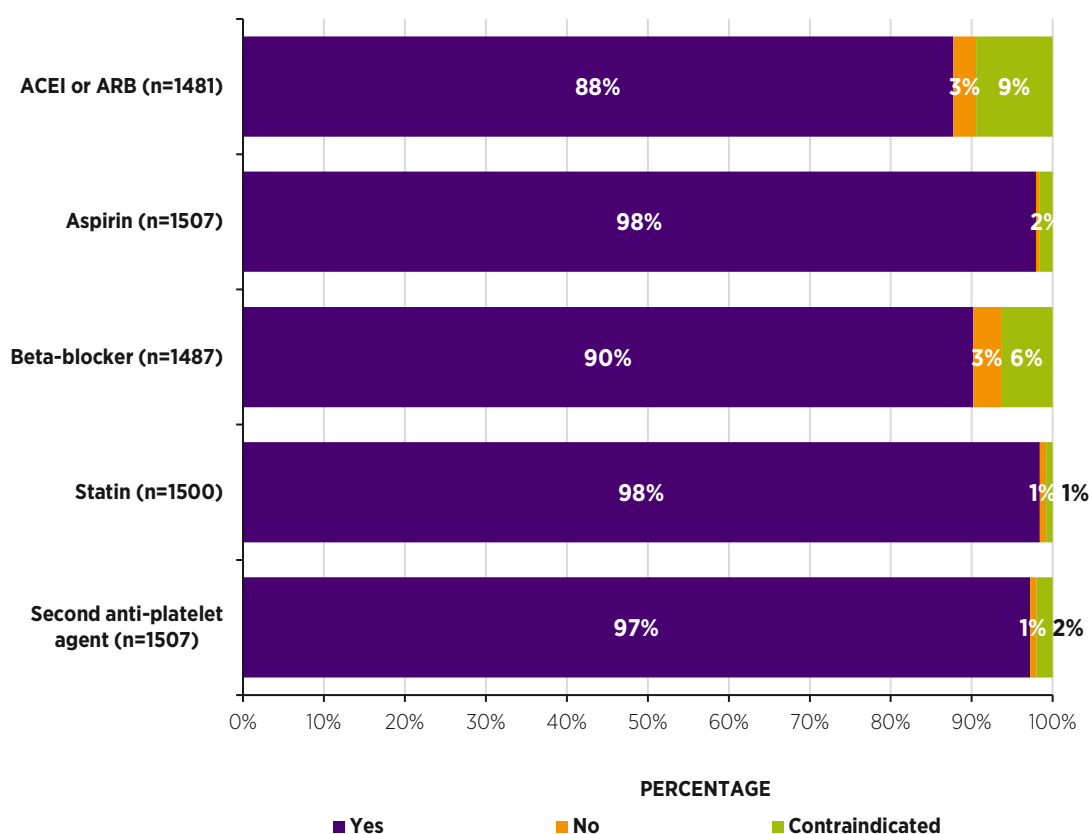


FIGURE 7.8: PROPORTION OF PATIENTS PRESCRIBED SECONDARY PREVENTION MEDICATION ON DISCHARGE⁵⁸

⁵⁸ Patients who had no information recorded are excluded from Figure 7.8. Each patient may have been prescribed one or more medications, and may therefore be counted more than once. Figure 6.8 excludes patients 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.

The proportion of eligible patients with a STEMI who were referred to CR phase 3 increased from 97% in 2024 to 98% in 2025. Figure 7.9 displays the recorded CR phase 3 referral rate by PCI centre.

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 exceeded in 2025 (98%).

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

TARGET: 90% 2025 RESULT: 98%

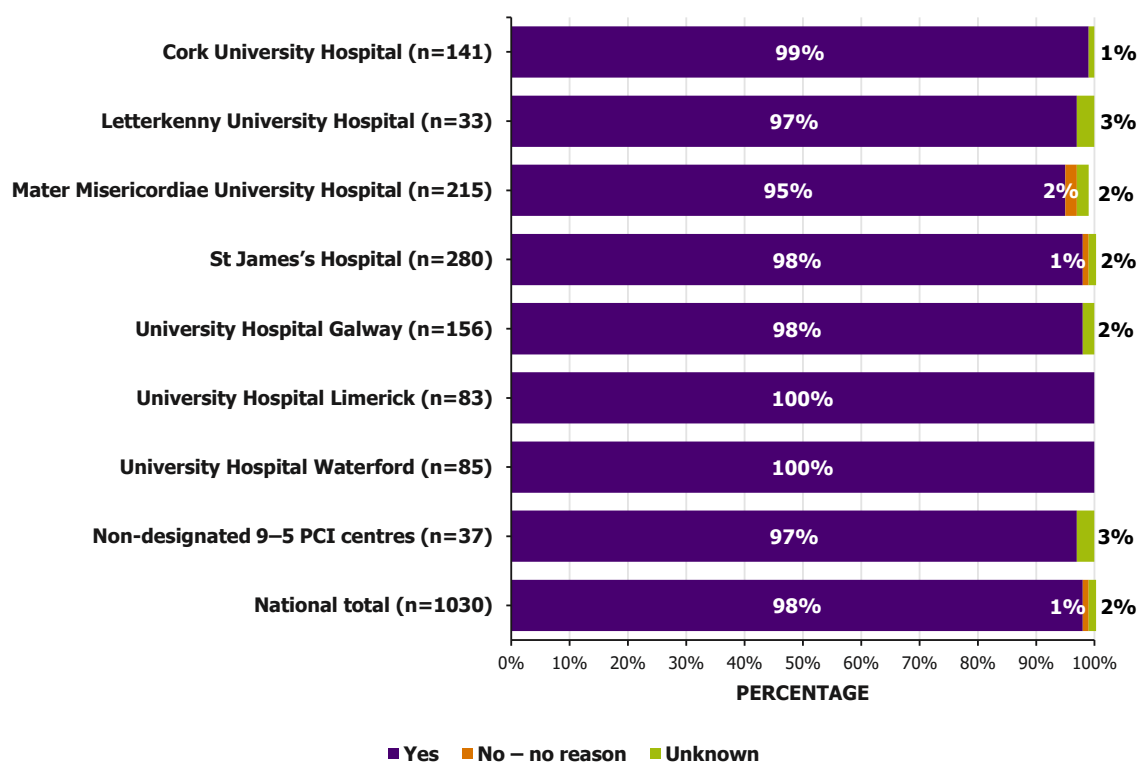


FIGURE 7.9: PROPORTION OF PATIENTS WITH A STEMI REFERRED FOR CARDIAC REHABILITATION PHASE 3, BY PCI CENTRE (n=1,030)⁵⁹

⁵⁹ Non-designated 9.00am to 5.00pm weekday PCI centres include Beaumont Hospital, St Vincent's University Hospital, and Tallaght University Hospital. CR phase 3 referral data for these hospitals are included in the corresponding frequency table in [Appendix 4](#). Figure 7.9 excludes patients who declined, those who were unable to participate due to comorbidity, and those who were dead on discharge.

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, with a target of 90%, was established as a KQI on the IHAA dashboard. Although the target of 90% has not yet been reached, the completeness of the 'date of first phase 3 CR appointment' data point, having improved from 25% in 2021 to 33% in 2022, 52% in 2023, and 63% in 2024, declined marginally to 61% in 2025.

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

TARGET: 90% 2025 RESULT: 61%



KEY FINDINGS FROM CHAPTER 7

- No PCI centre had a mortality rate higher than the expected range in 2025.
- Timely primary PCI is associated with reduced mortality. In 2025, those who received timely primary PCI had an unadjusted mortality rate of 4.2% (n=37), compared with 9.2% (n=46) for those who did not receive timely primary PCI. Although the numbers are small, this represents a potential 50% decrease in mortality.
- The proportion of patients with a STEMI who were current smokers and were recorded as receiving smoking cessation advice was 95% (n=572).
- One-half (n=786, 48%) of patients with a STEMI were discharged directly home from a PCI centre in 2025, similar to the 50% reported in 2024; 43% (n=706) were transferred to another acute hospital for ongoing STEMI care, which is a slight increase from 2024.

CHAPTER 8

QUALITY IMPROVEMENT



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 policymaking. The IHAA wishes to ensure that the audit findings support QI at local, national and policy levels.

HOW CAN THE IHAA DRIVE QI?

The findings in this report offer many opportunities for QI initiatives at local, regional, and national levels. 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 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: THE IRISH HEART ATTACK AUDIT DASHBOARD

The dashboard will be revised in 2026 to further disaggregate timeliness of primary PCI and to add some new KQIs. Please see Chapter 9 for further information.

IHAA KEY QUALITY INDICATOR TRENDS

KQI 1 (Figure 8.2); KQIs 5, 6, and 7 (Figure 8.5); and KQI 8 (Figure 8.6) are all achieving the agreed targets.

KQI 2 (Figure 8.3) was 77% unchanged from 2024. KQI 3 fluctuated within the 30–49% range from 2016 to 2025; there was an improvement from 30% in 2024 to 37% in 2025 (Figure 8.3).

The two data quality KQIs, KQI 8 and KQI 9 (Figure 8.6), have both increased annually since 2020. In 2025, KQI 8 exceeded the 90% target, and this improved data quality has allowed the reporting of 30-day mortality (Figure 7.5).

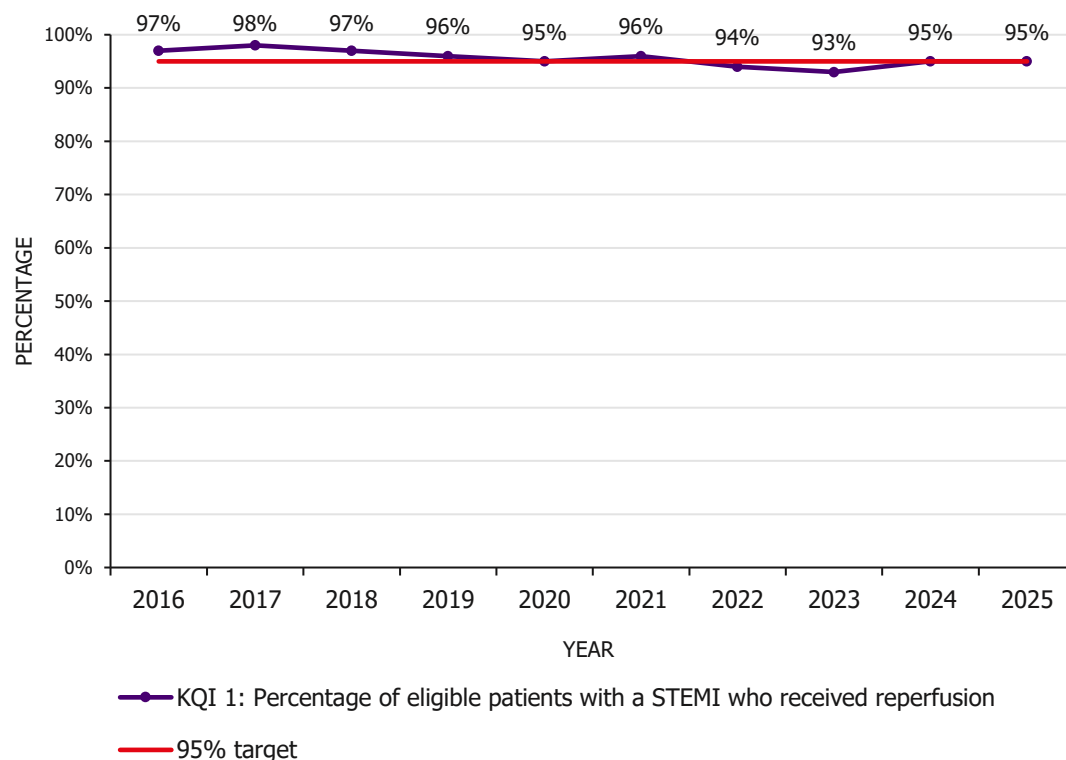


FIGURE 8.2: KQI 1: PERCENTAGE OF ELIGIBLE PATIENTS WITH A STEMI WHO RECEIVED REPERFUSION, BY YEAR

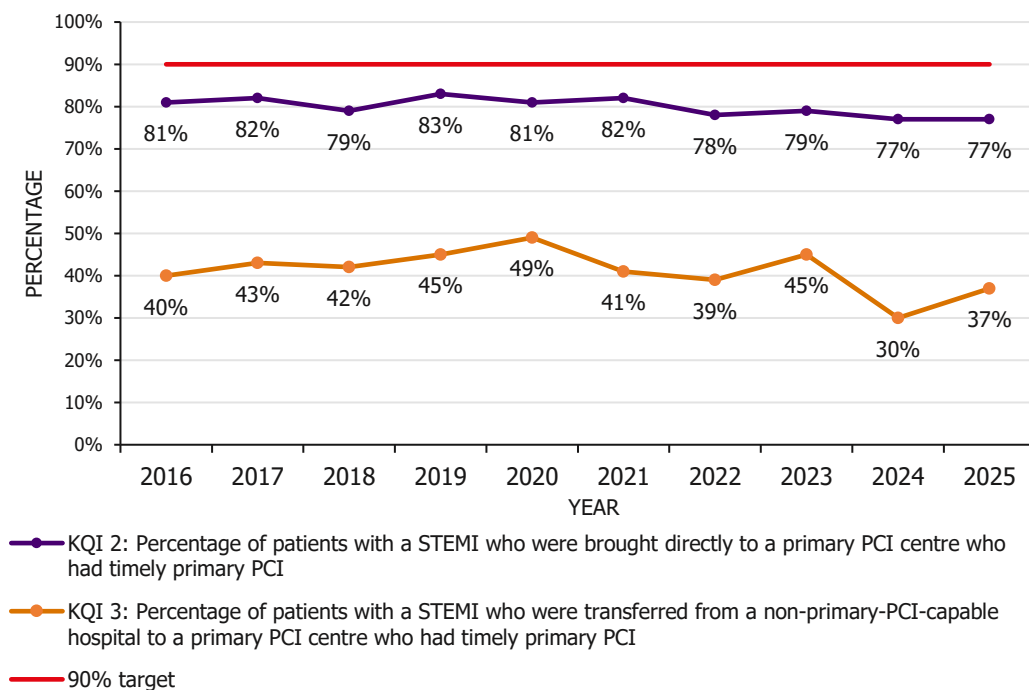


FIGURE 8.3: KQI 2: PERCENTAGE OF PATIENTS WITH A STEMI WHO WERE BROUGHT DIRECTLY TO A PRIMARY PCI CENTRE WHO HAD TIMELY PRIMARY PCI, AND KQI 3: PERCENTAGE OF PATIENTS WITH A STEMI WHO WERE TRANSFERRED FROM A NON-PRIMARY-PCI-CAPABLE HOSPITAL TO A PRIMARY PCI CENTRE WHO HAD TIMELY PRIMARY PCI, BY YEAR

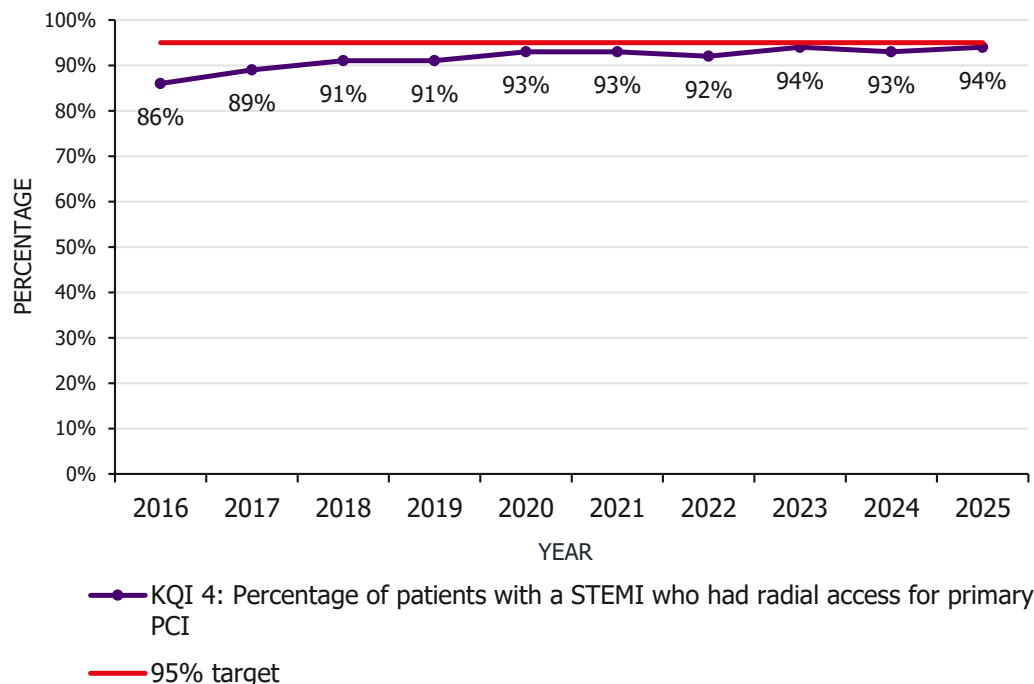


FIGURE 8.4: KQI 4: PERCENTAGE OF PATIENTS WITH A STEMI WHO HAD RADIAL ACCESS FOR PRIMARY PCI, BY YEAR

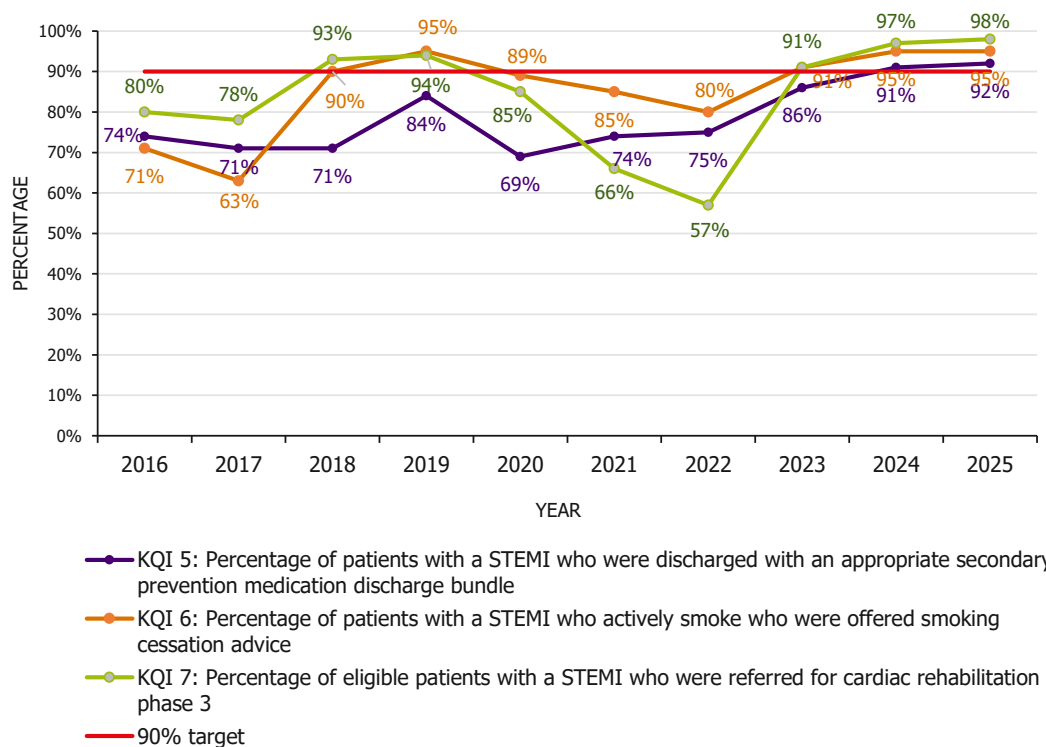


FIGURE 8.5: KQI 5: PERCENTAGE OF PATIENTS WITH A STEMI WHO WERE DISCHARGED WITH AN APPROPRIATE SECONDARY PREVENTION MEDICATION DISCHARGE BUNDLE; KQI 6: PERCENTAGE OF PATIENTS WITH A STEMI WHO ACTIVELY SMOKE WHO WERE OFFERED SMOKING CESSATION ADVICE; AND KQI 7: PERCENTAGE OF ELIGIBLE PATIENTS WITH A STEMI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

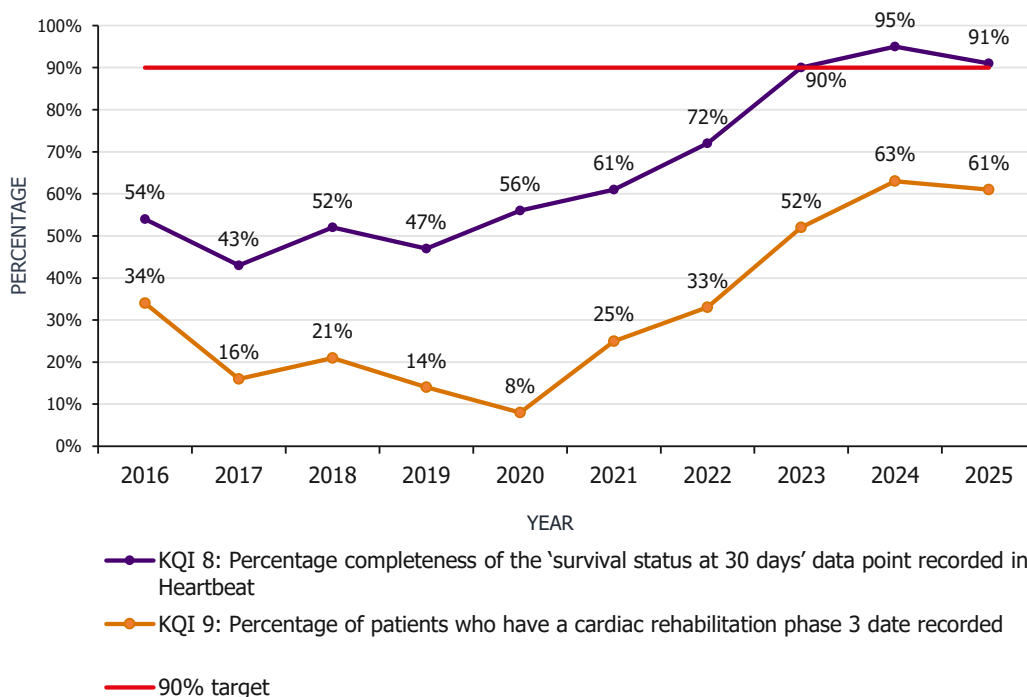


FIGURE 8.6: KQI 8: PERCENTAGE COMPLETENESS OF THE 'SURVIVAL STATUS AT 30 DAYS' DATA POINT RECORDED IN HEARTBEAT, AND KQI 9: PERCENTAGE OF PATIENTS WHO HAVE A CARDIAC REHABILITATION PHASE 3 DATE RECORDED, BY YEAR

IHAA DASHBOARD QUALITY IMPROVEMENT REPORTING

All data within Heartbeat are submitted by the PCI centre; however, often the data are reflective of care provided in a different hospital, e.g. time of first ECG in a non-PCI-capable hospital. Many of the QI initiatives to drive timely reperfusion are required in these hospitals; however, the number of patients in each hospital is low, making interpretation of results limited. The establishment of Regional PCI Networks will enhance the capacity of each network to work collaboratively to drive QI, and the IHAA wants to support these projects using IHAA data. We recommend that an additional QI page be developed within the IHAA dashboard to support this analysis, reporting each item by referring hospital. These data will be used to support service development and QI, but as small numbers will be reported, they will not be used for publication. These reporting metrics will include:



- Thrombolysis rate
- Time to first ECG
- Door to needle time
- DIDO
- FMCTD
- FMCTB.

A communication plan will be created to ensure that the non-PCI-capable hospitals that do not submit the data to Heartbeat will have access to these data in addition to the Regional PCI Networks.

HOW TO DELIVER QI

Clinical audit is a clinically led QI 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 (NOCA) 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. It also provides clinical audit training in order to support clinical teams to develop and run QI projects.

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.



CHAPTER 9

AUDIT UPDATE



CHAPTER 9: AUDIT UPDATE

The purpose of this chapter is to present an update on the activities within the IHAA audit. It identifies changes to the dataset and the data dictionary, highlights how IHAA data are utilised by other services, and presents information on other IHAA activities and projects undertaken by the IHAA in collaboration with other stakeholders. Updates on previous IHAA national report recommendations are presented in Chapter 10.

VALUE OF AUDIT

It takes many years to embed the capture of high-quality data into practice. All hospitals that provide a primary PCI service are now participating in the IHAA. The 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.



In February 2026, Jennifer Murnane O'Connor TD, Minister of State for Public Health, Wellbeing, and the National Drugs Strategy, launched the *Irish Heart Attack Audit National Report 2024* (NOCA, 2026) at the NOCA conference. Over 400 people attended the conference, and the report was widely reported in national and local media.



FIGURE 9.1: DR BRIAN CREEDON, PROFESSOR RONAN MARGEY, PROFESSOR DEBORAH MCNAMARA, MINISTER JENNIFER MURNANE O'CONNOR, PAULA CONNOR, JOAN MCCORMACK AND COLLETTE TULLY ATTENDING THE LAUNCH OF THE IHAA NATIONAL REPORT 2024.

AUDIT ACTIVITY

PCI NETWORK SURVEY

PCI network survey was completed in 2025. The results indicate that all PCI centres have a Clinical Lead for cardiology but only four have a cardiology governance committee and only two hold 'morbidity and mortality' conferences where primary PCI service is reviewed.

Hospitals have links between PCI centres and referring hospitals; however, the majority do not have formal communication links and those that do exist generally involve meeting on an 'ad-hoc' basis. Issues such as the IT infrastructure within the service, time and resources, and lack of electronic patient records are barriers to effective networks.



THE IHAA DASHBOARD UPDATE

The IHAA dashboard is available at each PCI centre and is refreshed quarterly. This can help support PCI centres to identify areas for improvement and to monitor the impact of QI projects.

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 IHAA informs the European Society of Cardiology (ESC) Atlas of Cardiology project through the Irish Cardiac Society.



Recommendations 3 and 4 from the *Irish Heart Attack Audit National Report 2024* (NOCA, 2026) called for a revision of the IHAA dashboard to include the reporting of time to first ECG for those who self-present to a hospital, door to balloon time, and timeliness of primary PCI for those who self-present to a PCI centre. In 2026, these three items will be added to the dashboard, in addition to the total timeliness of Primary PCI. To ensure the dashboard remains clear and easy to interpret, three KQIs will be removed where performance has consistently met the agreed targets. These KQIs will continue to be monitored annually, and any deterioration in performance will be reported accordingly. Table 9.1 outlines the agreed changes to the dashboard.

TABLE 9.1: CHANGES TO THE IHAA DASHBOARD, 2026

ORIGINAL IHAA KQI	CHANGE IN 2026	COMMENT
KQI 1: Percentage of eligible patients with STEMI who received reperfusion.	KQI 1 – No change	This is a national key performance indicator (KPI).
	NEW KQI 2: Percentage of patients who received timely Primary PCI. Target: 90%	This is a national KPI. It reflects the total timeliness of Primary PCI with different targets incorporated based on how the patient accessed the PCI centre: Primary PCI Direct = 120 minutes Primary PCI Transferred = 120 minutes Primary PCI Self-present to PCI centre = 60 minutes
KQI 2: Percentage of patients with STEMI who had timely Primary PCI - arrived directly to a Primary PCI centre	NEW KQI 3: Percentage of patients with STEMI who had timely Primary PCI - arrived directly by ambulance to a Primary PCI centre. Target: 90% within 120 mins	This KQI originally included those brought directly by ambulance, inpatients ⁶⁰ in a PCI centre, and those who self-presented to a PCI centre. The new KQI 3 will include only those brought directly by ambulance. Those who self-present to a PCI centre will be reported as a separate group in new KQI 5.

⁶⁰ Inpatients in a PCI centre will not be included in any analysis.

TABLE 9.1: CHANGES TO THE IHAA DASHBOARD, 2026 - CONTINUED

ORIGINAL IHAA KQI	CHANGE IN 2026	COMMENT
KQI 3: Percentage of patients with STEMI who had timely Primary PCI - transferred to a Primary PCI centre	New KQI 4 = Old KQI 3 Target: 90% within 120 mins	Only number of KQI changed.
KQI 4: Percentage of patients with STEMI who had radial access for Primary PCI.		Original KQI 4 removed as consistently achieving the 95% target.
	New KQI 5: Percentage of patients with STEMI who had timely Primary PCI - self-presented to a Primary PCI centre. Target: 90% within 60 mins	Timeliness of Primary PCI for those who self-present to a PCI centre has been added to align with ESC guidelines (Byrne et al., 2023).
	New KQI 6: Percentage of patients with STEMI who self-present to hospital that receive an ECG within 10 minutes. Target: 90%	This is out of all patients who had the first ECG in the ED of either a PCI centre or a non-PCI capable hospital. This has been added to align with ESC guidelines (Byrne et al., 2023).
	New KPI 7: Percentage of patients with STEMI who received Primary PCI that achieved a 'door to balloon' time within 30 minutes. Target: 90%	This is out of all patients who had Primary PCI excluding those who self-presented to a PCI centre.
KQI 5: Percentage of patients with STEMI who had an appropriate secondary prevention discharge bundle	New KQI 8 = Old KQI 5	Only number of KQI changed.
KQI 6: Percentage of patients with STEMI who smoke, offered smoking cessation.	New KQI 9 = Old KQI 6	Only number of KQI changed.
KQI 7: Percentage of eligible patients with STEMI referred for cardiac rehab.		Original KQI 7 removed as consistently achieving the 90% target.
KQI 8: Percentage completeness of survival status at 30 days		Original KQI 8 removed as consistently achieving the 90% target.
KQI 9: Percentage of patients who have cardiac rehab date recorded	New KQI 10 = Old KQI 9	Only number of KQI changed.

EUROHEART REGISTRY PROJECT: THE NOCA IRISH HEART ATTACK AUDIT IMPACT STUDY REPORT



The IHAA Impact Study, reported in the *Irish Heart Attack Audit National Report 2024* (NOCA, 2026), was commissioned by NOCA to assess the implications of adopting the EuroHeart platform as the future data source for the national audit of STEMI, NSTEMI, and unstable angina. The study represents a significant milestone in the ongoing development of cardiovascular audit infrastructure in Ireland and is intended to support strategic decision-making regarding the future collection, management, and reporting of heart attack data.

The study examined the viability of replacing the current Heartbeat/HIPE-based data collection model with EuroHeart and aimed to evaluate the potential impact on data quality, operational efficiency, user experience, and costs. As part of the first phase of the assessment, the existing Heartbeat and EuroHeart datasets were systematically aligned to identify areas of overlap, differences in data definitions and coverage, and gaps that would need to be addressed to support national audit requirements. In parallel, both data collection systems were characterised and evaluated from data management, reporting, technical, and information governance perspectives to understand the broader implications of transition.

A key strand of the current programme of work is the Comparative Assessment of EuroHeart and Irish Heart Attack Audit Quality Indicators. Early findings have reinforced the importance of developing and sustaining a strong collaborative relationship between the IHAA and EuroHeart analytical teams throughout implementation and beyond. This collaboration will be essential to support IHAA testing of reporting requirements, ensuring that EuroHeart-generated data can meet the needs of the IHAA reporting programme. It will also facilitate the transformation and recoding of EuroHeart data extracts for use in IHAA analyses, enable detailed assessment of the impact of EuroHeart variables on existing reports and quality indicators, and support the evaluation of future EuroHeart releases and enhancements. Establishing these processes early will help minimise risks during implementation and ensure that the transition to EuroHeart continues to support high-quality national audit reporting and QI initiatives.

As identified in the first phase of the Impact Study, full assessment of the impact on data quality, reporting outputs, operational processes, and stakeholder roles will not be possible until the proof-of-concept study has been completed and evaluated.

Audit update: recommendations arising from the IHAA Impact Study

Implementation of the recommendation arising from the first phase of the Impact Study is progressing in line with the plan. During 2025 and 2026, a number of activities have been completed to ensure that the IHAA business and technical requirements are incorporated into EuroHeart:

- Project working group has been established to support the gathering of the IHAA requirements for Euroheart
- Project Initiation Document agreed
- Stakeholder engagement and communication plan agreed
- ACS/PCI workshops were completed in April and May 2026, bringing together interventional cardiologists, cath lab staff, audit personnel, clinical leads, and EuroHeart project stakeholders. The workshops provided valuable feedback to refine the proof-of-concept dataset and support alignment of EuroHeart variables with existing clinical systems and workflows in preparation for implementation.
- IHAA/Euroheart integrated dataset has been agreed and provided to the IT partner for the design and build of the Euroheart platform.
- NOCA and the IHAA are represented on the recently convened EuroHeart Governance Board to support the ongoing development of cardiovascular audit infrastructure in Ireland and to progress/deliver on the IHAA Impact Study.

Current work is focused on operational preparation for testing and the proof of concept. Work will commence in the cath lab to review existing workflow systems and ensure they are aligned with the EuroHeart proof of concept phase to ensure accurate data capture and seamless integration into clinical practice.

The outcomes of the proof of concept will be critical in informing decisions regarding national implementation and the future expansion of EuroHeart to support NSTEMI audit and additional cardiovascular disease datasets.

AUDIT DEVELOPMENT PLAN



The audit development plan for 2026 includes the following.

- Continue to refine the risk-adjusted mortality modelling over time in conjunction with the National Audit of Hospital Mortality.
- Complete the 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.
- The IHAA plans to review how much variation there is in recording the hospital arrival time between PCI centres and we will work with the National Ambulance Service to ensure ease of access to hospital arrival information:
 - Identify variation between PCI centres
 - Identify reason why hospital arrival time is difficult to capture
 - Broaden definitions within the IHAA data dictionary
 - Engage with the National Ambulance Service (NAS) to understand time metrics reported within the NAS patient care record.
- Development of a QI page within the IHAA dashboard:
 - Agree metrics to be included in a QI dashboard with key stakeholders
 - Agree reporting structure
 - Agree a communication plan.

ABSTRACTS AND PUBLICATIONS

The IHAA now has nine years of validated data that can be utilised for secondary analysis for research and/or service evaluation.

A research project investigating gender-based disparities among Irish patients with a STEMI is currently awaiting publication.

The IHAA encourages the use of secondary analysis of validated data for service evaluation or research purposes.





CHAPTER 10

RECOMMENDATIONS



CHAPTER 10: RECOMMENDATIONS

RECOMMENDATIONS FROM 2025 DATA

RECOMMENDATION 1

Increase the proportion of patients with a STEMI receiving primary PCI by implementing a national, targeted public awareness campaign that encourages individuals to seek immediate medical attention when experiencing symptoms of a heart attack.

Rationale		
Timely primary PCI is recognised internationally as the preferred treatment for STEMI (Byrne <i>et al.</i>, 2023). Where primary PCI cannot be delivered within a clinically acceptable time frame, thrombolysis is recommended, followed by early transfer to a PCI centre for angiography (HSE, 2012). The proportion of patients with a STEMI who received primary PCI increased marginally from 77% (n=1251) in 2024 to 78% (n=1287) in 2025. However, this represents a decline from 86% (n=1232) in 2017 and remains substantially below the 90% target (HSE, 2012). The findings from this report suggest two key factors contributing to the lower rates of primary PCI. First, the patient's initial point of access to care appears to influence the type of reperfusion therapy received. In 2025, 24% (n=403) of patients with a STEMI did not call an ambulance for help and instead self-presented to a non-PCI-capable hospital. Among these patients, 62% (n=338) received primary PCI, compared with 87% (n=939) of those who presented directly to a PCI centre. Second, delays in seeking medical attention remain a significant issue. In 2025, 11% (n=179) of patients with a STEMI had a contraindication to reperfusion, with late presentation being the most common reason, accounting for 77% (n=138) of these cases. Late presentation is defined as seeking medical attention more than 12 hours after symptom onset. Among patients who did call an ambulance, only 48% (n=435) did so within 60 minutes of symptom onset in 2025. This continues to highlight persistent delays in help-seeking behaviour among patients experiencing STEMI symptoms.		
What actions should be taken?	Who is responsible for implementation?	When should this be implemented?
These findings again underscore the need for a targeted public awareness campaign to educate the public on recognising heart attack symptoms and the importance of seeking immediate care with pre-hospital ECG diagnosis with the National Ambulance Service (NAS) or at an appropriate hospital capable of performing primary PCI. A public awareness campaign is expected to result in increased call volumes to the NAS, potentially placing additional pressure on existing resources. This should contribute to a review of Protocol 37 arrangements and inform a decision about the need for dedicated resourcing to support the Protocol 37 service.	HSE National Heart Office NAS	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 quicker 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 or in earlier hospital presentations among patients with a STEMI during the campaign. However, there was an increase in the proportion of patients who presented to hospital 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 to a great extent 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 2

Improve the timeliness of primary PCI in patients with a STEMI where primary PCI is identified as the optimal reperfusion therapy.

Rationale		
In 2025, only 62% (n=775) of patients with a STEMI received timely primary PCI, representing a marginal improvement from 61% in 2024; this remains below the HSE target of 90% (HSE, 2012). None of the key time intervals in the patient pathway to timely primary PCI met the recommended targets, for those who presented directly to a PCI centre and even less so for those who presented initially to a non-PCI-capable hospital: - The proportion of patients receiving an ECG within 10 minutes of arrival at hospital is suboptimal. Only 38% of patients with a STEMI who self-presented to a non-PCI-capable hospital met this target in 2025, and the rate was even lower, at just 32%, for those who self-presented to a PCI centre. - The 'door in door out' (DIDO) time of 30 minutes, the recommended goal for patients who initially present to a non-PCI-capable hospital and are then transferred by ambulance to a PCI centre, was achieved in only 4% of cases in 2025. - Seventy-nine per cent of patients who presented directly to a PCI centre met the 90-minute target from first medical contact to arrival at the PCI centre in 2025, compared with only 29% of those who were transferred from another hospital. Patients who receive timely primary PCI demonstrate better outcomes compared to those who do not. In-hospital mortality is notably lower among patients who undergo timely primary PCI, at 4.2% (n=37), compared with 9.2% (n=46) in those who experience delays in reperfusion. In addition, patients who did not receive timely primary PCI had approximately double the 30-day mortality rate (11.5%) compared to those who received timely primary PCI (5.5%). Timely reperfusion is also associated with improved left ventricular function (LVF). Among patients who received timely reperfusion, 39% (n=301) had normal LVF, compared to only 29% of those who did not. Conversely, a greater proportion of patients with delayed reperfusion had severely reduced LVF, affecting 18% (n=79), compared to 10% (n=76) in the timely reperfusion group. These findings reinforce the importance of minimising delays to primary PCI, as timely treatment is associated with both reduced mortality and better preservation of cardiac function.		
What actions should be taken?	Who is responsible for implementation?	When should this be implemented?
- All Regional PCI Networks must establish and maintain effective governance structures in order to ensure coordinated and high-quality care delivery. - The NOCA dashboard, which in 2026 will report on an enhanced suite of key time intervals to support timely primary PCI, should be actively utilised in order to identify areas requiring improvement, and QI initiatives should be developed and implemented in order to enhance timeliness across all key time intervals in the STEMI care pathway. - All hospitals within each Regional PCI Network are expected to actively participate in QI projects. These should involve a collaboration of Emergency Medicine, Cardiology, and NAS/ Dublin Fire Brigade in the Primary PCI hospitals and non-PCI hospitals within a region to target improvements in time to ECG, DIDO times, DTB times, and inter-hospital transfer times. - NOCA should develop a new report to support QI in non-PCI-capable hospitals.	HSE National Heart Office Regional Executive Officers NOCA	As soon as possible

Evidence that the action will be effective

Timely primary PCI is recognised internationally as the preferred treatment for STEMI (Byrne *et al.*, 2023).

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 3

Improve the timeliness of thrombolysis in patients with a STEMI where thrombolysis is identified as the optimal reperfusion therapy.

Rationale		
While primary PCI remains the gold standard reperfusion therapy, timely delivery is not universally achievable. 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). The number of patients with a STEMI who were treated with thrombolysis increased from 81 cases in 2021 to 85 in 2022, 108 in 2023, and 111 in 2024, then went down to 101 in 2025. However, in 2025, only 27% (n=27) of patients with a STEMI received timely thrombolysis, representing an improvement from 22% in 2024 but far from the HSE target of 90% (HSE, 2012).		
What actions should be taken?	Who is responsible for implementation?	When should this be implemented?
- All regional PCI networks should routinely monitor the proportion of patients receiving thrombolysis. - Regional PCI networks should identify specific geographic areas where timely access to primary PCI is not achievable, due to logistical or distance-related constraints. - In regions where logistical or distance-related barriers prevent timely primary PCI, targeted QI strategies should be developed in collaboration with the NAS to improve access to timely Primary PCI and, where this is not feasible, timely thrombolysis as an alternative reperfusion strategy. - Regional PCI networks and the NAS should implement structured thrombolysis pathways, which may include: - Develop and implement a regional thrombolysis checklist/proforma to support safe and timely decision-making in designated geographic areas. - Introduce an ambulance 'pre-alert' protocol to non-PCI-capable hospitals, enabling emergency departments to prepare thrombolytic therapy in advance of patient arrival. - Establish an ambulance 'STEMI Pitstop' model, whereby patients receive rapid assessment and immediate thrombolysis (if indicated) or receive IV heparin bolus and adjunctive pharmacologic therapy if a decision to not administer thrombolysis is made, at the nearest appropriate hospital, followed by expedited transfer to a PCI centre. - The National Heart Office should consider updating the definition of timely thrombolysis to match the ESC 2023 <i>Guidelines for the Management of Acute Coronary Syndromes</i> definitions (Byrne <i>et al.</i>, 2023). - NOCA should develop a new report on thrombolysis in non-PCI-capable hospitals.	Regional Executive Officers NAS NOCA	As soon as possible

Evidence that the action will be effective

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).

Who will benefit from the recommendation?

Patients with a STEMI will benefit from a structured, data-driven approach that ensures that patients in geographically disadvantaged areas receive prompt and effective reperfusion, reducing mortality and preserving cardiac function.

RECOMMENDATION 4

NOCA should collaborate with the National Ambulance Service (NAS) and Dublin Fire Brigade (DFB) to develop and implement a standardised national reporting framework for pre-hospital STEMI care.

Rationale		
While 79% (n=599) of patients who were brought directly by ambulance to a PCI centre met the 90-minute first medical contact to balloon target, the absence of ambulance scene timestamps limits the ability to identify specific sources of delay within the pre-hospital pathway. Enhanced data capture of ambulance response, on-scene, and transport intervals is required to enable targeted QI. NOCA has established a mechanism to extract data from the NAS patient care record; however, this is unavailable from the DFB.		
What actions should be taken?	Who is responsible for implementation?	When should this be implemented?
- Establish a joint NHO, NOCA, NAS, and DFB working group. - Define a minimum dataset for pre-hospital STEMI care. - Integrate reporting into the Heartbeat dataset and national audit reports.	NOCA	2027
Evidence that the action will be effective		
Timely reperfusion is a critical determinant of survival in STEMI, and FMCTB time is recognised globally as a key quality indicator. Patients who do not meet these time targets have significantly higher mortality and worse clinical outcomes (Mehran, 2025). Studies demonstrate that detailed measurement and analysis of pre-hospital intervals enable targeted improvements. Continuous QI programmes incorporating structured data collection, performance monitoring, and feedback have been shown to significantly increase the proportion of patients meeting the 90-minute DTB target and improve triage accuracy (Reddy <i>et al.</i> , 2025).		
Who will benefit from the recommendation?		
All patients with a STEMI will benefit from continuous improvement of the STEMI care pathway, ensuring timely, equitable, and effective treatment for all patients.		

UPDATE ON PREVIOUS IHAA NATIONAL REPORT RECOMMENDATIONS

Table 10.1 displays an update on the recommendations from previous IHAA national reports (NOCA, 2022, 2023a, 2024b, 2026).

TABLE 10.1: UPDATE ON PREVIOUS IRISH HEART ATTACK AUDIT NATIONAL REPORT RECOMMENDATIONS

RECOMMENDATION	STATUS	UPDATE
Implement a national STEMI transfer form for use when transferring patients from a non-PCI hospital to a PCI centre.	On hold	The IHAA has established links with the 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 and the IHAA is awaiting further information on this pilot. In the interim the NAS is working with the NHO and the IHAA to include key items required in the pre-hospital into the NAS dataset where possible.
Improve the data quality of the follow-up dataset within the Heartbeat portal.	In progress	Two KQIs on follow-up data variables are reported on a quarterly basis via the NOCA IHAA dashboard: KQI 8: Percentage completeness of the ‘survival status at 30 days’ data point recorded in Heartbeat: The target of 90% has been achieved (2024: 95%; 2025: 91%). As a result of this improvement, this variable has been used to report on survival status at 30 days using the Global Registry of Acute Coronary Events (GRACE) stratification (Figure 7.5). KQI 9: Percentage of patients who have a cardiac rehabilitation phase 3 date recorded: This metric remains challenging to capture and requires monitoring in each PCI centre (2022: 33%, 2024: 63%; 2025: 61%) (Figure 3.1). Low coverage in one PCI centre has impacted on the national result. Once there is good completeness of this variable in all PCI centres, the IHAA can begin to report on the time it takes for patients to access phase 3 CR.
Introduce a KPI that measures DIDO time with the aim of achieving the ESC’s guideline target of 30 minutes or less.	Complete	The DIDO time by non-PCI centre is now reported annually (Figure 6.11). Recommendation 2 in this report supports the development of a report of key QI metrics to non-PCI-capable hospitals.
Improve timeliness of reperfusion for patients with a STEMI presenting to non-PCI centres.	In progress	In 2025, the Office of the Chief Clinical Officer and the HSE NHO have directed the establishment of Regional PCI Networks. These networks should involve a collaboration of Emergency Medicine, Cardiology, and NAS/DFB in the Primary PCI centres and non-PCI hospitals within a region to target improvements. The IHAA dashboard quarterly reports should inform the agenda for these meetings.

RECOMMENDATION	STATUS	UPDATE
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.	Closed	The NHO and the NAS have reviewed the evidence and impact of a public awareness campaign. It is likely that there will be an estimated 10 to 15 extra calls to NAS per 24-hour period if Australian data are replicated – a 1% increase in demand. The NHO has made a submission to the HSE to fund a public awareness campaign and this is a recommendation from this report.
Improve public awareness of the adverse impact of smoking on heart attack risk.	Ongoing	The IHAA continues to report on the adverse impact of smoking. IHAA data can be used to support further research or national campaigns in order to continue to reduce the proportion of the population who smoke.
There should be a national and regional focus on QI in the STEMI care pathway. All percutaneous coronary intervention (PCI) centres, non-PCI-capable hospitals, and ambulance services should participate in the STEMI care pathway QI project.	Closed	The NHO has stood down the National STEMI Care Pathway Quality Improvement Project as the Regional PCI Networks are being established and each region will be responsible for QI within its network. Once the ACS Model of Care is completed, this will inform the QI project regionally.
The Irish Heart Attack Audit should complete a survey of PCI networks.	Complete	The IHAA completed a PCI Network survey: please see Chapter 8 for further information.
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.	Complete	Reporting separately on patients who self-present to a PCI centre has been included in the IHAA national reports in 2024 and 2025. This metric has also been included in the IHAA Dashboard in 2026.
All PCI centres should implement targeted QI initiatives to increase the proportion of patients with a STEMI who arrive at a PCI centre by ambulance who achieve the recommended 'door to balloon' time of 30 minutes or less.	In progress	The IHAA dashboard was enhanced in July 2026 to incorporate 'door-to-balloon' time as part of the suite of IHAA KQIs. This indicator will be subject to quarterly monitoring and reporting across all PCI centres and Regional PCI Networks. The NHO will use these reports to drive QI initiatives within Regional PCI Networks.
All PCI centres should implement targeted QI initiatives to increase the proportion of patients with a STEMI who self-present to a PCI centre who achieve the recommended 'first medical contact to balloon' time of 60 minutes or less.	In progress	The IHAA dashboard was enhanced in July 2026 to incorporate FMCTB time as part of the suite of IHAA KQIs. This indicator will be subject to quarterly monitoring and reporting across all PCI centres and Regional PCI Networks. The NHO will use these reports to drive QI initiatives within Regional PCI Networks.



CHAPTER 11

CONCLUSION



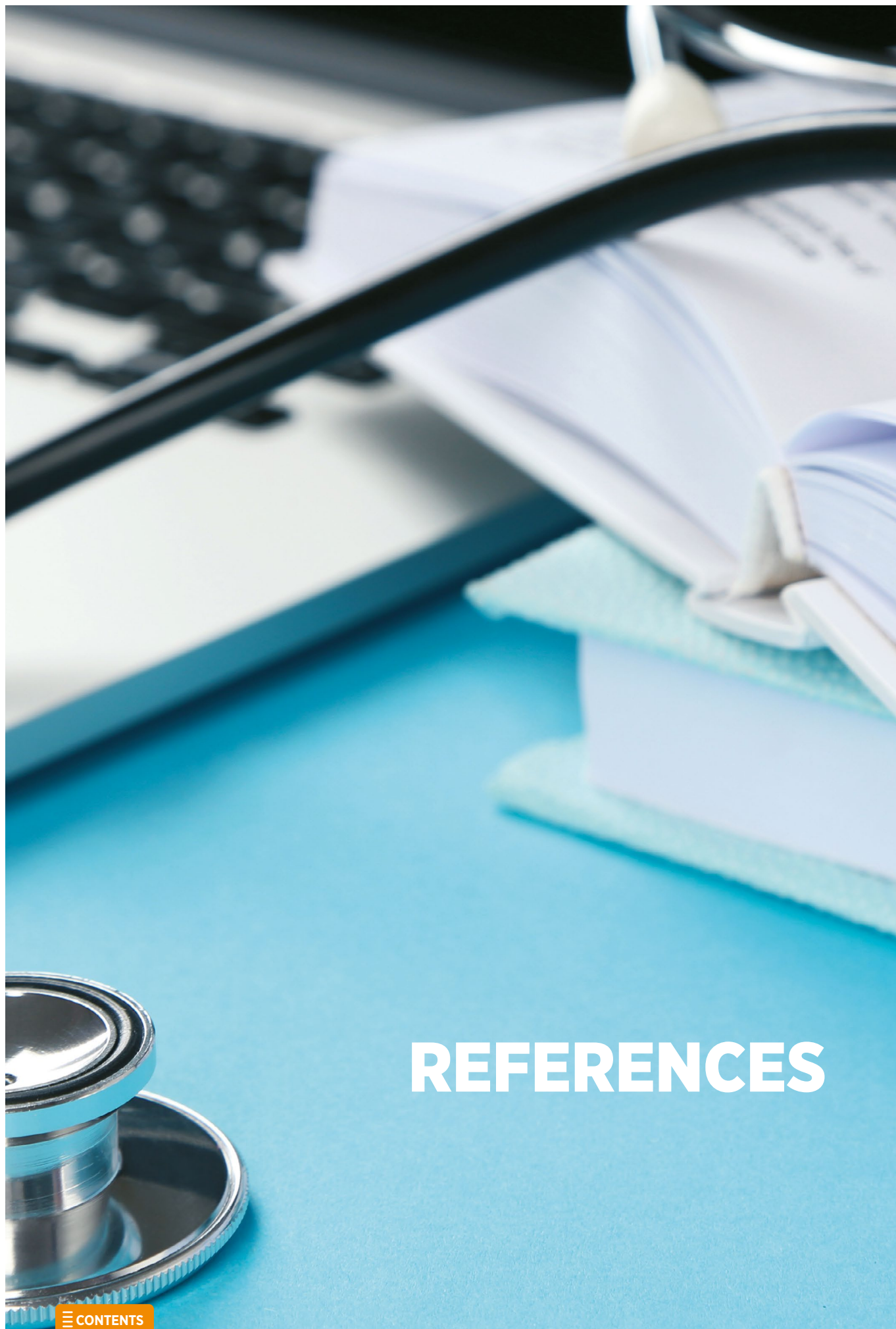
CHAPTER 11: CONCLUSION

The Irish Heart Attack Audit National Report 2025 highlights both progress and ongoing challenges in the delivery of STEMI care in Ireland. Nationally, high rates of reperfusion were achieved, with 95% of eligible patients receiving reperfusion therapy.

However, the report underscores significant gaps in achieving timely care. Only 59% of patients received reperfusion within recommended timeframes, well below the national target, with particularly poor performance among patients who self-present or are transferred to a PCI centre. Persistent delays in symptom recognition, time to first ECG, inter-hospital transfer (notably DIDO times), and access to timely primary PCI remain major barriers.

Outcomes data reinforce the clinical importance of addressing these delays: timely reperfusion is associated with lower mortality and improved cardiac function. At the same time, rising mortality, increasing complication rates, and the high burden of modifiable risk factors, especially smoking, highlight the need for stronger prevention and secondary care strategies.

To improve outcomes, a coordinated, system-wide approach is required. Key priorities include reducing pre-hospital delays through public awareness, strengthening regional PCI networks, improving inter-hospital transfer efficiency, enhancing thrombolysis pathways where appropriate, and ensuring consistent high-quality data collection. Continued audit, collaboration, and targeted QI initiatives will be essential to achieving timely, equitable, and effective care for all patients with STEMI in Ireland.



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APPENDIX 1:

AIM AND OBJECTIVES OF THE IRISH
HEART ATTACK AUDIT

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APPENDIX 2:

IHAA GOVERNANCE COMMITTEE MEMBERSHIP
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APPENDIX 3:

METADATA FOR KEY QUALITY INDICATORS

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HEARTBEAT VARIABLE COMPLETENESS

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SUPPLEMENTARY TABLES

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APPENDIX 7:

SPECIFICATIONS FOR COMPOSITE VARIABLES

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