ESC EUROHEART REPORT 2023

ESC
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of Cardiology

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ISBN:

EuroHeart collaboration presents the available data for 2023 from the first EuroHeart dataset on acute coronary syndrome (ACS) and percutaneous coronary intervention (PCI).

Iceland

Sweden

Estonia

Hungary, Romania

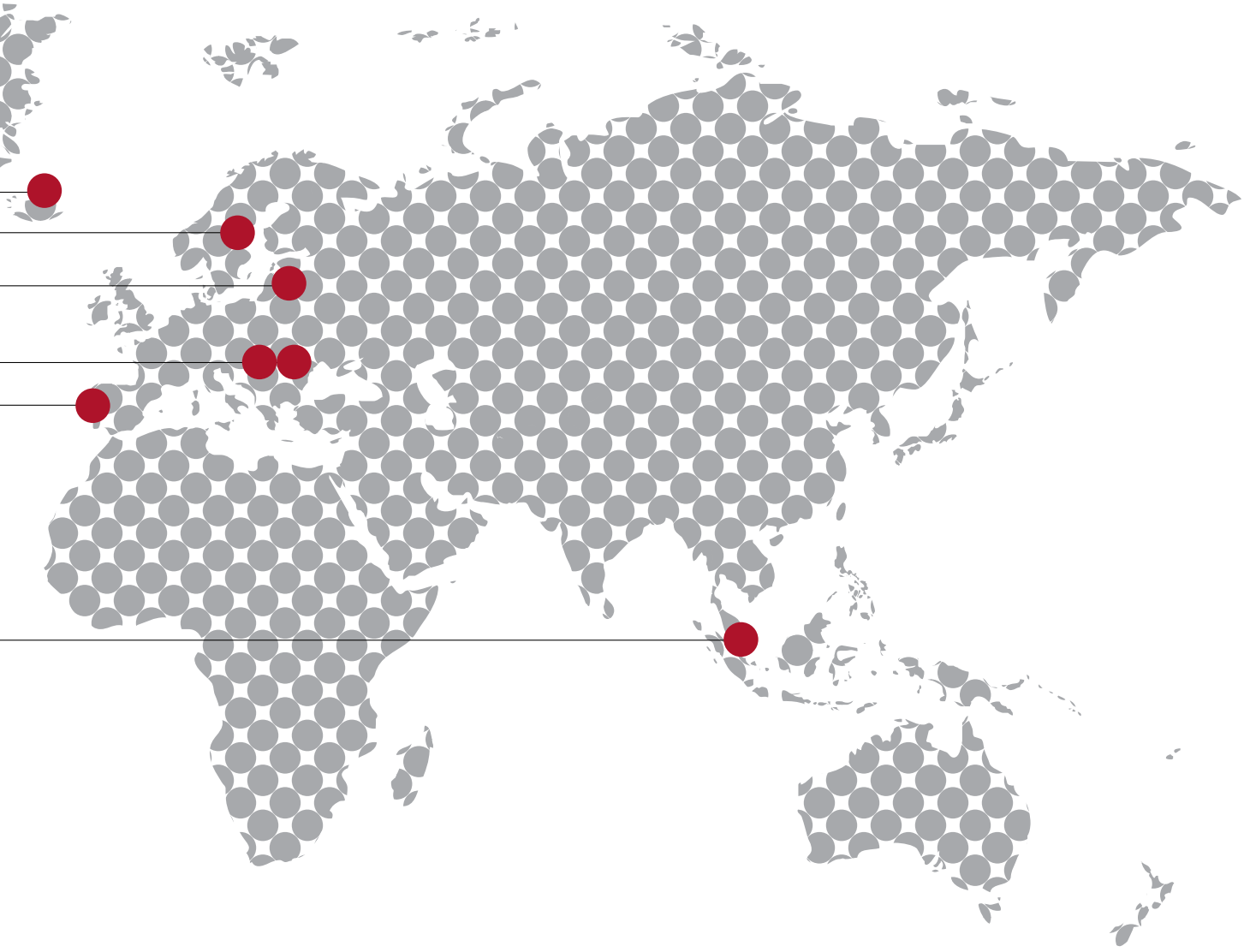
Portugal

Singapore

Data from around

40,000 patients

with acute coronary syndrome from seven countries: Estonia, Hungary, Iceland, Portugal, Romania, Singapore and Sweden



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The EuroHeart group is happy to present its very first yearly report including available patient data from 2022. The report describes the development of the EuroHeart collaboration, its central coordination, and the organization in the eleven currently participating countries. The report also summarises the currently ongoing activities and the planned further development.

The core of the report is the presentation of the available data for 2022 from the first EuroHeart dataset on acute coronary syndrome (ACS) and percutaneous coronary intervention (PCI). The individual data have been registered in the National Registries on ACS and PCI, in accordance with the data definitions developed and agreed in the EuroHeart group, endorsed by the European Society of Cardiology and published in the European Heart Journal. The predefined statistical analyses of the individual data have been performed at the national level and the aggregated data from the countries then transferred to the EuroHeart Data Science Group. Therefore, EuroHeart can now present data from around 40,000 patients with acute coronary syndrome from seven countries: Estonia, Hungary, Iceland, Portugal, Romania, Singapore and Sweden. Lithuania will hopefully be able to start-up registration in 2024.

The EuroHeart report from 2022, accordingly,

> EuroHeart can now present data from around 40,000 patients with acute coronary syndrome from seven countries: Estonia, Hungary, Iceland, Portugal, Romania, Singapore and Sweden

presents patient and disease characteristics, pharmacological treatments, invasive procedures, and in-hospital outcomes in patients with ST-elevation or non-ST-elevation myocardial infarction in seven countries. Overall, there is generally good quality of care with high proportions of patients treated with the guideline recommended medical and invasive treatments. There are also several learning experiences based on notable differences in patient risk factors, treatments with platelet inhibitors and timing of invasive procedures. There seems to be a slow implementation of the novel antidiabetic cardioprotective treatments which should be closely monitored over the next few years. It should be emphasized that the coverage and representativity of the included populations was variable in 2022. A few countries (Hungary, Sweden, Iceland) included complete populations of patients with myocardial infarction, while other countries were represented by a smaller proportion. Therefore, all comparisons of results between the countries should be taken with caution.

This report summarises the first steps on a long journey to establish the European Unified Registries On Heart Care Evaluation and Randomised Trials (EuroHeart). The next steps are to further expand the collaboration to additional countries, start-up datasets in additional disease domains and utilise the common registry infrastructure to initiate registry-based randomised trials and safety surveillance of novel drugs and devices. We thank all participating and candidate centres and countries for their dedication to the EuroHeart mission to improve standards of care, outcomes, and research in patients with common cardiovascular diseases and look forward to working on the many mutual opportunities in the EuroHeart collaborative network.

We are stronger together!

Barbara Casadei,
Lars Wallentin

Co-chairpersons EuroHeart

If you would like further information about EuroHeart or are interested in being part of EuroHeart, please email **euroheart@escardio.org**

Introduction from Chair of the Data Science Group

02

Professor Chris P Gale
Professor of Cardiovascular Medicine, University of Leeds
Consultant Cardiologist, Leeds Teaching Hospitals NHS Trust

Innovations and interventions to reduce the global burden of cardiovascular disease can only arise if we document, report and understand what is happening and where with real world clinical evidence.

Historically, cohorts, surveys and registries have described the extent and variation of cardiovascular disease between and within countries.[1,2,3] Yet, these studies are limited because they either collect local or regional data, do not collect individual participant data, do not report clinically meaningful variables, or use non-standardised definitions of cardiovascular disease.

Aligning data collection and standardising the variables collected allows for pooled and cross-countries analyses.

Accordingly, the EuroHeart Data Science Group has developed and published a suite of internationally endorsed variables with associated definitions for four cardiovascular datasets: acute coronary syndrome/ percutaneous coronary intervention (ACS/PCI)[4], heart failure[5], atrial fibrillation[6] and transcatheter aortic valve implantation (TAVI).[7] Here, we report the findings from the first pass data collection from the vanguard countries participating in EuroHeart in 2022.

In line with General Data Protection Regulation, the Data Science Group of EuroHeart only receives de-identified, aggregated data from countries participating in EuroHeart and who consent to data sharing.[8]

We are pleased to provide this report, as a proof of concept in the consolidation phase following the successful delivery of the pilot phase. We find variation in the demographics, access to treatments and outcomes from acute myocardial infarction. Such information is critical evidence for policy and clinical change.

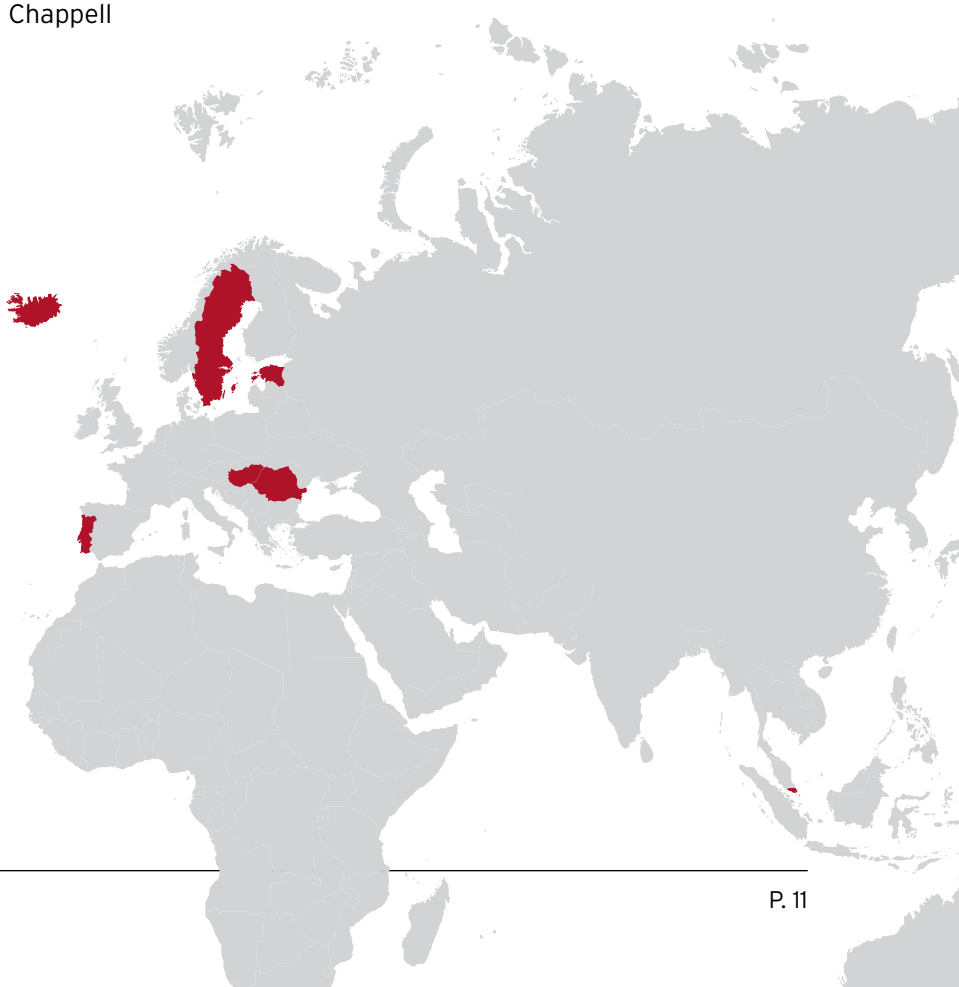
I am indebted to the EuroHeart Data Science team, without whom this project would not have been a success.

Accordingly, the EuroHeart Data Science Group has developed and published a suite of internationally endorsed variables with associated definitions for four cardiovascular datasets: acute coronary syndrome/percutaneous coronary intervention (ACS/PCI)[4], heart failure[5], atrial fibrillation[6] and transcatheter aortic valve implantation (TAVI).[7]

Thanks go to:

Clinical Management	Dr Suleman Aktaa Dr Gorav Batra Dr Asad Bhatty Dr Chris Wilkinson
Data Management	Sam Chappell
Statistics	Dr Bernadette Dondo Prof Jianhua Wu
Project Management	Catherine Reynolds

I also wish to express my sincerest thanks to the National Leaders of the Cardiac Societies for the countries who have submitted 2022 data: **Estonia, Hungary, Iceland, Portugal, Romania, Singapore** and **Sweden.** Additionally, thanks to National Leaders of the Cardiac societies of Denmark, Lithuania, Italy and the Republic of Ireland for their engagement with the EuroHeart collaboration.



Summary of the results 03

For the ACS/PCI dataset, aggregated data were supplied from seven EuroHeart participating countries: Estonia, Hungary, Iceland, Romania, Portugal, Singapore and Sweden.

Data are reported for admissions with a (final) diagnosis of ST segment elevation myocardial infarction (STEMI) or non-ST segment elevation myocardial infarction (NSTEMI) during 2022. Emergency, but not elective, PCI is included where collected. The principal analyses are based on the numbers of patient admissions and not unique patients.

The 2022 EuroHeart cohort for ACS/PCI comprised of 40,021 admissions with acute myocardial infarction. The mean age was 68 years and 31.6% were women. There was a total of 18,686 STEMI admissions and 21,335 NSTEMI admissions.

Numbers of admissions

There were **40,021 admissions with a STEMI or NSTEMI** between 1st January 2022 and 31st December 2022

The number of admissions submitted across the different countries was:

ESTONIA
310 STEMI and
296 NSTEMI admissions

HUNGARY
5,717 STEMI and 6,393
NSTEMI admissions

ICELAND[1]
203 STEMI and 306
NSTEMI admissions

PORTUGAL[2]
4,949 STEMI admissions and
3,106 NSTEMI admissions

ROMANIA[3]
1,661 STEMI and 1,019
NSTEMI admissions

SWEDEN
5,530 STEMI and 10,215
NSTEMI admissions

SINGAPORE
316 STEMI admissions

[1]No of patients used as a proxy measure for number of admissions
[2]Data collected in separate ACS and PCI registries
[3]Data collected between March 2022 and 31st December 2022

Demographics

About a third (31.6%) of admissions were of **female patients**

Nearly half (47.1%) of admissions were for patients aged **70 years and over**

The most **frequent age** category for patients was **70 to 74 years** (5,675 patients, 14.4%)

Co-morbidities

A quarter (25.8%) of admissions were for **patients with type II diabetes**

A fifth (20.2%) of admissions were for patients who had experienced a **prior myocardial infarction**

The **mean body mass index** of admissions was 27.8 (±1.8) kg/m^2

Two thirds (67.9%) of admissions were for **patients with hypertension**

Nearly a fifth (18.5%) of admissions were for patients who had **previously received PCI**

Almost a quarter (22.0%) of admissions were **current smokers,** with an additional quarter (24.3%) being **former smokers**

Medications at discharge

Beta blockers were prescribed for around eight in ten admissions (79.8%)[4]

An angiotensin-converting enzyme inhibitor, angiotensin receptor antagonist or angiotensin receptor-neprilysin inhibitor **(ACEi/ARB/ARNI)** was prescribed in eight in ten admissions (81.6%)[4]

[4]Data not available for Iceland and Portugal

What are the aims of EuroHeart?

04

In July 2019, the European Society of Cardiology (ESC) Board approved the launch of a two-year pilot phase to assess the feasibility of implementation of EuroHeart in different healthcare systems. EuroHeart was developed with the following aims:

To support the improvement in quality of care for **cardiovascular disease**

To develop quality datasets in common cardiovascular disease areas including **data variables, units and definitions**

To **create** and **maintain** an international collaboration network of national/regional quality registries

To develop an optional IT infrastructure for continuous online registration of high quality and harmonised patient data, with **real-time feedback**

To **provide an infrastructure** for observational and randomized research, safety surveillance of new drugs and devices, post market surveillance of existing devices

What was achieved in the pilot phase?

05

The pilot phase ran from January 2019 to June 2022. The results of the pilot phase can be summarised as follows:

The **EuroHeart IT Platform** was developed

Eight European and **one Asian country** joined the **collaboration**

Registration of patients in the EuroHeart ACS/PCI dataset **started in May 2021**

Data standards for four disease domains developed: **ACS-PCI, Heart Failure, Atrial Fibrillation, TAVI**

Collaboration established with nine **industry partners** and one **research foundation**.

What will be achieved in the next phase?

06

The EuroHeart project has transitioned to a 2-year consolidation phase with completion at the end of December 2024. In this phase, the focus will be on:

Supporting ongoing and novel quality registries in the **current network of eleven*** **countries**

Expanding the EuroHeart network to at least **four additional countries**

Developing data standards for **cardiovascular outcomes**

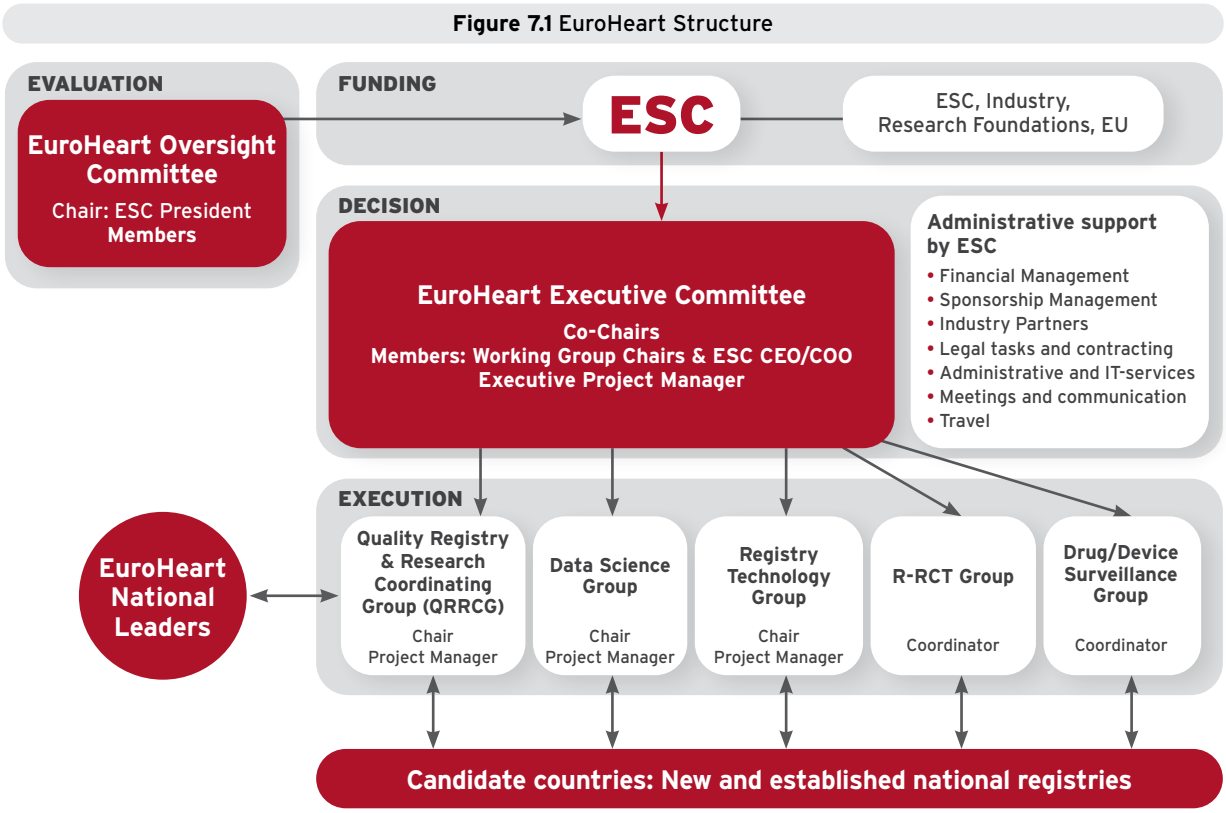
Initiate an international framework to support registry-based randomised **clinical trials (R-RCTs)**

** As of January 2024*

EuroHeart – Meet the team 07

EuroHeart is an ESC initiated project and was set up with oversight from the EuroHeart Oversight Committee and executed by the EuroHeart Executive Committee. The activities of EuroHeart are executed by the five working groups along with the EuroHeart National Leader, with administrative support provided by the ESC.[9]

Figure 7.1 EuroHeart Structure



7.1 EuroHeart Team

The Executive Committee consists of two chairs, **Professor Lars Wallentin** and **Professor Barbara Casadei**, representatives from the ESC are included and the chairs of the Quality Registry and Research Coordinating Group, Data Science Group and Registry Technology Group.

The **Quality Registry & Research Coordinating (QRRC) Group** is responsible for the development and management of the EuroHeart Network. The first point of contact is through the National Cardiovascular Societies but it may also be the National Leaders of countries who reach out to EuroHeart. Once contact is established, several rounds of dialogue and exchanges are undertaken to assess suitability to take part in EuroHeart.

This is followed by a formal decision by the Executive Committee.
The Chair of the QRRC Group is **Professor Aldo Maggioni.**

The **Data Science (DS) Group** is responsible for the design, development and maintenance of the EuroHeart common datasets and definitions which allow for collection and comparison of harmonised data within and between countries. The group is responsible for the collection and quality checks of the aggregated data and for the development of the statistical analysis plans. Countries that use their own IT platforms to collect EuroHeart data will be supported by the DS Group to ensure data variables are harmonised.
The Chair of the DS Group is **Professor Chris Gale.**

The **Registry Technology (RT) Group** is responsible for the development and maintenance of the EuroHeart IT platform. The group works closely with the countries implementing the platform and provides both technical support and expertise in running registry centre operations as well as in continuous quality of care follow-up and improvement, during and after implementation.
The Chair of the RT Group is Mrs **Sara Hansson.**

The **Registry Randomised Control Trial (RRCT) Group** is responsible for the development of randomised clinical trials within EuroHeart's datasets. Starting in the consolidation phase, their role is to initiate and support EuroHeart RRCTs and safety surveillance studies of drugs and devices (alongside the Drug/Device Surveillance Group) with the expectation of the first EuroHeart RRCT or observational study commencing by the end of the consolidation phase.
The Coordinator for the RRCT Group is **Professor Stefan James.**

The **Drug/Device Surveillance (DDS) Group** has recently started its work by advising on regulatory requirements during the development of the TAVI dataset. As the EuroHeart network grows, the DDS group will explore collaborations for drug and device.[9]
The Coordinator for the DDS Group is **Professor Alan Fraser.**

In addition to these working groups, EuroHeart works closely with the ESC. An integral component to the success of the project has been the ESC Project Manager who is the conduit for services provided by the ESC, including financial, business, sponsorship, legal issues and contracting, administrative and IT services, meetings and graphics support.

Countries participating in EuroHeart

08

8.1 Introduction

Country participation and engagement in EuroHeart is paramount to the success of the project.

Building National Quality Registries is a long-term commitment that evolves over time in a stepwise process. Currently, the term EuroHeart Country/Region is defined as a country, but it could also be a region or a large network of hospitals or healthcare organisations within a large country developing a registry based on the EuroHeart common dataset in at least one of the four disease domains. EuroHeart's long-term goal is to obtain a complete National/Regional coverage in all four EuroHeart disease domains. EuroHeart will continue to develop the network, aiming to include a range of countries/regions with different income levels, from large to small, and Western to Eastern, Northern to Southern European countries/regions.

The process of joining EuroHeart - from the initial contact with the president of the National Cardiac Society or national champions to signing the EuroHeart Letter of Intent - involves gaining local engagement not only in the medical, research and technical communities but also the engagement and commitment of government and authorities. Countries using their own IT platforms may need to adjust their current datasets to become aligned with EuroHeart and these changes should coincide with EuroHeart's annual reporting periods.

Since the start of the project in July 2019, EuroHeart's QRRC Working Group has been in communication with over 20 countries. During the pilot phase, nine countries joined the collaboration, of which seven commenced data collection during this period. Estonia and Romania are using the EuroHeart IT platform whereas Denmark, Hungary, Iceland, Portugal, Singapore and Sweden are using their own IT platforms. Lithuania is currently investigating potential options for data collection.

Since the start of the consolidation phase, we have welcomed the Republic of Ireland to EuroHeart. The country will be adopting the EuroHeart IT platform.

Figure 8.1.1 — EuroHeart Timeline

National Leaders Group

Representatives from each country participating, or considering participation, in EuroHeart are encouraged to be part of the National Leaders Group. The National Leaders Group is an integral part of the EuroHeart collaboration, consisting of National Leaders of Cardiac Societies and other country level representatives. As well as championing EuroHeart in their individual countries, their role is to provide input into the strategy and direction of the collaboration. They regularly meet to discuss progress in the EuroHeart collaboration at an international level as well as at their own national level.

EuroHeart Participating Countries

Figure 8.1.2 — European EuroHeart Countries

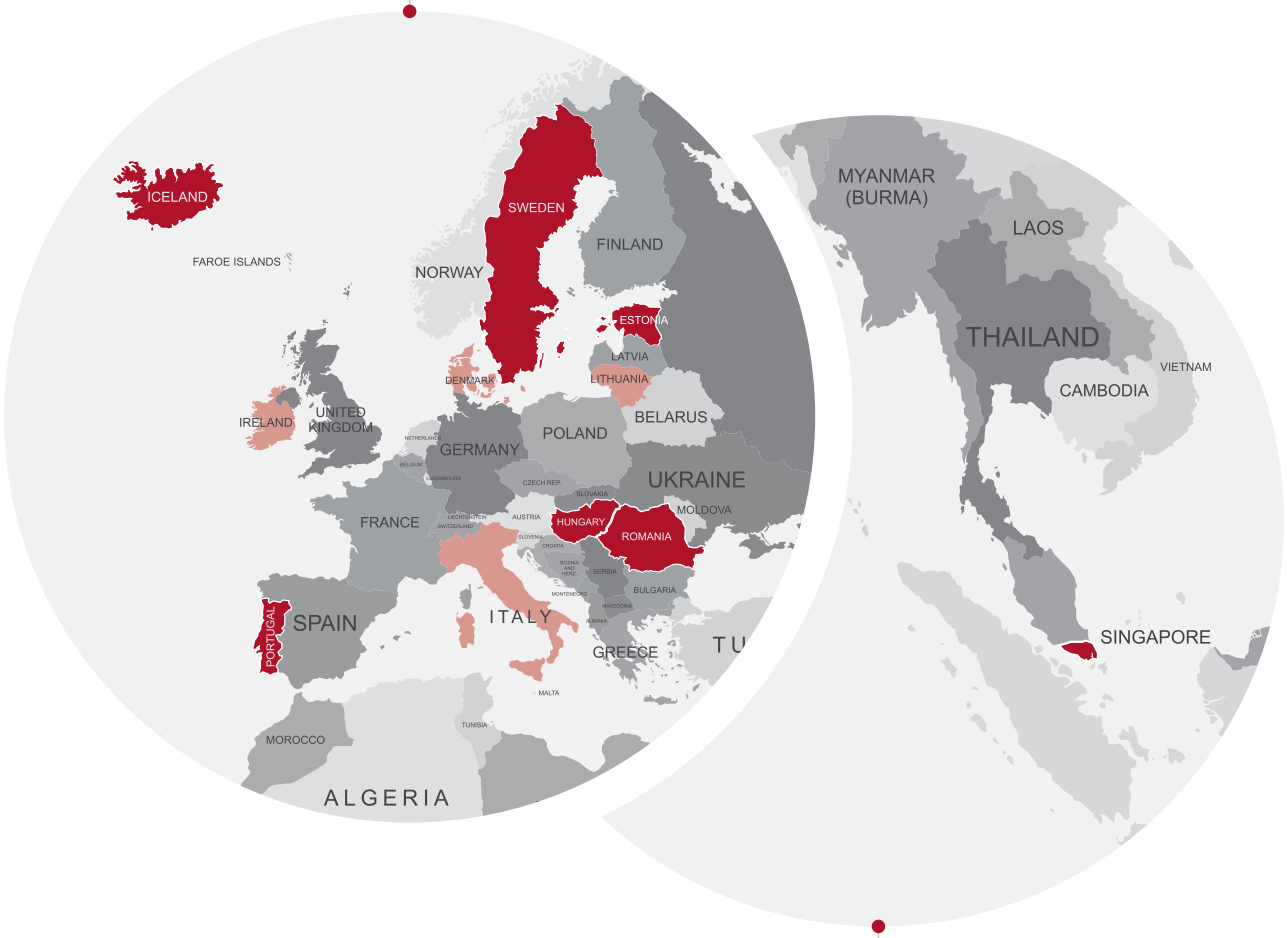


Figure 8.1.3 — Asian EuroHeart Country-Singapore

08 — Countries participating in EuroHeart

Countries participating in EuroHeart

8.1.1 Estonia

Estonia joined EuroHeart in 2020 during the pilot phase and entered their first patient onto the EuroHeart IT platform in May 2021. With a population of 1.32 million, Estonia has developed a universal healthcare model that provides comprehensive coverage and quality services to all its residents. Estonia has emerged as a global leader in terms of utilising technology to enhance healthcare access and streamline administrative processes.

Estonian healthcare is publicly funded via the Estonian Health Insurance Fund and has a national electronic health database located at Health and Welfare Information Systems Centre. The eHealth database retrieves data from various providers and includes 99% of all patient records in the country.[10]

2022 data were provided by 1 of Estonia's 2 tertiary care centres, with both hospitals providing data for 2023. This will increase the coverage from roughly 25% to around 70% of ACS cases. EuroHeart is currently used in parallel to the national myocardial infarction registry with a prospect of merging the two. The country is working closely with EuroHeart to set up a linkage between the current PCI system and the IT platform.

> EuroHeart brings closer the idea that through good quality recording of a patient's treatment, we will gain new knowledge to be used to improve the care of future patients.

Dr Alar Irs

Chief Medical Officer at Estonian Medicines Agency, Head of Heart Clinic at Tartu University Hospital

Countries participating in EuroHeart

08

8.1.2 Hungary

Hungary is an upper-middle income country in Central Europe with a population of about 9.6 million people. Despite improvements since 2000, life expectancy in Hungary was 5 years below the European Union average in 2020, with the leading cause of death being ischaemic heart disease, followed by stroke and cancers. While mortality from ischaemic heart disease reduced by more than 40% across the European Union between 2000 and 2016, the reduction was considerably less in Hungary, with a decline of only 12%.[1] Therefore, improving the country's cardiovascular care is a high priority for the Hungarian government and health authorities.

The health system in Hungary is organised around a single insurance fund, providing coverage for all Hungarian citizens. The National Institute of Health Insurance Fund Management administers the fund and plays a central role in financing healthcare services. The country's healthcare system is organised by the Ministry of the Interior and the National Directorate General for Hospitals.

The first regional myocardial infarction registry program started in 1970, initiated by the World Health Organisation. From 2014, all Hungarian hospitals are required by law to take part in the Hungarian Myocardial Infarction Registry (HUMIR).[10] At present, HUMIR is the only national registry in cardiology. There was a large overlap with their national HUMIR data variables and the EuroHeart ACS dataset and they started using the EuroHeart variables in July 2021 on their own IT platform.

Hungary has a high level of coverage for its EuroHeart data collection with 60 of its 70 hospitals providing ACS care and all 20 of its primary PCI centres report data using the EuroHeart dataset variables. In 2022, this equated to 86% of eligible patients being included in their EuroHeart dataset.

> For me, the importance of the EuroHeart program lies in the fact that by collecting data using the same method, we obtain comparable data on the care of patients treated for myocardial infarction in different countries.

Professor András Jánosi
Head of the Hungarian Myocardial Infarction Registry Program, György Gottsegen National Cardiovascular Institute

8.1.3 Iceland

Harmonising with the EuroHeart variables in 2022, Iceland is a high-income country in northern Europe. In 2017, the life expectancy at birth of people in Iceland was 82.6 years, well above the EU average (80.9 years). The health status of the Icelandic population is generally good, and the health system provides high-quality care. Although the mortality rate from ischaemic heart disease decreased substantially between 2000 and 2016, it remains the leading cause of death in Iceland, attributed to 13% of all deaths in 2016.[1]

Iceland has approximately 380,000 inhabitants as well as a large number of tourists. The health system in Iceland is a state-centred system with universal coverage. There are seven health care regions, and most health spending is publicly funded through the national health insurance system.[10]

The majority of people live or stay in Reykjavik or the surrounding towns (within 60 minutes by ambulance). There is one cardiology ward in Iceland, based at Landspitali – The National University Hospital of Iceland in Reykjavik, and most cardiac patients in the country are transferred here. Patients with STEMI who are further than 2 hours from the hospital normally receive thrombolysis and are then transferred via air ambulance or ambulance to Landspitali.

Iceland enrols their patients using their own platform. Data are entered prospectively at the time of the procedure by the responsible interventional cardiologist and the nursing staff with information obtained from both the patient and hospital records. A total of 1612 diagnostic coronary angiograms were performed in the year 2022 in Iceland.

> EuroHeart is a platform where people can collaborate. It can help us to work together with different countries.

Dr Ingibjörg Jóna Guðmundsdóttir
Director of Cardiac Intervention, National University Hospital of Iceland

Countries participating in EuroHeart

08

8.1.4 Portugal

Portugal is a high-income country located in Western Europe, with a population of 10.3 million people. Over the last five decades, Portugal's life expectancy has increased by 14 years, reaching 81 years in 2020, slightly higher than the European Union (EU) average. This increase in life expectancy has been driven mainly by reductions in mortality rates for circulatory diseases, notably stroke and ischaemic heart diseases. However, stroke and ischaemic heart diseases remain the leading causes of death in Portugal. Due to the steep increase in life expectancy, the share of people aged 65 years and over is growing, making up 23.4% of the Portuguese population.[10] Portugal is prioritising improvements in primary care management and strengthening public health interventions.

Portugal's National Health Service (Serviço Nacional de Saúde) forms the core of the system, ensuring that essential healthcare services are available to all, regardless of their financial means. This commitment to universal access is supported by a network of public hospitals and primary care centres across the country. With a focus on quality, accessibility, and a dedication to public health, Portugal's healthcare system strives to meet the evolving needs of its population.

The Portuguese Society of Cardiology founded the National Cardiology Data Collection Centre in 2001 for conducting observational registries and managing clinical studies. Continuous registries on acute coronary syndromes and percutaneous coronary interventions were launched in 2002, but national representativeness and quality of data are considered the main challenges, especially in the ACS registry.[10]

Portugal joined the EuroHeart project in 2021. The participation in EuroHeart represents the opportunity to join the mission of quality improvement in common cardiovascular diseases and to integrate the network of registry-based randomized clinical trials and drug/device surveillance. Currently, 35 out of 38 centres providing ACS care and 20 out of 21 Primary PCI centres provide data for EuroHeart. Portugal uses its own IT platforms to record the EuroHeart variables. For the 2022 report, Portugal's ACS and PCI datasets are presented separately, meaning some patients may appear in both datasets.

> Continuous clinical registries are critical for quality improvement, allowing us to assess the adherence to clinical guidelines, to identify deviations in quality indicators and to evaluate the performance of projects designed for improvement.

Dr Jorge Ferreira

Director, Portuguese Cardiology Data Centre CNCDC

8.1.5 Romania

Romania is a country in Eastern Europe with a population of around 19 million citizens. Despite recent improvements, Romania has among the lowest life expectancy in the EU. Ischaemic heart disease and stroke are the primary causes of death, with the death rate from ischaemic heart disease being more than double the EU average. The low life expectancy can partly be explained by a selection of behavioural risk factors, including a high rate of daily smoking particularly in men (32%, only 8% in women), high alcohol consumption, and low physical activity. However, Romania's obesity rates are among the lowest in the EU.[1] In recent years, there have been several national initiatives to improve care, including the implementation of national quality registries and participation in EuroHeart. Romania is also known for its strong collaboration and contribution to international clinical trials.

The Romanian healthcare system is primarily funded through contributions to the National Health Insurance Fund (Casa Națională de Asigurări de Sănătate), which is responsible for financing healthcare services and managing the overall healthcare system.[10]

Romania has 270 hospitals providing ACS care. There are 40 PCI centres, 21 of them being primary PCI centres (part of the ACS network).

From these, 15 primary PCI centres collect data as part of the EuroHeart dataset. For ACS care this means that 20% of the patient population's data are recorded on the IT platform, and for Primary PCI (STEMI) 25% of the patient population's data are recorded.

> It's a great project that I'm glad to be part of. In the last year, we've started putting patients in this huge database, and now we have data on more than 3800 patients.

Dr Cristian Udroiu
Interventional Cardiologist / Cardiologist
University Hospital of Bucharest

The Romanian Society of Cardiology provide their part of the EuroHeart dataset through the Registry Dataset and use of the EuroHeart IT platform. Romania enrolled their first patient in March 2022.

Countries participating in EuroHeart

08

8.1.6 Singapore

Located in Southeast Asia, Singapore is a city state with a population of around 5.5 million. In 2021, ischaemic heart disease was the country's second most common cause of death, accounting for 20.1% of all deaths. Singapore has an ageing population, with the median age rising from 37.4 years in 2010 to 42.1 years in 2022, with more than 15% of the population 65 years and above. This, alongside its high life expectancy, is expected to contribute to an increased incidence of acute myocardial infarction. Between 2010 and 2020, the median age at onset of acute myocardial infarction increased slightly from 68.9 to 69.9 years, with about 3 quarters of these patients being 60 or older in 2020.[11]

The secondary/tertiary care in Singapore is provided predominantly by the public sector and in part by the private sector. There are three regional healthcare public clusters and a total of 10 public hospitals. The system is primarily funded through a unique combination of co-payment and government subsidies. Singapore's healthcare system consistently ranks highly in terms of efficiency, healthcare outcomes, and patient satisfaction.[12]

Singapore joined EuroHeart in late 2021 and use their own IT platform. Data are collected from one tertiary cardiac institution, providing coverage of about 30-40% of the cardiovascular care in the public healthcare system.

Participating in EuroHeart is an opportunity for countries in the Asia region to benchmark the quality of cardiovascular care provided.

Professor Jonathan Yap

Clinical Associate Professor,
National Heart Centre Singapore;
Duke-NUS Graduate Medical School

8.1.7 Sweden

Sweden is renowned for its commitment to health registries as a means of improving patient care and outcomes. The first quality registry was established in 1991 as a regional ACS registry that transitioned into a national registry in 1995. In 2009, SWEDEHEART was formed by merging four already existing registries to form Sweden's largest quality registry covering acute and chronic coronary disease and catheter and surgery interventions as well as secondary care. The primary purpose of SWEDEHEART is to support evidence-based care through continuous feedback on the quality of care. SWEDEHEART is also an important source for research and conducting registry-based clinical trials.[14]

Alongside one of the highest life expectancies in the world, the country has an ageing population, with around 20% of its 10 million inhabitants now over the age of 65.3 In the last three decades Sweden has seen a sharp decrease in both incidence and mortality in acute myocardial infarction for both women and men and all age groups under 85 years. Ischaemic heart disease, stroke and lung cancer were the leading causes of death before the COVID-19 pandemic.[2] Sweden focuses on population-wide interventions, such as public health campaigns and community-based programmes, to promote healthy behaviours and reduce risk factors for cardiovascular disease.

Sweden operates a decentralised universal healthcare system, with 21 regional councils financing health spending through tax funding. As such, there is a challenge in ensuring equal access and quality of care to patients in different regions in which the more than 100 Swedish quality registries play an important part. Sweden began using the EuroHeart variables in January 2022 using their own IT platform.

Sweden has 100% of its 72 centres participating in EuroHeart, covering 100% of its patients admitted for ACS/PCI.

> We joined EuroHeart to improve healthcare outcomes for patients in Europe, and to build a harmonised platform with variables that are suitable for pan-European research and collecting real world data.

Dr Peter Vasko
Chair of SWEDEHEART
Senior Consultant Cardiologist, Department of Cardiology, Linköping University Hospital

Countries participating in EuroHeart

08

8.1.8 Denmark

In 2020, life expectancy in Denmark was 81.6 years, around one year above the average in the European Union. The country's life expectancy has been increasing more quickly than the European Union average, largely due to mortality reductions in some of the most frequent causes of death. However, chronic obstructive pulmonary disease, lung cancer, ischaemic heart disease and stroke are still leading causes of death, accounting for more than a quarter of all deaths in 2018. Although smoking rates amongst adults and adolescents have reduced sharply and Danes consume less alcohol than the European Union average, more than 40% of deaths can be linked to behavioural risk factors.[10] Residents of Denmark have universal access to comprehensive healthcare services and the country boasts a relatively high number of doctors and nurses.

Denmark joined EuroHeart in 2022 and will be using their IT platform, DANACS, to collect ACS/PCI data. Participation in the registry will be mandatory for healthcare providers with 100% of patients' data being recorded.

8.1.9 Italy

Italy has become the latest country to join EuroHeart, having joined in October 2023. At 83.1 years, Italy had the 2nd highest life expectancy in the European Union in 2017.[1] Recent improvements in life expectancy have coincided with reduced mortality rates for ischaemic heart disease and stroke. However, these conditions are still the country's leading causes of death.

Italy has a decentralised universal public healthcare system that is managed at a regional level and funded by central government through taxation. Around 50 cardiology centres across the country will begin collecting ACS/PCI data in 2024, with an estimated 9000 patient registrations each year. Italy will use its own IT platform and, following successful implementation, the country expects to also start collecting data on heart failure and atrial fibrillation.

8.1.10 Lithuania

Lithuania is home to around 2.8 million people. Though it continues to improve, the country's life expectancy is below the European Union average and cardiovascular disease is the leading cause of death. In 2018, ischaemic heart disease accounted for more than one third of deaths.[1] Meanwhile, mortality from stroke decreased slightly but still accounted for 13% of all deaths. As a result, Lithuania's healthcare system places significant emphasis on addressing cardiovascular disease, recognising it as a major health challenge. Health spending per capita in Lithuania in 2019 was around half the European Union average but this is among the highest in central and eastern Europe. Lithuania also prioritises research and collaboration with international partners to stay at the forefront of cardiovascular advancements and provide the best possible care to patients.

Lithuania's National Health Insurance Fund covers the entire population and, as they currently have no cardiovascular registries, data on morbidity and mortality are extracted from the State Health Insurance Fund administrative database.[10]

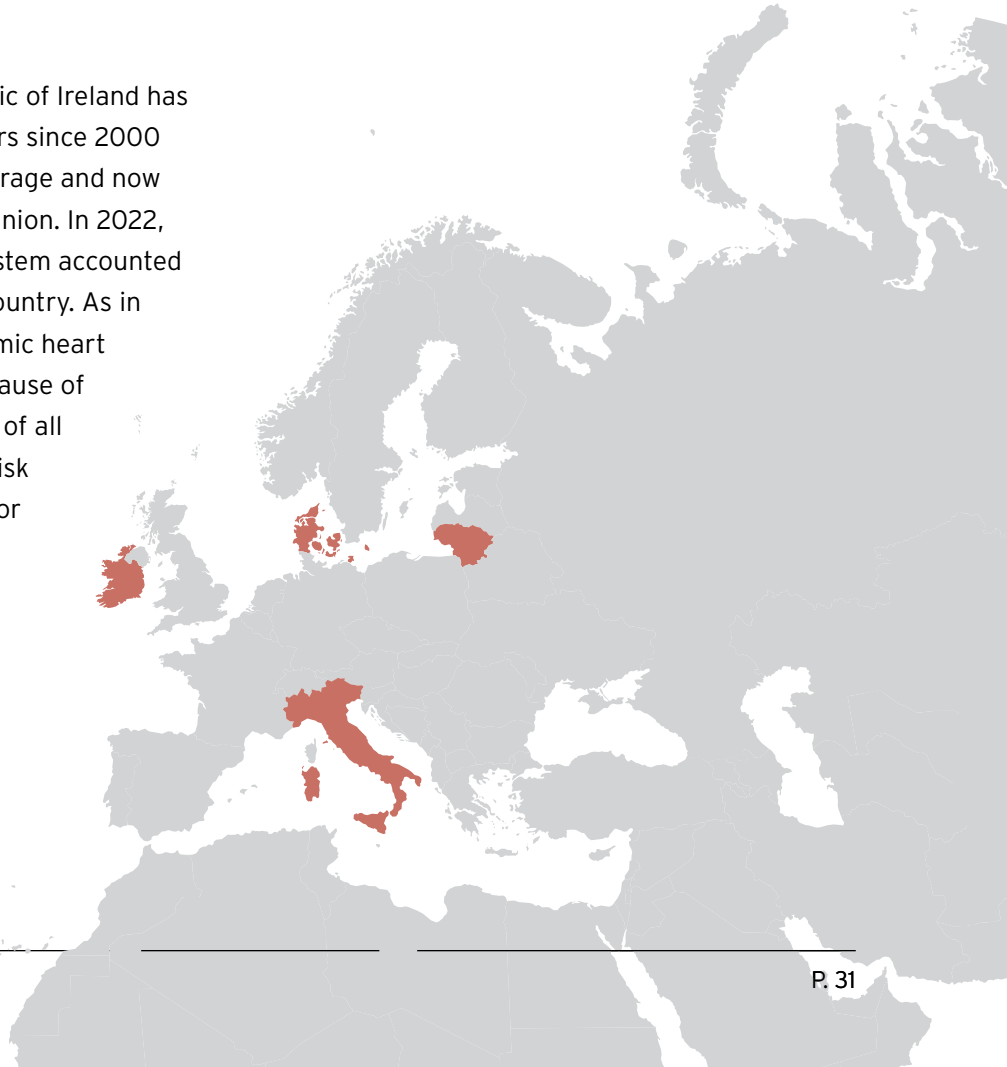
The country signed up to EuroHeart in 2021 with implementation activities scheduled to start in February 2022. Unfortunately, this was put on-hold following Russia's invasion of Ukraine however, Prof Jelena Čelutkienė, President of the Lithuanian National Cardiac Society, remained an active member of the National Leaders group.

8.1.11 Republic of Ireland

Life expectancy in the Republic of Ireland has improved by more than 6 years since 2000 and is 1.5 years above the average and now the highest in the European Union. In 2022, diseases of the circulatory system accounted for 27% of all deaths in the country. As in many other countries, ischaemic heart disease remains the leading cause of mortality, accounting for 12% of all deaths in 2022. Behavioural risk factors are thought to be major contributors to mortality in Ireland - over 35% of all deaths in 2019 could be attributed to behavioural risk factors, such as smoking, dietary risks, alcohol consumption and low physical activity.[1,10]

The Republic of Ireland has a national health service that is funded via taxation, though many people also have voluntary health insurance. The country's health spend per capita is roughly in line with the European Union average.

They are currently working with the Registry Technology group to set up the EuroHeart IT platform in their country with an expected start date for the collection of ACS/PCI data during 2024. Initially this will include admissions to eight hospitals in the south of Ireland, covering a population of 700,000. The intent is for this to become a national collaboration having all relevant hospitals in Ireland participating. Subsequently, registration of heart failure data on a national basis is planned.



Data collection 09

9.1 Introduction to the collection of data

The participating national registries own their data and are fully responsible for their registry infrastructure, IT systems, databases, and statistical analyses of patient level data.

The EuroHeart collaboration analyses de-identified, aggregated data that are compiled according to pre-defined subpopulations. The data are used for analyses as agreed in the statistical analysis plan.[15]

After a pilot for the 2021 data collection from Hungary, Estonia and Portugal, the Statistical Analysis Plan (SAP) was reviewed and the number of variables collected was reduced from 243 to 155. Countries supply these data aggregated for final diagnosis, age category and sex. The data are aggregated into 36 levels, meaning a total of 5,580 data items are requested.

9.2 Summary of the datasets provided

One of the fundamental aims of EuroHeart is to create and maintain an international collaboration network of National/Regional Quality registries. EuroHeart is in its early stages and for some countries there may be limitations as to the datasets they are able to currently provide. Over time, the expectations are that participating countries will develop towards data provision of all the EuroHeart data variables and full country/patient coverage. Further information regarding current patient and hospital coverage is included under each countries section however Table 1 provides further information on the patient admissions included in the datasets provided.

Table 9.2.1 — Patient Admission Datasets

Country	STEMI (Patient Admissions)	NSTEMI (Patient Admissions)
Estonia	STEMI and emergency PCI for patients admitted to Tartu University Hospital	NSTEMI and emergency PCI for patients admitted to Tartu University Hospital
Hungary	Admissions for ACS only, covering 60 out of 70 hospitals providing ACS care and 20 out of 20 PCI centres	Admissions for ACS only, covering 60 out of 70 hospitals providing ACS care and 20 out of 20 PCI centres
Iceland	STEMI and emergency PCI for patients admitted to National University Hospital of Iceland	NSTEMI and emergency PCI for patients admitted to National University Hospital of Iceland
Portugal	STEMI and emergency PCI admissions are provided separately due to independent ACS-PCI and PCI registries for 35 out of 38 hospitals	NSTEMI and emergency PCI admissions are provided separately due to independent ACS-PCI and PCI registries for 35 out of 38 hospitals
Romania	Data from March 2022 for STEMI and emergency PCI from 15 primary PCI Centres	Data from March 2022 for NSTEMI and emergency PCI from 15 primary PCI Centres
Singapore	STEMI and emergency PCI for patients admitted to the National Heart Centre, Singapore Health Services	Not included for 2022
Sweden	All STEMI and emergency PCI, 100% hospital coverage	All NSTEMI and emergency PCI, 100% hospital coverage

9.3 Completeness and Quality of data

The process of adopting the EuroHeart variables involves a substantial amount of work and some EuroHeart countries are in the process of transitioning to the EuroHeart variables and may not have adopted certain variables in time for the 2022 data set. For other data items, a country may not be in a position to collect the data items due to local set up. Where a country is unable to supply data items, we have indicated that data are not available (N/A).

Following submission of a country's aggregated data, the data underwent internal checks by the EuroHeart Data Manager and Statistician prior to analysis. After being analysed, the data were then returned to the data submission lead and National Leaders for their review. This process of reviewing, checking and amending the analyses continued until both National Leaders and EuroHeart reached agreement.

9.4 Data Collection - Looking forward

Three countries (Estonia, Iceland and Singapore) are now collecting heart failure data which we hope to include in the annual report for 2024. Following successful analysis of aggregated heart failure data, we will move onto the analysis of the TAVI aggregated data.

We will continue to work with the national leaders to refine the data provided in the annual report for ACS and PCI to ensure it remains relevant and meets the needs of the group.

For countries using the EuroHeart IT platform, over the next year we will be developing and implementing a report that will allow users to export their annual data. This will greatly reduce the time and effort required to provide an annual data submission to EuroHeart.

Data Analysis 10

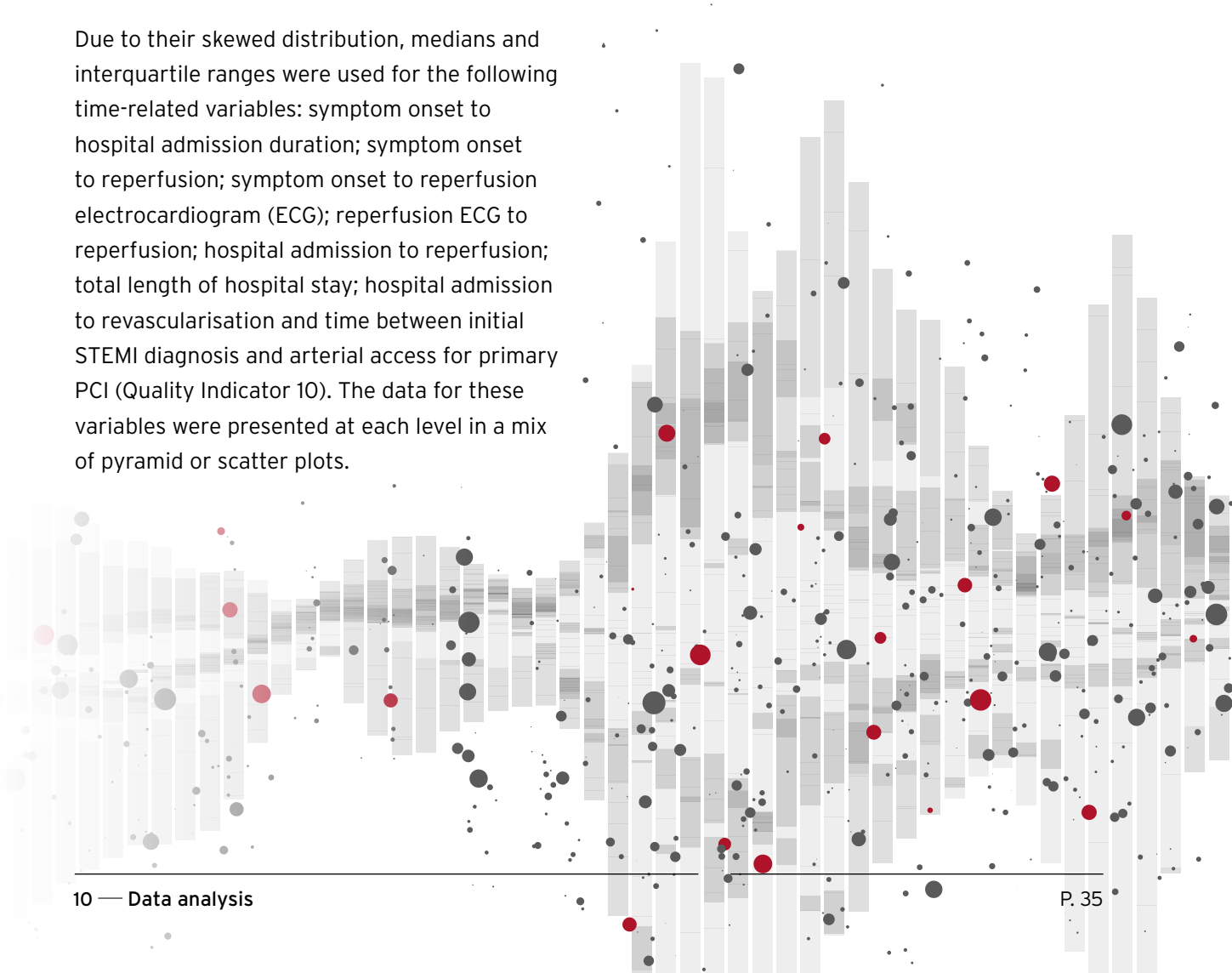
Data from the participating countries; Estonia, Hungary, Iceland, Portugal, Romania, Singapore and Sweden were provided as aggregated level by final diagnosis (STEMI, NSTEMI), age group (5-year bins), sex (male, female) and by year. Data on age (years), body mass index, systolic blood pressure (mmHg), heart rate (beats per min) and creatinine (μmol/L) were provided as means with standard deviation as these were approximately normally distributed.

The summary statistics for these variables were presented in tables by final diagnosis as weighted means/arithmetic means and weighted standard deviations.[16]

Due to their skewed distribution, medians and interquartile ranges were used for the following time-related variables: symptom onset to hospital admission duration; symptom onset to reperfusion; symptom onset to reperfusion electrocardiogram (ECG); reperfusion ECG to reperfusion; hospital admission to reperfusion; total length of hospital stay; hospital admission to revascularisation and time between initial STEMI diagnosis and arterial access for primary PCI (Quality Indicator 10). The data for these variables were presented at each level in a mix of pyramid or scatter plots.

Data on the collected categorical variables was provided as counts/frequency at each grouping level. Frequencies and percentages were derived to present the categorical data by final diagnosis, with total admission at each level as denominator data. For several variables where some data was not provided, missingness was calculated by subtracting the total number of observations from the number of admissions.

The quality indicator data were derived from each country and provided as numerator and denominator data at each grouping level. Frequencies and percentages were derived to present the categorical data in tables by final diagnosis.



EuroHeart combined cohort analysis

11

Data from all seven contributing countries has been combined to provide descriptions of the overall cohort.

Table 11.1 — Characteristics of admissions with STEMI and NSTEMI

Characteristic	N (%)
Number of Patients	**39694**
Number of Admissions	**40021**
Age (years), mean (SD) (n = 39512)	67.9 (12.6)
Female	12,628 (31.6)
Body mass index (kg/m^2), mean (SD)	27.8 (1.3)
Smoking status[1]	
Current smoker (n = 39453)	8696 (22.0)
Former smoker (n = 39362)	9553 (24.3)
Unknown (n = 39630)	8233 (20.8)

Table 11.2 — Past medical history of admissions with STEMI and NSTEMI

Characteristic	N (%)
Hypertension (n = 40021)	27185 (67.9)
Diabetes mellitus	
Type 1 (n = 36160)	526 (1.5)
Type 2 (n = 39654)	10246 (25.8)
Other (n = 21746)	143 (0.7)
Moderate/severe CKD (n = 23680)	1775 (7.5)
Heart failure (n = 35805)	3653 (10.2)
Prior MI (n = 39795)	8019 (20.2)
Prior PCI (n = 39746)	7353 (18.5)
Prior CABG (n = 37776)	1900 (5.0)
Prior stroke	
Ischaemic (n = 22563)	718 (3.2)
Haemorrhagic (n = 17168)	92 (0.5)
Unspecified (n = 21634)	549 (2.5)
Atrial fibrillation/flutter (n = 37444)	3328 (8.9)
COPD (n = 22813)	1401 (6.1)

CABG, coronary artery bypass graft; CKD, chronic kidney disease; COPD, chronic obstructive pulmonary disease; MI, myocardial infarction; PCI, percutaneous coronary intervention.

Table 11.3 — Clinical presentation of admissions with STEMI and NSTEMI

Characteristic	N (%)
Killip class (n = 31298)	
I	27408 (87.6)
≥ II	3890 (12.4)
Systolic blood pressure (mmHg)[2], mean (SD)	139.2 (8.2)
Heart rate (beats per min)[2], mean (SD)	81.2 (3.5)
Creatinine (µmol/L), mean (SD)	102.1 (17.8)

Table 11.4 — Discharge medication for admissions with STEMI and NSTEMI[3]

Characteristic	N (%)
ACEi/ARB/ARNI (n = 29545)	24110 (81.6)
Beta blockers (n = 29545)	23591 (79.8)
Aspirin (n = 30054)	26322 (87.6)
$P2Y_{12}$ Inhibitors (n = 30054)	25980 (86.4)
Clopidogrel (n = 30054)	12470 (41.5)
Prasugrel (n = 30054)	2898 (9.6)
Ticagrelor (n = 30054)	10612 (35.3)
Statins (n = 29545)	27225 (92.1)
Ezetimibe (n = 29545)	3994 (13.5)
GLP-1 analogues (n = 29545)	547 (1.9)
SGLT-2 inhibitors (n = 29545)	4469 (15.1)

ACEi, angiotensin-converting enzyme inhibitors; ARB, Angiotensin receptor blockers; ARNI, angiotensin receptor-neprilysin inhibitor; GLP-1, glucagon-like peptide 1; SGLT-2, sodium-glucose transport protein 2.

[1] Data are sent as separate variables, not a single variable that is categorical across three levels, therefore are summarised as reported for each variable. For each smoking category, the denominator (total number of patients reported on) varied.
[2] Weighted excluding Iceland and Singapore data as they had missing data.
[3] Does not include Portugal.

EuroHeart combined cohort analysis

11

Figure 11.1 — $P2Y_{12}$ inhibitor discharge medication rates for admissions with STEMI and NSTEMI

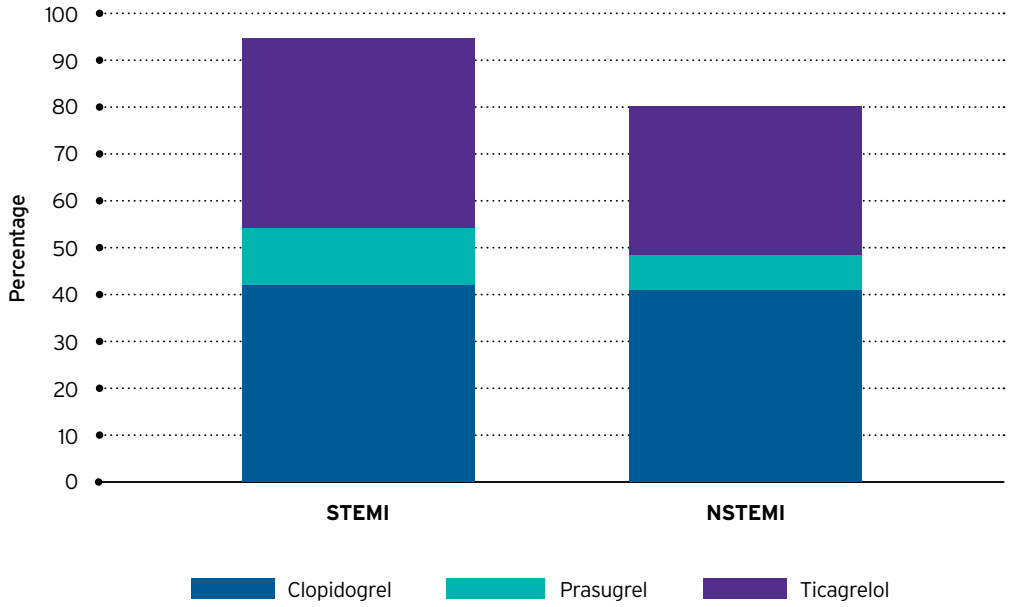
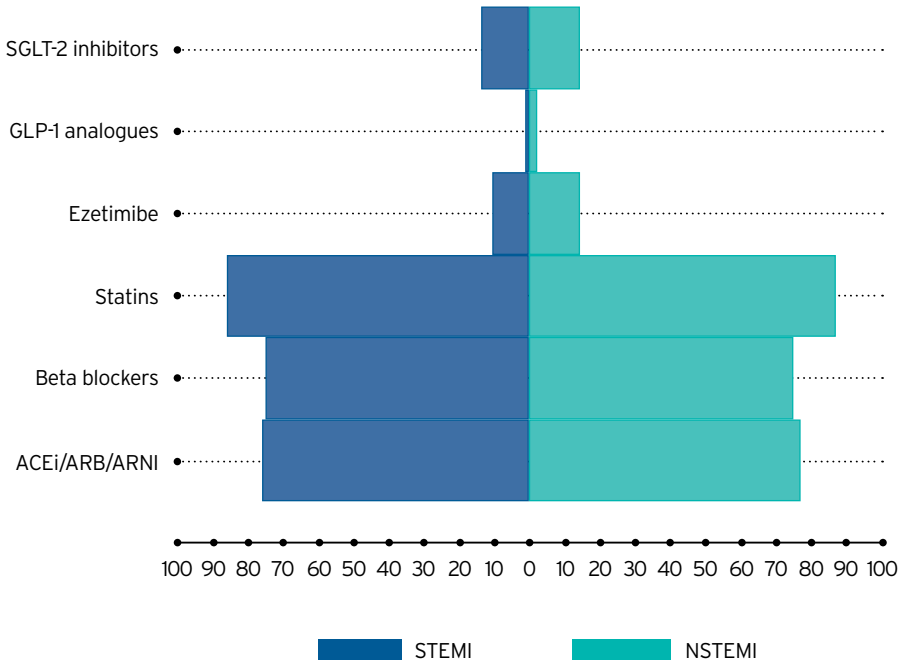


Figure 11.2 — Secondary prevention discharge medicationfoe admissions with STEMI and NSTEMI



ST-elevation myocardial infarction (STEMI) 12

12.1 Full cohort (STEMI)

Combined data from hospital admissions with STEMI from all seven contributing countries.

Table 12.1.1 — Characteristics of admissions with STEMI

Characteristic	N (%)
Number of Patients	**18644**
Number of Admissions	**18686**
Age (years), mean (SD) (n = 18483)	65.6 (12.8)
Female	5500 (29.4)
Body mass index (kg/m^2), mean (SD)	27.7 (1.2)
Smoking status[1]	
Current smoker (n = 18270)	4865 (26.6)
Former smoker (n = 18174)	3924 (21.6)
Unknown (n = 18330)	3880 (21.2)

Table 12.1.2 — Past medical history of admissions with STEMI

Characteristic	N (%)
Hypertension (n = 18686)	11242 (60.2)
Diabetes mellitus	
Type 1 (n = 15729)	165 (1.0)
Type 2 (n = 18370)	3850 (21.0)
Other (n = 9369)	113 (1.2)
Moderate/severe CKD (n = 12734)	650 (3.5)
Heart failure (n = 15303)	1078 (7.0)
Prior MI (n = 18552)	2490 (13.3)
Prior PCI (n = 18541)	2263 (12.2)
Prior CABG (n = 16890)	348 (2.1)
Prior stroke	
Ischaemic (n = 12119)	280 (2.3)
Haemorrhagic (n = 8201)	44 (0.5)
Unspecified (n = 11504)	243 (2.1)
Atrial fibrillation/flutter (n = 17203)	1007 (5.9)
COPD (n = 12267)	576 (4.7)

CABG, coronary artery bypass graft; CKD, chronic kidney disease; COPD, chronic obstructive pulmonary disease; MI, myocardial infarction; PCI, percutaneous coronary intervention.

ST-elevation myocardial infarction (STEMI) 12

Table 12.1.3 — Clinical presentation of admissions with STEMI

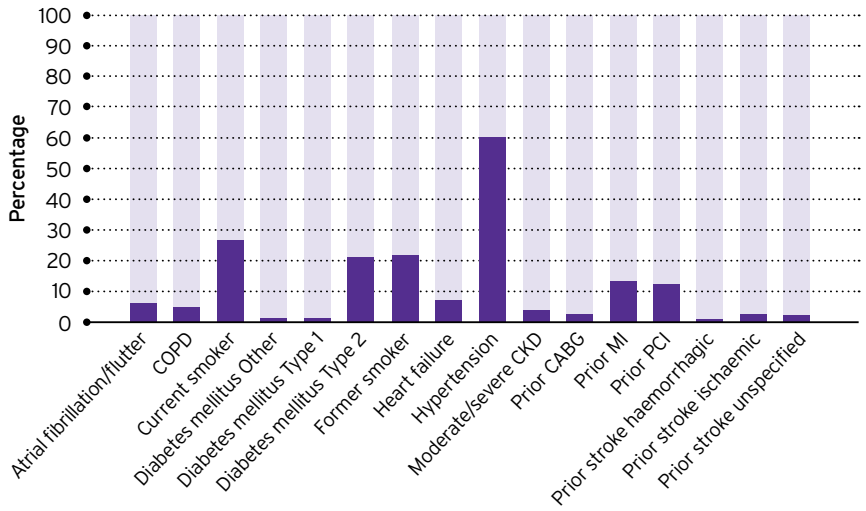
Characteristic	N (%)
Killip class (n = 16298)	
I	13928 (85.5)
≥ II	2370 (14.5)
Systolic blood pressure (mmHg)[2], mean (SD)	134.4 (6.1)
Heart rate (beats per min)[2], mean (SD)	80.6 (2.3)
Creatinine (µmol/L), mean (SD)	98.8 (18.4)

Table 12.1.4 — Discharge medication for admissions with STEMI[3]

Medication	N (%)
ACEi/ARB/ARNI (n = 12393)	10304 (83.1)
Beta blockers (n = 12393)	10163 (82.0)
Aspirin (n = 12596)	11502 (91.3)
P2Y12 Inhibitors (n = 12596)	11942 (94.8)
Clopidogrel (n = 12596)	5288 (42.0)
Prasugrel (n = 12596)	1568 (12.4)
Ticagrelor (n = 12596)	5086 (40.4)
Statins (n = 12393)	11660 (94.1)
Ezetimibe (n = 12393)	1444 (11.7)
GLP-1 analogues (n = 12393)	149 (1.2)
SGLT-2 inhibitors (n = 12393)	1932 (15.6)

ACEi, angiotensin-converting enzyme inhibitors; ARB, Angiotensin receptor blockers; ARNI, angiotensin receptor-neprilysin inhibitor; GLP-1, glucagon-like peptide 1; SGLT-2, sodium-glucose transport protein 2.

Figure 12.1.1 — Past medical history of admissions with STEMI



[1] Data are sent as separate variables, not a single variable that is categorical across three levels, therefore are summarised as reported for each variable. For each smoking category, the denominator (total number of patients reported on) varied.
[2] Weighted excluding Iceland and Singapore data as they had missing data.
[3] Does not include Portugal.

12.2 Characteristics of patients admitted with STEMI

Across the seven countries that provided data for patients with STEMI, there was a total of 18686, admissions to hospital. Of these, 5500, (29.4%) were for female patients and 13186, (70.6%) were for male patients. The highest proportion of females was 35.7% in Hungary, and the lowest was 16.5% in Singapore.

Overall, the mean age was 65.6 (SD 12.8) years. This varied between countries, from 61.4 (SD 12.1) years in Romania through to 69.4 (SD 12.2) years in Sweden.

The median time from symptom onset to hospital admission ranged from 140 (IQR 85 - 290) minutes to 358 (IQR 231 - 516) minutes between countries.

12.3 In-hospital management

The median time from the initial STEMI ECG to reperfusion ranged between 51 (IQR 45 - 58.8) minutes to 159 (IQR 67 - 322) minutes between countries.

Overall, 73.0% of patients received PCI within 90 minutes.

12.4 In-hospital outcomes

Median length of hospital stay ranged from 4 (3-5) days to 5 (3-8) days.

12.5 Discharge medication

Statins were prescribed in 94.1% of eligible patients, which ranged from 88.1% to 96.2%.

Amongst STEMI patients, 83.1% were discharged on an ACEi or ARB, which ranged between 78.6% and 87.0%; and 82.0% were discharged on a beta blocker, which ranged between 78.4% and 88.0%.

12.6 Key messages

Overall, prescription rates of guideline indicated medications are high for STEMI specifically aspirin, P2Y12 inhibitors and statins (91.3, 94.8 and 94.1% respectively).

However, the rates of primary PCI for STEMI within 90 minutes were lower (73.0%), with some variation in the time between diagnosis and reperfusion between countries.

Non-ST-elevation myocardial infarction (NSTEMI) 13

13.1 Full cohort (NSTEMI)

Data from hospital admissions for NSTEMI from six contributing countries (Estonia, Hungary, Iceland, Portugal, Romania, Sweden) has been combined to one dataset.

Table 13.1.1 — Characteristics of admissions with NSTEMI

Characteristic	N (%)
Number of Patients	**21050**
Number of Admissions	**21335**
Age (years), mean (SD) (n = 21029)	69.8 (12.2)
Female	7128 (33.4)
Body mass index (kg/m^2), mean (SD)	27.9 (1.4)
Smoking status[1]	
Current smoker (n = 21183)	3831 (18.1)
Former smoker (n = 21188)	5629 (26.6)
Unknown (n = 21300)	4353 (20.4)

Table 13.1.2 — Past medical history of admissions with NSTEMI

Characteristic	N (%)
Hypertension (n = 21335)	15943 (74.7)
Diabetes mellitus	
Type 1 (n = 20431)	361 (1.8)
Type 2 (n = 21284)	6396 (30.1)
Other (n = 12377)	30 (0.2)
Moderate/severe CKD (n = 10946)	1125 (10.3)
Heart failure (n = 20502)	2575 (12.6)
Prior MI (n = 21243)	5529 (26.0)
Prior PCI (n = 21205)	5090 (24.0)
Prior CABG (n = 20886)	1552 (7.4)
Prior stroke	
Ischaemic (n = 10444)	438 (4.2)
Haemorrhagic (n = 8967)	47 (0.5)
Unspecified (n = 10130)	306 (3.0)
Atrial fibrillation/flutter (n = 20241)	2321 (11.5)
COPD (n = 10546)	825 (7.8)

CABG, coronary artery bypass graft; CKD, chronic kidney disease; COPD, chronic obstructive pulmonary disease; MI, myocardial infarction; PCI, percutaneous coronary intervention.

Table 13.1.3 — Clinical presentation of admissions with NSTEMI

Characteristic	N (%)
Killip class (n = 15000)	
I	13480 (89.9)
≥ II	1520 (10.1)
Systolic blood pressure (mmHg)[2], mean (SD)	143.1 (7.7)
Heart rate (beats per min)[2], mean (SD)	81.7 (4.1)
Creatinine (µmol/L), mean (SD)	104.6 (16.9)

Table 13.1.4 — Discharge medication for admissions with NSTEMI[3]

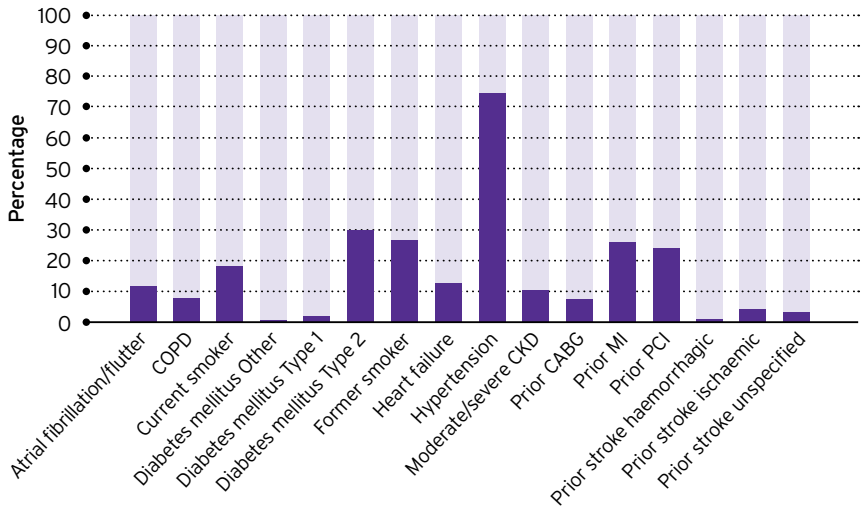
Medication	N (%)
ACEi/ARB/ARNI (n = 17152)	13806 (80.5)
Beta blockers (n= 17152)	13428 (78.3)
Aspirin (n = 17458)	14820 (84.9)
$P2Y_{12}$ Inhibitors (n = 17458)	14038 (80.4)
Clopidogrel (n = 17458)	7182 (41.1)
Prasugrel (n = 17458)	1330 (7.6)
Ticagrelor (n = 17458)	5526 (31.7)
Statins (n = 17152)	15565 (90.7)
Ezetimibe (n = 17152)	2550 (14.9)
GLP-1 analogues (n = 17152)	398 (2.3)
SGLT-2 inhibitors (n = 17152)	2537 (14.8)

ACEi, angiotensin-converting enzyme inhibitors; ARB, Angiotensin receptor blockers; ARNI, angiotensin receptor-neprilysin inhibitor; GLP-1, glucagon-like peptide 1; SGLT-2, sodium-glucose transport protein 2.

[1] Data are sent as separate variables, not a single variable that is categorical across three levels, therefore are summarised as reported for each variable. For each smoking category, the denominator (total number of patients reported on) varied.
[2] Weighted excluding Iceland data as they had missing data.
[3] Does not include Portugal.

Non-ST-elevation myocardial infarction (NSTEMI) 13

Figure 13.1.1 — PAST MEDICAL HISTORY OF ADMISSIONS WITH NSTEMI



13.2 Characteristics of patients admitted with NSTEMI

Across the six countries that provided data for patients with NSTEMI, there was a total of 21335 admissions to hospital. Of these, 7128 (33.4%) were for female patients and 14207 (66.6%) were for male patients. The highest proportion of females was 38.2% in Hungary, and the lowest was 25.4% in Portugal (PCI dataset).

Overall, the mean age was 69.8 (SD 12.2) years. This varied between countries, from 63.0 (SD 10.9) years in Romania through to 71.9 (SD 11.9) years in Sweden.

13.3 In-hospital management

Overall, 84.4% of NSTEMI patients received coronary angiography during their admission. This ranged from 82.7% to 99.3% between countries.

Coronary angiography was performed within 24 hours in 55.1% of cases, which ranged from 37.8% to 94.7%.

Of those that received a coronary angiogram, 63.8% had percutaneous coronary intervention (range 62.4% to 77.6%), and 7.1% underwent coronary artery bypass grafting (range 5.0% to 8.7%).

13.4 In-hospital outcomes

Median length of hospital stay for NSTEMI admissions ranged from 4 (3-6) days to 5 (3-10) days.

13.5 Discharge medication

Statins were prescribed in 90.7% of eligible patients, which ranged from 76.3% to 93.8%.

Amongst NSTEMI admissions, 80.5% were discharged on an ACEi or ARB, which ranged between 79.1% and 86.2%; and 78.3% were discharged on a beta blocker, which ranged between 74.3% and 86.5%.

13.6 Key Messages

Prescription rates of guideline-indicated medication showed variability with high rates of statin prescription (90.7%) but lower rates of aspirin and P2Y12 inhibitor prescriptions in NSTEMI admissions when compared to their STEMI counterparts (84.9% and 80.4%).

However, rates of coronary angiography were high (84.4%), with evidence of some variation amongst participating countries. Despite this, the rate of coronary angiography within 24 hours was low and performed in only 55.1% of cases.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EuroHeart Data by STEMI/NSTEMI by Country

14

14.1 STEMI Admissions

Table 14.1.1 — Characteristics of admissions with STEMI, by country

	Estonia	Hungary	Iceland[4]	Portugal ACS	Portugal PCI	Romania	Singapore	Sweden
Number of Patients	**305**	**5717**	**203**	**821**	**4128**	**1661**	**316**	**5493**
Number of Admissions	**310**	**5717**		**821**	**4128**	**1661**	**316**	**5530**
Age in years, mean (SD)	67.3 (12.6)	64.7 (12.7)	64.6 (12.3)	64.5 (13.1)	63.9 (12.7)	61.4 (12.1)	62.8 (12.3)	69.4 (12.2)
Male (no., %)	208 (67.1)	3674 (64.2)	157 (77.3)	606 (73.8)	3092 (74.9)	1201 (72.2)	264 (83.5)	3984 (72.0)
Female (no., %)	102 (32.9)	2043 (35.7)	46 (22.7)	215 (26.2)	1036 (25.1)	460 (27.7)	52 (16.5)	1546 (28.0)
Body mass index, mean (SD)	28.52 (1.59)	28.38 (1.05)	28.66 (2.10)	27.37 (1.15)	27.38 (0.50)	28.27 (0.81)	25.61 (1.78)	27.44 (1.22)
Smoking status (no.,%)								
Current smoker	119 (38.4)	1872 (32.7)	54 (26.6)	287 (35.0)	398 (9.6)	808 (48.6)	108 (34.2)	1219 (22.0)
Former smoker	40 (12.9)	339 (5.9)	77 (37.9)	117 (14.3)	1307 (31.7)	266 (16.0)	N/A	1778 (32.2)
Unknown	51 (16.5)	2509 (43.9)	72 (35.5)	55 (6.7)	767 (18.6)	73 (4.4)	N/A	353 (6.4)

[4]No of patients used as a proxy for number of admissions.

Table 14.1.2 — Past medical history of admissions with STEMI, by country

	Estonia	Hungary	Iceland[4]	Portugal ACS	Portugal PCI	Romania	Singapore	Sweden
Past medical history (N, %)								
Hypertension	221 (71.3)	4172 (73.0)	96 (47.3)	444 (54.1)	1905 (46.1)	1135 (68.3)	169 (53.5)	3100 (56.1)
Diabetes mellitus								
Type 1	3 (1.0)	57 (1.0)	8 (3.9)	5 (0.6)	21 (0.5)	6 (0.4)	N/A	65 (1.2)
Type 2	58 (18.7)	1713 (30.0)	19 (9.4)	164 (20.0)	508 (12.3)	383 (23.1)	N/A	1005 (18.2)
Other	0	0	1 (0.5)	1 (0.1)	7 (0.2)	0	94 (29.7)	10 (0.2)
No	249 (80.3)	3786 (66.2)	175 (86.2)	598 (72.8)	1822 (44.1)	1272 (76.6)	222 (70.3)	4425 (80.0)
Moderate/severe CKD	15 (4.8)	276 (4.8)	22 (10.8)	12 (1.5)	141 (3.4)	87 (5.2)	97 (30.7)	N/A
Heart failure	44 (14.2)	504 (8.8)	N/A	3 (0.4)	13 (0.3)	229 (13.8)	9 (2.8)	276 (5.0)
Prior MI	38 (12.3)	937 (16.4)	31 (15.3)	39 (4.8)	370 (9.0)	134 (8.1)	48 (15.2)	893 (16.1)
Prior PCI	36 (11.6)	768 (13.4)	32 (15.8)	32 (3.9)	432 (10.5)	112 (6.7)	50 (15.8)	801 (14.5)
Prior CABG	10 (3.2)	110 (1.9)	5 (2.5)	1 (0.1)	44 (1.1)	9 (0.5)	12 (3.8)	157 (2.8)
Prior stroke	6 (1.9)	353 (6.2)	10 (4.9)	15 (1.8)	119 (2.9)	44 (2.6)	20 (6.3)	297 (2.9)
Atrial fibrillation/ flutter	35 (11.3)	465 (8.1)	N/A	7 (0.9)	33 (0.8)	95 (5.7)	13 (4.1)	359 (6.5)
COPD	13 (4.2)	371 (6.5)	N/A	11 (1.3)	116 (2.8)	56 (3.4)	9 (2.8)	N/A

[4]No of patients used as a proxy for number of admissions.
CABG, coronary artery bypass graft; CKD, chronic kidney disease; COPD, chronic obstructive pulmonary disease; MI, myocardial infarction; PCI, percutaneous coronary intervention.

EuroHeart Data by STEMI/ NSTEMI by Country

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Table 14.1.3 — Clinical presentation of admissions with STEMI, by country

	Estonia	Hungary	Iceland[4]	Portugal ACS	Portugal PCI	Romania	Singapore	Sweden
Clinical presentation, mean (SD)								
Killip class (no., %)								
I	230 (74.2)	4793 (83.8)	119 (58.6)	265 (32.2)	2530 (61.3)	1404 (84.5)	N/A	4587 (82.9)
II	36 (11.6)	499 (8.7)	55 (27.1)	23 (2.8)	135 (3.3)	135 (8.1)	N/A	336 (6.1)
III	20 (6.5)	185 (3.2)	12 (5.9)	9 (1.1)	71 (1.7)	60 (3.6)	N/A	102 (1.8)
IV	23 (7.4)	237 (4.1)	17 (8.4)	19 (2.3)	161 (3.9)	62 (3.7)	N/A	173 (3.1)
Systolic blood pressure (mmHg)	140.4 (8.2)	132.0 (2.7)	N/A	138.6 (6.4)	125.6 (3.5)	137.7 (2.1)	N/A	139.7 (3.3)
Heart rate (beats per min)	78.3 (5.1)	82.1 (1.3)	N/A	79.4 (3.9)	79.6 (1.7)	81.8 (2.4)	N/A	79.5 (1.8)
Creatinine, µmol/L	85.1 (11.1)	103.7 (8.8)	96.7 (32.2)	99.4 (19.2)	103.4 (18.2)	106.3 (32.9)	121.0 (37.0)	90.0 (12.2)

[4]No of patients used as a proxy for number of admissions.

Table 14.1.4 — In-hospital management for admissions with STEMI, by country

Mode of reperfusion during hospitalisation (no., %)	Estonia	Hungary	Portugal PCI	Romania	Singapore	Sweden
Primary PCI	281 (90.6)	4928 (86.2)	3712 (89.9)	1566 (94.3)	316 (100)	5079 (91.8)
Thrombolysis	2 (0.6)	7 (0.1)	354 (8.6)	91 (5.5)	0	127 (2.3)
CABG	9 (2.9)	89 (1.6)	N/A	34 (2.0)	7 (2.2)	179 (3.2)

CABG, coronary artery bypass graft; PCI, percutaneous coronary intervention

Table 14.1.5 — In-hospital events for admissions with STEMI, by country

	Estonia	Hungary	Romania	Singapore	Sweden
In-hospital events (no., %)					
Myocardial re-infarction	1 (0.3)	19 (0.3)	11 (0.7)	4 (1.3)	54 (1.0)
Cardiogenic shock	22 (7.1)	384 (6.7)	123 (7.4)	15 (4.7)	365 (6.6)
Cardiac arrest	25 (8.1)	378 (6.6)	110 (6.6)	21 (6.6)	507 (9.2)
Major bleeding					
Fatal	0	4 (0.1)	2 (0.1)	N/A	5 (0.1)
Intracranial	1 (0.3)	3 (0.1)	1 (0.1)	N/A	4 (0.1)
Requiring surgery	0	11 (0.2)	1 (0.1)	N/A	N/A
Requiring transfusion	0	26 (0.5)	16 (1.0)	1 (0.3)	N/A
Other major bleeding	0	13 (0.2)	12 (0.7)	0	N/A
New-onset atrial fibrillation/flutter	12 (3.9)	227 (4.0)	113 (6.8)	N/A	426 (7.7)

Table 14.1.6 — Discharge medication for admissions with STEMI, by country

	Estonia	Hungary	Iceland[4]	Romania	Singapore	Sweden
Discharge medications (no., %)						
ACEi/ARB/ARNI	249 (85.9)	4157 (80.7)	N/A	1237 (78.6)	235 (80.8)	4426 (87.0)
Beta blockers	245 (84.5)	4327 (84.0)	N/A	1243 (78.4)	256 (88.0)	4092 (80.5)
Aspirin	259 (89.3)	4909 (95.3)	173 (85.2)	1538 (97.7)	277 (95.2)	4346 (85.5)
Clopidogrel	41 (14.1)	3457 (67.1)	156 (76.8)	545 (34.6)	43 (14.8)	1042 (20.5)
Prasugrel	0	996 (19.3)	0	1 (0.1)	0	571 (11.2)
Ticagrelor	237 (81.7)	406 (7.9)	11 (5.4)	1000 (63.5)	237 (81.4)	3177 (62.5)
Statins	278 (95.9)	4878 (94.7)	N/A	1386 (88.1)	280 (96.2)	4838 (95.1)
Ezetimibe	8 (2.8)	385 (7.5)	N/A	116 (7.4)	80 (27.5)	855 (16.8)
GLP-1 analogues	5 (1.7)	42 (0.8)	N/A	1 (0.1)	2 (0.7)	99 (1.9)
SGLT-2 inhibitors	34 (11.7)	371 (7.2)	N/A	308 (19.6)	79 (27.1)	1140 (22.4)

[4]No of patients used as a proxy for number of admissions.

ACEi, angiotensin-converting enzyme inhibitors; ARB, Angiotensin receptor blockers; ARNI, angiotensin receptor-neprilysin inhibitor; GLP-1, glucagon-like peptide 1; SGLT-2, sodium-glucose transport protein 2.

14.2 NSTEMI Admissions

Table 14.2.1 — Characteristics of admissions with NSTEMI, by country

	Estonia	Hungary	Iceland[4]	Portugal ACS	Portugal PCI	Romania	Sweden
Number of Patients	**295**	**6393**	**306**	**590**	**2516**	**1019**	**9931**
Number of Admissions	**296**	**6393**		**590**	**2516**	**1019**	**10215**
Age in years, mean (SD)	70.3 (11.4)	68.8 (12.1)	67.2 (13.6)	68.9 (11.8)	67.2 (12.1)	63.0 (10.9)	71.9 (11.9)
Male (no., %)	194 (65.5)	3952 (61.8)	206 (67.3)	409 (69.3)	1877 (74.6)	700 (68.7)	6869 (67.2)
Female (no., %)	102 (34.5)	2441 (38.2)	100 (32.7)	181 (30.7)	639 (25.4)	319 (31.3)	3346 (32.8)
Body mass index, mean (SD)	29.4 (1.6)	28.5 (1.3)	28.7 (1.8)	27.6 (1.1)	27.6 (0.7)	28.8 (0.9)	27.6 (1.4)
Smoking status (no., %)							
Current smoker	89 (30.1)	1333 (20.9)	53 (17.3)	105 (17.8)	418 (16.6)	369 (36.2)	1464 (14.3)
Former smoker	69 (23.3)	499 (7.8)	154 (50.3)	95 (16.1)	685 (27.2)	254 (24.9)	3873 (37.9)
Unknown	48 (16.2)	3418 (53.5)	3 (1.0)	125 (21.2)	56 (2.2)	79 (7.8)	624 (9.0)

[4]No of patients used as a proxy for number of admissions

EuroHeart Data by STEMI/ NSTEMI by Country

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Table 14.2.2 — Past medical history of admissions with NSTEMI, by country

	Estonia	Hungary	Iceland4	Portugal ACS	Portugal PCI	Romania	Sweden
Past medical history (no., %)							
Hypertension	229 (77.4)	5441 (85.1)	208 (68.0)	360 (61.0)	1763 (70.1)	848 (83.2)	7094 (69.4)
Diabetes mellitus							
Type 1	2 (0.7)	79 (1.2)	18 (5.9)	4 (0.7)	30 (1.2)	5 (0.5)	223 (2.2)
Type 2	77 (26.0)	2501 (39.1)	48 (15.7)	196 (33.2)	548 (21.8)	362 (35.5)	2664 (26.1)
Other	0	0	2 (0.7)	0	4 (0.2)	0	24 (0.2)
No	217 (73.3)	3646 (57.0)	238 (77.8)	277 (46.9)	1103 (43.8)	652 (64.0)	7265 (71.1)
Moderate/severe CKD	22 (7.4)	674 (10.5)	70 (22.9)	25 (4.2)	242 (9.6)	92 (9.0)	N/A
Heart failure	48 (16.2)	1066 (16.7)	N/A	14 (2.4)	61 (2.4)	336 (33.0)	1050 (10.3)
Prior MI	81 (27.4)	1533 (24.0)	57 (18.6)	43 (7.3)	520 (20.7)	237 (23.3)	3058 (29.9)
Prior PCI	66 (22.3)	1593 (24.9)	67 (21.9)	31 (5.3)	552 (21.9)	228 (22.4)	2553 (25.0)
Prior CABG	22 (7.4)	375 (5.9)	18 (5.9)	19 (3.2)	154 (6.1)	22 (2.2)	942 (9.2)
Prior stroke	16 (5.4)	552 (8.6)	0	10 (1.7)	152 (6.0)	42 (4.1)	812 (7.9)
Atrial fibrillation/flutter	41 (13.9)	822 (12.9)	N/A	12 (2.0)	42 (1.7)	109 (10.7)	1295 (12.7)
COPD	18 (6.1)	574 (9.0)	N/A	11 (1.9)	153 (6.1)	69 (6.8)	N/A

[4]No of patients used as a proxy for number of admissions.

CABG, coronary artery bypass graft; CKD, chronic kidney disease; COPD, chronic obstructive pulmonary disease; MI, myocardial infarction; PCI, percutaneous coronary intervention.

Table 14.2.3 — Clinical presentation of admissions with NSTEMI, by country

Clinical presentation, mean (SD)	Estonia	Hungary	Iceland4	Portugal ACS	Portugal PCI	Romania	Sweden
Killip class (no., %)							
I	240 (81.1)	5465 (85.5)	175 (57.2)	153 (25.9)	77 (3.1)	925 (90.8)	6445 (63.1)
II	30 (10.1)	652 (10.2)	70 (22.9)	19 (3.2)	17 (0.7)	37 (3.6)	233 (2.3)
III	11 (3.7)	171 (2.7)	3 (1.0)	11 (1.9)	15 (0.6)	13 (1.3)	58 (0.6)
IV	13 (4.4)	96 (1.5)	1 (0.3)	2 (0.3)	11 (0.4)	20 (2.0)	37 (0.4)
Systolic blood pressure (mmHg)	148.8 (7.6)	137.9 (2.3)	N/A	140.4 (9.7)	130.9 (5.7)	138.2 (2.9)	149.4 (3.1)
Heart rate (beats per min)	84.9 (5.2)	82.5 (1.7)	N/A	77.7 (4.6)	73.3 (2.0)	77.9 (1.9)	83.4 (3.0)
Creatinine, µmol/l	92.7 (19.4)	112.8 (9.6)	101.6 (22.9)	124.2 (40.1)	105.3 (14.7)	103.3 (20.8)	99.2 (16.0)

[4]No of patients used as a proxy for number of admissions.

Table 14.2.4 — In-hospital management for admissions with NSTEMI, by country

Mode of diagnostics/revascularisation during hospitalisation (no., %)	Estonia	Hungary	Romania	Sweden
Invasive coronary angiography	278 (93.9)	5388 (84.3)	1012 (99.3)	8446 (82.7)
PCI	211 (71.3)	4062 (63.5)	791 (77.6)	6373 (62.4)
CABG	20 (6.8)	317 (5.0)	52 (5.1)	891 (8.7)

CABG, coronary artery bypass graft; PCI, percutaneous coronary intervention

Table 14.2.5 — In-hospital events for admissions with NSTEMI, by country

In-hospital events (no., %)	Estonia	Hungary	Romania	Sweden
Myocardial re-infarction	0	8 (0.1)	4 (0.4)	47 (0.5)
Cardiogenic shock	13 (4.4)	216 (3.4)	20 (2.0)	145 (1.4)
Cardiac arrest	11 (3.7)	203 (3.2)	27 (2.5)	190 (1.9)
Major bleeding				
Fatal	1 (0.3)	4 (0.1)	1 (0.1)	5 (0.1)
Intracranial	0	5 (0.1)	0	7 (0.1)
Requiring surgery	1 (0.3)	6 (0.1)	4 (0.4)	N/A
Requiring transfusion	1 (0.3)	33 (0.5)	5 (0.5)	N/A
Other major bleeding	1 (0.3)	20 (0.3)	2 (0.2)	N/A
New-onset atrial fibrillation/flutter	19 (6.4)	226 (3.5)	31 (3.0)	440 (4.3)

Table 14.2.6 — Discharge medication for admissions with NSTEMI, by country

Discharge medications (no., %)	Estonia	Hungary	Iceland[4]	Romania	Sweden
ACEi/ARB/ARNI	249 (86.2)	4894 (82.1)	N/A	827 (82.9)	7836 (79.1)
Beta blockers	250 (86.5)	4964 (83.3)	N/A	856 (85.8)	7358 (74.3)
Aspirin	253 (87.5)	5411 (90.8)	173 (56.5)	947 (94.9)	8036 (81.1)
Clopidogrel	65 (22.5)	3995 (67.0)	155 (50.7)	391 (39.2)	2576 (26.0)
Prasugrel	0	779 (13.1)	0	0	551 (5.6)
Ticagrelor	184 (63.7)	422 (7.1)	3 (1.0)	470 (47.1)	4447 (44.9)
Statins	271 (93.8)	5571 (93.5)	N/A	761 (76.3)	8962 (90.5)
Ezetimibe	12 (4.2)	609 (10.2)	N/A	175 (17.5)	1754 (17.7)
GLP-1 analogues	9 (3.1)	102 (1.7)	N/A	3 (0.3)	284 (2.9)
SGLT-2 inhibitors	47 (16.3)	474 (8.0)	N/A	207 (20.7)	1809 (18.3)

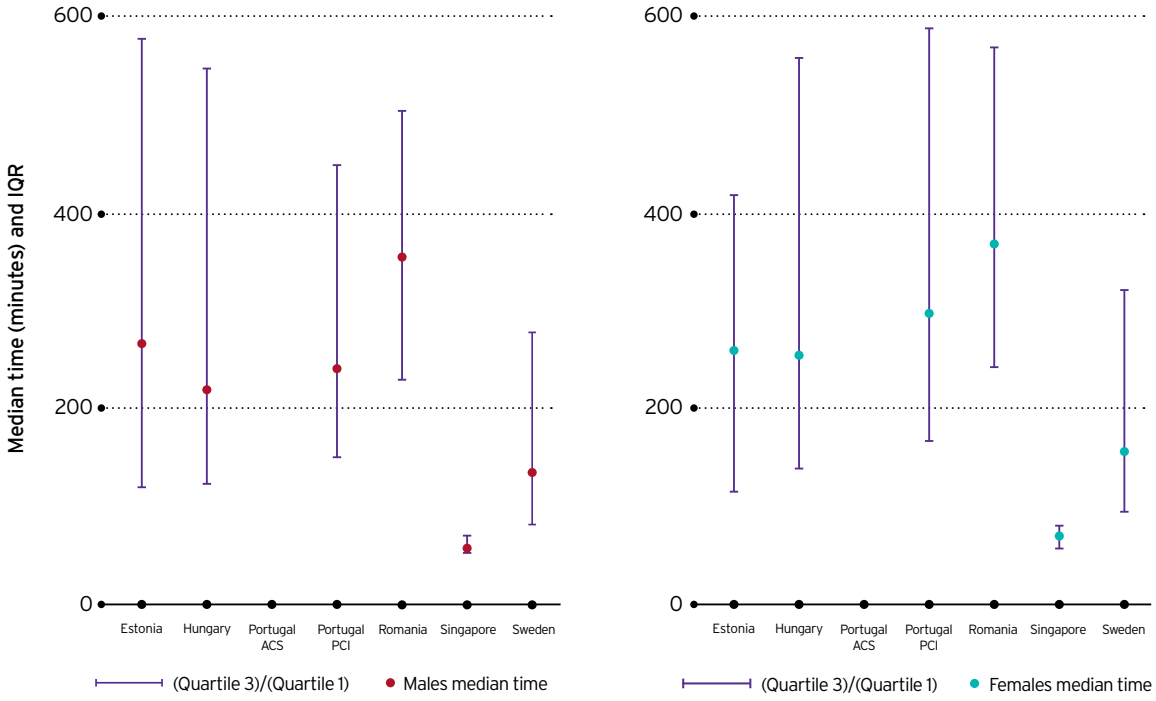
[4]No of patients used as a proxy for number of admissions

ACEi, angiotensin-converting enzyme inhibitors; ARB, Angiotensin receptor blockers; ARNI, angiotensin receptor-neprilysin inhibitor; GLP-1, glucagon-like peptide 1; SGLT-2, sodium-glucose transport protein 2.

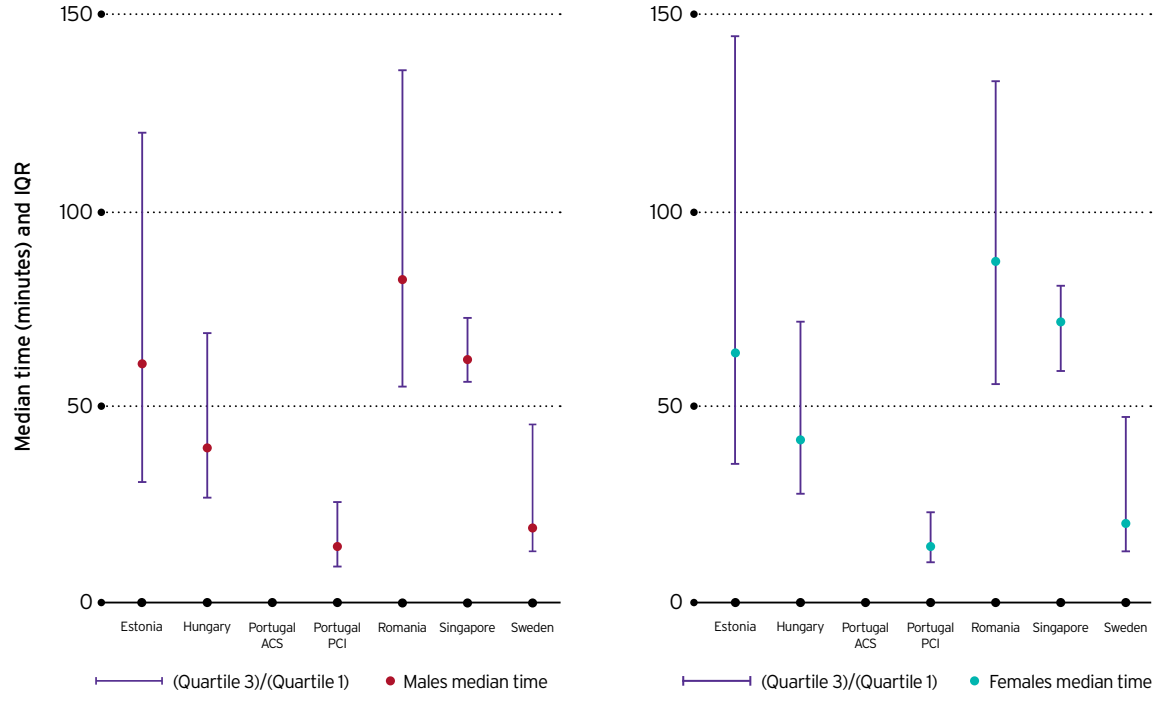
Timed Variables for STEMI/NSTEMI by country

15

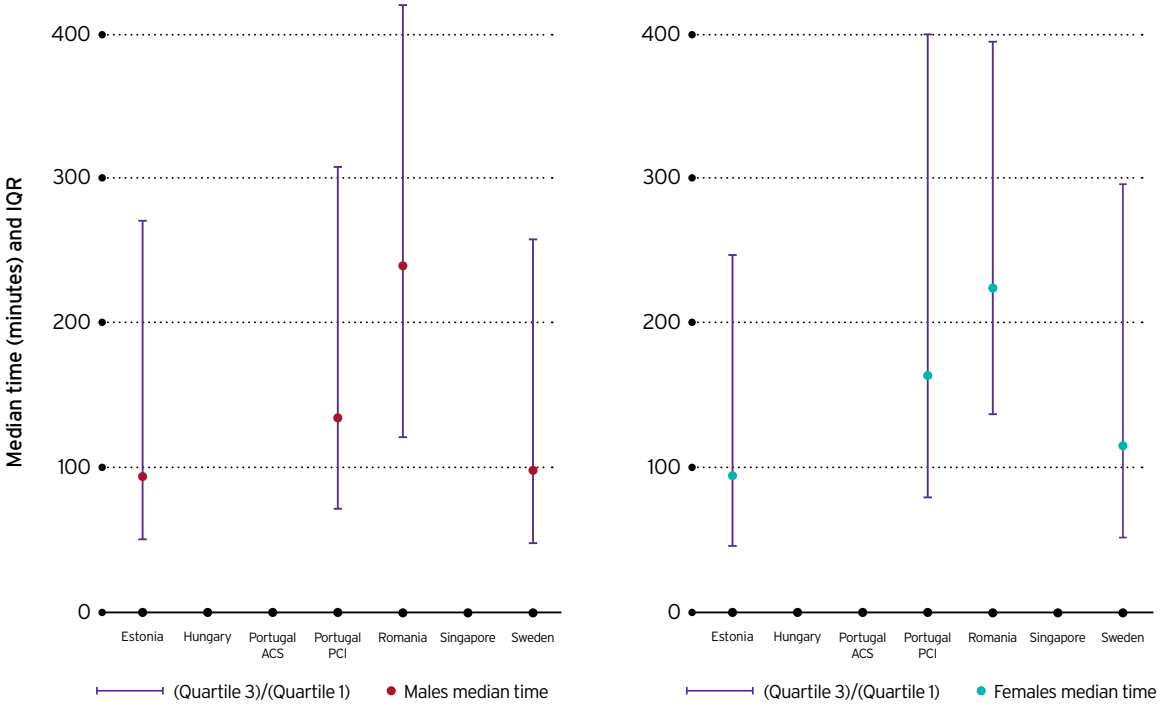
15.1 — Timed variables by Country – STEMI: symptom onset to hospital arrival duration (minutes)



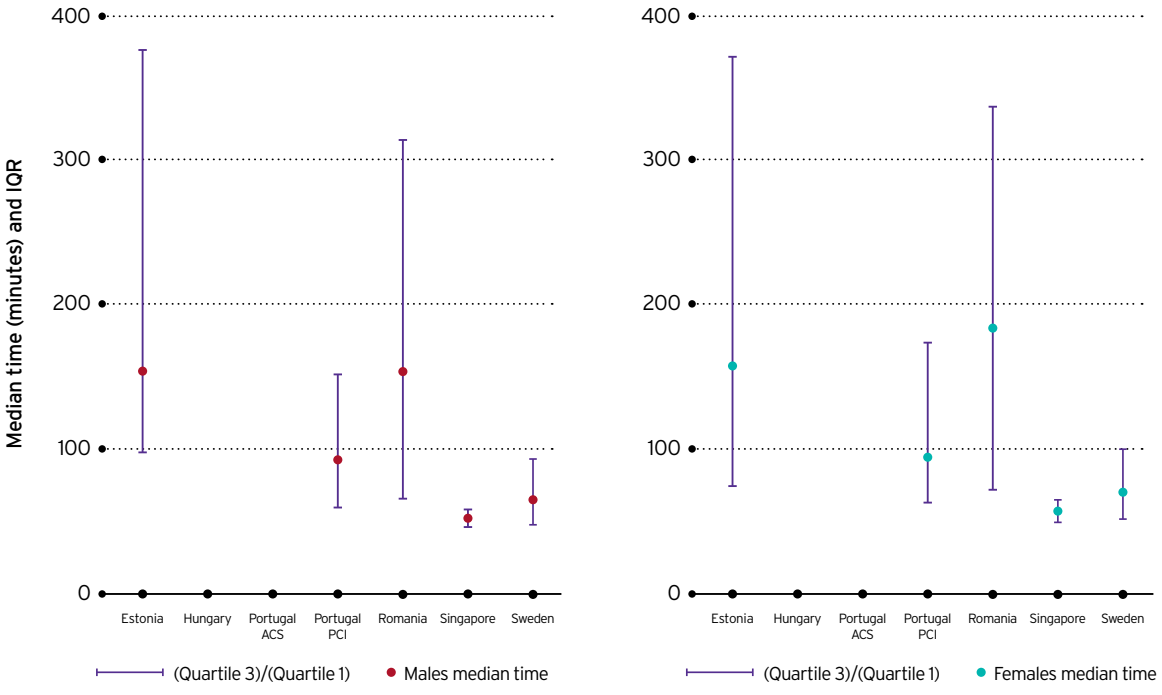
15.2 — Timed variables by Country – STEMI: hospital arrival to reperfusion (minutes)



15.3 — Timed variables by Country-STEMI: symptom onset to ECG establishing need for revascularisation (minutes)



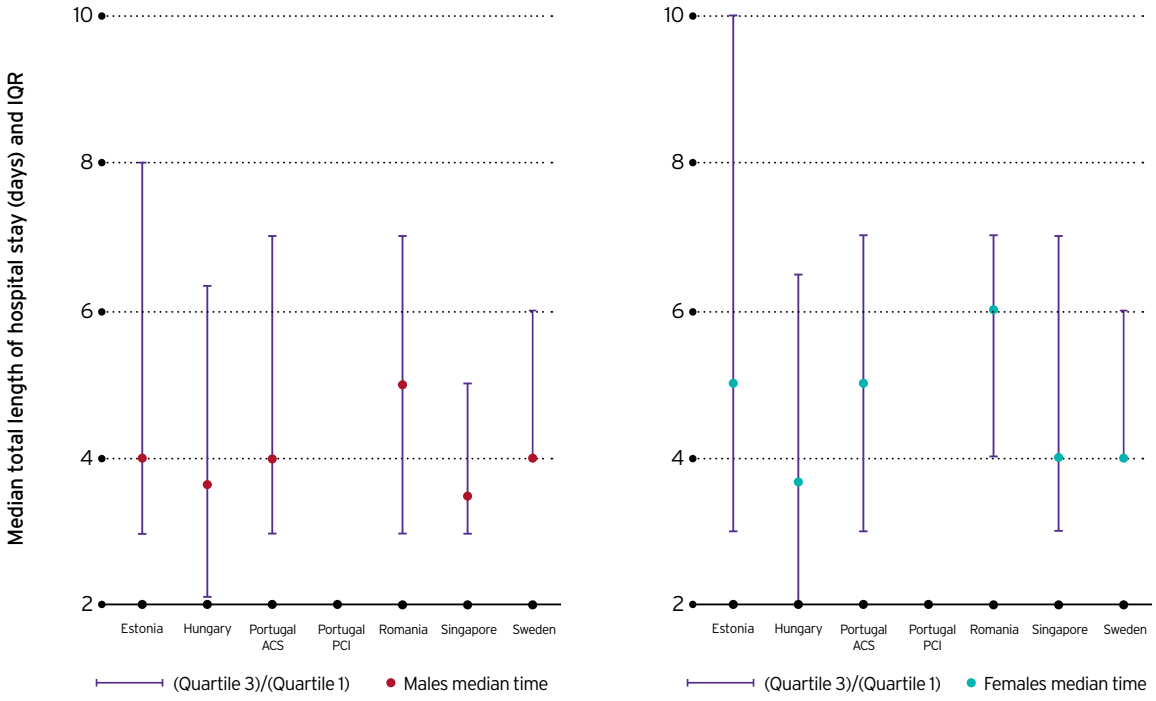
15.4 — Timed variables by Country – STEMI: ECG establishing need for revascularisation to reperfusion (minutes)



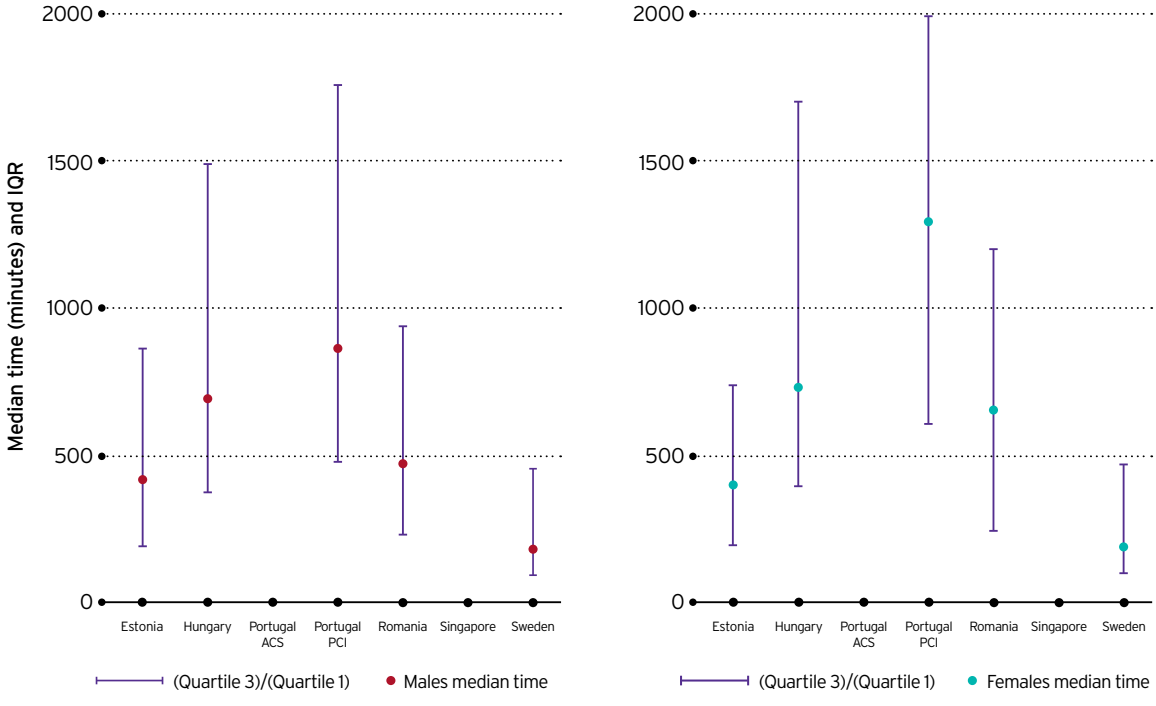
Timed Variables for STEMI/ NSTEMI by country

15

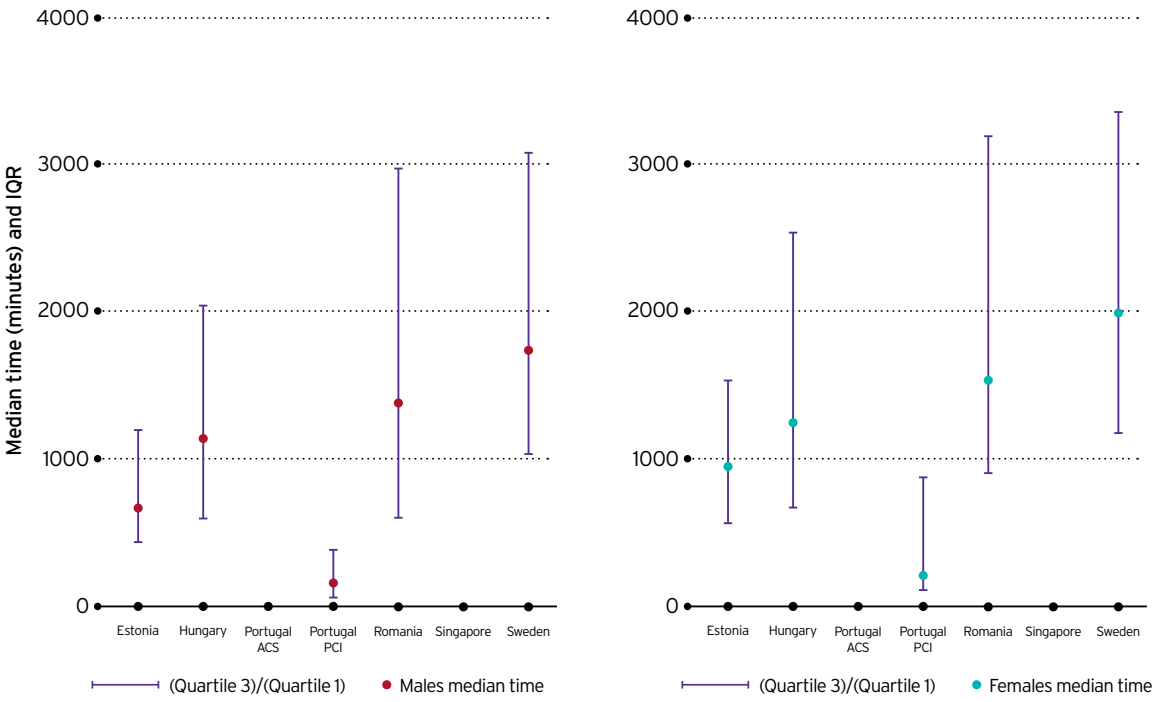
15.5 — Timed variables by Country – STEMI: Total length of hospital stay (days)



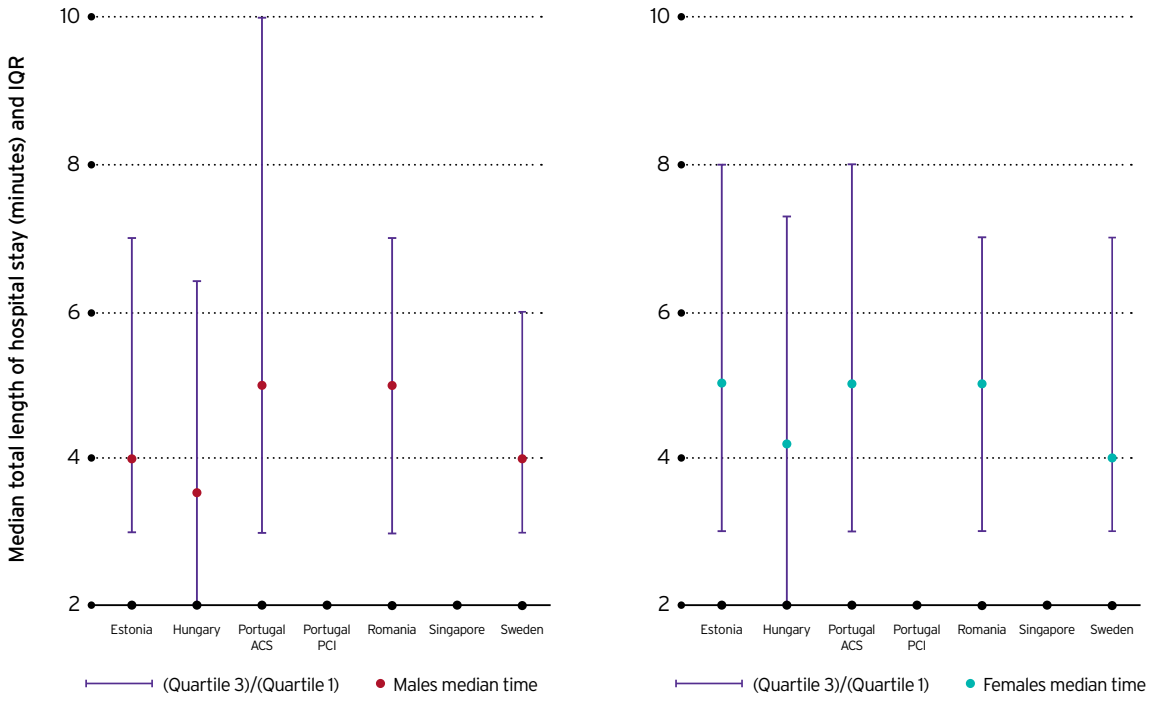
15.6 — Timed variables by Country – NSTEMI: Symptom onset to hospital arrival duration (minutes)



15.7 — Timed variables by Country – NSTEMI: Hospital arrival to revascularisation (minutes)



15.8 — Timed variables by Country – NSTEMI: Total length of hospital stay (days)



EuroHeart Quality Indicators 16

The ESC develops Clinical Practice Guidelines (CPG) for the management of a range of cardiovascular diseases and interventions. Data collected from countries applying these guidelines show diversity in the adoption of guideline directed treatments and variability in cardiovascular care and outcomes. To measure cardiovascular health care quality with the purpose of improving care, the ESC has developed Quality indicators, based on their Clinical Practice Guidelines.

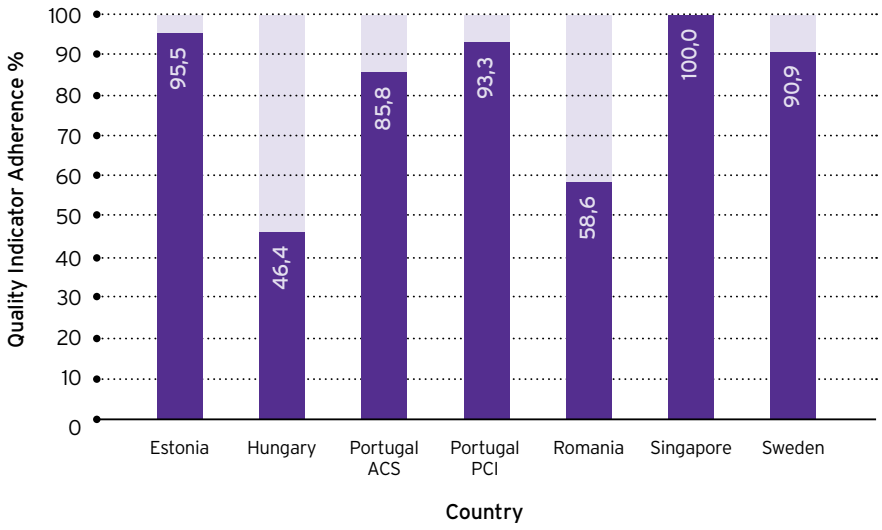
The term Quality Indicator (QI), as described by the ESC, is used to describe a specific clinical situation and the recommended process of care. Quality Indicators are tools to assess and benchmark quality of care in order to improve it.

During the development of the EuroHeart dataset, the ESC QIs were reviewed to see if they could be calculated using the EuroHeart variables. Those that could be calculated were adopted whilst others were adapted so they could be included in the EuroHeart dataset. QIs adopted or adapted from the ESC QIs formed the EuroHeart Quality Indicators. These EuroHeart QIs can be divided into structural, process and outcome indicators based on the aspect of care being measured. Such QIs include individual and composite indicators, the latter of which comprises a number of individual QIs combined as a single measurement.

16.1 Process Quality Indicators

QI Metric description/Name	QI6: Proportion of patients with ST-segment elevation myocardial infarction (STEMI) reperfused among those eligible (onset of symptoms to diagnosis <12 hours) (ACS, %)
Maps to ESC guideline	2017 ESC STEMI Guidelines, Eur Heart J (2018) 39:119-177[17] 2020 Quality indicators for acute myocardial infarction, Eur Heart J Acute Cardiovasc Care (2021) 10:224-233[18]
QI theme	Process QI – Reperfusion/Invasive Strategy
Numerator	Number of eligible patients with STEMI <12 hours undergoing reperfusion
Denominator	Number of patients with STEMI eligible for reperfusion and without contraindications
Country	**Result (%, Numerator (N), Denominator (N))**
Estonia	95.5 (212/222)
Hungary	46.4 (2654/5717)
Portugal ACS	85.8 (151/176)
Portugal PCI	93.3 (1946/2086)
Romania	58.6 (1571/2680)
Singapore	100.0 (316/316)
Sweden	90.9 (3786/4166)

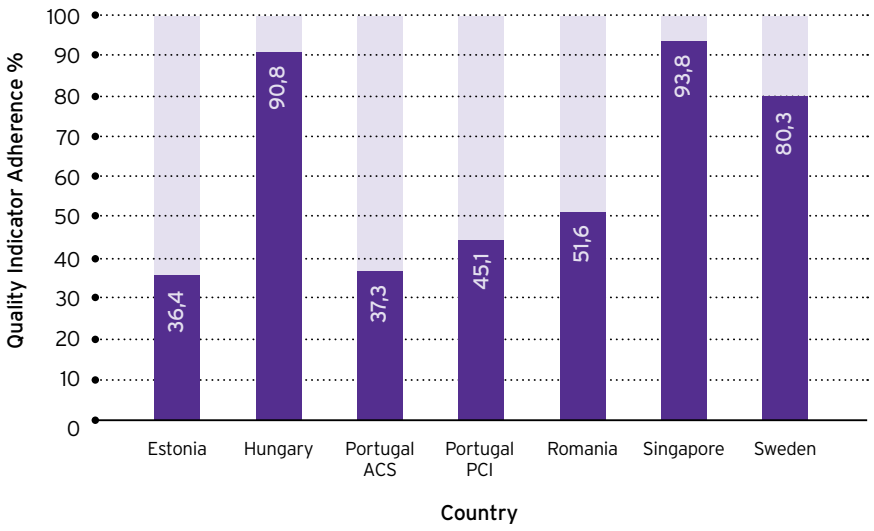
QUALITY INDICATOR 6



EuroHeart Quality Indicators 16

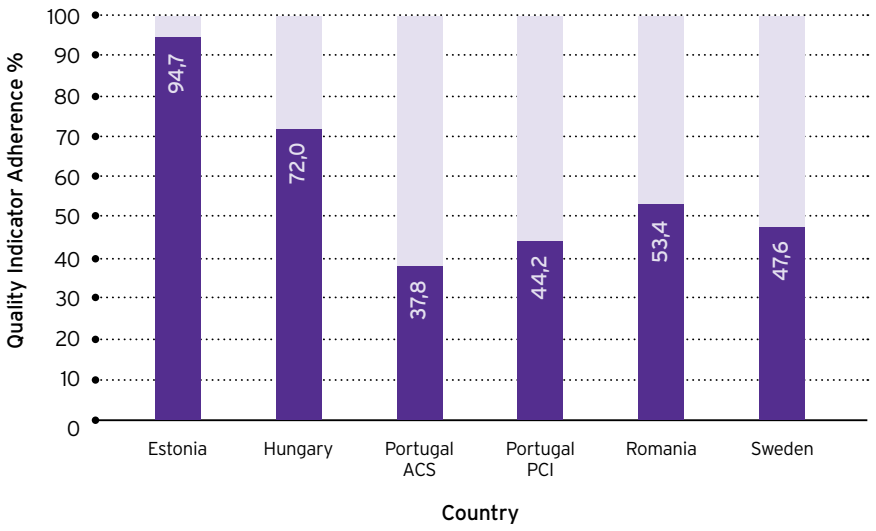
QI Metric description/Name	QI7: Proportion of patients with STEMI who receive timely reperfusion with PCI (wire crossing) within 90 minutes from initial diagnostic ECG, who do not receive fibrinolysis (ACS and PCI, %)
Maps to ESC guideline	2017 ESC STEMI Guidelines, Eur Heart J (2018) 39:119-177[17] 2020 Quality indicators for acute myocardial infarction, Eur Heart J Acute Cardiovasc Care (2021) 10:224-233[18]
QI theme	Process QI – Reperfusion/Invasive Strategy
Numerator	Number of patients with STEMI undergoing timely reperfusion with primary PCI
Denominator	All patients with STEMI eligible for primary PCI
Country	**Result (%, Numerator (N), Denominator (N))**
Estonia	36.4 (59/162)
Hungary	90.8 (2482/2733)
Portugal ACS	37.3 (56/150)
Portugal PCI	45.1 (741/1642)
Romania	51.6 (532/1032)
Singapore	93.8 (152/162)
Sweden	80.3 (2919/3633)

QUALITY INDICATOR 7



QI Metric description/Name	QI8: Rate of non-STEMI (NSTEMI) patients who receive invasive coronary angiography within 24 hours from their diagnosis (ACS and PCI, %)
Maps to ESC guideline	2020 ESC NSTEMI Guidelines, Eur Heart J (2021) 42:1289-1367[2] 2020 Quality indicators for acute myocardial infarction, Eur Heart J Acute Cardiovasc Care (2021) 10:224-233[18]
QI theme	Process QI – Reperfusion/Invasive Strategy
Numerator	Number of NSTEMI patients who receive invasive coronary angiography within 24h of their diagnosis
Denominator	All NSTEMI patients without contraindications
Country	**Result (%, Numerator (N), Denominator (N))**
Estonia	94.7 (197/208)
Hungary	72.0 (4600/6393)
Portugal ACS	37.8 (223/590)
Portugal PCI	44.2 (1113/2516)
Romania	53.4 (544/1019)
Sweden	47.6 (4860/10215)

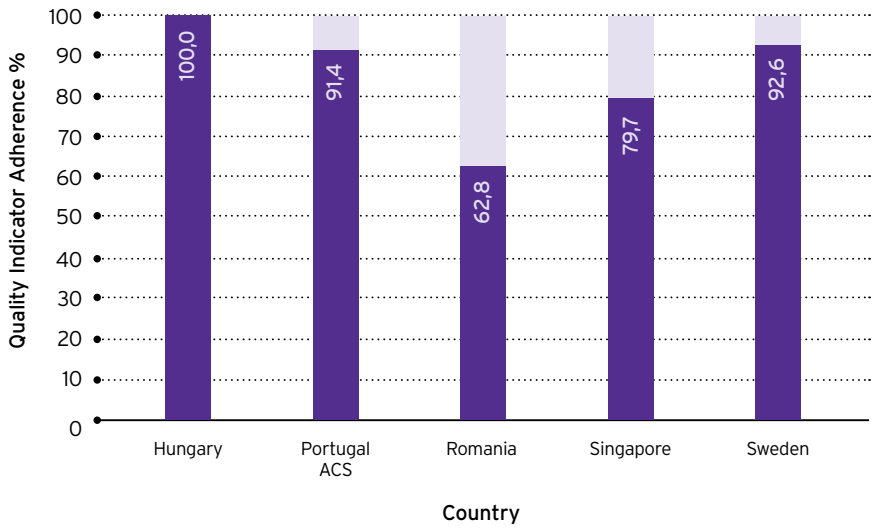
QUALITY INDICATOR 8



EuroHeart Quality Indicators 16

QI Metric description/Name	QI9: Use of radial access in case of invasive strategy for patients with STEMI and NSTEMI (ACS and PCI, %)
Maps to ESC guideline	2017 ESC STEMI Guidelines, Eur Heart J (2018) 39:119-177[17] 2020 ESC NSTEMI Guidelines, Eur Heart J (2021) 42:1289-1367[2] 2020 Quality indicators for acute myocardial infarction, Eur Heart J Acute Cardiovasc Care (2021) 10:224-233[18]
QI theme	Process QI – Reperfusion/Invasive Strategy
Numerator	Number of patients who receive invasive coronary angiography via radial access
Denominator	Number of patients who receive invasive coronary angiography without overriding procedural considerations against the use of radial access
Country	**Result (%, Numerator (N), Denominator (N))**
Hungary	100.0 (10097/10097)
Portugal ACS	91.4 (287/314)
Romania	62.8 (1684/2680)
Singapore	79.7 (252/316)
Sweden	92.6 (11606/12536)

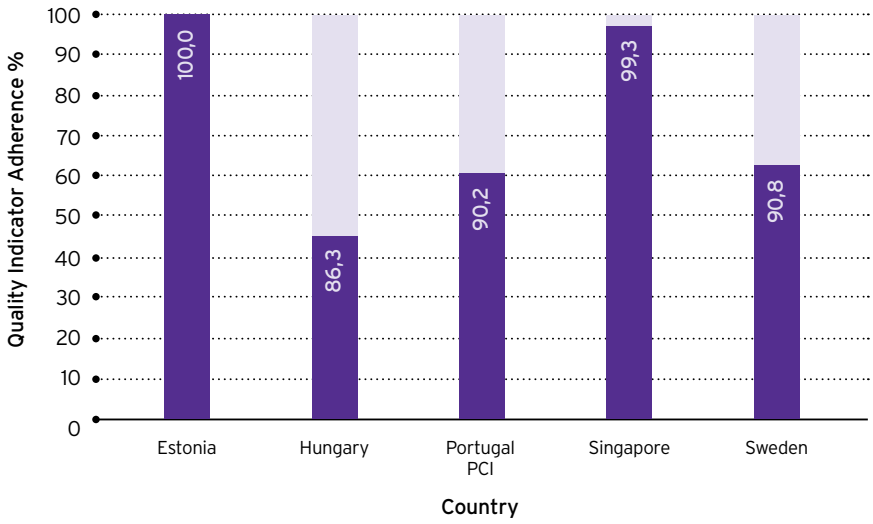
QUALITY INDICATOR 9



QI Metric description/Name	QI10: The time between the initial STEMI diagnosis and arterial access (absolute value) for primary PCI (ACS and PCI, minutes)
Maps to ESC guideline	2017 ESC STEMI Guidelines, Eur Heart J (2018) 39:119-177[17] 2020 Quality indicators for acute myocardial infarction, Eur Heart J Acute Cardiovasc Care (2021) 10:224-233[18]
QI theme	Process QI – Reperfusion/Invasive Strategy
Numerator	Median time between initial STEMI diagnosis and arterial access among STEMI patients undergoing reperfusion
Denominator	Number of STEMI patients who receive a PCI during hospital stay
Results	Please see Appendix 2

QI Metric description/Name	QI11: The proportion of patients with STEMI and NSTEMI who have an assessment of their left ventricular ejection fraction (LVEF) before hospital discharge (ACS, %)
Maps to ESC guideline	2017 ESC STEMI Guidelines, Eur Heart J (2018) 39:119-177[17] 2020 ESC NSTEMI Guidelines, Eur Heart J (2021) 42:1289-1367[2] 2020 Quality indicators for acute myocardial infarction, Eur Heart J Acute Cardiovasc Care (2021) 10:224-233[18]
QI theme	Process QI – In-Hospital Assessment
Numerator	Number of patients who have their LVEF measured before hospital discharge
Denominator	Total number of patients with a diagnosis of AMI
Country	**Result (%, Numerator (N), Denominator (N))**
Estonia	100.0 (574/574)
Hungary	86.3 (9589/11111)
Portugal PCI	90.2 (5714/6337)
Singapore	99.3 (289/291)
Sweden	90.8 (13613/14991)

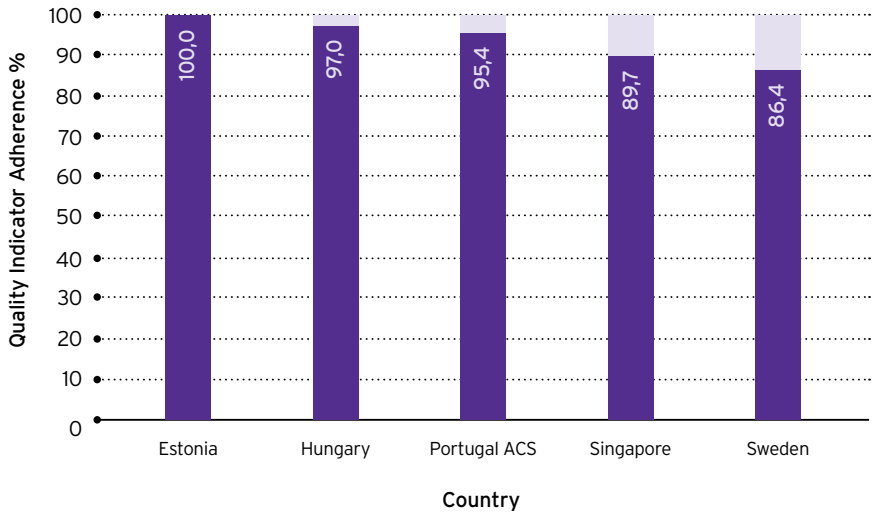
QUALITY INDICATOR 11



EuroHeart Quality Indicators 16

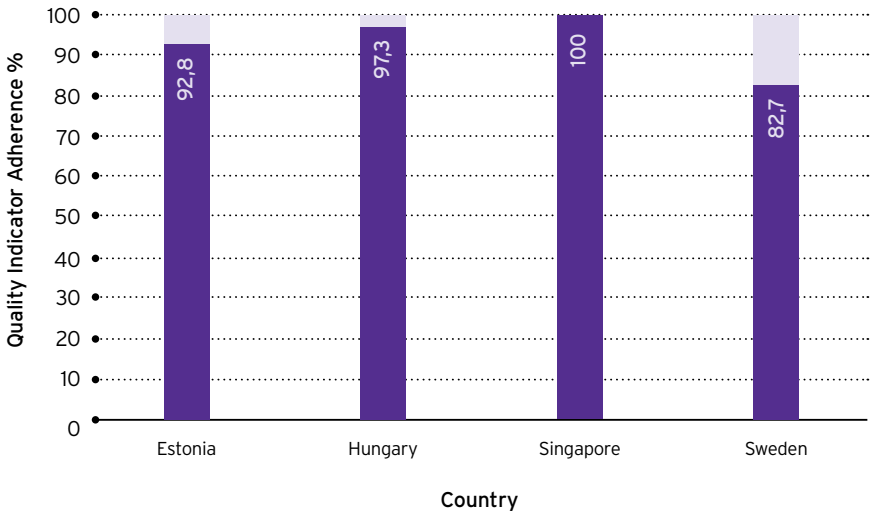
QI Metric description/Name	QI12: The proportion of patients with STEMI and NSTEMI who have their LDL cholesterol measured during hospitalisation (ACS, %)
Maps to ESC guideline	2017 ESC STEMI Guidelines, Eur Heart J (2018) 39:119-177[17] 2020 ESC NSTEMI Guidelines, Eur Heart J (2021) 42:1289-1367[2] 2020 Quality indicators for acute myocardial infarction, Eur Heart J Acute Cardiovasc Care (2021) 10:224-233[18]
QI theme	Process QI – In-Hospital Assessment
Numerator	Number of patients who have their LDL cholesterol measured during hospitalisation
Denominator	Total number of patients with a diagnosis of AMI
Country	**Result (%, Numerator (N), Denominator (N))**
Estonia	100.0 (558/558)
Hungary	97.0 (10781/11111)
Portugal ACS	95.4 (1199/1257)
Singapore	89.7 (261/291)
Sweden	86.4 (12957/14991)

QUALITY INDICATOR 12



QI Metric description/Name	QI14: Patients with STEMI and NSTEMI discharged on dual antiplatelet therapy (ACS, %)
Maps to ESC guideline	2017 ESC STEMI Guidelines, Eur Heart J (2018) 39:119-177[17] 2020 ESC NSTEMI Guidelines, Eur Heart J (2021) 42:1289-1367[2] 2020 Quality indicators for acute myocardial infarction, Eur Heart J Acute Cardiovasc Care (2021) 10:224-233[18]
QI theme	Process QI – Secondary Prevention Discharge Treatments
Numerator	Number of patients prescribed dual antiplatelet therapy at the time of hospital discharge
Denominator	Patients alive at the time of hospital discharge who have an indication for dual antiplatelet therapy with no contraindications
Country	**Result (%, Numerator (N), Denominator (N))**
Estonia	92.8 (438/472)
Hungary	97.3 (9584/9845)
Singapore	100.0 (277/277)
Sweden	82.7 (9962/12052)

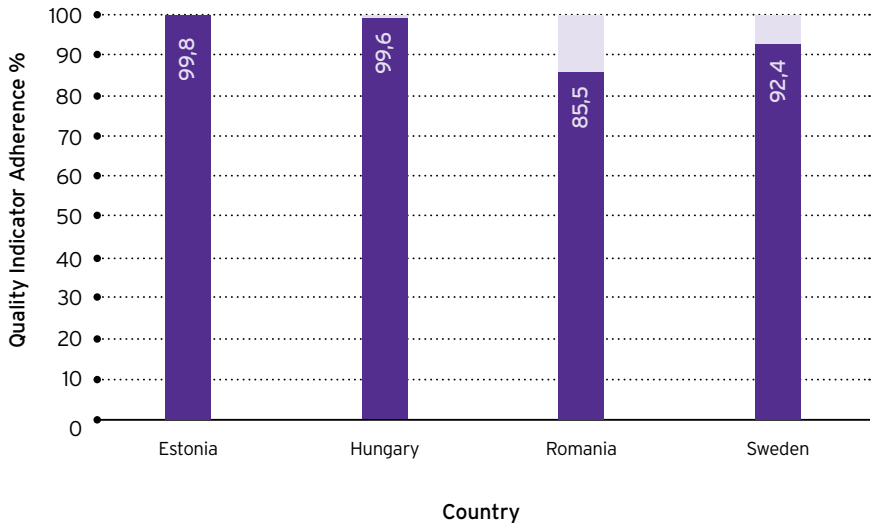
QUALITY INDICATOR 14



EuroHeart Quality Indicators 16

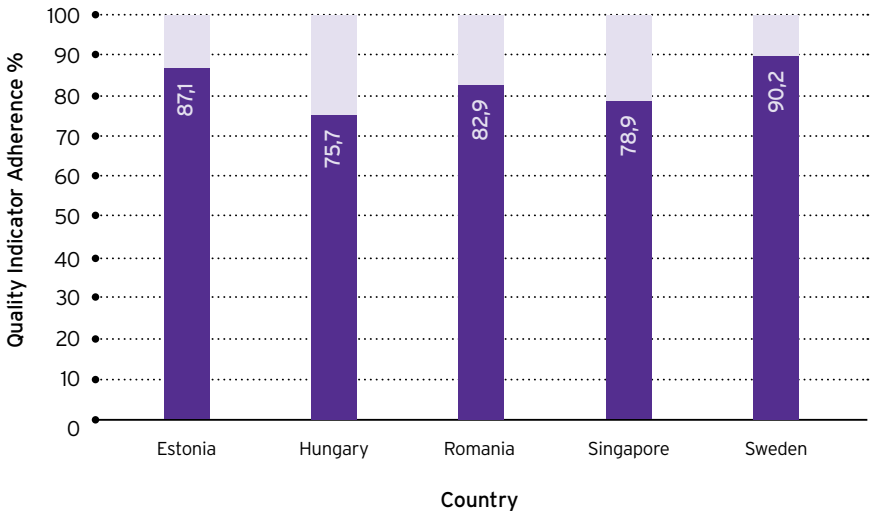
QI Metric description/Name	QI15: Proportion of patients discharged from hospital on statins (ACS, %)
Maps to ESC guideline	2017 ESC STEMI Guidelines, Eur Heart J (2018) 39:119-177[17] 2020 ESC NSTEMI Guidelines, Eur Heart J (2021) 42:1289-1367[2] 2020 Quality indicators for acute myocardial infarction, Eur Heart J Acute Cardiovasc Care (2021) 10:224-233[18]
QI theme	Process QI – Secondary Prevention Discharge Treatments
Numerator	Number of patients who receive statin therapy at the time of hospital discharge
Denominator	Number of patients alive at the time of hospital discharge
Country	**Result (%, Numerator (N), Denominator (N))**
Estonia	99.8 (549/550)
Hungary	99.6 (10449/10495)
Romania	85.5 (2147/2512)
Sweden	92.4 (13759/14892)

QUALITY INDICATOR 15



QI Metric description/Name	QI16: Proportion of patients with LVEF ≤40% who are discharged from hospital on angiotensin converting enzymes inhibitors (ACEi) or angiotensin receptor blockers (ARBs) or angiotensin receptor-neprilysin inhibition (ARNI) (ACS, %)
Maps to ESC guideline	2017 ESC STEMI Guidelines, Eur Heart J (2018) 39:119-177[17] 2020 ESC NSTEMI Guidelines, Eur Heart J (2021) 42:1289-1367[2] 2020 Quality indicators for acute myocardial infarction, Eur Heart J Acute Cardiovasc Care (2021) 10:224-233[18]
QI theme	Process QI – Secondary Prevention Discharge Treatments
Numerator	Number of patients with a LVEF <40%, prescribed ACEI/ARB at the time of hospital discharge
Denominator	Number of patients with LVEF <40% and alive at the time of hospital discharge who are eligible for ACEI/ARBs (no severe renal impairment, hyperkalaemia, other contra-indication, refusal, side effects, or allergy)
Country	**Result (%, Numerator (N), Denominator (N))**
Estonia	87.1 (115/132)
Hungary	75.7 (1401/1850)
Romania	82.9 (773/932)
Singapore	78.9 (228/289)
Sweden	90.2 (2023/2242)

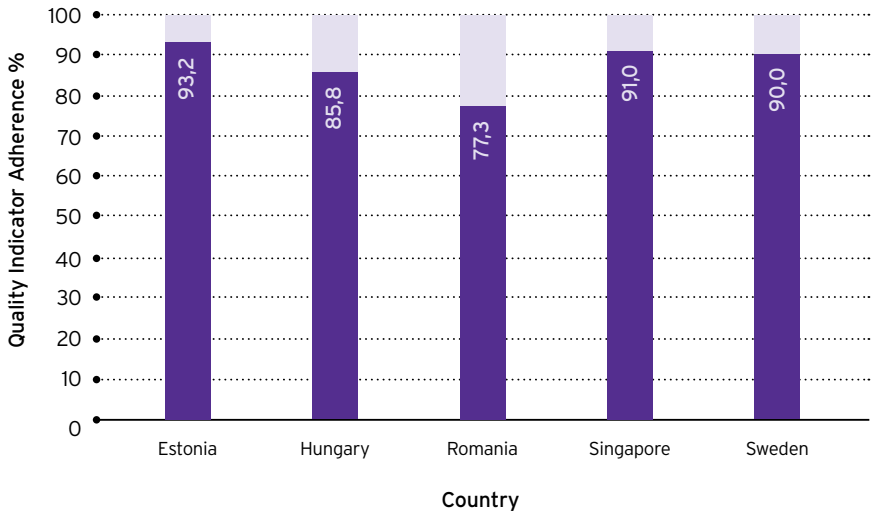
QUALITY INDICATOR 16

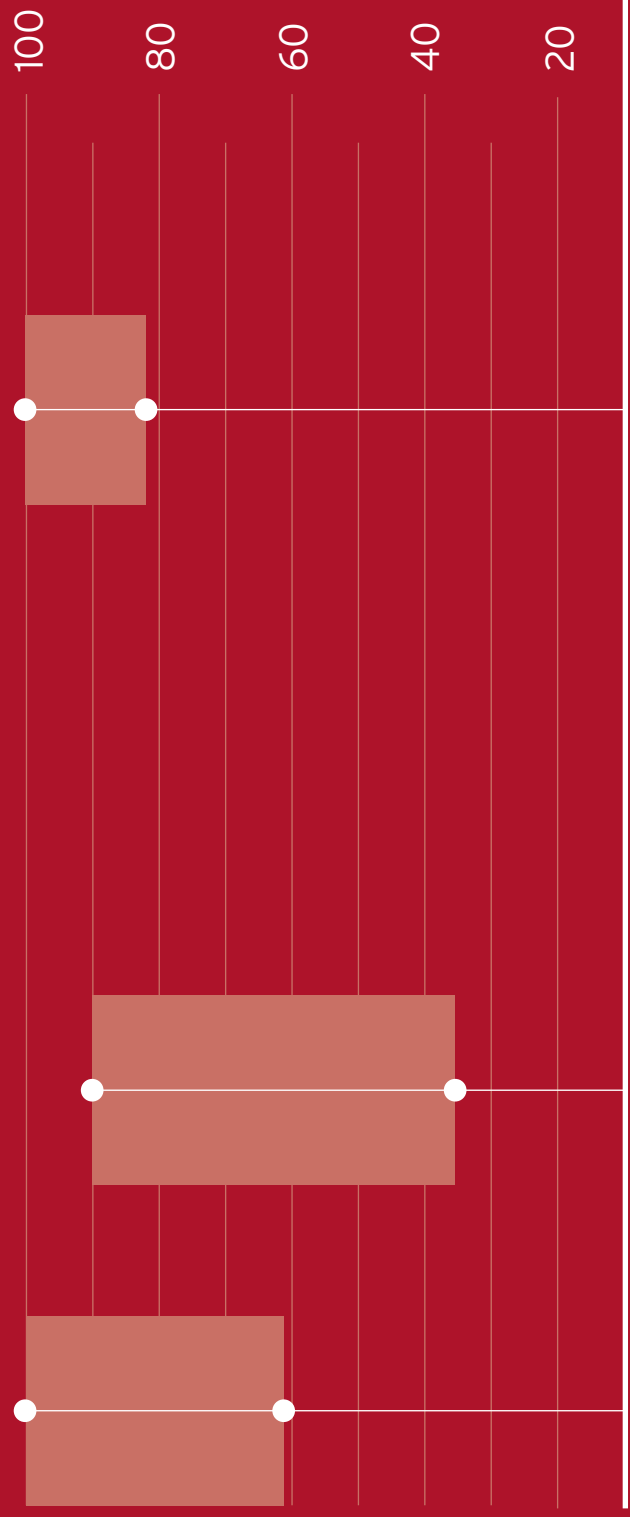


EuroHeart Quality Indicators 16

QI Metric description/Name	QI17: Proportion of patients with LVEF ≤40% who are discharged from hospital on beta blockers (ACS, %)
Maps to ESC guideline	2017 ESC STEMI Guidelines, Eur Heart J (2018) 39:119-177[17] 2020 ESC NSTEMI Guidelines, Eur Heart J (2021) 42:1289-1367[2] 2020 Quality indicators for acute myocardial infarction, Eur Heart J Acute Cardiovasc Care (2021) 10:224-233[18]
QI theme	Process QI – Secondary Prevention Discharge Treatments
Numerator	Number of patients with LVEF <40%, prescribed beta-blockers at the time of hospital discharge
Denominator	Number of patients with LVEF <40%, and alive at the time of hospital discharge who are eligible for beta-blockers
Country	**Result (%, Numerator (N), Denominator (N))**
Estonia	93.2 (123/132)
Hungary	85.8 (1587/1850)
Romania	77.3 (720/932)
Singapore	91.0 (71/78)
Sweden	90.0 (2017/2242)

QUALITY INDICATOR 17





16.2 Key messages

According to the ESC Quality Indicators (QI), delivery of secondary care therapies for acute coronary syndromes (ACS) were generally high with some geographical variation. Dual antiplatelet therapy (DAPT) for ACS ranged from **82% to 100%**, with statin use at least 85.5% across the member states.

However timely reperfusion (<12 hours) for STEMI, according to other ESC QIs, was variable, with some countries performing substantially better than others. Similarly, rates of invasive coronary angiography for NSTEMI within 24 hours ranged from **37.8% to 90%**.

Interestingly, the rates of radial approach for procedures were generally high, with rates ranging between **61.4% and 100.0%**.

Thanks and Acknowledgements 17

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Pilot phase (up to June 2022) industry partners: Astra Zeneca AB, Daiichi Sankyo Europe GmbH, Amgen (Europe) GmbH, Novartis Pharma AG, Edwards Lifesciences, Boehringer Ingelheim, Swedish Heart Lung Foundation, Janssen Global Services LLC, Bayer AG and Medtronic International Trading SARL.

Consolidation phase (since October 2022) industry partners: Astra Zeneca AB, Boehringer Ingelheim, Novartis Pharma AG, Roche, Swedish Heart Lung Foundation, Bayer AG.

A big thank you to, the ESC Working Groups and Associations who have collaborated with the development of the ACS/PCI Registry including:

- *Association of Cardiovascular Nursing and Allied Professions (ACNAP)*
- *Association for Acute CardioVascular Care (ACVC)*
- *European Association of Percutaneous Cardiovascular Interventions (EAPCI)*
- *EURObservational Research Programme (EORP) committee*
- *ESC Patient forum*
- *Working Group on Thrombosis*
- *Committee for Young Cardiovascular Professionals*

Finally, thank you to the ESC Board for their unwavering support to EuroHeart.

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Appendix 1 – Admissions Stratified by Age

19

Table 19.1.1 — Age distribution of admissions with STEMI and NSTEMI

CHARACTERISTIC	N (%)
Number of Patients	**39694**
Number of Admissions	**40021**
Age (years), mean (SD) (n = 39512)	67.9 (12.6)
Age category	
<50	3622 (9.2)
50-54	3188 (8.1)
55-59	3976 (10.1)
60-64	4796 (12.1)
65-69	5585 (14.1)
70-74	5675 (14.4)
75-79	5441 (13.8)
80-84	4148 (10.5)
≥85	3590 (9.1)

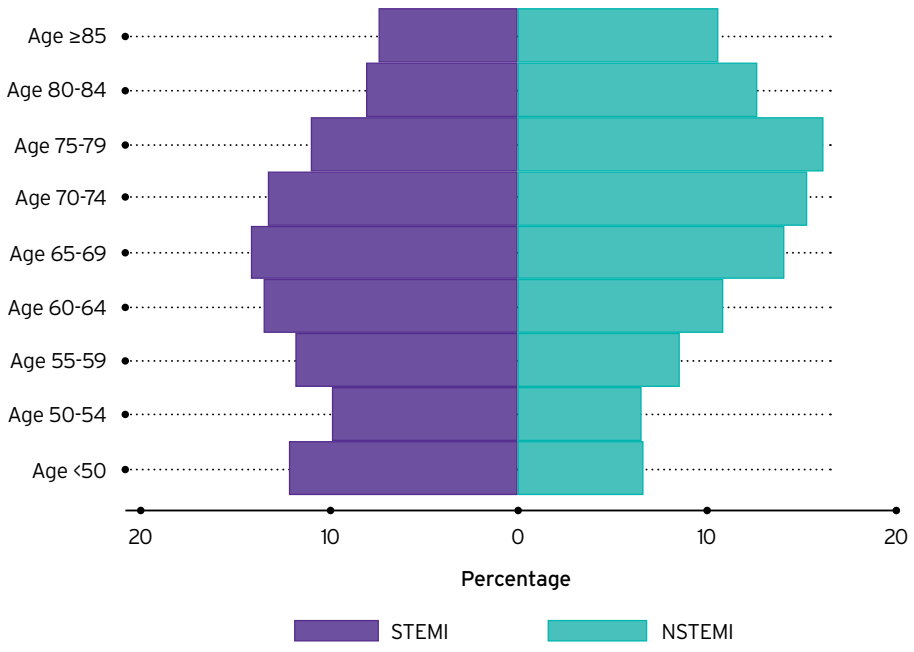
Table 19.1.2 — Age distribution of admissions with STEMI

CHARACTERISTIC	N (%)
Number of Patients	**18644**
Number of Admissions	**18686**
Age (years), mean (SD) (n = 18483)	65.6 (12.8)
Age category	
<50	2236 (12.1)
50-54	1827 (9.9)
55-59	2178 (11.8)
60-64	2501 (13.5)
65-69	2620 (14.2)
70-74	2450 (13.3)
75-79	2038 (11.0)
80-84	1476 (8.0)
≥85	1360 (7.4)

Table 19.1.3 — Age distribution of admissions with NSTEMI

CHARACTERISTIC	N (%)
Number of Patients	**21050**
Number of Admissions	**21335**
Age (years), mean (SD) (n = 21029)	69.8 (12.2)
Age category	
<50	1386 (6.6)
50-54	1361 (6.5)
55-59	1798 (8.6)
60-64	2295 (10.9)
65-69	2965 (14.1)
70-74	3225 (15.3)
75-79	3403 (16.2)
80-84	2672 (12.7)
≥85	2230 (10.6)

Figure 19.1.1 — Age category distribution for full cohort



Appendix 1 – Admissions Stratified by Age

19

Table 19.1.4 — Age distribution of admissions with STEMI, by country

	Estonia	Hungary	Iceland[4]	Portugal ACS	Portugal PCI	Romania	Singapore	Sweden
Number of Patients	**305**	**5717**	**203**	**821**	**4128**	**1661**	**316**	**5493**
Number of Admissions	**310**	**5717**		**821**	**4128**	**1661**	**316**	**5530**
Age in years, mean (SD)	67.3 (12.6)	64.7 (12.7)	64.6 (12.3)	64.5 (13.1)	63.9 (12.7)	61.4 (12.1)	62.8 (12.3)	69.4 (12.2)
Age category (no., %)								
<50	28 (9.0)	799 (14.0)	22 (10.8)	119 (14.5)	593 (14.4)	305 (18.4)	47 (14.9)	323 (5.8)
50-54	27 (8.7)	600 (10.5)	20 (9.9)	79 (9.6)	454 (11.0)	264 (15.9)	34 (10.8)	349 (6.3)
55-59	26 (8.4)	680 (11.9)	37 (18.2)	115 (14.0)	554 (13.4)	153 (9.2)	44 (13.9)	569 (10.3)
60-64	39 (12.6)	783 (13.7)	19 (9.4)	134 (16.3)	598 (14.5)	232 (14.0)	51 (16.1)	645 (11.7)
65-69	50 (16.1)	845 (14.8)	36 (17.7)	92 (11.2)	544 (13.2)	239 (14.4)	48 (15.2)	766 (13.9)
70-74	46 (14.8)	740 (12.9)	19 (9.4)	82 (10.0)	461 (11.2)	226 (13.6)	33 (10.4)	843 (15.2)
75-79	34 (11.0)	567 (9.9)	24 (11.8)	74 (9.0)	372 (9.0)	103 (6.2)	28 (8.9)	836 (15.1)
80-84	36 (11.6)	358 (6.3)	17 (8.4)	78 (9.5)	293 (7.1)	99 (6.0)	16 (5.1)	579 (10.5)
≥85	24 (7.7)	345 (6.0)	9 (4.4)	48 (5.8)	259 (6.3)	40 (2.4)	15 (4.7)	620 (11.2)

[4]No of patients used as a proxy for number of admissions

Table 19.1.5 — Age distribution of admissions with NSTEMI, by country

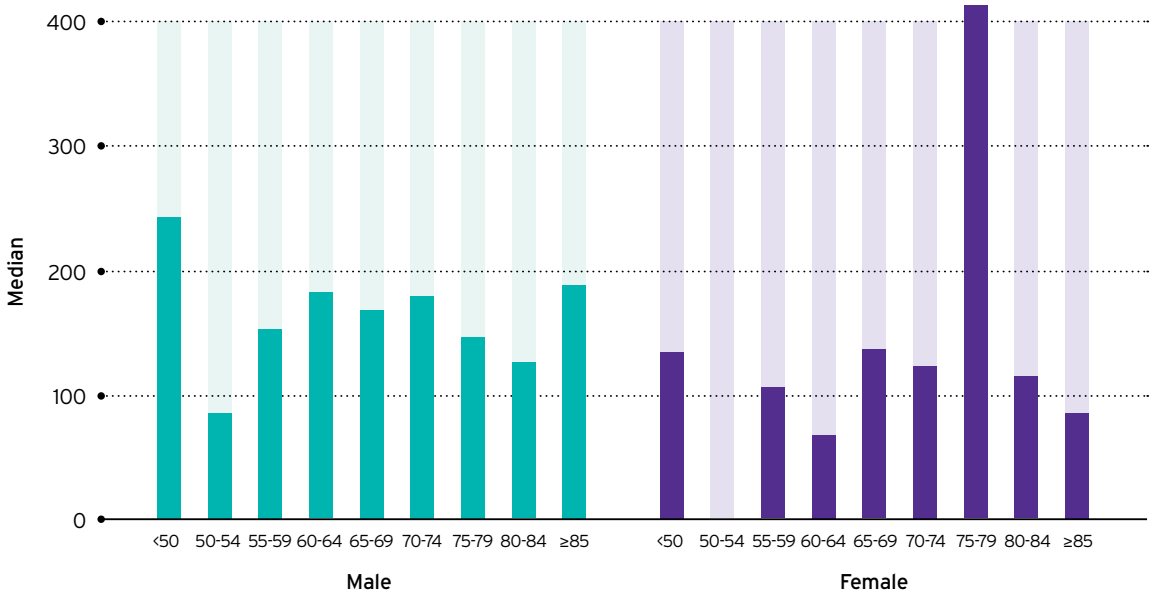
	Estonia	Hungary	Iceland[4]	Portugal ACS	Portugal PCI	Romania	Sweden
Number of Patients	**295**	**6393**	**306**	**590**	**2516**	**1019**	**9931**
Number of Admissions	**296**	**6393**		**590**	**2516**	**1019**	**10215**
Age in years, mean (SD)	70.3 (11.4)	68.8 (12.1)	67.2 (13.6)	68.9 (11.8)	67.2 (12.1)	63.0 (10.9)	71.9 (11.9)
Age category (no., %)							
<50	11 (3.7)	537 (8.4)	26 (8.5)	44 (7.5)	212 (8.4)	121 (11.9)	435 (4.3)
50-54	21 (7.1)	429 (6.7)	35 (11.4)	41 (6.9)	224 (8.9)	141 (13.8)	470 (4.6)
55-59	23 (7.8)	501 (7.8)	50 (16.3)	50 (8.5)	285 (11.3)	113 (11.1)	776 (7.6)
60-64	36 (12.2)	712 (11.1)	30 (9.8)	85 (14.4)	325 (12.9)	139 (13.6)	968 (9.5)
65-69	40 (13.5)	1092 (17.1)	15 (4.9)	66 (11.2)	327 (13.0)	185 (18.2)	1240 (12.1)
70-74	50 (16.9)	1026 (16.0)	34 (11.1)	94 (15.9)	353 (14.0)	164 (16.1)	1504 (14.7)
75-79	51 (17.2)	849 (13.3)	41 (13.4)	105 (17.8)	331 (13.2)	96 (9.4)	1930 (18.9)
80-84	33 (11.1)	751 (11.7)	43 (14.1)	67 (11.4)	263 (10.5)	50 (4.9)	1465 (14.3)
>=85	31 (10.5)	496 (7.8)	32 (10.5)	38 (6.4)	196 (7.8)	10 (1.0)	1427 (14.0)

[4]No of patients used as a proxy for number of admissions

Appendix 2 - Quality Indicator 10 Figures

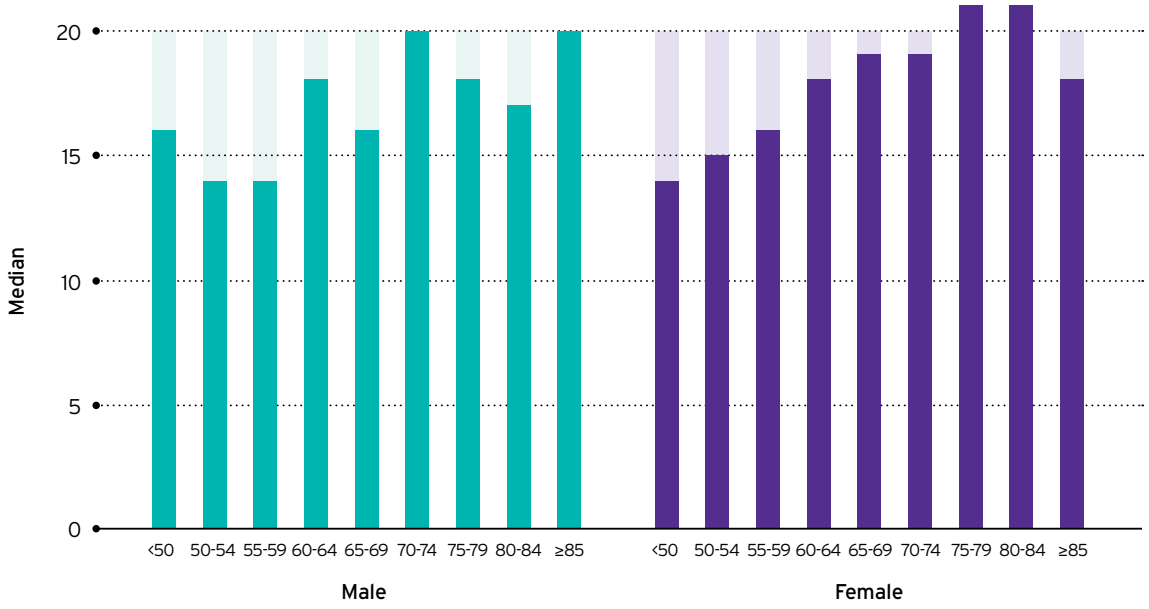
ESTONIA

Time between initial STEMI diagnosis and arterial access (minutes)



HUNGARY

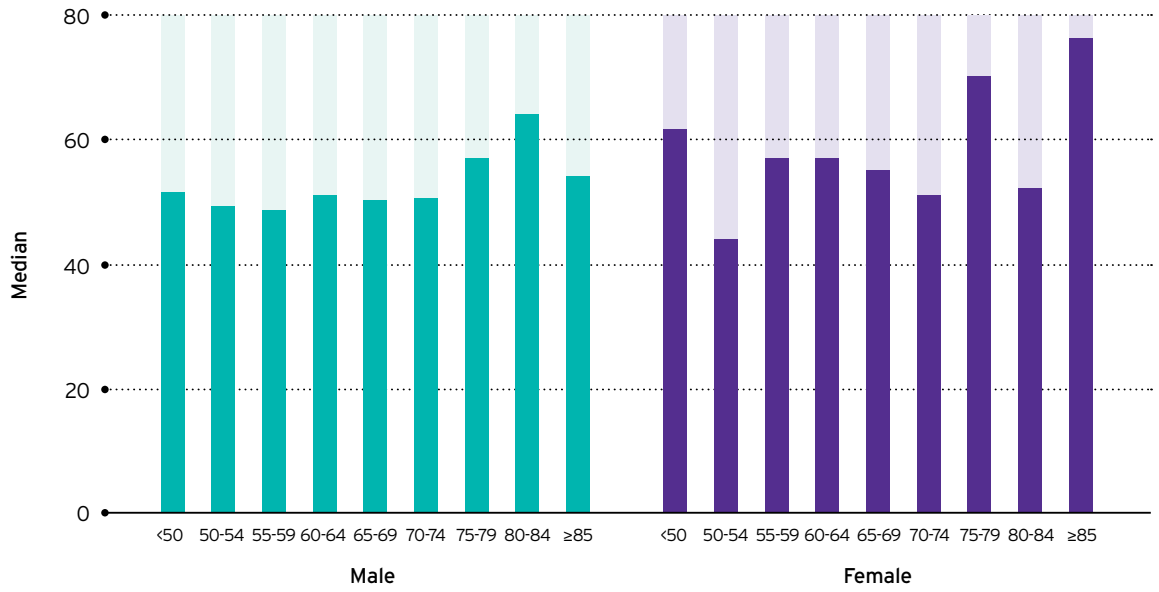
Time between initial STEMI diagnosis and arterial access (minutes)



Appendix 2 – Quality Indicator 10 Figures

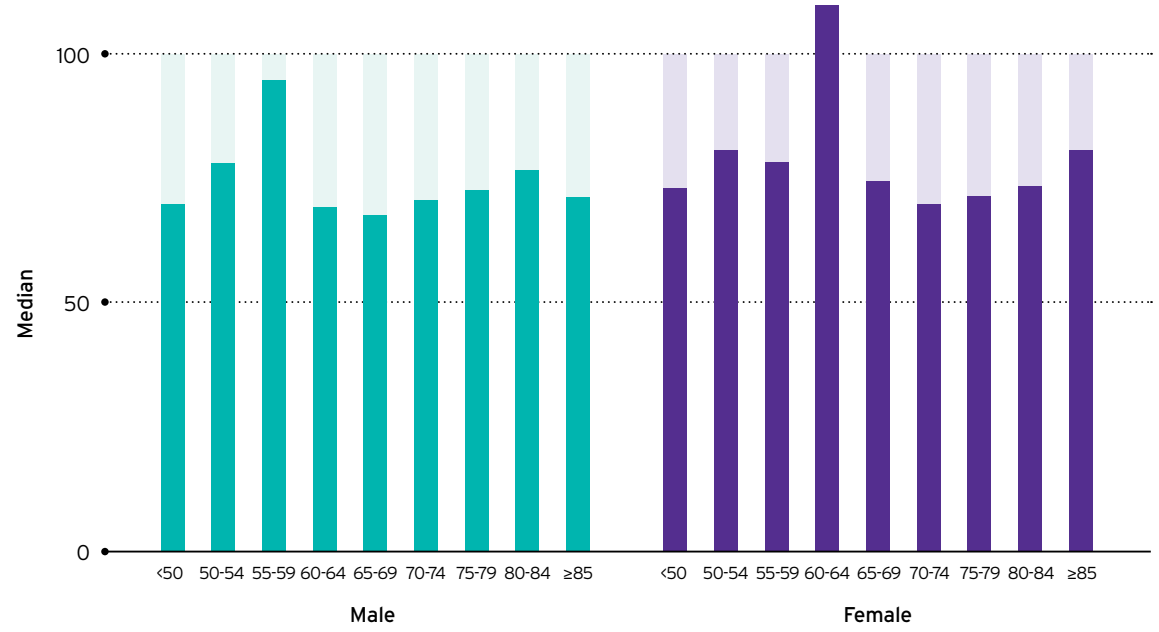
SINGAPORE

Time between initial STEMI diagnosis and arterial access (minutes)



SWEDEN

Time between initial STEMI diagnosis and arterial access (minutes)



Appendix 3 – Missingness 21

Missingness values for STEMI patients were (N, % of admissions): Age (203, 1.1%), Body Mass Index (3740, 18.9%), Current smoker (416, 2.2%), Former smoker (512, 2.7%), Unknown smoking status (356, 1.9%), Systolic blood pressure (2514, 13.5%), Heart rate (2429, 13.0%), Creatinine (6294, 29.5%).

Missingness values for NSTEMI patients were (N, % of admissions): Age (306, 1.4%), Body Mass Index (3976, 18.6%), Current smoker (152, 0.7%), Former smoker (147, 0.7%), Unknown smoking status (35, 0.2%), Systolic blood pressure (1124, 5.3%), Heart rate (1046, 4.9%), Creatinine (1201, 5.6%).

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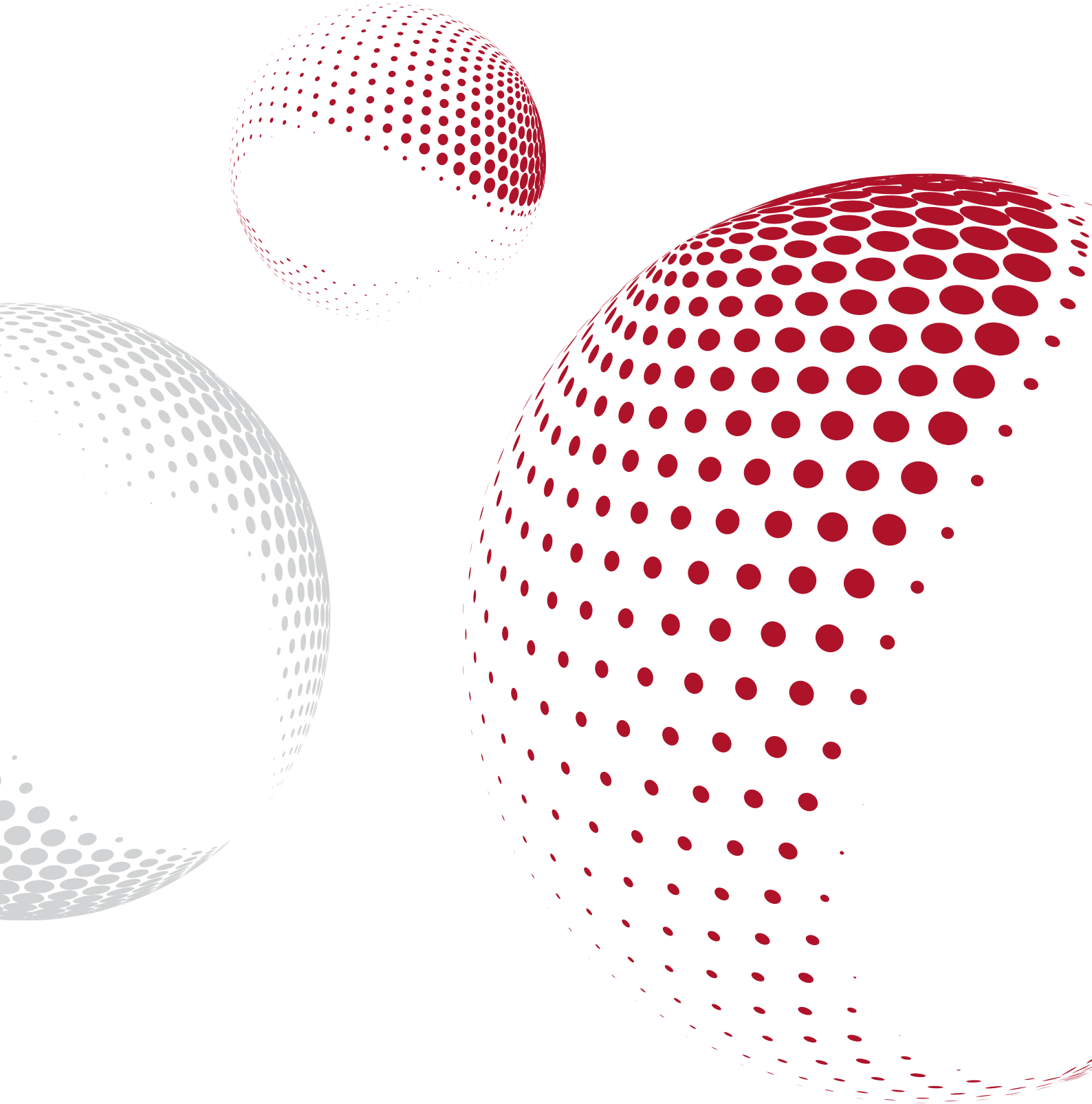

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