

Secondary prevention of

HEART ATTACK AND STROKE IN EUROPE

Consensus report

About this report

This report is part of a multi-year policy project on the secondary prevention of heart attack and stroke in Europe. It is based on interviews and consultation with 30 experts as well as an analysis of European data and research, with a particular focus on 11 countries: Austria, Belgium, France, Germany, Greece, Italy, the Netherlands, Poland, Romania, Spain and the UK.

Analysis and drafting were led by Kirsten Budig and Ed Harding, with research assistance from Jonathan Scrutton and administrative support from Rhiannon Lavin and Victoria Paxton. The report was edited by Madeleine Murphy and Kasia Trojanowska, and designed by Catarina Correia Marques.

The work was funded by Amgen (Europe) GmbH. All outputs developed as part of this project are non-promotional. Findings are based on existing literature and input and review from expert stakeholders, who have not been remunerated for their contributions. The Health Policy Partnership was appointed by Amgen to conduct research and drafting with full editorial control, incorporating input from expert stakeholders and the Amgen policy team on an equal and transparent basis. All outputs have been shared with contributors for final approval, and reviewed by Amgen's legal and medical team for the purposes of scientific accuracy and compliance with industry codes of conduct in public life.

All figures cited are based on the most recent data available at the time of research (October 2020).

We thank all members of the Advisory Panel and the 30 national experts for providing pro bono input and revision of drafts. This project would not have been possible without their support.

Acknowledgements

- Professor Theodora Benedek Professor of Cardiology, University of Medicine, Pharmacy, Sciences and Technology Tirgu Mures, Romania; President, Cardiology Committee of the Romanian Ministry of Health
- ▶ Dr Carlos Brotons General Practitioner, Sardenya Primary Health Care Center-Biomedical Research Institute Sant Pau, Barcelona, Spain
- ▶ **Dr Valeria Caso** Neurologist, University of Perugia Stroke Unit, Italy; Former president, European Stroke Organisation
- ▶ **Dr Christina Chrysohoou** Cardiologist, Director, Greek National Health Service, University Hospital Athens, Greece; Board member, Hellenic Society of Cardiology
- ▶ **Professor Donna Fitzsimons** Board member, ESC (Lead Patient Involvement); School of Nursing and Midwifery, Queen's University Belfast, UK
- Professor Piotr Jankowski Cardiologist; Jagiellonian University, Kraków, Poland
- ► Mr Neil Johnson Founder Global Heart Hub; Chief Executive, Croi, West of Ireland Cardiac & Stroke Foundation and National Institute for Prevention and Cardiovascular Health, Ireland
- ► **Professor Kornelia Kotseva** Professor of Cardiology, National Institute for Prevention and Cardiovascular Health, National University of Ireland Galway, Ireland
- ► **Professor Dafin Muresanu** President, European Federation of NeuroRehabilitation Societies; Director, Department of Neuroscience, Iuliu Hatieganu University of Medicine and Pharmacy, Romania
- ▶ **Dr Dimitri Richter** Chair, ESC Council for Cardiology Practice; author, 2019 ESC/EAS lipid guidelines, Euroclinic, Athens, Greece
- ▶ Ms Maria Teresa San Saturnino Peciña President, Cardioalianza, Spain
- ▶ Professor Peter Siostrzonek President, Austrian Society of Cardiology, Austria
- Mr Stefan Strilciuc Executive Director, RoNeuro Institute for Neurological Research, Romania
- ▶ **Professor Philippe Van de Borne** Professor of Cardiology, Erasme Hospital, Brussels; Université Libre de Bruxelles, Brussels, Belgium
- Professor Heinz Völler Cardiologist, Klinik am See, European Association of Preventive Cardiology;
 Department of Cardiology, University of Potsdam, Germany

Please cite this report as: Budig K, Harding E. 2021. Secondary prevention of heart attack and stroke in Europe: consensus report. London: The Health Policy Partnership.

CONTENTS

A message from the Advisory Panel	4
Call to action	6
Executive summary	7
The burden of repeat heart attack and stroke and why secondary prevention is important	10
Heart attack and stroke present a major sustainability challenge to health systems in Europe	11
Heart attack and stroke are among the least recognised non-communicable diseases, despite their significance to the health systems	12
Repeat events significantly contribute to the burden of heart attack and stroke	13
Secondary prevention can help avert repeat heart attacks and strokes and associated costs	15
What does best practice in heart attack look like?	18
What does best practice in stroke look like?	19
Reality check: where are we going wrong?	20
Gaps in best practice across Europe	22
Policy priorities	24
Achieving national policy leadership in secondary prevention of heart attack and stroke	24
Ensuring availability of comprehensive data on heart attack and stroke	29
Initiation of secondary prevention in the acute setting	32
Increasing participation in structured secondary prevention programmes	36
Increasing primary care capacity for long-term risk management	41
Appendices	45
Appendix I. Risk factors and comorbidities in detail	46
Appendix II. National experts	48
References	50

A MESSAGE FROM THE ADVISORY PANEL

All those who have dedicated their careers to improving the lives of people living with cardiovascular disease appreciate the missed opportunities of recent decades. It is true that many successes have been achieved in reducing vascular risks, not least in reducing smoking rates and in improving survival and recovery from acute events, including heart attacks and stroke.

The often untold story, however, is that millions of Europeans have continued to suffer serious disability and even death due to repeat events and poorly managed risk factors that could easily have been addressed, had we only used proven, widely available and largely cost-effective treatment models more often.

How has this situation arisen? Partly, our healthcare systems are not as readily engineered for long-term prevention and care as they are for acute events. This is most evident in our failure to protect and manage those who face the highest cardiovascular risks. Meanwhile, too many of society's leaders remain unaware as to the extent to which people at high risk of cardiovascular disease drive healthcare costs, hospital admissions, avoidable mortality and socioeconomic inequalities.

Against a backdrop of rising lifestyle and behavioural risk factors, and an ageing population with growing chronic risk factors, we must acknowledge that to continue on this path will lead us to disaster, as great as any we have faced. Cardiovascular disease is far from a problem solved.

This report is an opportunity for all our colleagues to challenge political inertia in cardiovascular disease, armed with a clear summary of evidence and a shared vision for action. With this goal in mind, we have lent our support to this vital work, and commend it to you. We ask you to join us in taking these arguments to governments across Europe. There is no alternative but to succeed.

SIGNED:



Prof. Theodora Benedek Romania



Dr Carlos Brotons Spain



Dr Valeria Caso Italy



Dr Christina Chyrsochoou Greece



Prof. Donna Fitzsimons UK



Prof. Piotr Jankowski Poland



Mr Neil Johnson Ireland



Prof. Kornelia Kotseva UK



Prof. Dafin Muresanu Romania



Dr Dimitri Richter Greece



Ms Maria Teresa San Saturnino Peciña Spain



Prof. Peter Siostrzonek Austria



Mr Stefan Strilciuc Romania



Prof. Philippe Van de Borne Belgium



Prof. Heinz Völler Germany

We thank all members of the Advisory Panel for providing pro bono involvement and input into drafts. This project would not have been possible without their support.

CALL TO ACTION

We call on governments to address the avoidable burden of cardiovascular events on hospital admissions, deaths and disability, for individuals and society alike.

WE CALL ON GOVERNMENTS TO:

- Develop national strategies in cardiovascular and cerebrovascular diseases, with clear goals
 for improved outcomes in prevention and meaningful linkages with wider societal policies,
 including workforce participation and healthcare sustainability.
- Recognise in such strategies the role of repeat events among people at high risk, and the
 enhanced risk management required in the community setting.
- Identify and remove reimbursement and organisational barriers to proven cost-effective models for people after a heart attack or stroke, where vigilant medical risk management is combined with support for behavioural changes.
- Develop national standards for local care pathways and protocols, challenging historic fragmentation of services and optimising systems for guideline-based care.
- Invest in systemic preparedness for telemedicine and use of digital technology to enable flexible, resilient models of care in the community setting.
- Conduct annual national audits of performance in key elements of cardiovascular disease
 prevention to ensure political accountability on unwarranted variations in patient survival, quality
 of life and experience of care for cardiovascular prevention.

We call on the European Union to guide European institutions and member states to recognise cardiovascular disease as a healthcare priority equivalent to cancer.

WE CALL ON:

- the European Parliament to host, via suitable committees and working groups, a full strategic review of EU competencies in cardiovascular and cerebrovascular disease prevention, evaluating opportunities for concrete EU action and identifying legislation and other measures that can help prevent and fight cardiovascular disease, equivalent to the Special Committee on Beating Cancer
- the European Commission to initiate policy and research workstreams on cardiovascular high-risk groups and secondary prevention as part of existing frameworks and programmes, such as EU4Health 2021–2027, to help secure strategic attention and adequate funding, spread best practice learning and accelerate the pace of innovation
- the Council of Ministers to schedule a dedicated session on cardiovascular and cerebrovascular disease prevention to help member states identify shared priorities in developing strategic plans, infrastructure and minimum common standards vital to EU-wide progress, for example in data collection, implementation of digital and remote technology, and workforce accreditation.

EXECUTIVE SUMMARY

KEY FACTS

THERE ARE MORE THAN

3 million

new cases of coronary heart disease, including heart attack, and more than

600,000

cases of stroke in the EU every year.¹

THE RISK of a second stroke can be up by

14%

in the first three months to a year, and can increase to

40% after ten years.3

Lifestyle management programmes post-stroke are only available in half of European countries.⁶

Proven vascular risk management and rehabilitation models can reduce



heart attacks by

30%



and strokes by

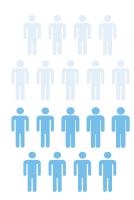
60%.



MORE THAN



of heart attacks and other cardiovascular events occur in people with existing coronary heart disease.²



Fewer than half of cardiac patients are referred to

crucial preventive cardiac rehabilitation programmes.5

Heart attack and stroke pose a major challenge to the sustainability of health systems in Europe. Coronary heart disease, which can lead to a heart attack, is the main cause of death in many European countries,⁷ accounting for 1.8 million deaths per year when combined with other cardiovascular diseases (CVDs).¹ Stroke is responsible for 7% of deaths in men and 10% of deaths in women.¹ In addition, both conditions are a considerable cause of long-term disability,⁸ often leading to cognitive and physical impairment.⁹

Stroke, heart attack and other types of CVD incur significant costs, in some countries taking up the biggest proportion of healthcare spending.¹¹⁰ In Germany, for example, they incur the greatest costs among all diseases in the healthcare system, accounting for 14.5% of all healthcare costs.¹¹

More people now survive a heart attack or stroke than ever before, but most remain at high risk of future events. In the EU, 17 million people are living with coronary heart disease or have experienced a stroke. For them, the danger of a subsequent heart attack or stroke remains high due to the underlying risk factors. A 12

Proven models to prevent repeat heart attacks and strokes exist. Multi-component prevention programmes have been shown to reduce cardiovascular mortality by 58%. They can reduce the chance of a repeat heart attack by 30% and of a repeat stroke by 60%.⁴

CVD prevention could bring a significant benefit for European economies. The key models of CVD prevention for high-risk groups are typically judged as cost-effective for healthcare. A recent global study showed that investing in interventions for stroke, heart attack, diabetes and other CVD leads, on average, to a wider societal return of USD \$10 for every \$1 invested.¹³

Reducing repeat events will be key to ensuring societal productivity in an ageing population that is showing rising rates of chronic disease. People who are able to return to work after an acute coronary event (including heart attack) or stroke lose 25% of their annual workdays on average, and even more if they experience a repeat event. Their informal carers lose an average of 11 workdays.¹⁴

Across Europe we are failing to reduce the risk of recurrent heart attack and stroke. Among the highest-risk groups, little has improved in the past ten years. Behavioural risk factors, such as smoking, unhealthy diet and sedentary lifestyle, are on the rise, while clinical risk factors, such as high blood pressure and cholesterol, remain poorly controlled.^{5 15 16}

CVD prevention should be initiated immediately in hospital after major events, but this rarely occurs. Fewer than two thirds of heart attack patients are prescribed guideline-recommended risk-reducing medication in hospital¹⁷ and under a third of stroke patients receive care in a specialist stroke unit, where rapid diagnosis, targeted treatment and follow-up care are more likely to be achieved.⁸

In the community setting, too few patients benefit from prevention programmes in the months after a heart attack or stroke. Fewer than half of cardiac patients are referred to cardiac rehabilitation programmes and, of those, fewer than a third attend.⁵

Primary care has a key role in supporting people in long-term secondary prevention, but it is often not equipped to deliver. Poor coordination between hospitals and primary care, lack of knowledge or clear guidance, compounded by time constraints all present barriers to providing optimal long-term care. 18-23

Despite these systemic barriers, and the vast and avoidable burden to the healthcare system, heart attack and stroke are often neglected by decision-makers. Fewer than half of the countries in this analysis have up-to-date dedicated strategies for heart attack and stroke, and funding for research is often lower than in other disease areas.

There is a startling lack of data on post-acute care after a heart attack or stroke, despite such data being vital to inform national strategic goals and clinical practice. Apart from some best practice examples, such as the existing comprehensive cardiac rehabilitation registries in the UK,²⁴ the majority of countries have little oversight of quality of care and patient outcomes, which hinders adequate planning and resourcing.

The historical lack of political leadership in CVD comes with a heavy price for European citizens. Policies and clinical guidelines for cardiovascular therapies were among the least recognised and implemented components of non-communicable disease policies in the analysed countries.²⁵ This has likely contributed to a slowdown in progress in CVD prevention and care.²⁶

THE BURDEN OF REPEAT HEART ATTACK AND STROKE AND WHY SECONDARY PREVENTION IS IMPORTANT

What are heart attack and stroke?



HEART ATTACK, also called **myocardial infarction**, occurs when the blood supply to the heart stops. This deprives the heart of oxygen, causing heart muscle tissues to die. It is usually caused by blood clots that create a blockage in the coronary artery.

A heart attack is the most dangerous consequence of **coronary heart disease**, which is characterised by a build-up of fatty substances on the walls of coronary arteries. Coronary heart disease is one of the most common types of **cardiovascular disease (CVD)**, which describes conditions that affect the heart, blood vessels and blood circulation system.



STROKE is caused when blood supply to a part of the brain is blocked, which leaves the brain deprived of oxygen. Most strokes are caused by blood clots (ischaemic), but between 9% and 27% happen because of a burst blood vessel (haemorrhagic).²⁷

As it is linked to the cardiovascular system, stroke is a type of **cerebrovascular disease** (which falls under the umbrella of CVD), but it is classified by the World Health Organization as a **neurological disease** owing to its effects on the brain and the nervous system.

SHARED RISK FACTORS Heart attack and stroke share many of the same risk factors, which often interact and sometimes exacerbate one another. The main risk factors may be clinical, such as high blood pressure, dyslipidaemia (abnormal blood cholesterol)²⁸ and obesity, or lifestyle-related, such as alcohol abuse and smoking (for a full list of risk factors and their impact, see Appendix I). Lack of physical activity, unhealthy diet, conditions such as diabetes, depression or, in the case of stroke, atrial fibrillation, certain medications and stress further contribute to an increased risk of heart attack or stroke.^{8 29} Many of the risk factors and heart attack and stroke themselves are also associated with an increased risk for cancer,³⁰ diabetes²⁰ and (vascular) dementia.^{3 31 32}

Encouragingly, many of the risk factors for heart attack and stroke can be addressed by targeted interventions at the population and individual level.



What is secondary prevention?

Efforts to assess and manage risk in people who have not yet developed CVD are considered

PRIMARY PREVENTION.

Their aim is to prevent a heart attack or stroke from occurring in the first place.

People who survive a heart attack or stroke typically have underlying risk factors and are therefore at high risk of **REPEAT EVENTS** – in other words, a subsequent heart attack or stroke. ³¹² **SECONDARY PREVENTION** describes more intensive efforts to manage chronic risk in such people and, ultimately, to avoid another heart attack or stroke. ³³

Heart attack and stroke present a major sustainability challenge to health systems in Europe

Coronary heart disease and stroke are the leading causes of death in many European countries. Together, they are the biggest contributor to the burden of disease in Europe, 34 accounting for 1.8 million deaths in 2016 together with other CVDs.¹³⁵ Every year, there are more than three million new cases of coronary heart disease and more than 600,000 cases of stroke in the European Union (EU).1 A staggering 17 million EU citizens live with coronary heart disease or have had a stroke. In stroke in particular this often leads to increased dependency and cognitive or physical impairment.89

In many European countries, stroke, heart attack and other types of CVD take up a large, if not the biggest, proportion of healthcare spending. In Germany, for example, they incur the greatest costs among all diseases in the healthcare system, accounting for 14.5% of all healthcare costs. Across the EU, hospitalisations account for 53% of healthcare expenditure for CVD, including heart attack and stroke. Combined direct and indirect costs of CVD to the EU health system amounted to €210 billion in 2015.1

The number of people at risk of a heart attack or stroke is likely to rise, which poses a threat to social and economic sustainability of healthcare in European countries. Not only are direct costs high, but people who have had a heart attack or stroke must often cope with disability and loss of independence, which are factors contributing to indirect costs. For example, 43% of people who have had a stroke are partially or fully dependent and require support.³⁶ Both direct and indirect costs will rise, driven by population ageing and endemic lifestyle and behavioural risk factors, such as obesity.³⁷ In addition, as survival rates for heart attack and stroke have improved in most European countries, 26 partly due to progress in acute and follow-up care,³⁸ people often live with long-term consequences and remain at particularly high risk of repeat events.312

Heart attack and stroke are among the least recognised non-communicable diseases, despite their significance to the health systems

Heart attack and stroke have been deprioritised by decision-makers for too long.

A recent comparison found that policies and clinical guidelines for cardiovascular therapies were among the least recognised and implemented components of non-communicable disease (NCD) policies in European countries.²⁵ This has likely contributed to a slowdown in progress in CVD prevention and care.²⁶ In addition, EU research funding for CVD is proportionally lower than for other disease areas, resulting in significantly less pan-European cooperation and research.³⁹

The deprioritisation of major CVD events such as heart attack and stroke in health strategies ignores their major contribution to avoidable mortality and hospitalisations. In some countries, CVD has been identified as playing a dominant role in otherwise avoidable admissions. For example, World Health Organization expert panels in Germany nominated a group of CVD conditions (heart attacks, heart failure and hypertension) as an area with by far the greatest opportunity to reduce hospitalisations. The panel estimated that of 426,000 annual admissions for coronary heart disease, 61% were preventable – equivalent to 260,000 hospitalisations.⁴⁰

Political failures to take advantage of the opportunities in CVD risk management also undermine other high-level health targets, such as those for NCDs. People who have had a heart attack or stroke often face the burden of multiple conditions, as many of the risk factors are shared and interact. A comprehensive approach to risk factors and conditions that affect people with NCDs can not only help prevent heart attack and stroke, but has the potential to simultaneously address common risk factors and associated chronic conditions.⁴¹



We urgently need a more holistic view on NCD prevention. We are all trying to achieve the same goal – fewer hospitalisations and better patient outcomes for people with long-term conditions. Reducing these risk factors will help reduce the burden of many of the diseases that are threatening the sustainability of our health systems.

DR VALERIA CASO, NEUROLOGIST, ITALY

Repeat events significantly contribute to the burden of heart attack and stroke

Many heart attacks and strokes occur in people who have already experienced one such event.

Nearly half of all major coronary events (such as a heart attack) occur in people who have coronary heart disease 42 and 25–30% of strokes are repeat events.43 Surviving a heart attack or stroke is a decidedly positive outcome, but it is often

25%-**30**%



only the start of a longer journey. The underlying cardiovascular risk factors that led to the first event are likely to endure – and, as a result, the person is at a high risk of repeat, potentially life-threatening events.42 44

The risk of repeat events often dramatically increases with time. This emphasises the need for continuous risk factor control.³ In Europe, the risk of a second stroke can go up by 14% in the first three months to a year, depending on the type of stroke, and can increase to 40% after ten years.3 For heart attack, data from England have shown recurrence in the first year in 5.6% of men and 7.2% of women.¹² Furthermore, one in five patients discharged from hospital after a heart attack has another heart attack, stroke or dies of cardiovascular illness within the first year.⁴²

Figure 1. The burden of first and repeat heart attack and stroke on healthcare costs and workforce participation



Substantial acute costs:45

Heart attack: \$547-\$10,435 (variation by country)

Stroke (ischaemic): \$5,016 - \$24,451 (variation by country)



Heart attack: up to 3 x higher than acute costs⁴⁵

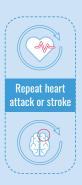
Increased risk in the first year:

After heart attack: 18.3% of patients will have a subsequent cardiovascular event⁴²

After stroke: 7–13% risk of repeat stroke³ 33% risk of all-cause readmission within the first year3

Lost productivity:

After heart attack: 59 workdays lost14 After stroke: 56 workdays lost14



Further increased follow-up costs:

In highest-risk group 2.5 times higher than in low-risk group⁴⁶

Further lost productivity:

After heart attack: 80 workdays lost14 After stroke: 73 workdays lost14



With the more effective treatments we have now, more people are surviving a heart attack or stroke, but it also means they are living with high levels of disability and impaired quality of life. The human and economic costs are considerable – we need to enhance secondary prevention and provide better support.

PROFESSOR DONNA FITZSIMONS, QUEEN'S UNIVERSITY BELFAST, UK

The costs of healthcare after a heart attack or stroke are high, and often grow further with repeat events.

International data suggest that the cost of follow-up care post-stroke is at least as high as the acute care and in heart attack it is as much as three times higher (see *Figure 1*). 45 In England, the National Health Service spends over £23,000 per high-risk patient in the first five years after a cardiovascular event – 2.5 times more than for a low-risk patient. 46 Costs are incurred through frequent



£23,000

per high-risk patient over 5 years

hospitalisations⁴⁷ and clinical consultations, and are greater in the highest-risk group and people with comorbidities.⁴⁶ Lack of access to programmes for secondary prevention leads to an increased number of years lived in ill health or to early death. Data from England showed that, for 10,753 cardiac patients, not taking up cardiac rehabilitation resulted in a combined loss of 3,936 years of life expectancy.⁴⁸

Anxiety, depression and lost productivity are major contributors to the societal cost of heart attack and stroke, which increase in the case of repeat events.

The experience of a heart attack or stroke can have a profound and lasting impact on the quality of life of those affected as well as their families or carers, often causing substantial stress, anxiety and, in some cases, depression.^{49 50} People with coronary heart disease are twice as likely to experience anxiety and panic compared with the general population.⁵¹

30% 40% heart attack patients experience depressive symptoms

People are often unable to return to work immediately, if at all, and may require care. Such care often involves informal carers such as family and friends. In the case of repeat events, the number of lost working days can be more than 35% higher than after the first event.¹⁴

Secondary prevention can help avert repeat heart attacks and strokes and associated costs

The increased risk of a repeat event can be mitigated through secondary prevention after the first heart attack or stroke. This includes comprehensive, structured rehabilitation programmes such as cardiac rehabilitation, pharmacotherapy and lifestyle changes.^{20 55} Such programmes have proven highly effective at reducing the risk of repeat events and improving participants' mobility and quality of life.^{56 57}

Best practice secondary prevention for heart attack and stroke patients is costeffective and can also be cost-saving. Secondary prevention models have been shown to reduce not just mortality but recurrent hospitalisation and healthcare costs. Pepeat events are costly to the health systems, due to re-hospitalisation and longer hospital stays. They also contribute to indirect costs through lost productivity, as well as putting significant strain on families and communities. Interventions such as counselling and risk-reducing medication in people with a very high ten-year risk of a cardiovascular event could reduce the burden of stroke, heart attack and other CVD by as much as 35%, and are cost-effective.

The social and economic benefit of investing in care and prevention for people recovering from a heart attack or stroke can be huge, bringing in a high return on investment. A recent global study showed that investing in interventions for diabetes, stroke, heart attack and other CVD leads on average to a return of USD \$10 for every \$1 invested.¹³ This is achieved through reduced mortality and morbidity and increased productivity at work. Proven models, such as cardiac rehabilitation, reduce

hospitalisations and could save \leq 30,500 in the first year after a coronary event owing to a faster return to work. Yet currently, across Europe, less than 3% of healthcare spending is allocated to preventive services and programmes. 61



There is far too great a disparity in the funding of preventive healthcare compared with acute care. Failure to treat to target is like pouring money down the drain. There needs to be some real joined up thinking about costs and return on investment. We need to incentivise best practice care and tackle key issues such as medication adherence.

NEIL JOHNSON, PATIENT ORGANISATION CEO, IRELAND

Effective secondary prevention starts in hospital, immediately after the acute event, and continues in the form of structured programmes and long-term management in primary care. Early initiation of preventive measures is key, but these measures must be based on a thorough assessment of the person's total cardiovascular risk as well as their needs, and may require treatment of existing conditions (see What does best practice look like?, pp. 18–19).²⁰ In heart attack, guidelines clearly state that after the initial assessment all eligible patients must be immediately referred to a cardiac rehabilitation programme (see Box 1).²⁰ A delay in referral has shown to lead to reduced uptake and completion of the programme.⁴⁸

Comprehensive cardiac rehabilitation

Cardiac rehabilitation (sometimes referred to as cardiovascular rehabilitation) is the most widespread model of secondary prevention post-heart attack and its benefits and effectiveness in improving patient outcomes are well evidenced.^{57 59 62 63} It is also increasingly being recognised as an integral part of secondary prevention in stroke.^{4 44 59 64 65}

Participation in cardiac rehabilitation has been shown to reduce hospitalisations by up to 30%. Multi-component cardiac rehabilitation that includes exercise and preventive medication has been shown to reduce cardiovascular mortality by 58%; it lessens the chance of a repeat heart attack by 30% and of another stroke by 60%. This creates a strong argument for both heart attack and stroke patients to participate in this type of cardiac rehabilitation.



Delivery will vary depending on the national context, available resources and patient population. But the core set of evidence-based components applies to a broad range of patients, including those who have had a heart attack or stroke. These components typically comprise a package of exercise-based interventions, patient education on self-management strategies that enable risk factor modification, initiation of risk-reducing medication and psychological support.^{4 59 67-70} This package of care should be delivered by a multidisciplinary team.²⁰

Low uptake of cardiac rehabilitation is one of the key issues in service provision⁵ for both heart attack and equivalent models in stroke.⁷¹ It is therefore paramount that programmes are tailored to the participants' needs and preferences. Multidisciplinary models, including nurseled programmes, often improve effectiveness of services.⁷¹⁷² Telerehabilitation can be offered remotely and use technology to engage, monitor and provide longer-term support for patients to self-manage their risk factors.⁷⁰⁷³⁷⁴ The COVID-19 pandemic has demonstrated the importance of flexible delivery models, including technology-based approaches.⁷⁰

The package of secondary prevention measures should be adapted to each person's needs and risk profile to ensure they stay actively engaged in their

own care. Maintaining risk factor control is a lifelong task and people need to be adequately supported through regular assessments and follow-up care.²⁰ The person will need to maintain behaviour change and adhere to daily intake of multiple preventive medications for the rest of their life.⁷⁵ Low levels of adherence are a major barrier to achieving risk factor control, so regular patient assessments are crucial to identify and act on barriers to successful risk factor management.⁷⁶ If targets for risk factor control are not achieved, efforts must be further intensified and alternative

therapies may be considered.^{20 77} Data from the US suggest that for every USD \$1 spent on medication for those who follow recommended intake, savings of USD \$3–13 can be achieved due to reduced emergency department visits and hospitalisations.⁷⁸





What does best practice in heart attack look like?

Figure 2. Key elements of secondary prevention of **heart attack** along the patient journey, from immediate acute care to long-term management



Hospital/care units



Outpatient/home-based care



Primary and social care: life after a heart attack

Who should be involved?

 Multidisciplinary acute care team²²

Who should be involved?

 Multidisciplinary team including cardiologists, physiotherapists, nurses, psychologists, dietitians and pharmacists⁸⁰

Who should be involved?

 Primary care physicians, nurses, pharmacists, social care professionals and informal carers

What does best practice care look like?

- Comprehensive clinical risk assessment taking comorbidities and patients' preferences into account
- Optimising medical therapy and initiating preventive medication to lower lipids and blood pressure²⁰
- ▶ Patient education²⁰
- ► Referral to exercise-based cardiac rehabilitation
- ► Discharge protocol to inform outpatient facilities and primary care⁷⁹

What does best practice care look like?

- ► Exercise-based cardiac rehabilitation^{81 82} in different settings (outpatient, home-based telerehabilitation⁸³) that includes:
 - Functional rehabilitation and physical activity
 - Modification of behavioural and medical risk factors (lifestyle advice and pharmacotherapy)
 - Psychosocial support
 - Routine review with healthcare professionals, monitoring of symptoms and risk factors, and progression of treatments (e.g. titration)⁸⁴

What does best practice care look like?

- ▶ Ideally, long-term management led by a GP, nurse or care coordinator^{72 86} that includes:
 - Regular assessment of cardiovascular risk factors, symptoms and vital signs
 - Continued patient education and advice on heart-healthy lifestyle
 - Ensuring medication adherence
 - Signposting to community services
 - Implementing strategies to reduce patient's care burden,⁷⁵ e.g. polypill⁸⁷
 - Supporting people in selfmanagement

What is the value?

▶ Initiation of secondary prevention before hospital discharge is key, as opportunities for risk factor management tend to decrease thereafter²⁰

What is the value?

- Multi-component cardiac rehabilitation can reduce cardiovascular mortality by 58% and lower the chances of a repeat heart attack by 30%⁴
- Home-based telerehabilitation can further increase costeffectiveness and participants' satisfaction⁸⁵
- ► Participation in cardiac rehabilitation results in reduced depression and anxiety and better medication adherence⁸⁴

What is the value?

- ► Long-term nurse-coordinated programmes can reduce mortality by around 36%⁷²
- ► Easing the burden of risk factor management is important for successful control: the polypill (combined medication) can boost medication adherence⁸⁸



What does best practice in stroke look like?

Figure 3. Key elements of secondary prevention of **stroke** along the patient journey, from immediate acute care to long-term management



Hospital/care units



Outpatient/home-based care



life after stroke

Who should be involved?

► Multidisciplinary team including medical, nursing and therapy staff^{6 89}

Who should be involved?

▶ Multidisciplinary team including cardiologists, physiotherapists, nurses, psychologists, dietitians and pharmacists80

Who should be involved?

▶ Primary care physicians, nurses, care coordinators, pharmacists, carers43

What does best practice care look like?

- ► Specialist treatment in stroke units43 90
- ▶ Early rehabilitation should be initiated if feasible8
- ▶ Optimisation of medical therapy and initiation of preventive medication: antiplatelet, antithrombotic/ anticoagulant, blood pressure and lipid-lowering medicines⁴³
- ▶ Patient education, smoking cessation43
- ► Discharge protocol to inform outpatient facilities and primary care

What does best practice care look like?

- ► Early assessments of needs after discharge90
- ▶ Functional rehabilitation and physical activity
- ▶ Modification of behavioural and medical risk factors (lifestyle advice and pharmacotherapy)
- ▶ Psychosocial support

What does best practice care look like?

- ▶ Long-term support or disease management programmes, supported by telemedicine
- ▶ Regular assessment of stroke risk factors and review of medications
- ► Ensuring adherence to antithrombotic/anticoagulant medication76
- ► Continued patient education and advice on healthy lifestyle
- ► Supporting people in self-management
- ▶ Practical and emotional support
- Signposting to community services

What is the value?

► Early use of preventive treatment could reduce the risk of repeat stroke by 80-90%91

What is the value?

- ▶ Participation in intensified secondary prevention programmes results in better secondary prevention targets: 10% more patients achieving blood pressure targets and 17% more quitting smoking⁹²
- ► Availability of a multidisciplinary team can increase likelihood of attendance by 63.8%71
- ► Multi-component cardiac rehabilitation lessens the chance of a repeat stroke by 60%4
- ▶ Novel approaches, such as homebased telerehabilitation, may offer an alternative to in-person programmes and have the potential to save costs, but more evidence is needed93

What is the value?

▶ Continuous nurse-based telemedicine programmes have been shown to reduce the number of people with suboptimal risk factor control from 73% to 44%76

REALITY CHECK: WHERE ARE WE GOING WRONG?



Across Europe, we are often failing to reduce the risk of repeat events for people who have had a heart attack or stroke. Results from a major long-term research initiative, the EUROASPIRE surveys, have lent a vital understanding to the key issues that lie behind this. The surveys, which have been running since 1995, provide crucial data on risk factor management after a heart attack or other coronary events, tracking trends over time. EUROASPIRE III, published in 2014, also covered stroke.

The surveys highlight the consequences of system failures across Europe:

- ▶ Behavioural risk factors are on the rise and are often mismanaged. Little progress has been made in this area over the past decade. Among people over the age of 50 who have had a heart attack or other coronary artery event, about half of those who smoked were still smokers six months to two years later.⁵ Rates of obesity increased by 7% among people with coronary heart disease between 1999 and 2013.³⁷
- ▶ Patients are frequently not offered the right care and advice. For example, only half of people who have had a heart attack or other coronary artery event appear to receive advice on physical activity, and only a quarter of those with obesity report being informed by a healthcare professional that they are overweight.⁵
- ▶ Clinical risk factors remain poorly controlled, despite some improvements. For people who have had a heart attack or other coronary artery event, lipid control and the management of blood pressure are improving but optimal control is often not achieved. ^{5 16} Of post-heart attack patients on lipid-lowering medication, only 22% achieve guideline-recommended targets. ⁹⁴ Further, despite 95% of patients being prescribed blood pressure-lowering medication, almost half still had raised blood pressure six months to two years after the event. ⁵ In the case of stroke, these figures were 76% for cholesterol and 62% for blood pressure: of people on risk-reducing medication, only about a third achieved guideline-recommended blood pressure and lipid targets. ¹⁵

Gaps in best practice across Europe

5 GAPS While many individual best practice centres have pioneered effective models, mainstream care typically lags behind and many patients experience fragmented and incomplete care. Analysis of 11 European countries has highlighted five major gaps in the organisation and delivery of care (the size and impact of these gaps varies between countries).

GAP 1

Decision-makers do not address secondary prevention in plans and policies

Policies for the secondary prevention of heart and attack and stroke, and in some cases broader national policies, appear to be severely lacking across Europe.

Austria, Germany and Greece have no national health strategy for either heart attack or stroke. Governments have little oversight of quality

GAP

Across Europe, the lack of data collected in the post-acute phase is restricting the assessment of service provision and performance in secondary prevention.

Many countries do not collect data on post-acute care and secondary prevention on a regular basis, and few have established quality

of care and outcomes for people who have had a heart

attack or stroke

indicators.95-97

Of the 11 countries analysed, only the UK has a comprehensive registry for cardiac rehabilitation.²⁴ GAP

3.

Access to specialist acute care is unequal, posing a barrier to the timely initiation of secondary prevention

Access to specialist acute care units for heart attack and stroke varies significantly across Europe, posing a serious problem for the timely instigation of secondary prevention, as well as for recovery from the event itself.⁶⁸ Such units are typically better prepared than non-specialist units to initiate secondary prevention measures early.

In France, Greece, Romania and Spain, the number of stroke units is below the recommended target of three per one million inhabitants.



Not enough people are benefiting from secondary prevention programmes

After discharge, people who have had a heart attack or stroke lack access to comprehensive structured secondary prevention programmes. This is often due to a lack of facilities and inadequate referral. 5698

Across Europe, fewer than half of cardiac patients are referred to – and fewer than a third attend - cardiac rehabilitation programmes.⁵ In the majority of European countries early discharge to rehabilitation is not available.8

Long-term risk factor control in primary care is often insufficient

Too few people with a prior heart attack or stroke achieve or maintain targets for risk factor control in the long term. This is despite the known elevated risks of a subsequent event and the high visibility of this population to healthcare providers. For example, prescription and use of key medications appear to steadily decrease over time, putting people at an ever-increasing risk of recurrent events. 99 100 This situation typically arises through fragmentation of care post-discharge and lack of preparedness for this population in primary care.23

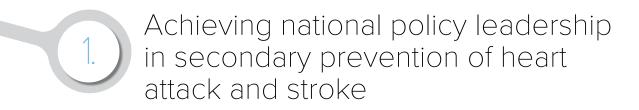
In Spain, about 75% of stroke and heart attack patients in primary care do not reach their guideline-recommended cholesterol targets and almost 80% are overweight or obese.101

In Poland, 70% of patients with coronary heart disease, including those who had had a heart attack, did not meet guideline-recommended cholesterol targets 6-18 months after hospitalisation.¹⁰²

In Italy, adherence to risk factor medication two years after a heart attack can be as low as 27% in some regions.¹⁰³

In England, Wales and Northern Ireland, adherence to guideline-recommended medication for secondary prevention in primary care is only achieved in about 46% of stroke and 52% of coronary heart disease patients.104

POLICY PRIORITIES



Why does it matter?

Whole-system strategies at governmental level are necessary to fully coordinate healthcare systems to mitigate the burden of heart attack and stroke. Both the United Nations and the World Health Organization have called on governments to set out clear goals and targets to reduce the burden of NCDs, and highlighted the urgency of improving detection and control of key cardio- and cerebrovascular risk factors in Europe.^{28 41}

At the European and national levels, dedicated, goal-oriented policies will help boost implementation if they include commitments to invest in vital services. EU programmes can have significant impact on raising awareness and coordinating different sectors such as research.¹⁰⁵ They can also play a role in establishing Europe-wide registries, thus helping to expose inequalities between different regions and populations, as well as promoting shared learning and the implementation of best practice frameworks.

What is the current situation?

The lack of political leadership addressing heart attack and stroke appears to be a major factor in pervasive gaps in prevention and care. Across Europe, it is of serious concern that few countries appear to have functional cardiovascular strategies of any kind. Where strategies do exist, the majority are outdated and may require revision. Many countries do not appear to have an allocated budget for research and implementation in heart attack and stroke. In some countries, such as Italy and Germany, research funding is comparably lower than for other NCDs, which points to a wider political and societal deprioritisation.

Governments rarely provide any substantial recognition or improvement targets for secondary prevention of heart attack and stroke. Only a minority of countries in this study provide dedicated targets (see *Table 1*). One positive example came from England, where *The NHS Long-Term Plan* lays out clear targets for cardiac rehabilitation (see *Best practice examples*, p. 28). Overall, there appears to be greater focus on primary prevention of CVD and improvement of acute care as opposed to long-term, sustainable risk-factor management to prevent repeat events.¹⁰⁶

Table 1. Existence of policy for CVD and secondary prevention of heart attack and stroke

	Dedicated heart attack/stroke policy that covers secondary prevention	Broader CVD policy
Austria	No	No
Belgium	No	No
France	Yes Heart attack ¹⁰⁸ and stroke ¹⁰⁹ (2010–2014)	No
Germany	No	No
Greece	No	No
Italy	No	No
The Netherlands	Yes Heart attack and stroke ¹¹⁰ ¹¹¹	No
Poland	No	Yes ¹¹⁵
Romania	No	Yes ¹¹⁶
Spain	Yes Care standard on cardiovascular risk management (2019) ¹¹²	Yes ¹¹⁷
UK	Yes Heart attack and stroke in England (2019) ¹¹³ and heart attack in Scotland ¹¹⁴ (2014)	Yes England (2019) ¹¹⁸

The neglect of CVD at the national level is mirrored in the lack of clear strategic focus in European-level policy initiatives. There is currently no specific European plan for prevention and care of heart attack or stroke. European health policy initiatives instead incorporate them within wider initiatives to improve management of chronic diseases and multi-morbidities. A positive example of an EU-funded initiative is CoroPrevention, a personalised prevention programme focused on coronary heart disease that involves nurses and a smartphone coaching app to promote behaviour change.

What are the barriers to progress?

Heart attack and stroke may be perceived as 'solved' by a large proportion of policymakers in many European countries. National experts have reported that due to vast improvements in treating heart attacks and stroke and reducing deaths, decision-makers and parts of the clinical community often do not see the need for further action, despite the high risk of repeat events.¹²³⁻¹²⁵



To many policymakers it appears it is often not clear that heart attack and stroke are still driving hospital admissions. In Germany, the number of people admitted to the hospital due to coronary heart disease continues to increase.

PROFESSOR BERNHARD SCHWAAB, CARDIOLOGIST, GERMANY

A lack of harmonised messaging on secondary prevention of heart attack and stroke is a likely factor in the lack of attention at the policy level. The existence of different disease categories and medical disciplines (cardiology and neurology) may be a value segmentation of medical science and specialism, but may prove an organisational barrier to closer, shared advocacy among healthcare professionals. A recently published joint report by the European Society of Cardiology (ESC) and the European Stroke Organisation (ESO) highlighted the need for closer collaboration between cardiologists and stroke physicians, with a view to improving care post-stroke.¹²⁶

How do we get it right?

European and national strategies for secondary prevention in high-risk groups should chart a clear path forwards to effective and sustainable services, including post-heart attack and stroke. Strategies should determine a system-wide response and give clear direction to local and regional organisations as to revised expectations and roles. This should include commitments to key outcome and process goals, underpinned by measurable indicators.

Strategies should be data driven, evidence based and rooted in the national context. They should also be closely informed by the perspectives of patients, carers, and healthcare and allied professionals.



To ensure strategies are implemented, it is crucial to involve all key players including all relevant medical professional societies, public health institutions and ministries of health.

DR CARLOS BROTONS, GENERAL PRACTITIONER, SPAIN

Policymakers should make use of existing frameworks and guidance in the prevention and care of heart attack and stroke. For example, the ESC and European Heart Network's 2020 Blueprint for EU Action³⁹ and the ESO's Action Plan for Stroke in Europe 2018–2030¹²⁷ provide comprehensive advice for policymakers to address key issues in both disease areas. The EU4Health 2021–2027 is the biggest monetary fund yet made available to EU countries, institutions and non-governmental organisations.¹²⁸ It offers a key opportunity for national policymakers and stakeholders to secure investment in heart attack and stroke. Other disease areas, such as cancer, can further serve as a model for political prioritisation and commitment. The European Commission is currently developing Europe's Beating Cancer Plan and the European Parliament has set up a formal cancer committee.¹²⁹

Best practice examples



Implementation of CVD policies

In England, *The NHS Long-Term Plan* (2019) includes **pledges related to the secondary prevention of heart attack and stroke**, aiming to prevent more than '150,000 heart attacks, strokes and dementia cases over the next 10 years'. The Plan incorporates a National CVD Prevention Programme and National Stroke Programme, which spell out targets to improve access to cardiac and stroke rehabilitation and regular medical reviews.

As part of the National CVD Prevention Programme, NHS England, Public Health England and the British Heart Foundation are working together to create a **new registry** to help achieve the target of 85% of eligible patients accessing cardiac rehabilitation by 2028.¹¹⁸



Post-heart attack care programme

A recent government drive to improve care coordination has resulted in a major new programme to improve post-heart attack care. Introduced in October 2017 by the Polish Ministry of Health, the National Health Fund and the Polish Cardiac Society, the Managed Care in Acute Myocardial Infraction programme (KOS-zawał) creates a fully reimbursed, best practice pathway to improve post-discharge prognosis of heart attack patients.¹³¹ 132

The programme optimises the use of acute interventions, cardiac rehabilitation and 12-month outpatient cardiology follow-up care to prevent repeat events.¹³¹

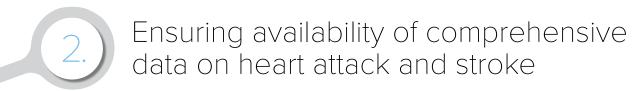
Early data suggest that **the programme has significantly increased participation in cardiac rehabilitation** – from 14% to 98%. It reduced major cardiovascular events by 40%¹³¹ and resulted in high levels of patient satisfaction.¹³³



Multidisciplinary alliance to advance prevention of CVD

The Spanish Interdisciplinary Vascular Prevention Committee (El Comité Español Interdisciplinario para la Prevención Vascular, CEIPV) is an alliance of 15 professional scientific societies supported by the Spanish Ministry of Health and Carlos III Health Institute. It was created in 2000 with the aim of developing and disseminating clear guidance based on multidisciplinary consensus and supporting Spanish healthcare professionals in vascular prevention.

Activities include fostering the dissemination and use of guidelines.¹³⁴ Most recently, the CEIPV published a **consensus on the updated European guidelines on cardiovascular prevention**.¹³⁴ ¹³⁵ The CEIPV puts particular emphasis on making guidance useful for primary care.¹³⁴ ¹³⁶



Why does it matter?

Data are an essential prerequisite for central leadership. Data on the number of cases of heart attack and stroke and on post-acute care, such as availability and uptake of cardiac rehabilitation and long-term risk factor control, are crucial for planning and assessing healthcare delivery.¹³⁷ They can highlight local and national gaps as well as successes, and prompt action among policymakers to target avoidable hospitalisation, mortality and morbidity, and reduce inequalities.¹³⁷⁻¹³⁹



We urgently need more investment in research for secondary prevention models and outcomes. We need to create a stronger evidence base to ensure we can give clear recommendations for action.

PROFESSOR PHILLIPE VAN DE BORNE, CARDIOLOGIST, BELGIUM

What is the current situation?

A severe lack of comprehensive data is impeding governments' understanding of gaps and opportunities in post-acute care and secondary prevention for both heart attack and stroke. Data on risk factor management in these groups appear to be scarce and patchy, and often suffer from a time lag of several years. Most countries fail to collect data on post-acute care for CVD patients (see *Table 2*). While mortality data are often readily available from death registries, data on morbidity and risk factor control are often not captured in health records. Other types of data, such as treatment cost, are also rarely available, with great variation between countries. Where systems cannot provide accurate, up-to-date data, healthcare planning and research may be held back.

Recognising the critical need for better data on CVD, European professional societies have set up regular pan-European surveys. The EUROASPIRE surveys or the ESO's member surveys are used to assess care quality and outcomes. However, it is possible that findings are still underestimating the true state of play in secondary prevention, as people who volunteer to participate in the surveys tend to have better health outcomes.⁵

Table 2. Availability of national registries recording post-acute care in heart attack and stroke

	Austria	Belgium	France	Germany	Greece	Italy	The Netherlands	Poland	Romania	Spain	UK
	Yes (but not comprehen- sive) ¹⁴¹	No	Yes ¹⁴²	No	No	No	No	Yes ¹⁴³	No	No	Yes (England, Wales, Northern Ireland) ²⁴
55	Yes ¹⁴⁴	No	No	No	No	No	No	Yes ¹⁴⁵	No	No	Yes (England, Wales, Northern Ireland) ¹⁴⁶

What are the barriers to progress?

Underdeveloped data infrastructure hinders the collation and use of real-world data in political decision-making. In particular, lack of available registries appears to obstruct the analysis of quality of care and outcome indicators in many countries.⁵ Furthermore, if the importance of gathering data is not acknowledged and prioritised in clinical practice, the monitoring and evaluation of outcomes will not be available to drive quality improvement and optimise patient care.¹⁴⁷

Policymakers seem to lack pragmatic indicators that can be used at scale. High-quality indicators developed for research purposes may play a vital role in advancing scientific understanding, but may need to be adapted for use in routine clinical settings.

How do we get it right?

Quality indicators, national registries and regular audits are all essential building blocks for quality data collection. Together, they create meaningful intelligence for political leadership. The benefits of national registries are well evidenced and have such registries helped improve care in countries where they are established, for instance Sweden and the UK (see *Best practice examples*, p. 31).¹³⁹

National data should be integrated into a wider European data system to accelerate research. The European Commission's Joint Action on the European Health Data Space,¹³⁸ due to start in 2021, will promote data sharing to support research on new preventive strategies, treatments and outcomes. It is therefore important that data are accessible and comparable, and that data exchange and shared learning are enabled.¹³⁸

Healthcare professionals need to be supported and encouraged to collect quality data on the secondary prevention of heart attack and stroke. In busy clinical practice with competing priorities, it is vital that specialists, general practitioners (GPs), nurses and allied health professionals all understand the value of collecting data. What will help in this process is if data collection is made as easy and seamless as possible within care processes.¹⁴⁸

Best practice examples



Clinical practice indicators for secondary prevention of heart attack

The French National Authority for Health (Haute Autorité de Santé) has been working with all major stakeholders to develop and share best practice, based on international guidelines. This has led to the development of **clinical practice indicators covering secondary prevention** that can be used to measure the optimal clinical pathway over the full patient care cycle, from diagnosis to follow-up after one year.⁹⁶



Data collection for heart attack patients

The Myocardial Ischaemia National Audit Project (MINAP)¹⁴⁹ collects and analyses data on care provision for patients admitted to hospital with a heart attack, with the aim of illustrating the patient journey from the first point of contact to discharge, including secondary prevention.¹⁴⁹

The British Heart Foundation's National Audit for Cardiac Rehabilitation collects care quality and clinical outcomes data for heart attack patients taking part in cardiac rehabilitation.²⁴ This includes data on referral and uptake rates, completion figures and individual patient data from assessments.

Why does it matter?

in the acute setting

subsequent event should start as soon as possible, and patients are less likely to receive any sort of secondary prevention after discharge.^{20 38} It has been estimated that early in-hospital initiation of preventive treatment could reduce the risk of early recurrent stroke by 80%.⁹¹ Furthermore, initiation of key risk-reducing medication before discharge has been associated with 31% lower risk of death one year after stroke.¹⁵⁰ Ideally, patients should be treated in dedicated stroke units, neurology wards or cardiology wards, as this makes it more likely that secondary prevention

Initiation of secondary prevention

Stroke units: the gold standard of acute care

measures will be initiated (see Box 2).43

Specialist care provided in dedicated settings such as stroke units has led to significant advancements in acute care, including reduced length of hospital stay and improved outcomes.

8 151-154 Multidisciplinary teams and collaboration are essential and have been linked to improved outcomes in terms of early discharge and delivery of care overall. This normally involves stroke physicians, specialist nurses, physiotherapists, occupational therapists and speech and language therapists.

90 High-quality, guideline-recommended care can be offered more consistently in a specialist unit.

90

What is the current situation?

For heart attack patients, there is clear evidence of significant gaps and inequalities across Europe in the initiation of key measures for secondary prevention in hospital. Recent results from the ESC EORP CICD-LT registry found that under two thirds of patients who had had a heart attack were prescribed guideline-recommended risk-reducing medication while in hospital.¹⁷ Availability of care may vary. In Spain, for example, death rates for cardiac events are twice as high in regions where specialist units are not available.¹⁵⁵

In stroke, access to specialist acute care varies hugely, leading to major inequalities in patient outcomes. Only 30% of stroke patients in Europe receive care in a stroke unit.⁸ This is highly variable, with the lowest rates in Eastern Europe.⁸ The recommended target of three stroke units per one million inhabitants is not always met (see *Table 3*). Even when countries meet the recommended national target, regional variation in the availability of facilities⁸ ¹⁵⁶ means that patients still often miss out on stroke unit care. Austria, for example, has a higher number of stroke units per person than the UK, ¹⁵⁷ yet fewer patients in Austria are treated in a stroke unit (around 66% vs. over 83% in the UK). ⁸ ¹⁵⁸ ¹⁵⁹

Table 3. Stroke units per one million inhabitants¹⁵⁷

	Austria	Belgium	France	Germany	Greece	Italy	The Netherlands	Poland	Romania	Spain	UK
Stroke units per 1 million inhabitants	4.4	No data found	2.2	3.7	0.4	3	5	4.4	0.5	1.3	3.1

What are the barriers to progress?

Lack of standardisation in acute treatment for a heart attack or stroke has an impact on the extent to which a patient receives secondary prevention. Secondary prevention measures may not be automatically integrated into hospital care pathways. Some countries have national protocols for hospital discharge, including management plans and advice on secondary prevention, 160 161 but it has also been noted that implementation in practice may vary significantly. 162

Secondary prevention often appears to be deprioritised in hospital. Specialists in acute care units may focus on treatment of the acute symptoms and not consider initiation of secondary prevention as part of their remit.^{124 163} Gaps in knowledge, coupled with a lack of time and clearly defined responsibilities, could lead to patients being discharged with limited secondary prevention measures in place.



Cardiologists at the hospital focus all their attention on treating the acute event and often perceive their job as done once the patient is saved. They often do not see the initiation of secondary prevention as their responsibility or a priority.

PROFESSOR PIOTR JANKOWSKI, CARDIOLOGIST, POLAND

How do we get it right?

Secondary prevention after a heart attack or stroke should be integrated seamlessly into care protocols and multidisciplinary teams' remits. This allows the healthcare professionals to correctly induct the patient into the most appropriate prevention programme and incorporate or adjust for any underlying clinical considerations. Before hospital discharge, healthcare professionals should initiate preventive pharmacological treatment and provide counselling and education on risk factor modification.

Governments must set targets for access to specialist care such as stroke or cardiac care units. For example, the Action Plan for Stroke in Europe has defined a goal of achieving 90% of stroke patients being treated in dedicated stroke units by 2030.¹⁶⁴ This will help ensure all patients have access to high-quality, specialist care and enable initiation of secondary prevention at the point of discharge.

Best practice examples



Treatment pathway for secondary prevention of stroke

Developed with Reformpool funding, the Tyrol Stroke Pathway has created a **structured rescue and treatment chain**. ¹⁶⁵ ¹⁶⁶ This has **standardised the treatment pathway for stroke patients**, ¹⁶⁵ including secondary prevention. The recently added element of outpatient rehabilitation aims to deliver **services in proximity to patients through new networks of GPs, neurologists and therapists**. Efforts are monitored using quality indicators, one of which is a three-month review after hospital discharge to check that appropriate secondary prevention interventions are being implemented.

By the end of 2017, outpatient rehabilitation had become a standard part of the pathway in the majority of counties in the Tyrol region. The quality indicators are measured and evaluated in a yearly report. Data do not yet appear to be available on outpatient rehabilitation services, although significant improvements have been observed during the acute stage.

In Greece, an e-prescription system with integrated therapeutic prescribing protocols was introduced to align medication prescriptions with national guidelines, streamline referrals and reduce costs, including for heart attack and stroke.

The system operates across all the national social insurance funds,

with information in the database made available to health insurance organisations, the Ministry of Health and supervising authorities. With almost all prescriptions and referrals now prescribed through the system, ¹⁶⁷ policymakers are provided with real-time and comprehensive prescribing data, aiding transparency and supporting decision-making. ¹⁶⁸

Physicians accessing the service are given a clear overview of each patient's medical history, which aids therapeutic decision-making and improves alignment with guidelines and pharmaceutical practice. 168 Patients can easily renew their prescriptions through the electronic system, which aids medication adherence.

In 2013, the e-prescription system was extended to become a decision support tool for physicians through the addition of **electronic therapeutic prescribing protocols, including for coronary heart disease**, dyslipidaemia (abnormal amount of lipids in the blood, e.g. high cholesterol) and hypertension (high blood pressure). The protocols have been shown to lead to significant cost savings – for example, by ensuring appropriate prescription, the dyslipidaemia protocol has led to a reduction in expenditure on statins. To



E-solution for prescriptions and treatment decisions



Increasing participation in structured secondary prevention programmes

Why does it matter?

Across Europe, cardiac rehabilitation has proven a highly effective secondary prevention model in improving patient outcomes in a range of conditions. As the name suggests, the intervention was originally designed for cardiac patients, including those post-heart attack and those living with heart failure, but it is now becoming recognised as an adequate model for secondary prevention of stroke. It has been shown to restore quality of life, improve functional capacity and wellbeing, and prevent hospital admissions, repeat events as well as death.¹⁷¹ In Germany, for example, participation in exercise-focused heart groups could reduce morbidity, including repeat heart attacks, by 54% and reduce associated costs by 47%.¹⁷²

Secondary prevention programmes should start as soon as possible upon discharge. Key components should include a full clinical assessment, functional rehabilitation, exercise, lifestyle advice, medication review and psychosocial support (see *Box 1*, p. 17).

What is the current situation?

For people who have had a heart attack, access to structured secondary prevention programmes post-discharge is poor, with most patients unable to benefit. In cardiac care, less than half of eligible patients are referred to a secondary prevention programme.⁵ A lack of facilities has resulted in a large estimated unmet

need for these services. Research suggests that for every seven coronary heart disease patients there is only one spot for cardiac rehabilitation, leading to almost 3.5 million patients across Europe missing out every year. 98

In stroke, comprehensive rehabilitation is often underused, due to a combination of low referral



rates and undersupply of services. The benefits of comprehensive rehabilitation, including modification of underlying risk factors, have only been recognised more recently and are currently being investigated.^{65 92} In any case, referral rates to any rehabilitation post-stroke remain low, below 40% in some European countries,

including Austria,¹⁷³ France,¹⁷⁴ Italy¹⁷⁵ and Romania.¹⁷⁶ For those who receive it, the benefits may be diluted by long waiting times and gaps in comprehensiveness of programmes.⁸



In stroke, comprehensive rehabilitation has long been neglected, despite the fact it is such an important part of care. We need more information on the current gaps in knowledge and patient access, as well as more effort to integrate existing evidence into clinical guidelines.

PROFESSOR DAFIN MURESANU, NEUROLOGIST, ROMANIA

In both heart attack and stroke, there are significant inequalities and variation in access to secondary prevention programmes across Europe and within countries. Availability of services varies in European countries, whereas age, ethnicity and level of deprivation affect uptake of programmes.⁷¹

What are the barriers to progress?

Across Europe, the low recognition of cardiac rehabilitation is evident in its lack of formalisation, integration and funding within the healthcare systems. Only four of the 11 countries studied have a national accreditation programme for cardiac rehabilitation, and only eight of the 30 member countries of the European Association of Preventive Cardiology (EAPC) have a national cardiac rehabilitation registry. Despite existing guidance, cardiac rehabilitation appears to vary in terms of uptake, intensity and duration. 137 176

In many countries, fragmentation between care settings appears to be a major factor behind low referral rates and poor uptake of secondary prevention. A lack of automatic referral systems and protocols, lack of multidisciplinary teams and low awareness among healthcare professionals are likely hindering access to cardiac rehabilitation.



Cardiac rehabilitation programmes are frequently not fit for purpose due to lack of standardisation in the model of care and many patients' inability to participate due to accessibility issues such as location, time of day, flexible delivery models etc. These issues need to be urgently addressed as part of an optimal care pathway.

NEIL JOHNSON, PATIENT ORGANISATION CEO, IRELAND

The effectiveness of secondary prevention programmes is stifled by low uptake and high drop-out rates. Across Europe, 69% of patients referred to cardiac rehabilitation attended at least half of the sessions.⁵ In many European countries, up to 50% of those who do attend ultimately drop out.¹⁷⁶ From a participant perspective, barriers to uptake and adherence may include psychosocial factors, lack of information, and access-related factors such as distance, misconceptions about the intervention and distrust of hospitals.⁵⁶

How do we get it right?

Structured secondary prevention programmes need to be formalised, accredited, adequately resourced and fully integrated into the patient pathway. Best practice implementation and full effectiveness will be improved through increased patient and healthcare professional awareness of the importance of secondary prevention.

There is an urgent need to develop and adopt minimal shared standards for secondary prevention across Europe. The planned EAPC accreditation programme provides an opportunity to advance and unify care standards between its members.¹³⁷



We need to rethink models for the delivery of cardiac rehabilitation. For too long prevention relied on standardised approaches, not allowing for flexibility and patient-centredness. We need to get away from a one-size-fits all approach. Greater use of online resources and virtual rather than face-to-face support in the post-COVID era opens up many potential opportunities.

PROFESSOR DONNA FITZSIMONS, QUEEN'S UNIVERSITY BELFAST, UK

Innovative and flexible delivery models that cater to the patients' needs and preferences should be promoted to facilitate participation in structured programmes. Home-based approaches, such as telerehabilitation, can increase the reach of such programmes by offering more convenience, engagement and flexibility in access. They can further improve patient outcomes and quality of life, and reduce costs.¹⁷⁸ Multidisciplinary care models involving specialist nurses are well evidenced and can support the cost-effective delivery of care.¹⁷⁹



Cardiovascular prevention requires modern programmes appropriately adapted to medical and cultural settings in each country, delivered by interdisciplinary teams of healthcare professionals and addressing all aspects of lifestyle and risk factor management.

PROFESSOR KORNELIA KOTSEVA, CARDIOLOGIST, UK

Best practice examples



PRADO – returning home after stroke hospitalisation

PRADO is a service initiated by the National Health Insurance Fund to **help hospitalised patients return home** by providing continued contact with a range of healthcare professionals, as well as domestic support. In 2017, the service was implemented for people leaving hospital after a stroke to reduce recurrent events and deaths.

PRADO aims to:

- carry out an aetiological assessment to find the cause of the stroke
- improve secondary prevention of risk factors
- $\bullet \ \ \text{optimise the use of post-stroke multi-professional/specialist consultation}.$

All PRADO stroke patients receive:

- two consultations with the attending physician in coordination with a specialist doctor one consultation within seven days of leaving the hospital and one within a month
- a multi-professional consultation within one to three months of leaving hospital
- assisted living arrangements, if necessary.



MyAction, a community-based, nurse-led cardiac rehabilitation programme MyAction is a 12-week programme applicable to patients with established CVD (or at high risk). Once a week, patients enrolled in the programme receive an educational workshop that covers lifestyle and risk factor management, a supervised exercise session and a meeting with a cardiologist. The cardiologist reviews the patient's risk factor management, including medication, and passes on any changes in their regime to their GP.

By the end of the programme, significant increases in the proportion of patients achieving their blood pressure and cholesterol targets were noted, as well as an increase in the use of statins and antihypertensive medications. Depression scores and quality-of-life measures also improved, as did fitness levels. Most of these improvements were maintained at a follow-up one year later.



Heart groups

The German Society for Prevention and Rehabilitation of Cardiovascular diseases has set up **around 8,800 heart groups across Germany**. The groups deliver **ongoing education and support to cardiac patients** to prevent repeat events.

Each group is medically supervised by a doctor who is responsible for adapting each patient's medication for risk factor control.¹²⁴ Groups have a maximum of 20 participants and meet at least once a week for physical activity, learning relaxation techniques, advice on maintaining a healthy diet, and support to stop smoking.¹⁸² Attendance is covered by insurance for the first two years after the acute event, after which reimbursement is decided on a case-by-case basis.¹²⁴



Pioneering eHealth and home-based risk factor management and cardiac rehabilitation for heart attack and stroke The Netherlands has been spearheading eHealth interventions to improve uptake and effectiveness and to reduce costs for secondary prevention.¹⁸³

A 2010 internet-based, nurse-led vascular risk factor management programme¹⁸⁴ consisted of a website where patients after a heart attack or stroke or those with peripheral arterial disease could access individualised information on their risk factors, medications and treatment goals, along with bespoke advice from nurses.¹⁸⁴ Every two weeks, patients submitted measurements for key clinical risk factors, such as cholesterol, weight and blood pressure. They received prescriptions if any medication changes were needed. The programme led to lower costs and had a small effect on vascular risk factors, in particular cholesterol levels.¹⁸⁴ ¹⁸⁵

In the 2017 **FIT@Home study**, the exercise-focused component of cardiac rehabilitation was converted into home-based training. After three initial in-person sessions, participants continued their training at home, supported through heart rate monitors and weekly feedback sessions. The programme resulted in higher patient satisfaction and was highly cost-effective, even bringing in a small societal cost saving due to the **patients being able to resume work sooner**.⁸⁵



Why does it matter?

For people who have had a heart attack or stroke, risk factor control will be a lifetime task requiring continuous support. The risk of subsequent events remains high for years after the first event, often increasing over time.^{3 42} It requires continuous self-management and medication adherence. Even where structured secondary prevention programmes exist post-heart attack or stroke, few continue indefinitely.

Primary care must be ready to play an effective role in helping heart attack and stroke patients sustain risk factor control in the longer term. In most countries, primary care professionals are responsible for long-term chronic disease management, including coordinating and monitoring long-term follow-up for heart attack and stroke.^{20 186} For example, across Europe 51% of stroke patients are followed up in primary care, highlighting its essential role in management.⁶ A comprehensive management should include regular medical assessments to help individuals maintain behaviour changes and ensure medication adherence.²⁰ In Poland, a nurse-led long-term programme led to a 36% lower risk of death in coronary heart disease patients over ten years.⁷²

What is the current situation?

Risk factor control in the primary care setting often worsens over time. In many countries, there appears to be a significant drop in use of guideline-recommended medications when patients' management is moved into primary care. ⁶ ¹⁸⁷ In France, for example, treatment with key medication to reduce risk factors post-heart attack drops from 74% at hospital discharge to 48% at 12 months. ¹⁸⁸ In Germany, only 24.1% of people who have had a heart attack receive the four major classes of preventive medications one year after the event. ¹⁰⁰ In stroke, long-term risk factor management in Europe is highly variable, with anticoagulants and blood pressure control achieved in 60% of patients in less than two thirds of all European countries. ⁶

What are the barriers to progress?

Inadequate collaboration between specialists and primary care, combined with a lack of resourcing, impedes secondary prevention in the long term. Poor coordination between hospitals and primary care, 8 22 25 lack of knowledge or clear guidance, complexity of treatment and, on top of that, time constraints present

barriers to providing optimal long-term care.^{19 21 189 190} As a result, primary care professionals may feel they are inadequately equipped to manage heart attack and stroke patients in the long term. For example, only half of GPs across Europe appear to use comprehensive risk assessments and established CVD prevention guidelines in clinical practice.⁵⁶

Gaps in funding for secondary prevention in primary care and limited reimbursement for risk factor management are also likely contributing factors. In Germany, for example, current reimbursement structures may present a disincentive for GPs to implement secondary prevention: unlike in some other countries, German GPs have a restricted budget per patient and face penalty payments if they exceed it.¹⁹¹ Gaps in resourcing may also present a barrier to people using risk-reducing medication after a heart attack or stroke. One country where this is particularly notable is Spain, where a recent healthcare reform resulted in higher co-payments for people in employment, as well as higher payments for pensioners and for people with chronic illnesses, who previously did not have to contribute.¹⁹²



Governments need to understand that an optimal recovery of someone who has had a heart attack or stroke does not finish after the hospital discharge. An optimal recovery also consists of gradually recovering their daily life – family, social, work life.

MARIA TERESA SAN SATURNINO PECIÑA, PATIENT ORGANISATION PRESIDENT, SPAIN

Lack of clear guidance and support models may hinder patients' ability to maintain behaviour change and continue taking risk-reducing medication in the long term.

Patients must manage risk factors alongside their normal daily tasks – potentially while struggling with the mental health impact of their condition, which in some cases may develop into anxiety or depression. Multiple factors may lead to poor adherence to medication, including psychosocial factors, lack of information, complexity of treatment and concern over potential side effects. Primary care professionals must anticipate these challenges and be prepared to address them over the longer term with each individual.

How do we get it right?

Primary care must be adequately equipped to support heart attack and stroke patients in managing their risk in the long term. Education on the importance of risk factor management coupled with adequate reimbursement and resourcing are key to ensuring primary care professionals can adequately monitor and support patients. Involving nurses and allied health professionals can relieve the pressure on GPs. There is evidence to support that – programmes run by nurses or care coordinators have been shown to improve risk factor control and long-term prognosis after a heart attack or stroke.^{72 76 178}

Implementation in primary care should promote multidisciplinary collaboration.

The provision of clear discharge protocols, treatment plans and shared electronic health records could help close the treatment gap and facilitate continuing best practice care. National guidelines for specialists and GPs should be aligned to avoid conflicting recommendations.

Innovative and flexible care models may support both primary care professionals and patients in managing cardiovascular risk factors in the long term. Care must be adapted to patients' needs and preferences. ^{56 75 186 193} Such adaptations may involve disease management programmes, e-learning and telemedicine technologies, or novel medication delivery models, such as the polypill. ^{87 194 195}

Best practice examples



STROKE-CARD

Initiated in 2014, STROKE-CARD¹⁹⁶ is Austria's **first post-stroke disease management programme**. STROKE-CARD aims to reduce the percentage of patients who experience recurrent strokes by addressing the gap between real-life risk factor management and the recommendations of international guidelines.

Participants in the STROKE-CARD programme receive a **three-month outpatient appointment** where their risk factors are reassessed by a multidisciplinary team. A medical report is sent to each patient's GP with detailed instructions on how to optimise secondary prevention efforts, including the refinement of rehabilitation and treatment goals. Additional six-month and nine-month appointments are arranged where needed. Participants are also given access to an interactive, **web-based patient portal called 'My Strokecard', which allows them to monitor their own risk factors**. The portal feeds back on whether targets have been achieved to both the participant and the GP.



COACH, a telephonebased coaching programme to promote cardiovascular health The COACH programme was first piloted in 2000 and has been running since. It has also been extended to other disease areas. People with coronary heart disease, including after a heart attack, receive an average of five sessions, delivered by a trained health coach. Participants receive targets for risk factor control and jointly develop an action plan of how to achieve those goals. Risk factors are tracked and evaluated regularly, and participants are also linked to their primary care practitioners to receive additional support.

The first evaluation showed that participants of the COACH programmes achieved lower cholesterol, blood pressure and body weight, and improved their diet and physical activity habits.¹⁹⁷

Follow-up after two years showed sustained improved adherence to risk-reducing medication,¹⁹⁸ and after four years there was a 16% reduction in hospital admissions and a 20% reduction in bed days for any cause. This was achieved with four coaching sessions over six months.¹⁹⁹



Heartwatch,
a national programme
for secondary
prevention of CVD
in primary care

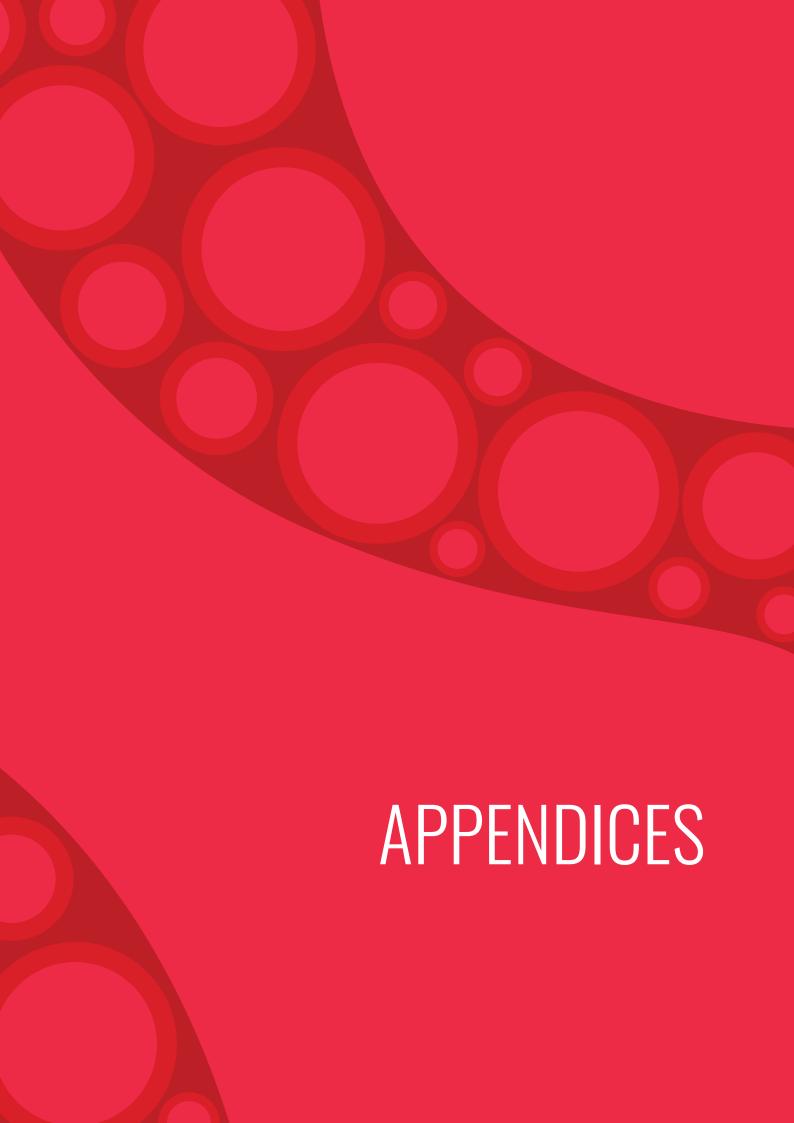
Heartwatch was set up in 2003 with the aim of improving long-term risk factor management for people after a cardiac event in primary care. The pillars of the programme are: implementing guideline-recommended care; thorough data collection and evaluation; patient self-management and use of community resources.

Patients visit their GP up to four times a year for an assessment of risk factors and brief interventions, such as lifestyle advice. Practices

physical activity officers and nutritionists.²⁰⁰
The programme places particular emphasis on data quality and comprehensiveness, as its **aim is to inform clinical practice and political decision-making**. Data collection was overseen by a national steering committee and an independent national data centre.²⁰⁰

can refer patients to community services, such as smoking cessation,

The first evaluation of the project showed substantial decreases in several risk factors, including blood pressure and cholesterol levels, and an increase in medication usage.²⁰¹ The programme also appears to be successful at sustaining risk factor management in the long term.



Risk factors and comorbidities in detail



High blood pressure

(hypertension)

Significantly increases the risk of having a heart attack or stroke.202 It is estimated that around 22% of heart attacks and more than 50% of strokes are related to hypertension.²⁰³ A diet that is high in sodium can increase the risk of

hypertension.²⁰⁴



High LDL-cholesterol

(dyslipidaemia/ hypercholesterolemia)

Abnormal levels of cholesterol in the blood, particularly high levels of low-density lipoprotein cholesterol (LDL-C), can cause blockages in blood vessels, leading to an increased risk of CVD.206

Among the major CVD risk factors of high blood pressure, unhealthy diet, lack of exercise and high cholesterol, dyslipidaemia is the biggest contributor to coronary heart disease and the second biggest contributor to stroke.29



Smoking

Smoking significantly contributes to CVD risk: the 10-year risk of dying from CVD is twice as high for smokers than non-smokers.²⁰ Globally, Europe has the highest prevalence of smoking, which is estimated to be responsible for 10% of CVD.209



Unhealthy diet

Low fruit and vegetable intake accounts for about 20% of CVD worldwide. A diet high in saturated fats causes about 31% of coronary heart disease and 11% of stroke worldwide.204

Lifestyle changes (weight reduction and physical activity) and blood-pressure lowering medications (diuretics, ACE-inhibitors, calcium antagonists, angiotensin receptor blockers and beta blockers) can effectively lower blood pressure.20

► For stroke patients, adhering to blood-pressure lowering medications reduces the risk of recurrence by 28%.205

A combination of lifestyle changes (dietary changes, physical activity and smoking cessation) and medication can lower cholesterol. Medication for lowering LDL-C includes statins, fibrates and niacin, along with PCSK9 inhibitors if cholesterol targets are not achieved with standard medication.20 PCSK9 inhibitors have been shown to lower LDL-C by up to 60%.20

- ► Benefits of lowering LDL-C have been shown independent of baseline risk factors (age, sex, previous CVD):207 each 1mmol/L reduction in LDL-C leads to a 21% risk reduction of any major cardiovascular event (17% stroke, 23% heart attack). This positive impact is amplified the bigger the reduction and the longer it is maintained.208
- ▶ Use of statins following a stroke is estimated to reduce the risk of recurrence by 16% during the first two to three years.205

Smoking cessation programmes, including brief advice and nicotine replacement therapy, can support people to stop smoking.20

- ▶ Evidence suggests that to stop smoking after a heart attack may be the single most cost-effective intervention to improve patient outcomes.20
- ► People who quit smoking after a heart attack have a 43% lower risk of a repeat event.56

Dietary advice, including on salt intake and fatty acids, coupled with support for weight reduction in overweight and obese people, can help people reduce their weight and other risk factors, such as blood pressure and raised LDL-C levels.20

► A Mediterranean diet is associated with a 10% reduction in incidence of cardiovascular disease or mortality.20



Physical inactivity

Physical inactivity increases the risk of both heart attack and stroke. It also contributes to other risk factors for CVD, including obesity, high blood pressure and dyslipidaemia. 210 It is estimated to be responsible for 6% of the global burden of coronary heart disease. 68



Blood clotting

Clots formed by blood cells and other tissues can develop in the blood vessels (thrombosis).



Comorbidities

(co-existing health conditions)



Obesity

A range of conditions can contribute to an increased risk of a heart attack or stroke, including diabetes, which also shares many of the lifestyle-related risk factors with CVDs.²¹⁵

Atrial fibrillation, a type of irregular heartbeat, is a major risk factor for stroke. It can contribute to blood clots forming in the heart, substantially increasing the risk of stroke. ²¹³ ²¹⁶

An increase in body weight comes with complications such as increased blood pressure, dyslipidaemia, diabetes and, finally, CVD (including heart failure, coronary artery disease, atrial fibrillation or stroke).²⁰

Advice on and prescription of physical activity is key in reducing sedentary behaviour and improving overall fitness and health.²⁰

- ➤ Studies suggest that doing more than 150 minutes of moderate physical activity every week reduces the risk of coronary heart disease by about 30%.²⁰³
- ▶ Regular physical activity has been shown to reduce all-cause and CVD mortality in healthy people by as much as 20–30% as well as lowering risk of recurrence in people with coronary conditions and in cardiac patients.²⁰ 211
- ▶ Preliminary research suggests that regular physical activity drastically reduces the risk of recurrent strokes. In a recent study, moderate to vigorous physical activity four times a week was associated with a 40% lower risk of recurrent stroke three years after the event.²¹⁰

Antiplatelet therapy is crucial to preventing blood clotting and thus reducing the risk of repeat CVD events.²¹² A range of medications can be used to prevent blood clotting, often in combination.

► For stroke patients with underlying atrial fibrillation, anticoagulation therapy is required to reduce blood clotting.^{213 214} Comorbidities need to be treated alongside postacute care for heart attack and stroke, carefully taking into account linkages and interactions. Optimal body mass index over the life course (especially after a cardiovascular event), diet, exercise and behaviour modification are crucial elements of prevention.²⁰

National experts

During the process of research and drafting of the country profiles over 2018–2020, HPP consulted national experts through interviews and in writing. Their commentary was incorporated into the respective country profiles. We thank them for their time and contributions. The final country reports and any conclusions therein are the responsibility of HPP.

AUSTRIA

- ▶ Professor Peter Siostrzonek, President, Austrian Society of Cardiology
- ▶ Professor Stefan Kiechl, President, Austrian Stroke Society
- ▶ Professor Andreas Zirlik, Head of Cardiology Department, LKH-University Hospital Graz

BELGIUM

- ► Professor Johan de Sutter, EAPC National CVD Prevention Coordinator for Belgium, Maria Middelares General Hospital, Ghent University
- ▶ Professor Peter Sinnaeve, Professor of Cardiology, Universitair Ziekenhuis Leuven
- ▶ Professor Philippe Van de Borne, Professor of Cardiology, Erasme Hospital, Brussels

FRANCE

▶ Philippe Thébault, President, Alliance de Coeur

GERMANY

- ► Professor Bernhard Schwaab, President, German Society for Prevention and Rehabilitation of Cardiovascular Diseases (DGPR) and Guth Klinikgruppe
- ▶ Professor Andreas M. Zeiher, President, German Society of Cardiology

GREECE

- ► Dr Dimitri Richter, President, ESC Council for Cardiology Practice Author 2019 ESC/EAS lipid guidelines, Euroclinic, Athens
- ► Professor Konstantinos Tsioufis, Chair-elect, EAPC Cardiac Rehabilitation Section, Centre of Rehabilitation Research, University of Potsdam
- ▶ Dr Kostas Vemmos, President, Hellenic Stroke Organisation University of Athens
- ▶ Dr Christina Chrysohoou, Cardiologist, Director, Greek National Health Service, University Hospital Athens, Greece; Board member, Hellenic Society of Cardiology

ITALY

- ▶ Dr Damiano Parretti, Head of Cardiovascular Diseases, Società Italiana di Medicina Generale (SIMG)
- ▶ Professor Carlo Gandolfo, Professor of Neurology, Genoa University; Member of the scientific committee of ALICe Italia Onlus
- ► Professor Pasquale Perrone Filardi, Associate Professor of Cardiology, Director, School of Cardiology, Federico II University Hospital, Naples
- ► Professor Aldo Pietro Maggioni, Associazione Nazionale Medici Cardiologi Ospedalieri Research Center, Florence
- ▶ Dr Simona Giampaoli, Former Director, Department of Cardiovascular and Endocrinemetabolic Diseases and Aging, Istituto Superiore di Sanità, Rome, Italy

THE NETHERLANDS

- ▶ Dr Arend Mosterd, Cardiologist, Meander Medical Centre, Amersfoort
- ▶ Dr Petra van de Pol, Cardiologist, Program Director NVVC Connect, Utrecht
- ► Professor Jaap W Deckers, Professor of Cardiology, Department of Epidemiology, Erasmus University Medical Center, Rotterdam

POLAND

- ▶ Dr Adam Kozierkiewicz, Consultant, JASPERS, European Investment Bank
- ▶ Professor Piotr Jankowski, Cardiologist; Jagiellonian University, Kraków

ROMANIA

- ► Dr Christina Tiu, President, Romanian Society of Neurology; Associate Professor, University of Medicine and Pharmacy 'Carol Davila', Bucharest
- ► Professor Dragoş Vinereanu, President-elect, Romanian Society of Cardiology; Professor of Cardiology, Emergency Hospital of Bucharest

SPAIN

- ▶ Dr Manuel Anguita, Former President, Spanish Society of Cardiology
- ▶ Ms Maria Teresa San Saturnino Peciña, President, Cardioalianza
- ▶ Dr Carlos Brotons, IR-Sant Pau Sant Pau Institute of Biomedical Research, Barcelona

UK

- ▶ Dr Patrick Doherty, Chair of Cardiovascular Health, Department of Health Sciences, Director, York University; Director, British Heart Foundation
- ► Professor Mike Hannay, Managing Director, East Midlands Academic Health Science Network (AHSN)
- ▶ Professor Donna Fitzsimons, Board member, ESC (Lead Patient Involvement), School of Nursing and Midwifery, Queen's University Belfast

REFERENCES

- 1. Wilkins E, Wilson L, Wickramasinghe K, *et al.* 2017. *European Cardiovascular Disease Statistics 2017*. Brussels: European Heart Network
- Briffa TG, Hobbs MS, Tonkin A, et al. 2011. Population Trends of Recurrent Coronary Heart Disease Event Rates Remain High. Circ Cardiovasc Qual Outcomes 4(1): 107-13
- 3. Béjot Y, Bailly H, Durier J, et al. 2016. Epidemiology of stroke in Europe and trends for the 21st century. Presse Med 45(12, Part 2): e391-98
- van Halewijn G, Deckers J, Tay HY, et al. 2017.
 Lessons from contemporary trials of cardiovascular prevention and rehabilitation: A systematic review and meta-analysis. Int J Cardiol 232: 294-303
- Kotseva K, De Backer G, De Bacquer D, et al. 2019. Lifestyle and impact on cardiovascular risk factor control in coronary patients across 27 countries: Results from the European Society of Cardiology ESC-EORP EUROASPIRE V registry. Eur J Prev Cardiol 26(8): 824-35
- Webb A, Heldner MR, Aguiar de Sousa D, et al. 2019. Availability of secondary prevention services after stroke in Europe: An ESO/SAFE survey of national scientific societies and stroke experts. Eur Stroke J 4(2): 110-18
- 7. Eurostat. Causes of death standardised death rate, EU-27, 2016. Available from: https://ec.europa.eu/eurostat/statistics-explained/index.php?title=File:Causes_of_death_%E2%80%94_standardised_death_rate,_EU-27,_2016_(per_100_000_inhabitants)_Health20.png [Accessed 09/11/20]
- 8. Stevens E, Emmett E, Wang Y, et al. 2017. The burden of stroke in Europe. London: Stroke Alliance for Europe
- Mellon L, Brewer L, Hall P, et al. 2015. Cognitive impairment six months after ischaemic stroke: a profile from the ASPIRE-S study. BMC Neurol 15: 31
- Ie Roux CW, Hartvig NV, Haase CL, et al. Obesity, cardiovascular risk and healthcare resource utilization in the UK. Eur J Prevent Cardiol: 2047487320925639
- 11. Robert Koch Institute. 2015. *Health in Germany*. Berlin: Robert Koch Institute

- 12. Smolina K, Wright FL, Rayner M, et al. 2012. Long-Term Survival and Recurrence After Acute Myocardial Infarction in England, 2004 to 2010. Circ Cardiovasc Qual Outcomes 5(4): 532-40
- U.S. Chamber of Commerce. 2020. Increasing Social and Economic Benefits Globally: Rates of Return on Health Investments. Washington DC: U.S. Chamber of Commerce
- Kotseva K, Gerlier L, Sidelnikov E, et al. 2019. Patient and caregiver productivity loss and indirect costs associated with cardiovascular events in Europe. Eur J Prev Cardiol 26(11): 1150-57
- Heuschmann PU, Kircher J, Nowe T, et al. 2015.
 Control of main risk factors after ischaemic stroke across Europe: data from the stroke-specific module of the EUROASPIRE III survey. Eur J Prev Cardiol 22(10): 1354-62
- 16. De Smedt D, De Backer T, Petrovic M, et al. 2020. Chronic medication intake in patients with stable coronary heart disease across Europe: Evidence from the daily clinical practice. Results from the ESC EORP European Survey of Cardiovascular Disease Prevention and Diabetes (EUROASPIRE IV) Registry. Int J Cardiol 300: 7-13
- 17. Komajda M, Cosentino F, Ferrari R, et al. 2020. Profile and treatment of chronic coronary syndromes in European Society of Cardiology member countries: The ESC EORP CICD-LT registry. Eur J Prev Cardiol: 10.1177/2047487320912491
- 18. Pepió Vilaubí JM, Orozco-Beltrán D, Gonçalves AQ, et al. 2018. Adherence to European Clinical Practice Guidelines for Secondary Prevention of Cardiovascular Disease: A Cohort Study. Int J Environ Res Public Health 15(6): 1233
- Jankowski P, Czarnecka D, Badacz L, et al. 2018.
 Practice setting and secondary prevention of coronary artery disease. Arch Med Sci 14(5): 979-87
- 20. Piepoli MF, Hoes AW, Agewall S, et al. 2016. 2016 European Guidelines on cardiovascular disease prevention in clinical practice. Eur Heart J 37(29): 2315-81
- 21. Brotons C, Lobos JM, Royo-Bordonada MA, et al. 2013. Implementation of Spanish adaptation of the European guidelines on cardiovascular disease prevention in primary care. BMC Fam Pract 14: 36

- Hernández-Afonso J, Facenda-Lorenzo M, Rodríguez-Esteban M, et al. 2017. New Model of Integration Between Primary Health Care and Specialized Cardiology Care. Rev Esp Cardiol 70(10): 873-75
- 23. Schang L, Koller D, Franke S, et al. 2019. Exploring the role of hospitals and office-based physicians in timely provision of statins following acute myocardial infarction: a secondary analysis of a nationwide cohort using cross-classified multilevel models. BMJ Open 9(10): e030272
- 24. British Heart Foundation. 2018. The National Audit of Cardiac Rehabilitation: Quality and Outcomes Report 2018. London: British Heart Foundation
- 25. Allen LN, Nicholson BD, Yeung BYT, et al. 2020. Implementation of non-communicable disease policies: a geopolitical analysis of 151 countries. Lancet Glob Health 8(1): e50-e58
- 26. Organisation for Economic Co-operation and Development, The King's Fund. 2020. Is Cardiovascular Disease Slowing Improvements in Life Expectancy? Paris: OECD Publishing
- Steiner T, Al-Shahi Salman R, Beer R, et al. 2014. European Stroke Organisation (ESO) guidelines for the management of spontaneous intracerebral hemorrhage. Int J Stroke 9(7): 840-55
- 28. World Health Organization. 2016. Action Plan for the Prevention and Control of Noncommunicable Diseases in the WHO European Region. Copenhagen: World Health Organization
- 29. World Health Organization. 2009. Cardiovascular disease atlas. Geneva: World Health Organization
- Koene RJ, Prizment AE, Blaes A, et al. 2016. Shared Risk Factors in Cardiovascular Disease and Cancer. Circulation 133(11): 1104-14
- 31. van Oijen M, Jan de Jong F, Witteman JCM, *et al.* 2007. Atherosclerosis and risk for dementia. *Ann Neurol* 61(5): 403-10
- 32. Kalaria RN, Akinyemi R, Ihara M. 2016. Stroke injury, cognitive impairment and vascular dementia. *Biochim Biophys Acta* 1862(5): 915-25
- 33. Fitzsimons D, Stępińska J, Kerins M, et al. 2019. Secondary prevention and cardiovascular care across Europe: A survey of European Society of Cardiology members' views. Eur J Cardiovasc Nurs 19(3): 201-11
- 34. McDaid D. 2018. Using economic evidence to help make the case for investing in health promotion and disease prevention. Copenhagen: World Health Organization

- European Heart Network. European Cardiovascular Disease Statistic. Available from: http://www.ehnheart. org/cvd-statistics.html [Accessed 14/12/20]
- 36. Sennfält S, Ullberg T. 2020. Informal caregivers in stroke: Life impact, support, and psychological wellbeing—A Swedish Stroke Register (Riksstroke) study. *Int J Stroke* 15(2): 197-205
- 37. Kotseva K, De Bacquer D, Jennings C, et al. 2016. Time Trends in Lifestyle, Risk Factor Control, and Use of Evidence-Based Medications in Patients With Coronary Heart Disease in Europe: Results From 3 EUROASPIRE Surveys, 1999–2013. *Glob Heart*: 10.1016/j.gheart.2015.11.003
- 38. Quiles J, Miralles-Vicedo B. 2014. Secondary Prevention Strategies for Acute Coronary Syndrome. Rev Esp Cardiol 67(10): 844-48
- European Society of Cardiology, European Heart Network. 2020. Fighting cardivascular disease - a blueprint for EU action. Brussels: European Heart Network
- World Health Organization. 2015. Ambulatory care sensitive conditions in Germany. Geneva: World Health Organization
- 41. World Health Organization. 2017.
 Fact sheets on sustainable development goals: health targets. Noncommunicable Diseases.
 Available from: http://www.euro.who.int/__data/assets/pdf_file/0007/350278/Fact-sheet-SDG-NCD-FINAL-25-10-17.pdf [Accessed 02/06/20]
- 42. Jernberg T, Hasvold P, Henriksson M, et al. 2015. Cardiovascular risk in post-myocardial infarction patients: nationwide real world data demonstrate the importance of a long-term perspective. Eur Heart J 36(19): 1163-70
- 43. Hankey GJ. 2014. Secondary stroke prevention. *Lancet Neurol* 13(2): 178-94
- 44. Lennon O, Blake C. 2009. Cardiac rehabilitation adapted to transient ischaemic attack and stroke (CRAFTS): a randomised controlled trial. *BMC Neurol* 9(1): 9
- Nicholson G, Gandra SR, Halbert RJ, et al. 2016.
 Patient-level costs of major cardiovascular conditions: a review of the international literature. Clinicoecon Outcomes Res 8: 495-506
- 46. Walker S, Asaria M, Manca A, et al. 2016. Long-term healthcare use and costs in patients with stable coronary artery disease: a population-based cohort using linked health records (CALIBER). Eur Heart J Qual Care Clin Outcomes 2(2): 125-40

- 47. Shetty S, Halpern R, McCollam PL. 2008. Cost of care for new versus recurrent acute coronary syndrome patients. *J Med Econ* 11(1): 81-99
- Hinde S, Harrison A, Bojke L, et al. 2020.
 Quantifying the impact of delayed delivery of cardiac rehabilitation on patients' health. Eur J Prev Cardiol 27(16): 1175-81
- 49. Medeiros GC, Roy D, Kontos N, et al. 2020. Poststroke depression: A 2020 updated review. *Gen Hosp Psychiatr* 66: 70-80
- 50. Atteih S, Mellon L, Hall P, et al. 2015. Implications of Stroke for Caregiver Outcomes: Findings from the ASPIRE-S Study. Int J Stroke 10(6): 918-23
- 51. Tully PJ, Harrison NJ, Cheung P, et al. 2016. Anxiety and Cardiovascular Disease Risk: a Review. Curr Cardiol Rep 18(12): 120
- 52. Schöttke H, Giabbiconi C-M. 2015. Post-stroke depression and post-stroke anxiety: prevalence and predictors. *Int Psychogeriatr* 27(11): 1805-12
- 53. Thombs BD, Bass EB, Ford DE, et al. 2006. Prevalence of Depression in Survivors of Acute Myocardial Infarction. J Gen Intern Med 21(1): 30-38
- 54. Fitzsimons D. 2020. Personal communication by email: 02/11/20
- 55. Paoli G, Notarangelo MF, Mattioli M, et al. 2018. ALLiance for sEcondary PREvention after an acute coronary syndrome. The ALLEPRE trial: A multicenter fully nurse-coordinated intensive intervention program. Am Heart J 203: 12-16
- 56. Piepoli MF, Corra U, Dendale P, et al. 2016. Challenges in secondary prevention after acute myocardial infarction: A call for action. *Eur J Prev Cardiol* 23(18): 1994-2006
- 57. Anderson L, Oldridge N, Thompson DR, et al. 2016. Exercise-Based Cardiac Rehabilitation for Coronary Heart Disease: Cochrane Systematic Review and Meta-Analysis. J Am Coll Cardiol 67(1): 1-12
- 58. Shields GE, Wells A, Doherty P, et al. 2018. Costeffectiveness of cardiac rehabilitation: a systematic review. *Heart* 104(17): 1403-10
- 59. Ambrosetti M, Abreu A, Corrà U, et al. 2020. Secondary prevention through comprehensive cardiovascular rehabilitation: From knowledge to implementation. 2020 update. A position paper from the Secondary Prevention and Rehabilitation Section of the European Association of Preventive Cardiology. Eur J Prev Cardiol: 10.1177/2047487320913379
- 60. Nurse J, Dorey S, Sigfrid L, et al. 2014. The case for investing in public health. Copenhagen: World Health Organization

- 61. Gmeinder M, Morgan D, Mueller M. 2017. How much do OECD countries spend on prevention? OECD Health Working Papers, No. 101. Paris: OECD Publishing
- 62. Sjölin I, Bäck M, Nilsson L, et al. 2020. Association between attending exercise-based cardiac rehabilitation and cardiovascular risk factors at one-year post myocardial infarction. PLoS One 15(5): e0232772-e72
- 63. Wallert J, Olsson EM, Pingel R, et al. 2020. Attending Heart School and long-term outcome after myocardial infarction: A decennial SWEDEHEART registry study. Eur J Prev Cardiol 27(2): 145-54
- 64. Kirk H, Kersten P, Crawford P, et al. 2014. The cardiac model of rehabilitation for reducing cardiovascular risk factors post transient ischaemic attack and stroke: a randomized controlled trial. Clin Rehabil 28(4): 339-49
- 65. Heron N, Kee F, Mant J, et al. 2017. Stroke Prevention Rehabilitation Intervention Trial of Exercise (SPRITE) - a randomised feasibility study. BMC Cardiovasc Disord 17(1): 290
- 66. Martin B-J, Hauer T, Arena R, et al. 2012. Cardiac Rehabilitation Attendance and Outcomes in Coronary Artery Disease Patients. Circulation 126(6): 677-87
- 67. Richards SH, Anderson L, Jenkinson CE, et al. 2018. Psychological interventions for coronary heart disease: Cochrane systematic review and metaanalysis. Eur J Prev Cardiol 25(3): 247-59
- 68. Mampuya WM. 2012. Cardiac rehabilitation past, present and future: an overview.

 Cardiovasc Diagn Ther 2(1): 38-49
- 69. Salzwedel A, Jensen K, Rauch B, et al. 2020. Effectiveness of comprehensive cardiac rehabilitation in coronary artery disease patients treated according to contemporary evidence based medicine: Update of the Cardiac Rehabilitation Outcome Study (CROS-II). Eur J Prev Cardiol: 10.1177/2047487320905719
- 70. Scherrenberg M, Wilhelm M, Hansen D, et al. 2020. The future is now: a call for action for cardiac telerehabilitation in the COVID-19 pandemic from the secondary prevention and rehabilitation section of the European Association of Preventive Cardiology. Eur J Prev Cardiol: 10.1177/2047487320939671
- 71. Harrison AS, Gaskins NJ, Connell LA, et al. 2020. Factors influencing the uptake of cardiac rehabilitation by cardiac patients with a comorbidity of stroke. *IJC Heart Vasc*: 10.1016/j.ijcha.2020.100471

- 72. Pająk A, Wolfshaut-Wolak R, Doryńska A, et al. 2020. Longitudinal effects of a nurse-managed comprehensive cardiovascular disease prevention program for hospitalized coronary heart disease patients and primary care high-risk patients. Kardiol Pol 78(5): 429-37
- Frederix I, Solmi F, Piepoli MF, et al. 2017. Cardiac telerehabilitation: A novel cost-efficient care delivery strategy that can induce long-term health benefits. Eur J Prev Cardiol 24(16): 1708-17
- 74. Frederix I, Hansen D, Coninx K, et al. 2015. Telerehab III: a multi-center randomized, controlled trial investigating the long-term effectiveness of a comprehensive cardiac telerehabilitation program. Rationale and study design. BMC Cardiovasc Disord: 10.1186/s12872-015-0021-5
- 75. van der Laan DM, Elders PJM, Boons CCLM, et al. 2018. The impact of cardiovascular medication use on patients' daily lives: a cross-sectional study. Int J Clin Pharm 40(2): 412-20
- 76. Ögren J, Irewall AL, Söderström L, et al. 2018. Long-term, telephone-based follow-up after stroke and TIA improves risk factors: 36-month results from the randomized controlled NAILED stroke risk factor trial. BMC Neurol 18(1): 153
- Mach F, Baigent C, Catapano AL, et al. 2019. 2019 ESC/EAS Guidelines for the management of dyslipidaemias: lipid modification to reduce cardiovascular risk. Eur Heart J: 10.1093/eurheartj/ ehz455
- 78. Khan R, Socha-Dietrich K. 2018. Investing in medication adherence improves health outcomes and health system efficiency: Adherence to medicines for diabetes, hypertension, and hyperlipidaemia. Paris: OECD Publishing
- 79. Ibanez B, James S, Agewall S, et al. 2017. 2017 ESC Guidelines for the management of acute myocardial infarction in patients presenting with ST-segment elevation. Eur Heart J: 10.1093/eurheartj/ehx393:
- 80. Piepoli MF, Corrà U, Adamopoulos S, et al. 2014. Secondary prevention in the clinical management of patients with cardiovascular diseases. Core components, standards and outcome measures for referral and delivery. Eur J Prev Cardiol 21(6): 664-81
- Lawler PR, Filion KB, Eisenberg MJ. 2011. Efficacy
 of exercise-based cardiac rehabilitation post—
 myocardial infarction: A systematic review and metaanalysis of randomized controlled trials. Am Heart J
 162(4): 571-84.e2
- 82. Benzer W, Rauch B, Schmid J-P, et al. 2017. Exercise-based cardiac rehabilitation in twelve European countries: results of the European cardiac rehabilitation registry. *Int J Cardiol* 228: 58-67

- 83. Milewski K, Malecki A, Orszulik-Baron D, et al. 2019. The use of modern telemedicine technologies in an innovative optimal cardiac rehabilitation program for patients after myocardial revascularization: Concept and design of RESTORE, a randomized clinical trial. Cardiol J 26(5): 594-603
- 84. Kotseva K, Wood D, De Bacquer D. 2018. Determinants of participation and risk factor control according to attendance in cardiac rehabilitation programmes in coronary patients in Europe: EUROASPIRE IV survey. Eur J Prev Cardiol 25(12): 1242-51
- 85. Kraal JJ, Van den Akker-Van Marle ME, Abu-Hanna A, et al. 2017. Clinical and cost-effectiveness of home-based cardiac rehabilitation compared to conventional, centre-based cardiac rehabilitation: Results of the FIT@Home study. Eur J Prev Cardiol 24(12): 1260-73
- 86. Wood DA, Kotseva K, Connolly S, et al. 2008. Nurse-coordinated multidisciplinary, family-based cardiovascular disease prevention programme (EUROACTION) for patients with coronary heart disease and asymptomatic individuals at high risk of cardiovascular disease: a paired, cluster-randomised controlled trial. Lancet 371(9629): 1999-2012
- Roshandel G, Khoshnia M, Poustchi H, et al. 2019. Effectiveness of polypill for primary and secondary prevention of cardiovascular diseases (Polylran): a pragmatic, cluster-randomised trial. Lancet 394(10199): 672-83
- 88. Baumgartner A, Drame K, Geutjens S, et al. 2020. Does the Polypill Improve Patient Adherence Compared to Its Individual Formulations? A Systematic Review. Pharmaceutics 12(2): 190
- Canavan M, Ni Mhaille G, Mulkerrin EC. 2011.
 Development of acute stroke units—a cost effective reconfiguration which benefits patients. QJM 105(1): 99-102
- European Stroke Organisation Executive Committee.
 2008. Guidelines for management of ischaemic stroke and transient ischaemic attack 2008.
 Cerebrovasc Dis 25(5): 457-507
- 91. Rothwell PM, Giles MF, Chandratheva A, et al. 2007. Effect of urgent treatment of transient ischaemic attack and minor stroke on early recurrent stroke (EXPRESS study): a prospective population-based sequential comparison. *Lancet* 370(9596): 1432-42
- Ahmadi M, Laumeier I, Ihl T, et al. 2020. A support programme for secondary prevention in patients with transient ischaemic attack and minor stroke (INSPiRE-TMS): an open-label, randomised controlled trial. Lancet Neurol 19(1): 49-60

- Laver KE, Adey-Wakeling Z, Crotty M, et al. 2020.
 Telerehabilitation services for stroke. Cochrane Database Syst Rev 1(1): Cd010255
- 94. Ray KK, Molemans B, Schoonen WM, et al. 2020. EU-Wide Cross-Sectional Observational Study of Lipid-Modifying Therapy Use in Secondary and Primary Care: the DA VINCI study. Eur J Prev Cardiol: 10.1093/ eurjpc/zwaa047
- 95. AQUA Institut für angewandte Qualitätsförderung und Forschung im Gesundheitswesen GmbH. 2014. Versorgungsqualität bei Schlaganfall Konzeptskizze für ein Qualitätssicherungsverfahren. Goettingen: AQUA
- 96. Haute Autorité de Santé. 2012. Clinical Practice Indicators Myocardial Infarction (MI) "From 1st symptoms to follow-up at 1 year". Saint-Denis: Haute Autorité de Santé
- 97. Haute Autorité de Santé. 2010. Stroke programme for 2009-2014 A progress report in 2010. Saint-Denis: Haute Autorité de Santé
- 98. Abreu A, Pesah E, Supervia M, et al. 2019. Cardiac rehabilitation availability and delivery in Europe: How does it differ by region and compare with other high-income countries? Eur J Prev Cardiol 26(11): 1131-46
- 99. Lang IM, Badr-Eslam R, Greenlaw N, et al. 2017. Management and clinical outcome of stable coronary artery disease in Austria: Results from 5 years of the CLARIFY registry. Wien Klin Wochenschr 129(23-24): 879-92
- 100. Ulrich R, Pischon T, Robra B-P, et al. 2020. Health care utilisation and medication one year after myocardial infarction in Germany – a claims data analysis. Int J Cardiol 300: 20-26
- 101. Fernández D, Brotons C, Moral I, et al. 2019. Lifestyle behaviours in patients with established cardiovascular diseases: a European observational study. BMC Fam Pract 20(1): 162-62
- 102. Jankowski P, Czarnecka D, Lysek R, et al. 2014. Secondary prevention in patients after hospitalisation due to coronary artery disease: what has changed since 2006? Kardiol Pol 72(4): 355-62
- 103. Di Martino M, Lallo A, Davoli M, et al. 2019. [Adherence to chronic polytherapy in secondary prevention of myocardial infarction: limits and perspectives.]. Recenti Prog Med 110(1): 7-9
- 104. Sheppard JP, Fletcher K, McManus RJ, et al. 2014. Missed opportunities in prevention of cardiovascular disease in primary care: a cross-sectional study. Br J Gen Pract 64(618): e38-46
- 105. McCarthy M, Harvey G, Conceição C, et al. 2009. Comparing public-health research priorities in Europe. Health Res Policy Syst 7(1): 17

- 106. European Commission. 2009. Cardiovascular disease prevention: national policies differ widely across EU, study shows. Available from: https:// cordis.europa.eu/article/id/31236-cardiovasculardisease-prevention-national-policies-differ-widelyacross-eu-study-shows [Accessed 11/11/20]
- 107. Stephani V, Sommariva S, Spranger A, et al. 2017. Non-communicable diseases: mapping research funding organisations, funding mechanisms and research practices in Italy and Germany. Health Res Policy Syst 15(1): 85
- 108. Haute Autorité de Santé. 2009. PROGRAMME INFARCTUS 2007 – 2010. Ensemble, améliorons la prise en charge de l'infarctus du myocarde. Saint-Denis: Haute Autorité de Santé
- 109. Ministere de la Sante et des Sports. 2010. *Plan d'actions national « accidents vasculaires cérébraux 2010-2014 »*. Paris: Ministère de la Santé et des Sports
- Nederlands Huisartsen Genootschap NIV, Nederlandse Vereniging voor Cardiologie. 2019. [Richtlijn Cardiovasculair risicomanagement (CVRM)]. Utrecht
- 111. Rijken M, Bekkema N, Boeckxstaens P, et al. 2014. Chronic Disease Management Programmes: an adequate response to patients' needs? *Health Expect* 17(5): 608-21
- 112. Ministry of Health and Social Policy. 2009. Summary Ischaemic Heart Disease Strategy Spanish National Health System. Madrid: Healthcare 2009
- 113. National Health Service England. Cardiovascular disease (CVD). Available from: https://www.england. nhs.uk/ourwork/clinical-policy/cvd/ [Accessed 13/11/20]
- 114. Scottish Government. 2014. *Heart Disease Improvement Plan*. Edinburgh: Scottish Government
- 115. Ministry of Health. 2016. [National Cardiovascular Disease Prevention and Treatment Programme 2017-2020, POLKARD]. Warsaw: Ministry of Health
- 116. Ministry of Health. 2014. *National Health Strategy* 2014–2020. *Health for wealth*. Bucharest: Ministry of Health
- 117. Ministerio de Sanidad Consumo y Bienestar Social. 2020. El Ministerio de Sanidad traslada a las CCAA el borrador de la Estrategia en Salud Cardiovascular del SNS. Available from: https://www.mscbs.gob. es/gabinete/notasPrensa.do?id=4993 [Accessed 01/09/20]
- 118. National Health Service. 2019. *The NHS Long Term Plan*. London: National Health Service

- 119. European Commission. 2020. Steering Group on Health Promotion, Disease Prevention and Management of Non-Communicable Diseases. Available from: https://ec.europa.eu/health/ non_communicable_diseases/steeringgroup_ promotionprevention_en [Accessed 03/06/20]
- 120. European Commission. 2014. The Third Health Programme 2014-2020 Funding Health Initiatives. Available from: https://ec.europa.eu/health/sites/health/files/programme/docs/factsheet_healthprogramme2014_2020_en.pdf
- 121. European Chronic Disease Alliance, European Public Health Alliance, NCD Alliance. 2019. *Towards* an EU Strategic Framework for the Prevention of Non-communicable Diseases (NCDs). Joint Paper. Brussels: European Chronic Disease Alliance
- 122. European Society of Cardiology (ESC). Europe to personalise prevention of second heart attacks. Available from: https://www.escardio.org/The-ESC/ Press-Office/Press-releases/Europe-to-personaliseprevention-of-second-heart-attacks [Accessed 04/06/20]
- 123. Endres M. 2020. Interview with Kirsten Budig at The Health Policy Partnership [telephone]. 04/08/20
- 124. Schwaab B. 2020. Interview with Kirsten Budig and Ed Harding at The Health Policy Partnership [telephone]. 19/08/20
- 125. de Sutter J. 2020. Interview with Jonathan Scrutton and Kirsten Budig at The Health Policy Partnership [telephone]. 05/08/20
- 126. Doehner W, Mazighi M, Hofmann BM, et al. 2019. Cardiovascular care of patients with stroke and high risk of stroke: The need for interdisciplinary action: A consensus report from the European Society of Cardiology Cardiovascular Round Table. Eur J Prev Cardiol 27(7): 682-92
- 127. European Stroke Organisation. European Stroke Action Plan Implementation: First Steering Committee meeting held in Munich. [Updated 30/08/2019]. Available from: https://eso-stroke.org/eso/european-stroke-action-plan-implementation-first-steering-committee-meeting-held-in-munich/[Accessed 03/12/2019]
- 128. European Commission. 2020. EU4Health 2021-2027 — a vision for a healthier European Union. Available from: https://ec.europa.eu/health/funding/ eu4health_en [Accessed 02/09/20]
- 129. European Commission. 2020. EU policy on cancer. Available from: https://ec.europa.eu/health/non_ communicable_diseases/cancer_en [Accessed 03/06/20]

- National Health Service England. Stroke. Available from: https://www.england.nhs.uk/ourwork/clinicalpolicy/stroke/ [Accessed 13/11/19]
- 131. Wita K, Wilkosz K, Wita M, et al. 2019. Managed Care after Acute Myocardial Infarction (MC-AMI) a Poland's nationwide program of comprehensive post-MI care improves prognosis in 12-month follow-up. Preliminary experience from a single high-volume center. Int J Cardiol 296: 8-14
- 132. Telec W, Kalmucki P, Krysztofiak H, et al. 2019. Failure of completion of post-myocardial infarction rehabilitation programme - Who and why? Single center experience with novel Coordinated Comprehensive Care program in Poland. Eur Heart J: 10.1093/eurheartj/ehz748.0847
- 133. Feusette P, Gierlotka M, Krajewska-Redelbach I, et al. 2019. Comprehensive coordinated care after myocardial infarction (KOSZawal): a patient's perspective. Kardiol Pol 77(5): 568-70
- 134. Comité Español Interdisciplinario para la Prevención Vascular (CEIPV). Presentacion. Available from: http://www.ceipc.info/ [Accessed 12/11/20]
- 135. Armario P, Brotons C, Elosua R, et al. 2020. Comentario del CEIPV a la actualización de las Guías Europeas de Prevención Vascular en la Práctica Clínica. Hipertens Riesgo Vasc: 10.1016/j. hipert.2020.07.004
- 136. Royo-Bordonada MA, Lobos Bejarano JM, Villar Alvarez F, et al. 2016. Statement of the Spanish Interdisciplinary Cardiovascular Prevention Committee on the 2012 European Cardiovascular Prevention Guidelines. Neurologia 31(3): 195-207
- 137. Abreu A, Frederix I, Dendale P, et al. 2020. Standardization and quality improvement of secondary prevention through cardiovascular rehabilitation programmes in Europe: The avenue towards EAPC accreditation programme: A position statement of the Secondary Prevention and Rehabilitation Section of the European Association of Preventive Cardiology (EAPC). Eur J Prev Cardiol: 10.1177/2047487320924912
- 138. European Commission. 2020. Joint Action addressing differences in national General Data Protection Regulation (GDPR) implementation in the health sector, including the European Health Data Space and the health data use. Available from: https://ec.europa.eu/chafea/health/funding/joint-actions/documents/ja-european-health-dataspace-2020_en.pdf [Accessed 12/11/20]

- 139. Wallentin L, Gale CP, Maggioni A, et al. 2019. EuroHeart: European Unified Registries On Heart Care Evaluation and Randomized Trials: An ESC project to develop a new IT registry system which will encompass multiple features of cardiovascular medicine. Eur Heart J 40(33): 2745-49
- 140. De Smedt D, Annemans L, De Backer G, et al. 2018. Cost-effectiveness of optimized adherence to prevention guidelines in European patients with coronary heart disease: Results from the EUROASPIRE IV survey. Int J Cardiol 272: 20-25
- 141. Niebauer J, Reich B. 2016. Country report Austria – October 2016: EACPR "Country of the Month" initiative. Biot: European Society of Cardiology
- 142. Belle L, Cayla G, Cottin Y, et al. 2017. French Registry on Acute ST-elevation and non – ST-elevation Myocardial Infarction 2015 (FAST-MI 2015). Design and baseline data. Arch Cardiovasc Dis 110(6-7): 366-78
- 143. Gierlotka M, Zdrojewski T, Wojtyniak B, et al. 2015. Incidence, treatment, in-hospital mortality and oneyear outcomes of acute myocardial infarction in Poland in 2009-2012--nationwide AMI-PL database. Kardiol Pol 73(3): 142-58
- 144. Ferrari J, Tomek A, Polák M, et al. 2018. Experience from Today for the Stroke Care of the Future. *Oruen* 4(1): 1
- 145. Niewada M, Skowrońska M, Ryglewicz D, et al. 2006. Acute Ischemic Stroke Care and Outcome in Centers Participating in the Polish National Stroke Prevention and Treatment Registry. Stroke 37(7): 1837-43
- 146. Royal College of Physicians. Sentinel Stroke National Audit Programme. Available from: https:// www.rcplondon.ac.uk/projects/outputs/sentinelstroke-national-audit-programme-ssnap [Accessed 20/11/20]
- 147. Zander B, Busse R. 2017. Is there enough research output of EU projects available to assess and improve health system performance? An attempt to understand and categorise the output of EU projects conducted between 2002 and 2012. Health Res Policy Syst 15(1): 13
- 148. Fitzsimons D. 2020. Interview with Jonathan Scrutton and Kirsten Budig at The Health Policy Partnership [telephone]. 06/08/20
- 149. National Institute for Cardiovascular Outcomes Research. Myocardial Ischaemia/MINAP (Heart Attack audit). Available from: https://www.nicor.org. uk/national-cardiac-audit-programme/myocardialischaemia-minap-heart-attack-audit/ [Accessed 20/11/20]

- 150. Bravata DM, Myers LJ, Reeves M, et al. 2019. Processes of Care Associated With Risk of Mortality and Recurrent Stroke Among Patients With Transient Ischemic Attack and Nonsevere Ischemic Stroke. JAMA Netw Open 2(7): e196716
- 151. Pross C, Berger E, Siegel M, et al. 2018. Stroke units, certification, and outcomes in German hospitals: a longitudinal study of patient-based 30-day mortality for 2006–2014. BMC Health Serv Res 18(1): 880
- 152. Langhorne P, Baylan S. 2017. Early supported discharge services for people with acute stroke. Cochrane Database Syst Rev 7(7): Cd000443
- 153. Langhorne P, Ramachandra S. 2020. Organised inpatient (stroke unit) care for stroke: network meta-analysis. Cochrane Database Syst Rev 4(4): Cd000197
- 154. Rocha MSG, Almeida ACF, Abath Neto O, et al. 2013. Impact of stroke unit in a public hospital on length of hospitalization and rate of early mortality of ischemic stroke patients. Arq Neuropsiquiatr 71: 774-79
- 155. Organisation for Economic Co-operation and Development. 2019. Spain: Country Health Profile 2019. Paris: OECD
- 156. Ministry of Health Social Services and Equality. 2012. Stroke Strategy of the Spanish National Health System. Madrid: Healthcare 2012
- 157. Aguiar de Sousa D, von Martial R, Abilleira S, et al. 2019. Access to and delivery of acute ischaemic stroke treatments: A survey of national scientific societies and stroke experts in 44 European countries. Eur Stroke J 4(1): 13-28
- 158. Stevens E, Emmett E, Wang Y, et al. 2017. The Burden of Stroke in Austria. London: Stroke Alliance for Europe
- 159. Gattringer T, Posekany A, Niederkorn K, *et al.* 2019. Predicting Early Mortality of Acute Ischemic Stroke. *Stroke* 50(2): 349-56
- 160. Bundesgesundheitsministerium. 2017. Entlassungsmanagement. Available from: https://www.bundesgesundheitsministerium.de/service/begriffe-von-a-z/e/entlassmanagement.html
 [Accessed 13/08/20]
- 161. National Institute for Health and Care Excellence. 2019. Myocardial infarction: rehabilitation and preventing further cardiovascular disease overview. Available from: https://pathways.nice.org.uk/ pathways/myocardial-infarction-rehabilitation-andpreventing-further-cardiovascular-disease [Accessed 11/09/20]
- 162. Perrone-Filardi P. 2020. Interview with Kirsten Budig at The Health Policy Partnership [telephone]. 24/08/20

- 163. Jankowski P. 2020. Interview with Kirsten Budig at The Health Policy Partnership [telephone]. 04/09/20
- 164. Norrving B, Barrick J, Davalos A, et al. 2018. Action Plan for Stroke in Europe 2018–2030. Eur Stroke J 3(4): 309-36
- 165. Willeit J, Geley T, Schöch J, et al. 2015. Thrombolysis and clinical outcome in patients with stroke after implementation of the Tyrol Stroke Pathway: a retrospective observational study. Lancet Neurol 14(1): 48-56
- 166. Reiter K, Runge J, Welte S, et al. 2019. eHealth Service for Integrated Care and Outpatient Rehabilitation - Pilot Application of the Tyrol Stroke Pathway. Stud Health Technol Inform 260: 218-25
- 167. Kyritsi V. Innovation as an antidote to the crisis: meet Greece's ehealth ecosystem. Available from: http://www.ifg.cc/en/aktuelles/nachrichten/regionen/228-gr-griechenland-greece/54416-innovation-as-an-antidote-to-the-crisis-meet-greece-s-ehealth-ecosystem [Accessed 01/10/20]
- 168. Panorama. 2016. Greek health system goes digital [online]. Available from: https://ec.europa.eu/ regional_policy/sources/docgener/panorama/pdf/ mag58/mag58_en.pdf [Accessed 01/10/20]
- 169. Ministry of Health. Therapeutic Prescribing Protocols. Available from: https://www.moh.gov. gr/articles/health/domes-kai-draseis-gia-thnygeia/kwdikopoihseis/therapeytika-prwtokollasyntagografhshs/ [Accessed 01/10/20]
- 170. Karanikas H, Papadakis M, Thireos E. 2015. Development Of Prescription E-Protocols For Medicines And Integration On The Greek National E-Prescription System. Value Health 18(7): A385
- 171. Dalal HM, Doherty P, Taylor RS. 2015. Cardiac rehabilitation. *BMJ* 351: h5000
- 172. Bjarnason-Wehrens B, Held K, Karoff M. 2006. Herzgruppen in Deutschland—Status quo und Perspektiven. *Herz* 31: 559-65
- 173. Javor A, Ferrari J, Posekany A, *et al.* 2019. Stroke risk factors and treatment variables in rural and urban Austria: An analysis of the Austrian Stroke Unit Registry. *PLoS One* 14(4): e0214980-e80
- 174. Gabet A, Béjot Y, de Peretti C, et al. 2017. Évolution de l'admission en soins de suite et de readaptation des patients hospitalises pour accident vasculaire cerebral en France, 2010-2014. Bull Epidemiol Hebd 11: 196-207
- 175. Guidetti D, Spallazzi M, Baldereschi M, et al. 2014. Post-stroke rehabilitation in Italy: Inconsistencies across regional strategies. Eur J Phys Rehabil Med 50: 335-41

- 176. Tiu C, Tuta S, Stan A, et al. 2018. 'Mortality and disability in stroke patients in Romania: Quality assessment of stroke care inside RES-Q registry and ESO East Project' in European Stroke Organisation Conference: Abstracts. Eur Stroke J 3: 3-586
- 177. European Association of Preventive Cardiology.
 Overview of Cardiac Rehabilitation in ESC member countries (OCRE). Available from: https://www.escardio.org/static_file/Escardio/Subspecialty/EAPC/Country%20of%20the%20month/Documents/OCRE%203.0_presentation_kit2019_Final.pdf
 [Accessed 12/11/20]
- 178. Wienbergen H, Fach A, Meyer S, et al. 2019. Effects of an intensive long-term prevention programme after myocardial infarction - a randomized trial. Eur J Prev Cardiol 26(5): 522-30
- 179. Ruiz-Bustillo S, Ivern C, Badosa N, et al. 2019. Efficacy of a nurse-led lipid-lowering secondary prevention intervention in patients hospitalized for ischemic heart disease: A pilot randomized controlled trial. Eur J Cardiovasc Nurs 18(5): 366-74
- 180. l'Assurance Maladie. 2017. Prado, le service de retour à domicile. Available from: https://www.ameli. fr/hauts-de-seine/medecin/exercice-liberal/servicespatients/prado [Accessed 01/03/18]
- 181. Connolly SB, Kotseva K, Jennings C, et al. 2017. Outcomes of an integrated community-based nurse-led cardiovascular disease prevention programme. Heart 103(11): 840-47
- 182. Bruggemann I, Guha M. 2018. Herzgruppen in Deutschland: Hintergrunde, Rahmenbedingungen und aktuelle Situation. Available from: https://www. dgpr.de/fileadmin/files/DGPR/DSH_2018_06_ DGPR_Herzgruppen.pdf [Accessed 01/09/20]
- 183. Jørstad HT, Snaterse M, Ter Hoeve N, et al. 2020. The scientific basis for secondary prevention of coronary artery disease: recent contributions from the Netherlands. Neth Heart J 28(Suppl 1): 136-40
- 184. Vernooij JWP, Kaasjager HAH, van der Graaf Y, et al. 2012. Internet based vascular risk factor management for patients with clinically manifest vascular disease: randomised controlled trial. BMJ 344: e3750
- 185. Public Health England, British Heart Foundation. 2018. International Cardiovascular Disease Prevention case studies. London: Public Health England
- 186. Marchal S, Van't Hof AWJ, Hollander M. 2018. The new European guideline on cardiovascular disease prevention; how to make progress in general practice? *Eur J Gen Pract* 24(1): 57-59

- 187. Kotseva K, Investigators E. 2017. The EUROASPIRE surveys: lessons learned in cardiovascular disease prevention. Cardiovascular diagnosis and therapy 7(6): 633-39
- 188. Dibao-Dina C, Angoulvant D, Lebeau J-P, et al. 2018. Patients' adherence to optimal therapeutic, lifestyle and risk factors recommendations after myocardial infarction: Six years follow-up in primary care. PLoS One 13(9): e0202986
- 189. van Peet PG, Drewes YM, Gussekloo J, et al. 2015. GPs' perspectives on secondary cardiovascular prevention in older age: a focus group study in the Netherlands. *Br J Gen Pract* 65(640): e739-47
- 190. Pedersen RA, Petursson H, Hetlevik I. 2018. Stroke follow-up in primary care: a prospective cohort study on guideline adherence. BMC Fam Pract 19(1): 179-79
- 191. März W, Dippel F-W, Theobald K, et al. 2018. Utilization of lipid-modifying therapy and low-density lipoprotein cholesterol goal attainment in patients at high and very-high cardiovascular risk: Real-world evidence from Germany. Atherosclerosis 268: 99-107
- 192. Hernández-Izquierdo C, González López-Valcárcel B, Morris S, et al. 2019. The effect of a change in copayment on prescription drug demand in a National Health System: The case of 15 drug families by price elasticity of demand. PLoS One 14(3): e0213403-e03
- 193. Osteresch R, Fach A, Schmucker J, et al. 2019. Long-Term Risk Factor Control After Myocardial Infarction - A Need for Better Prevention Programmes. J Clin Med 8(8): 1114
- 194. Gandhi S, Chen S, Hong L, et al. 2017. Effect of Mobile Health Interventions on the Secondary Prevention of Cardiovascular Disease: Systematic Review and Meta-analysis. Can J Cardiol 33(2): 219-31
- 195. Hamilton SJ, Mills B, Birch EM, et al. 2018. Smartphones in the secondary prevention of cardiovascular disease: a systematic review. BMC Cardiovasc Disord 18(1): 25
- 196. Toell T, Boehme C, Mayer L, et al. 2018. Pragmatic trial of multifaceted intervention (STROKE-CARD care) to reduce cardiovascular risk and improve quality-of-life after ischaemic stroke and transient ischaemic attack - study protocol. BMC Neurol 18(1): 187
- 197. Vale MJ, Jelinek MV, Best JD, *et al.* 2003. Coaching patients On Achieving Cardiovascular Health (COACH): a multicenter randomized trial in patients with coronary heart disease. *Arch Intern Med* 163(22): 2775-83

- 198. Jelinek M, Vale MJ, Liew D, et al. 2009. The COACH program produces sustained improvements in cardiovascular risk factors and adherence to recommended medications-two years follow-up. Heart Lung Circ 18(6): 388-92
- 199. Vale MJ, Sundararajan V, Jelinek MV, et al. 2004. Four-year follow-up of the multicentre randomised controlled trial of Coaching patients On Achieving Cardiovascular Health (The COACH study) shows that The COACH Program keeps patients out of hospital (Conference proceedings). Circ J 110(17): 801-02
- 200. Collins C, Finn C, Meade B, et al. 2014. Strengthening the Foundation of General Practice Evidence in Ireland by Addressing the Data Quality Issues in a Structured Secondary Prevention Programme for Cardiovascular Disease. JMED Res: 10.5171/2014.315020
- 201. Bennett K, Jennings S, Collins C, et al. 2008. Heartwatch: A secondary prevention programme in primary care in Ireland. Eur J Cardiovasc Prev Rehabil 15: 651-6
- 202. Timmis A, Townsend N, Gale CP, et al. 2019. European Society of Cardiology: Cardiovascular Disease Statistics 2019. Eur Heart J 41(1): 12-85
- 203. Mendis S, Puska P, Norrving B, et al. 2011. Global atlas on cardiovascular disease prevention and control. Geneva: World Health Organization, World Stroke Organization
- 204. World Heart Federation. 2017. Risk factors. Available from: https://www.world-heart-federation.org/resources/risk-factors/ [Accessed 15/06/20]
- 205. Talelli P, Greenwood RJ. 2008. Recurrent stroke: where do we stand with the secondary prevention of noncardioembolic ischaemic strokes? *Ther Adv Cardiovasc Dis* 2(5): 387-405
- 206. National Health Service. 2019. What is high cholesterol? [Updated 15/04/2019]. Available from: https://www.nhs.uk/conditions/high-cholesterol/ [Accessed 16/06/20]
- 207. Mihaylova B, Emberson J, Blackwell L, et al. 2012. The effects of lowering LDL cholesterol with statin therapy in people at low risk of vascular disease: meta-analysis of individual data from 27 randomised trials. Lancet 380(9841): 581-90
- 208. Cholesterol Treatment Trialists' (CTT) Collaborators. 2005. Efficacy and safety of cholesterol-lowering treatment: prospective meta-analysis of data from 90,056 participants in 14 randomised trials of statins. *Lancet* 366(9493): 1267-78

- 209. World Health Organization. 2009. Global health risks: mortality and burden of disease attributable to selected major risks. Geneva: World Health Organization
- 210. Prior PL, Suskin N. 2018. Exercise for stroke prevention. *Stroke Vasc Neurol* 3(2): 59-68
- 211. Lee IM, Shiroma EJ, Lobelo F, et al. 2012. Effect of physical inactivity on major non-communicable diseases worldwide: an analysis of burden of disease and life expectancy. *Lancet* 380(9838): 219-29
- 212. Gremmel T, Michelson AD, Frelinger AL, III, et al. 2018. Novel aspects of antiplatelet therapy in cardiovascular disease. Res Pract Thromb Haemost 2(3): 439-49
- 213. Kirchhof P, Benussi S, Kotecha D, et al. 2016. 2016 ESC Guidelines for the management of atrial fibrillation developed in collaboration with EACTS. Eur J Cardiothorac Surg 50(5): e1-e88

- 214. National Institute for Health and Care Excellence. 2014. Atrial fibrillation: medicines to help reduce your risk of a stroke – what are the options? Available from: https://www.nice.org.uk/guidance/cg180/resources/cg180-atrial-fibrillation-update-patient-decision-aid-243734797 [Accessed 05/12/2019]
- 215. Leon BM, Maddox TM. 2015. Diabetes and cardiovascular disease: Epidemiology, biological mechanisms, treatment recommendations and future research. World J Diabetes 6(13): 1246-58
- 216. Ntaios G, Sagris D, Gioulekas F, et al. 2018. 20-year trends of characteristics and outcomes of stroke patients with atrial fibrillation. *Int J Stroke* 13(7): 707-16

FOR MORE INFORMATION, PLEASE CONTACT:

The Health Policy Partnership

68–69 St Martin's Lane, London, WC2N 4JS, United Kingdom info@hpolicy.com

© 2021 Amgen (Europe) GmbH. This report may be used for personal, research or educational use only, and may not be used for commercial purposes. Any adaptation or modification of the content of this report is prohibited, unless permission has been granted by Amgen.



The Health Policy Partnership is a specialist health policy consultancy with longstanding experience in research and the coordination of policy leadership networks.