MINISTRY OF INTERIOR

IMPROVING CARDIOVASCULAR HEALTH IN EUROPE: THE CASE FOR EU AND NATIONAL CVH PLANS

Hungarian Ministry of Health in collaboration with the European Society of Cardiology

Ministerial Foreword

At this pivotal moment, under the Hungarian Presidency of the Council, we are poised to take a decisive step forward in the fight against cardiovascular diseases (CVDs) in Europe. This leadership opportunity allows us to spearhead initiatives that prioritize heart health at the highest levels of policy and public discourse. The Hungarian Presidency is deeply committed to leveraging this period to galvanize support, foster cross-border collaborations, and champion comprehensive strategies that address the root causes and disparities associated with CVDs.

Our approach is holistic, recognizing that a multifaceted strategy is required to effectively combat against cardiovascular diseases. This includes promoting healthy lifestyles across all age groups, advancing public health policies that target risk reduction, and ensuring that innovations in medical research and high level healthcare delivery are equitably accessible. The Presidency aims to highlight the critical role of prevention, advocating for environments that support physical activity, healthy nutrition, and mental health and well-being, alongside fighting against – inter alia - tobacco and alcohol consumption which are significant risk factors for CVDs.

Furthermore, recognizing the disparities in accessing health services as well as in health outcomes between and within European countries, the Hungarian Presidency calls for a renewed focus on health equity. This means advocating for policies that ensure all Europeans, regardless of their socio-economic status or geographical location, have access to the necessary health services. It involves pushing for investments in health infrastructure, from rural clinics to advanced urban centres, and promoting the use of digital health technologies to bridge gaps in care delivery.

Health innovation is another cornerstone of our vision for a heart-healthy Europe. The Hungarian Presidency encourages the adoption of cutting-edge technologies and

research in cardiovascular care, from telemedicine to personalized medicine approaches that can significantly improve patients' health outcomes. This period of leadership is seen as an opportunity to foster an innovative and resilient European health ecosystem that is also responsive to the needs of its citizens.

As we mobilize these efforts, the importance of collaboration cannot be overstated. The Hungarian Presidency seeks to inspire partnerships across nations, sectors, and disciplines, bringing together health providers, researchers, policymakers, communities and patients to share knowledge, experiences and best practices and resources. This collaborative spirit is essential for achieving sustainable change and our shared goal of significantly reducing the burden of cardiovascular diseases across Europe. In line with this, the "Healthier Together" EU non-communicable diseases initiative will serve as a cornerstone, providing a robust foundation to unite our efforts and enhance the improvement of collective health outcomes.

To underscore the urgency of our mission, we should carefully consider the stark realities: cardiovascular diseases are one of the leading causes of mortality worldwide, claiming nearly 18 million lives each year. In Europe alone, CVDs account for 37% of all deaths, translating to over 1.7 million lives lost annually. This not only represents a profound loss of life but also imposes a significant economic burden, costing EU economies an estimated €282 billion in 2021 alone. These figures are not just statistics; they represent fathers, mothers, siblings, children and friends whose lives are cut short by preventable conditions.

Our vision for the future is one where cardiovascular health is not just a matter of individual concern but a collective priority that shapes policies, health systems, and societal norms. It is a future where every European has the opportunity to live a longer, healthier life free from the burden of CVDs. Through the initiatives and leadership of the Hungarian Presidency, we are committed to contribute to the future, driven by a commitment to public health, equity, and innovation. Together, we can transform the landscape of cardiovascular health in Europe, creating a legacy of well-being for generations to come.

Dr Péter Takács

Minister of State for Health

Foreword – Professor Franz Weidinger, President of European Society of Cardiology

Neglect and a lack of public investment in cardiovascular health threatens to undo hard fought trends in reducing mortality in cardiovascular disease. Today cardiovascular disease represents not only the biggest cause of death in the EU but is reflective of deep inequalities and inequities that we see across the Union.

From environment to employment, from climate change to demographic change, from infrastructure to research investment, the impact of cardiovascular disease can be felt everywhere except in policy.

The EU institutions aim to adhere to the principle of evidence-based decision making. Given that cardiovascular disease is the biggest killer in the Union today and comes at a cost of 100 billion euro more than the entire EU budget, we have the evidence to justify meaningful policy action.

We should not deceive ourselves in thinking that we can avoid expenditure. We will pay the price for CVD one way or another. The question is will we decide to invest now and save lives and protect our economies, or be forced to pay later in lives lost and broken health systems?

No Member State should be without a plan to tackle the biggest threat to the lives of its citizens, nor should we view such a plan as solely the responsibility of health ministries.

Action to promote cardiovascular health is the fight for gender, generational and geographical equity. It is the fight against ageism and structural inequalities. It is the means to enable a silver economy and keep our systems sustainable. It is the public health campaign of this generation.

This paper is intended to inform discussions on cardiovascular health and provide general policy suggestions which may help to preserve it.

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Summary

Cardiovascular diseases (CVDs) are disorders related to the heart and circulatory (vascular) system, which include ischaemic heart disease (IHD), stroke, heart failure (HF), heart rhythm disturbances (e.g., atrial fibrillation), hypertension, congenital heart diseases, inherited cardiac conditions, and diseases of the aorta, heart valves and peripheral arteries.

Today cardiovascular disease represents the biggest killer in the EU accounting for 1.7 million deaths each year and comes with an economic cost of 100 billion euro more than the entire annual EU budget.

This burden is not distributed evenly but is reflective of deep-seated inequalities in the EU spanning geographies, genders and generations.

In recent years and particularly since COVID-19, there has been an increased awareness at EU and national level of the threat that CVDs represent to life and livelihood. The inability of Non-Communicable Disease (NCD) plans to deliver meaningful results and the ambitions of the EU Beating Cancer plan have put a new spotlight on the need for action on the biggest threat to the lives of EU citizens.

Just over 50% of CVDs could be prevented by lowering blood pressure, cholesterol and weight, by stopping smoking and controlling diabetes; however, these risk factors are highly prevalent in the general EU population, suggesting the need for an increased roll out of evidence based primary prevention programmes to the benefit of future generations.

Given that many countries such as the UK demonstrate rising levels of CVD death in those under 75 years of age, implementing multiple types of prevention measures – from early life to old age – is crucial[1].The issues are much more complex than blaming individuals – they require population-level policy interventions and a mindset shift. Environmental stressors also contribute to CV risk. There is increasing understanding of the links between different CVDs and pollution, noise exposure and climate change, representing another critical area for action.

Currently, there is lack of screening for CV risk factors, including hypertension, and also missed opportunities to screen for, and diagnose, a wide range of CVDs that are

not caused by modifiable factors. Some common CVDs, such as heart failure, are often diagnosed late in their disease course, missing an important opportunity to delay progression and leading to an unnecessarily heavy burden of morbidity, hospitalisations and untimely death. Novel tools have been developed to enable earlier diagnosis, but these are not always widely available or used. Similarly, some CVDs can be effectively treated with established and novel treatments or procedures, but these may not be widely available in certain countries or are not implemented appropriately.

Many CVDs lack effective treatments that target their molecular cause and, despite the enormous healthcare burden, the developmental pipeline of new CV drugs is limited, with no new therapies coming to market in CVD in 2022. Innovation is needed to develop new diagnostics and treatments, personalised for patient needs, which are integrated into care models and widely accessible.

Patients with CVD are often at high risk of another CV-related event or disease. Appropriate secondary prevention strategies, including risk factor control and patient education, and multidisciplinary rehabilitation should be initiated rapidly to improve prognosis. Best-practice guidelines have been developed by medical societies, including the ESC. Yet, access, implementation, quality and adherence are often suboptimal and there remain wide inequalities between and within EU countries.

It is suggested that a meaningful reduction in the burden of CVDs across the Union cannot be reached without a stand-alone plan for the EU's biggest killer. Such an EU framework, supported by National Action Plans on Cardiovascular Health would ensure the needs of citizens in prevention, diagnosis treatment and rehabilitation are effectively met as well as tackling the environmental stressors and co-morbidities that drive CVDs. The joint action on cardiovascular diseases and diabetes with the funding of €53 million from EU4health programme provides a basis for developing national plans and strategies on cardiovascular disease as well as on diabetes and their interlinked risk factors. In addition, with an unprecedented budget of €75 million Member States are collaborating under the joint action to address common risk factors. These collaborative actions are the starting point for both developing national plans in the future, as well as implementing the joint EU Action Plan in countries with national action plan already in place.

Current burden of CVDs across the EU

Despite a decline in CV mortality in many countries in the European Union (EU), CVDs remain the most common cause of death, accounting for about 1.7 million deaths across EU-27 member countries, which equates to 37% of all deaths. [Timmis 2022 - ESC Atlas].

Many patients suffer from the long-term effects of CVDs, living for years with considerable disability. An estimated 53 million people were living with CVDs in EU-27 in 2021 [Timmis 2022], making CVD the biggest cause of death today.
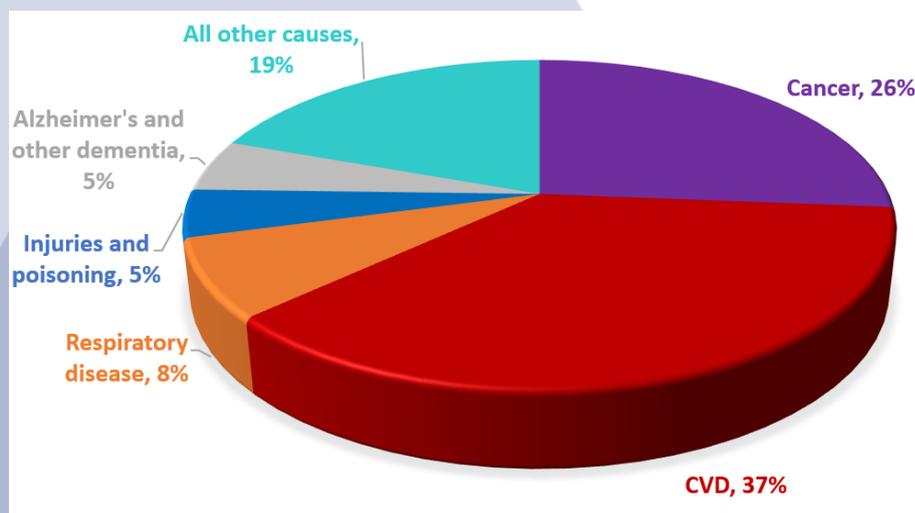
Figure 1. National causes of death in EU27 *[Timmis 2022 - ESC Atlas]*

The economic burden is enormous for healthcare systems, for society and for patients and their families. In 2021, CVDs were estimated to cost the EU €282 billion, which is roughly 100 billion more than the EU budget [Luengo-Fernandez 2023]. Around €155 billion – 55% of the total – was attributed to direct health and long-term care costs, equalling 11% of total EU health expenditure. Productivity losses associated with early mortality and incapacity for work were estimated at €32 billion and €15 billion, respectively, and the cost of unpaid care by friends/relatives was estimated at €79 billion. When expressed per capita, the total CVD cost equals €630 per EU citizen, ranging from €381 in Cyprus to €903 in Germany, after adjustment for price

differentials[1]. In addition to mortality, morbidity and cost, the experience of a heart attack or stroke can also have a profound and lasting impact on the quality of life (QoL) of those affected as well as their families or carers, causing substantial stress, anxiety and, in some cases, depression, which are associated with significantly worse outcomes [Iles-Smith 2015; Mitchell 2017].
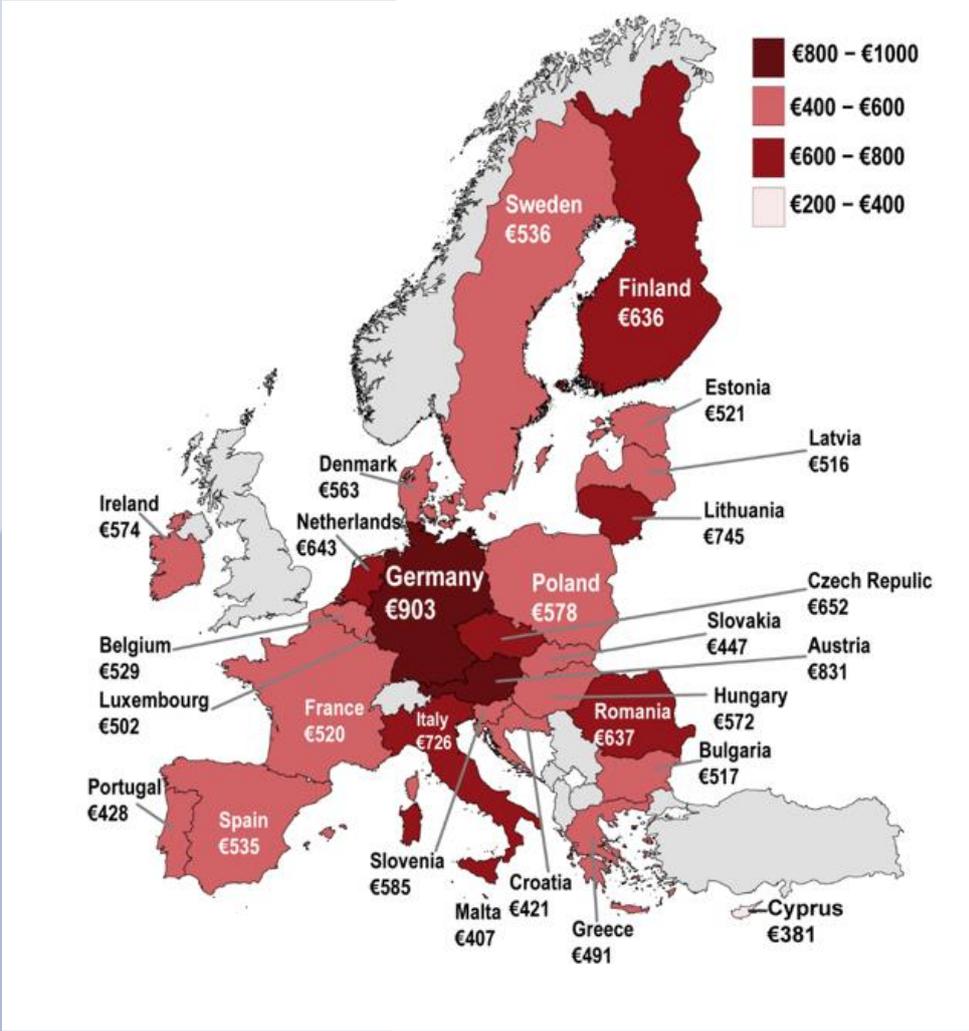
Figure 2. Total CVD costs per capita adjusted for price differentials [Luengo-Fernandez 2023]

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[1] All costs were expressed in 2021 prices and converted to euros where applicable. To account for price differentials across countries, the purchasing power parity (PPP) method has been employed. [Luengo-Fernandez 2023].

Geographic disparities

The CVD burden is distributed unevenly across EU member states. 6,300 per 100,000 inhabitants had CVDs across the EU as a whole in 2019, but this varied widely, ranging from 5,500 in some countries to 7,500 in others. CVD kills considerably more people in central and eastern parts of the EU, whereas western and northern parts of the EU are less affected. The CVD mortality is ranging from about 20% of all mortality causes in Denmark, to over 60% in some central and eastern EU countries.
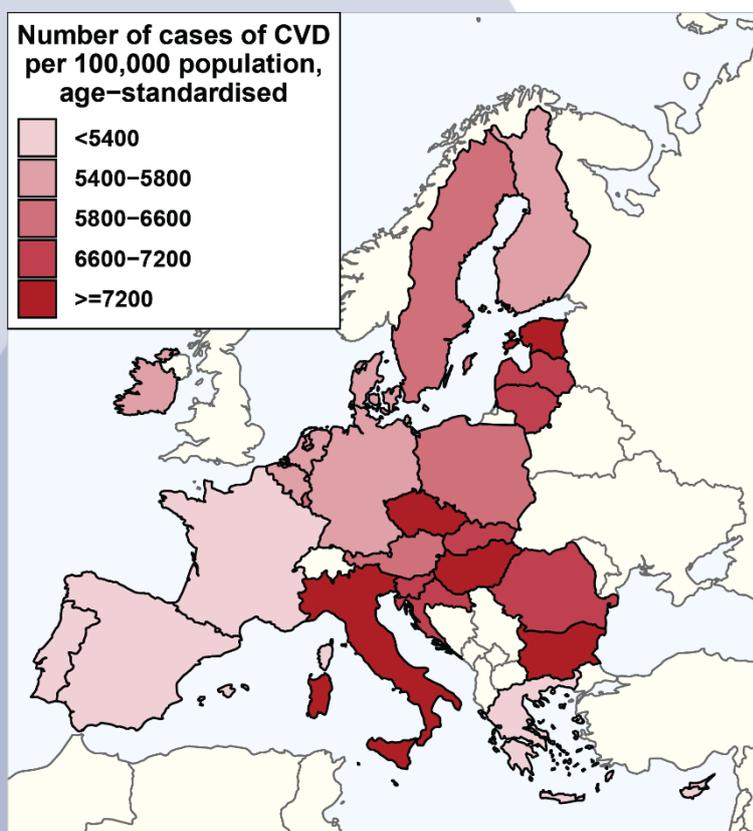
Figure 3. Prevalence of CVDs across Europe in 2019 *[Timmis 2022 - ESC Atlas]*

Similar wide EU variations are seen with Disability Adjusted Life Years (DALYs), which combine information regarding premature death (years of life lost) and disability caused by CVDs (years lived with CVDs) to provide a summary measure of health lost. In 2019, median DALYs due to CVDs were more than double in those countries which the EU recently in comparison to initial EU-14 countries (4,651 versus 2,091 per

100,000 inhabitants). The differences between less and more prosperous countries confirm the close correlation between health and wealth. The fact that such huge variations exist shows that it is possible to achieve the lower rates of CVDs seen in some more prosperous countries.

Within countries, there are many underserved population groups based on factors including age, sex, race, socioeconomic status and region [Mensah 2023]. There is a need to promote epidemiological studies on differences in the prevalence of CVDs by gender or other inequities. Additional initiatives include targeting vulnerable communities with multidisciplinary approaches and better training of healthcare professionals to tackle and raise awareness of differences in care.
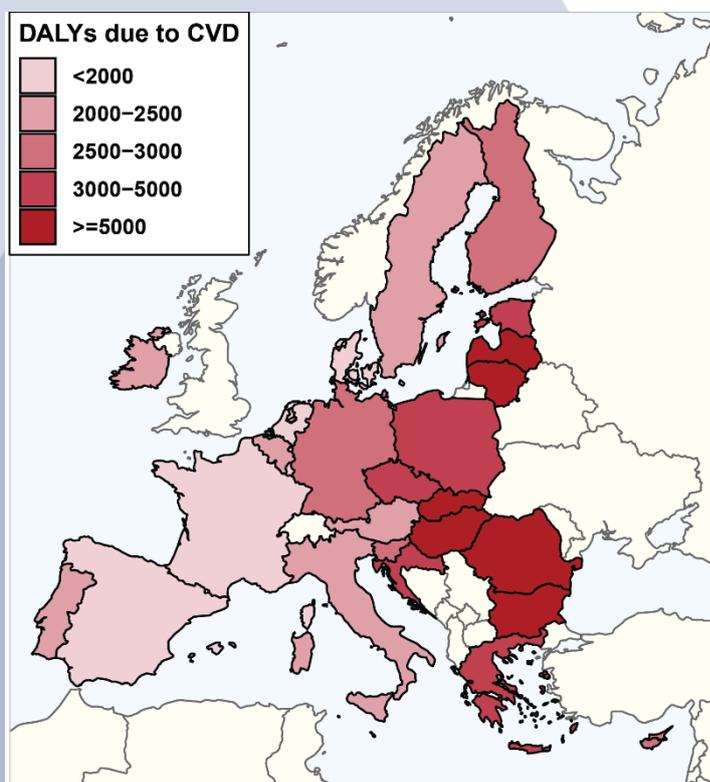
Figure 4. DALYs due to CVD *[Timmis 2022 - ESC Atlas]*

Gender inequalities

In the EU today, more women than men suffer from CVD. Despite this, women are under-represented in research. A meta-analysis of 86 CVD randomised controlled trials conducted in Europe between 2010 and 2017 found that only 37.4 % of the 68 000 participants were women. [Jin 2020]

The cultural mislabelling of CVD as a "men's disease" may be partly responsible for the risk of mortality following a heart attack being 20% greater in women compared to men. Women face a 20% increased risk of developing heart failure or dying within five years after their first severe heart attack compared with men. [Ezekowitz 2020]

What is also not fully understood is that women during the fertile age have a lower risk of cardiac events, but this protection fades after menopause thus leaving women with untreated risk factors vulnerable to develop myocardial infarction, heart failure, and sudden cardiac death. Furthermore, clinical manifestations of ischaemic heart disease in women may be different from those commonly observed in males, potentially contributing to under-recognition of the disease.[i] Understanding these differences may enhance the clinical management of CVDs, potentially leading to the development of new gender-specific diagnostic and therapeutic options. [Stramba-Badiale 2006]

The European Commission has already funded a project related to the gender specific mechanisms linked to the cardiovascular diseases in women. GENCAD project provided also fact sheets in all EU languages for health professionals and the general public related to cardiovascular diseases in women.

[GENCAD: Institute of Gender in Medicine (GiM) - Charité – Universitätsmedizin Berlin (charite.de)](#)
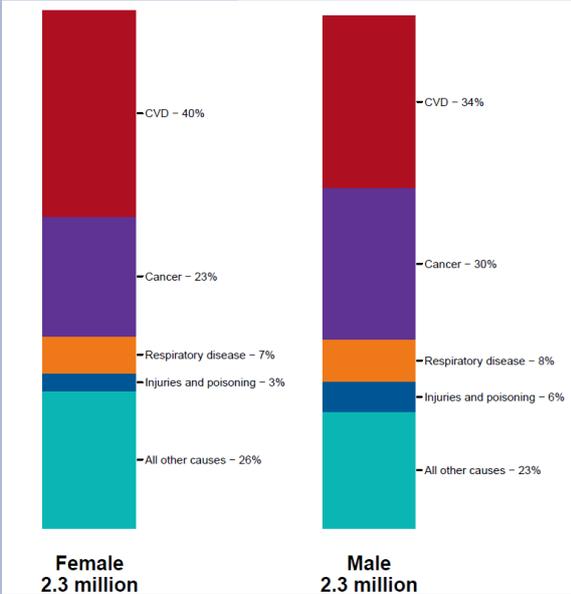
Figure 5. National causes of death in EU27 per gender [Timmis 2022 - ESC Atlas]

Generational inequalities

While CVDs can occur at any age, their risk and prevalence increase in older people, which is particularly relevant given Europe's ageing population. The population aged 65 years or older is predicted to increase significantly in the EU, rising from 90.5 million at the start of 2019 to an estimated 130 million by 2050 [Eurostat 2020], and there will be corresponding increases in CVD incidence and burden.

However, a common misperception is that CVDs are limited to older people, when in fact, CVDs account for around 23% of deaths before the age of 70 [Timmis 2022], heavily impacting all ages. Furthermore, individuals can be born with a spectrum of congenital heart/vessel diseases, and although more than 90% now survive to adulthood, many have complex CV problems requiring highly specialised care. In addition, a wide range of inherited CV conditions are related to genetics and are not linked to modifiable risk factors. These include familial hypercholesterolaemia (a disease involving very high cholesterol levels), certain cardiomyopathies (a disease of the heart muscle) and heart rhythm disorders. Such diseases can be detected and treated early with appropriate screening.

Improving primary prevention of CVD across all ages

Primary prevention refers to strategies and interventions to reduce the risk of developing heart and vascular problems in individuals without established CVD who have not yet experienced a CV event.

To influence the risk factors leading to the development of cardiovascular disease (CVD) and yield the expected benefits (health gains, life years gained, economic consequences at individual and societal level), it is essential that the various prevention interventions and options are defined and designed, not only from a clinical perspective but also from a public health perspective. Given that the beneficial effects of influencing risk factors can be identified at the individual and societal level from the time of intervention, it is proposed to consider related preventive interventions across the life course. The planning and implementation of prevention activities in daily practice requires an integrated, multidisciplinary approach.

At present, CVD prevention mainly focuses on risk reduction later in life, and while this is important, it is also necessary to recognise that CVD development – particularly the formation of atherosclerotic plaques that lead to heart attacks – starts early [Dendale 2019; Braunwald 2023]. Parents' behaviours before conception and during pregnancy can impact CV risk, while childhood is a key period for instilling healthy lifestyle habits. The 'tsunami' of obesity that we are currently seeing is beginning early, with around one in five children in Europe being overweight or obese [Garrido 2019]. Opinions and regulation of physical activity in schools differ greatly within Europe. There seems to be a trend moving away from the norm of regular exercise for children. Coupled with an unhealthy diet, this potentially lethal combination could have devastating consequences on the burden of cardiovascular disease (CVD) in the future.

Primary prevention has suffered from a failure to pair individual responsibility with support for evidence based public health interventions in the field. When focusing on 'cardiovascular health', it becomes evident that both individual responsibility and preventive measures are crucial. Therefore, it's essential to acknowledge individuals' roles in preventing lifestyle risk factors for cardiovascular disease and implementing policies to promote health. [Vassilaki 2015]

To strengthen the public health approach, more attention must be given to fostering the idea of "health as a value and experience" from early childhood. Without this foundation, it will be difficult in the long term to ensure that the public possesses the necessary competencies and knowledge to maintain good health for as long as possible. This entails empowering individuals to make informed decisions regarding both their personal health and the health of their community. However, beyond merely imparting skills and knowledge, fostering an environment conducive to healthy choices is equally imperative. The promotion of health literacy and the development of health understanding are integral components that cannot be overlooked without strengthening health promotion, particularly in educational and workplace settings. In addition to individual health promotion, community health promotion programmes should also be launched, given their key role in prevention and in influencing risk behaviour towards the desired positive direction.

In this context, cardiovascular prevention strategies should adopt a multifaceted approach. This involves directing efforts towards the entire population, as well as targeting specific high-risk or vulnerable groups, and addressing individuals who have either been diagnosed with or have a history of cardiovascular disease. Emphasising the significance of patient education and support is crucial, necessitating a tailored approach that accommodates the diverse needs of patients, encompassing factors such as educational backgrounds, age, health conditions, cultural backgrounds, and any disabilities they may have. The goal of patient support is to transform patients from passive recipients of care into active participants within the healthcare process. Enhancing the dialogue and collaboration between patients and healthcare providers can significantly boost the effectiveness and efficiency of prevention, treatment, rehabilitation, and health promotion activities. For those with established cardiovascular diseases, a partnership approach to communication and action is essential. This approach involves sharing information about the risks and benefits of treatments while considering the individual's needs, preferences, comorbidities, medications, and other relevant factors.

Risk factors in the context of primary prevention

A recent global analysis has shown that over half (53–57%) of CVDs are attributable to five modifiable risk factors: systolic blood pressure, non-high-density lipoprotein cholesterol, current smoking, body mass index (BMI) and diabetes [Global CV Risk Consortium 2023]. The ESC Atlas project highlights the alarmingly high levels of these CV risk factors across the general populations of EU-27 countries [Timmis 2022]:

- More than 1 in 5 had elevated blood pressure (≥140/90 mmHg)
- About 1 in 7 had high cholesterol levels (total cholesterol ≥6.2 mmol/L)
- More than 1 in 5 smoked tobacco
- More than 1 in 5 had obesity (BMI ≥30 kg/m^2), a massive rise from 1 in 10 in 1980
- More than 1 in 20 had diabetes

Around 10% of CVD deaths are attributable to smoking. Smokers have a 30% higher risk of developing coronary heart disease than non-smokers. Secondary smoking is estimated to increase the risk of stroke by the same amount. Understanding the impact of smoking, including the effects of emerging tobacco products, on cardiovascular disease (CVD) is crucial. Recent findings also suggest that e-cigarettes may raise blood pressure and heart rate, increase arterial stiffness, and lead to poorer cardiovascular and respiratory health outcomes compared to non-users, as indicated by measurements like blood pressure, heart rate, exhaled carbon monoxide, and nitric oxide levels [Gernun 2022].

Additionally, inadequate nutrition is a key lifestyle risk factor for cardiovascular disease, with strong evidence showing that factors such as overweight/obesity, high salt intake [Wang 2020], and increased intake of trans fatty acids significantly contribute to the risk of developing cardiovascular diseases [Guasch-Ferré 2015]. A key to prevention is the reduction of high nutritional risk factors, excessive salt, saturated fat and trans-fatty acid intake, which are already present in childhood. With regard to the health impact of industrial (artificial) trans fatty acids, studies show that they pose a major health risk, with an intake of just 5 g/day of trans fatty acids, equivalent to 2% of total energy intake, increasing the risk of cardiovascular disease by 23% [Oomen 2001].

This intake is 4 to 5 times higher per gram of saturated fatty acids, as they increase LDL cholesterol levels in the serum, reduce HDL cholesterol levels and increase triglyceride levels, thus causing a significant atherosclerotic effect.

The consideration of diabetes is also crucial in cardiovascular health because it markedly increases the risk of various cardiovascular diseases, including coronary artery disease, heart failure, and stroke. [Shah 2015] High blood sugar levels associated with diabetes can damage blood vessels and the nerves that control the heart. Over time, elevated glucose levels can lead to fatty deposits accumulating on blood vessel walls, causing them to narrow and harden—a condition known as atherosclerosis—thereby reducing blood flow and forcing the heart to work harder. Diabetes is often accompanied by unhealthy cholesterol levels, further contributing to atherosclerosis. Moreover, many people with diabetes have hypertension, a significant risk factor for heart disease and stroke. Diabetes also promotes increased inflammation and a greater tendency for blood clot formation, heightening the risk of cardiovascular events. Additionally, diabetes can lead to diabetic cardiomyopathy, affecting the heart's structure and function and potentially causing heart failure. Therefore, effective management of diabetes—including controlling blood sugar, blood pressure, and cholesterol levels, following a heart-healthy diet, engaging in physical activity, and avoiding tobacco—is vital in minimizing the risk of cardiovascular complications.

Governments have a crucial role to play in creating 'heart healthy' environments and opportunities for physical activity and active living for all. The evidence that compact neighbourhoods with easy access to amenities, parks and public transport underpin a healthy and sustainable city is rarely effectively incorporated into city planning policy, which perpetuates physical inactivity [Münzel 2021; Giles-Corti 2022].

Across age groups, simple promotion of healthy behaviour is insufficient. School, family and community-based education is needed to address the current lack of knowledge of the impact of an unhealthy lifestyle while behavioural change support is needed to help children and adults develop healthy habits. Schools4Health project, led by EuroHealthNet, is EU-wide in scale with partners from Belgium, Denmark, Germany, Greece, Hungary, Latvia, the Netherlands, Romania, Slovenia and Spain.

These partners collectively bring extensive knowledge and experience in the fields of school health and health promotion.

Improving primary CVD prevention in the primary-care setting – spotlight on Hungary

Hungary's government measures such as the public health product tax introduced in 2011, compulsory daily physical education in schools, and public catering, school milk and fruit programmes to promote healthy eating habits have produced significant results. The introduction of daily physical education has been shown to contribute to the prevention of childhood obesity, blood pressure problems and to increase health motivation.

Primary care is a key site for CV prevention and lessons can be learned from a recent government initiative in Hungary designed to improve provision. Until 2021, primary care was provided by isolated general practices (GP) consisting of one doctor and one or two practice nurses, with insufficient focus on preventive activities due to a lack of time and well-defined tasks [Jancsó 2022]. 'Three Generations for Health Programme' was launched in 2019, which focuses on providing preventive and continuous care services and the mandatory establishment of GP partnerships. A key aim is to assess CV risk factors and risk levels and to launch personalised interventions in a large population involving three generations (0–18 years, 40–65 years and 65+ years). Over 800 GPs in Hungary are participating in the programme, with central data analysis to assess its success.

An analysis of risk factors and guideline-recommended target achievement was performed at the beginning of the programme start in around 37,000 individuals aged 40–65 years. Of these 31% were found to be at very high CV risk. Achievement of target blood pressure levels was lower among very high-risk Hungarian individuals than the European average (49% versus 58%, respectively). Similarly, attainment of LDL-C target was only 8% among very high-risk patients, also falling below the European average (29%). Continuous assessment of risk factors over time will provide key information on progress.

<u>Recommendation:</u>

It is recommended that the European Commission's Expert Group on Public Health actively identify public health policy interventions in primary CVD prevention that have a proven track record of success and that appropriate funding is provided to implement these across the EU. There is need for coordinated action at EU level to reduce and prevent nutritional risk factors (e.g. a European salt reduction programme, in addition to the existing EU regulation on the maximum levels of trans fatty acids in food). The subgroup on prevention of non-communicable diseases has agreed to map all national non-communicable disease policies and programs as a first step when defining future actions. It should be also highlighted that the major joint action on health determinants is looking at different types of determinants including commercial.

Reducing the impact of environmental stressors

In addition to traditional CV risk factors, there is growing evidence that environmental factors – including air and noise pollution – contribute significantly to the burden of CVDs [Münzel 2022]. Evidence also links adverse CV health with particles from natural sources (e.g., desert dust, wildfires and volcano eruptions) [Münzel 2022] and climate-change-related extremes of temperature [Zhao 2021]. Environmental stressors contribute to CVD development and also exacerbate existing risk factors or diseases (e.g., diabetes or hypertension) due to similar mechanisms.

The main components of air pollution include particulate matter (PM; ranging in diameter from coarse 2.5–10 μm [PM_{10}], fine <2.5 μm [$PM_{2.5}$] and ultrafine <0.1 μm particles) and gaseous pollutants including ozone, nitrogen dioxide, carbon monoxide and sulphur dioxide, produced primarily by combustion of fossil fuels such as oil, gas and coal. In analyses, increases in PM concentration were related to HF hospitalisation or death ($PM_{2.5}$: 1.29% per 10 μg/m^3, PM_{10}: 1.30% per 10 μg/m^3), with adverse relationships also observed with gaseous pollutants [Yang 2023]. In other studies, a 10 μg/m^3 increase in long-term $PM_{2.5}$ exposure was associated with an increased risk of 23% for IHD mortality, 24% for stroke mortality, 13% for incident stroke and 8% for incident heart attack [Alexeeff 2021].

The mechanisms by which air pollution cause CVDs include general stress responses, thrombosis and direct damage to the endothelial cells lining blood vessels, leading to cell stress, inflammation and the accumulation of toxic mediators that increase the risk of atherosclerotic plaque formation and rupture [Münzel 2018].

In EU, the median $PM_{2.5}$ was estimated at 12.2 μg/m^3 based on 2019 reported data. There was a big variation between the EU member states, with $PM_{2.5}$ levels ranging from 5.6 μg/m^3 in Finland to 22.6 μg/m^3 in Poland. Thus the difference between the most $PM_{2.5}$ polluted and the least polluted country was 4-fold [data based on the ESC CV Realities 2022]. The air pollution for PM2.5 in Europe is about 2.5 times higher than the World Health Organization recommendations.

Noise pollution is estimated to be responsible for 48,000 new cases of CHD per year, as well as 12,000 premature deaths across Europe [CV Realities 2022]. In addition, 6.5 million people experience chronic sleep disturbances The EU limit of 55 dB is linked to adverse health consequences, and yet noise above this level is experienced by around 113 million Europeans (20%) caused by road traffic, by 22 million due to trains and by 6 million due to aircraft and these figures are likely underestimations [Münzel 2021]. reaction and the release of stress hormone and inflammatory markers [Münzel 2022]. Mitigation of environmental stressors could make a major contribution to CVD prevention. In Europe, air pollution leads to a loss of approximately 2.9 years in life expectancy, with 1.7 years considered avoidable through emissions controlled measures. [Münzel 2022]. For comparison, life reduction caused by cigarette smoking is in the range of 2.2 years [Lelieveld 2020]. Smart city planning incorporating 'heart healthy designs' is an important mitigation strategy not only for improving physical activity but also reducing unhealthy environmental exposures since noise, air pollution or heat islands show an accumulation in urbanised areas. 'Clean air' legislation promoting decreased particle emissions and promotion of public transport should also be encouraged.

Recommendation:

Funding for research and education on the consequences of pollution and climate change on CVDs must be intensified dramatically to protect the health of our current and future generations.

The European Agency for Safety and Health at Work (OSHA) should conduct, if appropriate, in cooperation with the European Environment Agency, an evaluation on the extent to which workers are exposed to cardio-hazardous substances or environments with recommendations on relevant health and safety at work legislation updates.

CVD and mental health

The results of several studies, including large case-control population cohort studies, show that there is a link between chronic stress and increased CVD risk.

Depression and mental health problems have been associated with early-onset CVD and suboptimal cardiovascular health in young adults. [Kwapong 2023] However, mental disorders also have an impact on cardiovascular disease outcomes, with studies demonstrating that pre-existing depression is a risk factor for poor prognosis of acute coronary syndrome. [Lichtman JH 2014]

An epidemiological cohort study by researchers from the Catholic University of Leuven found that people with major mental illness (schizophrenia, bipolar affective disorder, major depression) have a higher risk of cardiovascular disease (adjusted hazard ratio: 1.54 CI: 95%) compared to people without these disorders. Anxiety symptoms/disorders or persistent/severe stressors, PTSD (post-traumatic stress disorder), although less severe, increase the risk of cardiovascular disease (RR: 1, 41). On the other hand, the authors also point out that there is an inverse association, i.e. mental disorders/illnesses are common in these patients and substantially increase the risk of recurrent cardiovascular disease and cardiovascular mortality. [De Hert M, 2018]

In a Swedish cohort study of population-controlled twins, the hazard ratio for any CVD, looking at the year after diagnosis of any of the stress-related psychiatric disorders (acute stress reaction, adjustment disorder, post-traumatic stress disorder), was 1.64 (95% CI). The highest (6.95) hazard ratio was for heart failure. [Song H 2019]

The Commission communication for a comprehensive approach on mental health has created a comprehensive framework for the member States and the EU for tackling mental health issues. Therefore, risk factors related to mental health can be also addressed via a number of actions, including best and promising practices related to mental health as available at Best practices - European Commission (europa.eu)

Providing adequate secondary prevention strategies

Detection of modifiable risk factors (including high blood pressure, high cholesterol and diabetes) and subclinical CVD, before an individual experiences a major event or symptoms, provide key opportunities to prevent or delay morbidity and mortality. However, as highlighted in the EUROASPIRE project, detection and treatment at the early stages of disease is often suboptimal [Kotseva 2017].

In addition to CVDs caused by modifiable factors, individuals may be born with a wide spectrum of congenital CVDs that affect them in infancy and lead to complex CV problems in adulthood. There are also many rare CVDs that collectively affect a large population of children and adults. Inherited CV conditions affect millions of children and adults, including some cardiomyopathies and familial hypercholesterolaemia (FH). Screening for these CVDs can enable early detection and diagnosis; however, this is currently lacking for many diseases or is not widely available in all countries. For example, FH results in life-long cholesterol elevations leading to premature CV events (from aged 30 years) and premature deaths. In Europe, over 500,000 children and 2,000,000 adults are affected by FH [Bedlington 2022]. However, only 5% of children are identified and subsequently only a small fraction of all affected individuals receives life-saving treatment.

Early diagnosis of clinical CVDs, when the individual has established disease, provides the opportunity to reverse/delay the trajectory and reduce the burden, but again, diagnosis is often missed or delayed. As an example, HF is a commonly occurring CVD (median prevalence of 17 cases per 1,000 people) that is associated with frequent hospitalisations and high mortality [Seferovic 2021; Crespo-Leiro 2016]. Around 60–80% of HF cases are diagnosed in the emergency department (ED) [Bayes-Genis 2023], although many patients have symptoms that should have triggered an assessment earlier.

Better detection and thus earlier treatment could make a tremendous difference in CVDs linked to other chronic conditions or therapies, including, but not limited to, diabetes and chronic kidney disease.

Individuals with type 2 diabetes mellitus (T2DM) face a 2–3 times higher cardiovascular risk than people without diabetes and see their life expectancy reduced by 10–14 years.[ii] The number of adults diagnosed with diabetes in the EU has almost doubled over the last decade, from about 17 million in 2000 to 33 million in 2019 and it's projected to increase to 38 million by 2030.[iii]

To identify people at risk of developing diabetes, the Finnish Diabetes Risk Score (FINDRISC) can be used to predict the 10-year risk for developing type 2 diabetes. FINDRISC uses age, BMI, physical activity, vegetable & fruit intake, medical treatment of hypertension, history of hyperglycemia and family history to determine risk of developing diabetes. Depending on the score, further investigations such as the measurement of HbA1c may be needed. [Lindström J 2003]

A systematic global CVD risk assessment is recommended in individuals with any major vascular risk factor i.e. family history of premature CVD, FH, CVD risk factors such as smoking, arterial hypertension, diabetes, raised lipid level, obesity, or comorbidities increasing CVD risk.

A Systematic CV risk assessment in the general population in men >40 years of age and in women >50 years of age or postmenopausal with no known ASCVD risk factors may be considered.

Recommendation:

There is a need for stronger emphasis on the system-wide development of health and risk assessments and age-related screening in primary care. Special attention should be paid to targeted risk assessment, screening and more effective care for hypertension, diabetes and lipid metabolism disorders. The timely and frequent performance of these assessments and screening, and timely initiation of care activities, contribute significantly to increasing the number of healthy life years.

It is suggested that European Council Recommendations on a Joint Cardiovascular-Diabetes Health Check would be the most effective policy mechanism to promote secondary prevention and would provide a common framework for national secondary prevention programmes for CVD.

Screening of cardiovascular diseases takes place in primary care most often and therefore it falls under the national responsibility for organizing and financing health services as stipulated in article 168 of the Treaty of the functioning of the EU. However, if member states wish to discuss overall practices related to such screening this can take place at an appropriate EU level forum (such as the public health expert group).

Avoiding repeat cardiovascular events

Nearly half of all CV events occur in people with established heart disease, and 25–30% of strokes are repeat events [Jernberg 2015; Hankey 2014]. One in five patients discharged from hospital after a heart attack has another heart attack, stroke, or dies of CV illness within the first year [Jernberg 2015].

Results from EUROASPIRE highlight that most patients have suboptimal risk factor control in the 6 months after a heart attack [Kotseva 2019]. At least 20% of patients did not receive heart-protective medications, 58% did not met blood pressure targets and 71% did not achieve LDL-C goals. High LDL-C levels could be due to low statin doses and failure to prescribe combination therapy, due to cost and/or difficulties accessing newer therapies. Adherence is also poor with LDL-C-lowering therapy, which may be due to patient concerns about side effects and a lack of understanding of their disease [Karalis 2023].

Best-practice secondary prevention within the first year can mitigate a large part of the risk of recurrent events, providing an estimated gain of around 7 CV event-free years [van Trier 2023] and can also improve QoL, with cost-savings due to reduced hospitalisations and healthcare utilisation.

Secondary prevention should be initiated immediately in the hospital after a major CV event with the optimisation of preventive medication. A discharge protocol should inform outpatient facilities and primary care. Long-term management should include regular assessment of risk factors, symptoms and vital signs, continued patient education and advice on a healthy lifestyle, monitoring of medication adherence and support for self-management.

Digital technologies may be useful in optimising risk factor control in secondary prevention. For example, with easy-to-apply telemedicine techniques, more than 70% of heart-attack patients reached recommended LDL-C levels after 1 years' follow-up in a Spanish study [Ruiz 2022].

Recommendation:

It is recommended to reallocate the burden of hospital care as appropriate, emphasizing primary and community care alongside self-management, supported by digital health solutions (EACH, 2022). Monitoring the cost-effectiveness of prescribed therapies and other innovations is essential. Recommendations should focus on improving adherence to medical advice, particularly concerning preventive medications and promoting appropriate health behaviours, including risk awareness.

Restoring CVD innovation in the EU

Currently, the pipeline of new CV drugs is limited compared with many other clinical areas including oncology and contrasts with the huge number of in-need patients [Warner 2020; Szymanski 2023]. In 2021, three new CV drugs were approved by the European Medicine Agency (EMA) among 92 positive opinions. In 2020 and 2022, no new CV drugs were approved and only one has received a positive EMA opinion in 2023. Despite representing the biggest burden of disease, the pipeline for new treatments is not reflective of a market environment appropriately calibrated to develop new solutions for CVD.
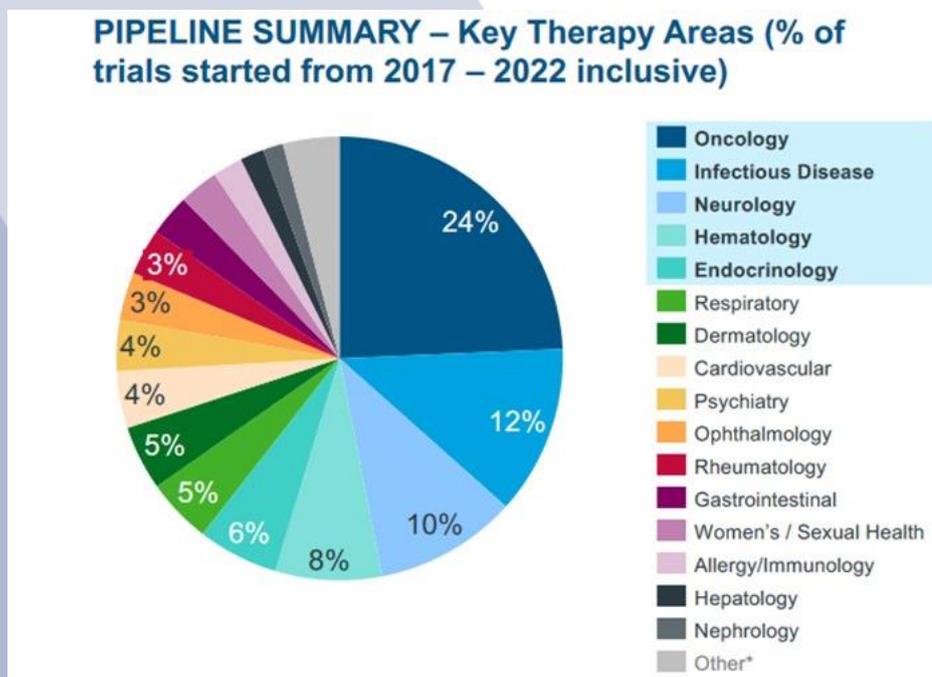
Figure 6 – Pipeline summary of key therapy areas [EFPIA Pipeline Innovation Review, 2022,]

In order for innovation in CVD to be restored, research budgets need to be allocated based at least some extent, on the mortality and morbidity of diseases.

Regulatory challenges impeding new CV treatments

Challenges causing lagging drug innovation include the duration and expense of CV clinical trials needed for regulatory evaluation and approvals, and the complexities of the approval process itself [Warner 2020]. There is also a perception that the price payers would be willing to pay for CV drugs – which are expected to yield a moderate beneficial effect on a large number of eligible patients – would not bring sufficient financial gains to industry given the high costs associated with bringing new drugs to the market [Wallentin 2019].

Enhancing patient engagement in trial design, with convenient participation and meaningful endpoints may help to improve recruitment and retention, which are major trial expenses. Indeed, research priorities should be set based on what patients themselves identify as gaps and needs. In a survey involving patients with advanced HF, the main research priority identified by patients was further research on treatments that have the biggest impact on the Quality of life [Taylor 2020].

Enhancing support for personalised CV medicine

Research is needed to better understand and treat the 40–50% of CVDs that cannot be attributed to major modifiable risk factors, including numerous orphan CVDs.

Currently, most CV treatments do not target the exact cause of the disease at the molecular level, but rather try to fix downstream processes non-specifically. With technological advances, more cause-specific and personalised management strategies have been developed for certain cancers and neurological diseases, and these 'precision' approaches are now becoming a reality in CV medicine.

New drug targets may be identified using advanced technology e.g., genomics (assesses gene expression) and proteomics (assesses protein expression). Although this research may appear expensive to conduct in the short term, it has the potential to bring considerable long-term gains and has already proved successful. Advanced technology may also provide ways to predict patient's response to certain treatments,

for example, genetic variants have been identified that reduce responsiveness or increase side effects to antiplatelet medications. [Sethi 2023].

__Recommendation:__

A longer-term perspective is needed towards funding to fuel a move towards a more personalised patient-care pathway including the development of a dedicated CV health mission as part of the next Framework Programme for Research and Innovation with more structured collaboration and emphasis on the translation of research into implementation and new models of care.

Supporting registries and real-world studies to enable the EHDS and fuel research

Only 25% of national CVD Registries in the EU are supported with public funding [Dawson 2021]. Despite strong interest from medical societies in expanding registries and real-world observational studies, a lack of resources to facilitate this is cited as the most common barrier.

This lack of support for the centralisation of high-quality data and real-world evidence serves to undermine the goals of the European Health Data Space (EHDS). Any functional EHDS will be dependent on the ability to generate robust data and this cannot be done if the bulk of society's understanding of CVDs is primarily dependent on the private sector and charitable donations.

Improvements can only be made if the epidemiology of CVDs in Europe and their real-world monitoring and treatment patterns are accurately understood and built on a strong evidence base.

__Recommendation:__

The creation of a 'European Cardiovascular Health Data Knowledge Centre' to bring together existing data and initiatives is suggested as a potential solution. One of the primary goals would be to provide comprehensive and standardised data to support treatment and care innovation, personalized management, and the enhancement of

care delivery through integrated, data-driven care pathways and outcomes measurement, all based on the latest real-world evidence.

Improving access to care and reducing inequalities

Access to specialist acute care is unequal across Europe and there is a need for governments to set targets for access to specialist care, such as stroke or cardiac care units. For example, the Action Plan for Stroke in Europe aims to achieve 90% of patients being treated in dedicated stroke units by 2030 [Norrving 2018].

Access to lifesaving treatments is also suboptimal. For example, four therapies are recommended to reduce mortality, prevent recurrent hospitalisations and improve the clinical status, functional capacity and QoL in patients with HF [McDonagh 2021 & 2023], and yet many are not prescribed these therapies or do not receive treatment promptly or at sufficient doses [Jankowska 2023; Khan 2021]. Strategies proposed to help optimise treatment include more standardised care pathways, improved use of digital tools (e.g., integration of guidelines into primary care workflow), improved education for primary care practitioners and patients, and improved access and affordability of therapies [Jankowska 2023].

Access to lifesaving procedures is problematic and varies widely across the EU [CV Realities 2022]. Middle-income countries are severely under-resourced compared with high-income countries in terms of cardiological person-power, leading to procedural deficits e.g., in coronary interventions, ablation procedures, device implantation (e.g., pacemakers and implantable cardioverter defibrillators) and in heart valve procedures (e.g., transcatheter aortic valve implantation) [CV Realities 2022].

Righting current wrongs in rehabilitation

After a CV event or stroke, and in patients hospitalised with HF, multidisciplinary rehabilitation involving medical treatment, counselling, psychological support, exercise prescription/advice and education are crucial to help prevent recurrence, improve functional capacity, recovery and psychological well-being [Ambrosetti 2021]. Rehabilitation should involve a multidisciplinary team and a clear plan for discharge from the hospital with documented responsibility for continuing rehabilitation needs in the community. Providing information and education on the perception of disease, empowerment and self-management are recommended.

A recent survey found that cardiac rehabilitation was available in 91% of European countries; however, there is only one spot for every seven patients in need, with well over 3 million more spots needed per year to treat patients with IHD alone [Abreu 2019]. When examined by region, one spot for every two patients was available for northern countries, but this reduced to one spot for every 13 patients in southern countries and one spot for every 21 patients for eastern countries. When provided, cardiac rehabilitation is often of suboptimal quality, with short duration [Ruivo 2023]. Results from the EUROASPIRE survey found that of almost 8,000 patients interviewed, only 51% were advised to participate in a cardiac rehabilitation programme and of these, 81% attended at least half of the sessions with wide variation between countries [Kotseva 2018].

Barriers to implementing prevention and rehabilitation at the patient level include low education, older age, lack of benefit awareness, comorbidities, transport problems and financial concerns [Ruivo 2023]. At the personnel level, barriers include lack of automatic referral, no financial incentives, lack of multidisciplinary teams and time consumption. Healthcare obstacles include reimbursement issues, lack of specialised locations and geographical issues. A lack of cardiology training, guidance documents, national accreditation and electronic database registries were also identified.

Life after a CVD event must be included in any national CVD plan to address survivors' and their families' long-term unmet needs and minimum standards set for what every CV survivor should receive regardless of where they live.

Recommendation:

Building on the Stroke Action Plan for Europe, it is recommended that in hospital and community based rehabilitation for cardiovascular patients should be included in all national cardiovascular health programmes in member states.

Conclusion

As it stands today, there is no stand-alone plan to tackle the EU's biggest killer.

An EU Cardiovascular Health (CVH) Plan with clear deliverables and common targets accompanied by National CVH plans, would preserve the lives and livelihoods of Europeans for generations to come.

A genuine effort to fund evidence based public health interventions in primary prevention across the EU can give youth a future and unshackle the concepts of old age and ill-health.

Early detection of cardiovascular disease and its risk factors could prevent premature death and future costs to the healthcare system.

Dedicated research programmes for cardiovascular health research could help translate novel ideas trapped in the mind of researchers without the necessary funding and transform this into an opportunity for necessary new age treatments to reduce the burden of CVDs.

Rehabilitation policies that recognise a patient's needs after they have left the hospital could ease the suffering of millions and rapidly accelerate their return to the life they wish to lead.

Investing in a dedicated Cardiovascular Health Plan would not only offer the necessary practical framework to address the EU-wide challenge of cardiovascular disease (CVD), but it would also signal a commitment by all Member States to systematically address inequalities and strive for improvement. This proactive approach signifies that the EU's leading cause of mortality will not go unchallenged. This could also take into account the ongoing actions and discussions which are taking place under the two major joint actions related to help determinants and cardiovascular diseases.

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