

# European Society of Cardiology: cardiovascular disease statistics 2021: Executive Summary

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## Aims

This report from the European Society of Cardiology (ESC) Atlas Project updates and expands upon the widely cited 2019 report in presenting cardiovascular disease (CVD) statistics for the 57 ESC member countries.

## Methods and results

Statistics pertaining to 2019, or the latest available year, are presented. Data sources include the World Health Organization, the Institute for Health Metrics and Evaluation, the World Bank, and novel ESC sponsored data on human and capital infrastructure and cardiovascular healthcare delivery. New material in this report includes sociodemographic and environmental determinants of CVD, rheumatic heart disease, out-of-hospital cardiac arrest, leftsided valvular heart disease, the advocacy potential of these CVD statistics, and progress towards World Health Organization (WHO) 2025 targets for non-communicable diseases. Salient observations in this report: (i) Females born in ESC member countries in 2018 are expected to live 80.8 years and males 74.8 years. Life expectancy is longer in high income (81.6 years) compared with middle-income (74.2 years) countries. (ii) In 2018, high-income countries spent, on average, four times more on healthcare than middle-income countries. (iii) The median PM<sub>2.5</sub> concentrations in 2019 were over twice as high in middle-income ESC member countries compared with high-income countries and exceeded the EU air quality standard in 14 countries, all middle-income. (iv) In 2016, more than one in five adults across the ESC member countries were obese with similar prevalence in high and low-income countries. The prevalence of obesity

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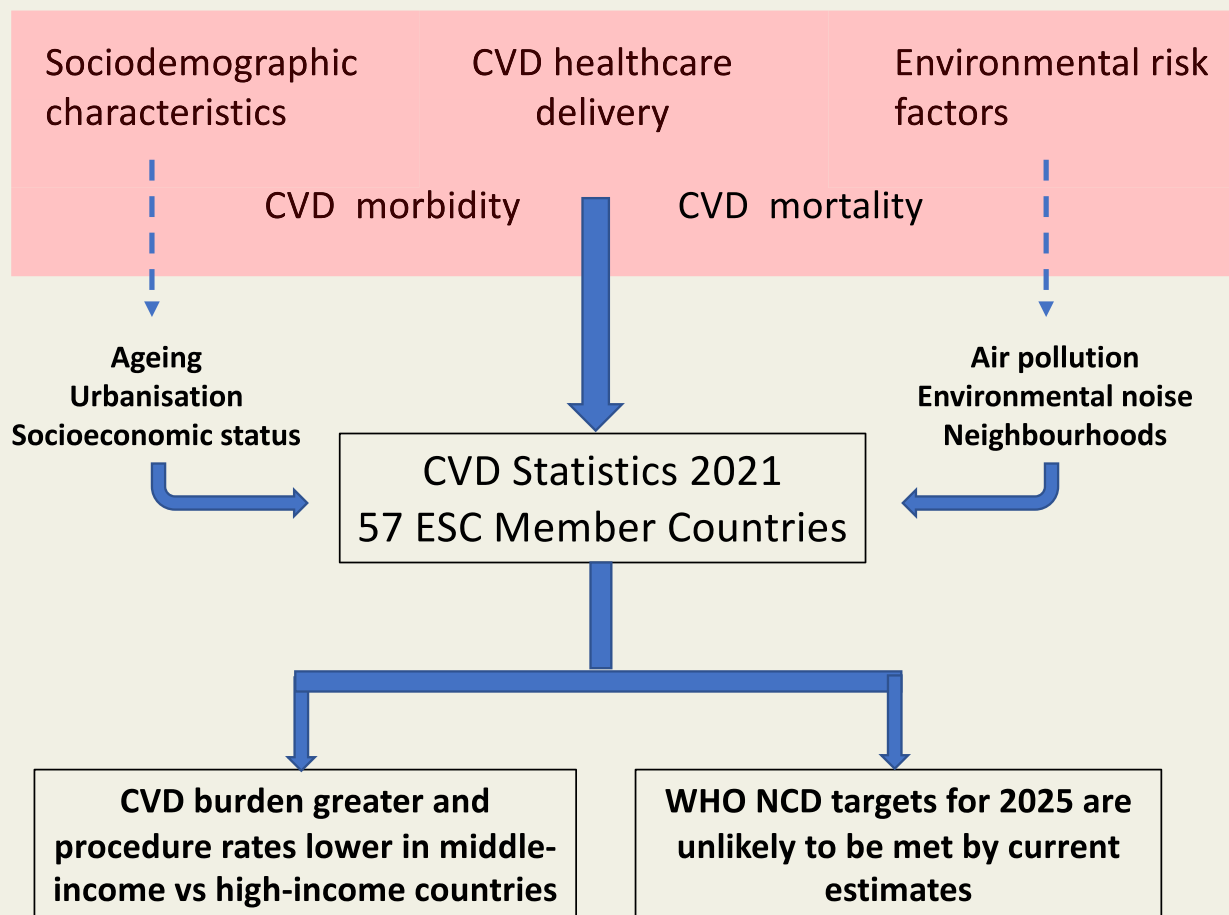
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has more than doubled over the past 35 years. (v) The burden of CVD falls hardest on middle-income ESC member countries where estimated incidence rates are ~30% higher compared with high-income countries. This is reflected in disability-adjusted life years due to CVD which are nearly four times as high in middle-income compared with high-income countries. (vi) The incidence of calcific aortic valve disease has increased seven-fold during the last 30 years, with age-standardized rates four times as high in high-income compared with middle-income countries. (vii) Although the total number of CVD deaths across all countries far exceeds the number of cancer deaths for both sexes, there are 15 ESC member countries in which cancer accounts for more deaths than CVD in males and five-member countries in which cancer accounts for more deaths than CVD in females. (viii) The under-resourced status of middle-income countries is associated with a severe procedural deficit compared with high-income countries in terms of coronary intervention, ablation procedures, device implantation, and cardiac surgical procedures.

### Conclusion

Risk factors and unhealthy behaviours are potentially reversible, and this provides a huge opportunity to address the health inequalities across ESC member countries that are highlighted in this report. It seems clear, however, that efforts to seize this opportunity are falling short and present evidence suggests that most of the WHO NCD targets for 2025 are unlikely to be met across ESC member countries.

**Graphical Abstract** This 2021 report from the ESC Atlas Project provides contemporary cardiovascular disease (CVD) statistics for 57 ESC member countries. It builds on the 2017 and 2019 reports with presentation of new data on sociodemographic and environmental determinants of CVD. Huge inequalities in disease burden persist between high-income and middle-income ESC member countries and across all member countries evidence suggests that most of the World Health Organization noncommunicable disease targets for 2025 are unlikely to be met. Advocacy to increase awareness of policy makers, members of the public and other stakeholders about the continuing importance of CVD as the leading cause of death among ESC member countries is a responsibility for all who are involved in cardio-vascular research and healthcare.



### Keywords

Cardiovascular disease • Statistics • European Society of Cardiology • Health infrastructure • Service provision • Risk factors • Mortality • Morbidity

## Abbreviations

AED	Automatic external defibrillator
ABI	Ankle—brachial index
AMI	Acute myocardial infarction
ASMR	Age-standardized mortality rate
AF	Atrial fibrillation
AVD	Aortic valve disease
BMI	Body mass index
CABG	Coronary artery bypass graft
CHD	Coronary heart disease
CHE	Current healthcare expenditure
COI	Cost of illness
CRT-P	Cardiac resynchronization pacemaker ('biventricular pacemaker')
CRT-D	Cardiac resynchronization pacemaker with implantable cardioverter defibrillator
CVD	Cardiovascular disease
DALYs	Disability-adjusted life years
Db[A]	A-weighted decibels
€	Euro
EHN	European Heart Network
EHRA	European Heart Rhythm Association
ESC	European Society of Cardiology
ESP	European Standard Population
EU	European Union
EuReCa	European Registry of Cardiac Arrest
EHN	European Heart Network
FAO	Food and Agriculture Organization of the United Nations
GBD	Global burden of disease
GDP	Gross domestic product
GNI	Gross national income
HEDIC	Health Expenditures by Diseases and Conditions
HIC	High-income countries
ICD	Implantable cardioverter-defibrillator
IHD	Ischaemic heart disease
IHME	Institute for Health Metrics and Evaluation
IQR	Inter-quartile range
LVAD	Left ventricular assist device
MIC	Middle-income countries
MVD	Mitral valve disease
NCDs	Noncommunicable diseases
NCD-RisC	Noncommunicable Diseases Risk Factor Collaboration
NCS	National cardiac societies
NHS	National Health Service
OECD	Organisation for Economic Co-Operation and Development
OHCA	Out-of-hospital cardiac arrest
PAD	Peripheral arterial disease
PCI	Percutaneous coronary intervention
PM2.5	Particulate matter $\leq 2.5 \mu\text{m}$ in diameter
PPP	Purchasing power parity
PPB	Parts per billion
PVD	Peripheral vascular disease
PYLL	Potential years of life lost
SES	Socioeconomic status
SHA	System of Health Accounts

TAVI	Transcatheter aortic valve implantation
UK	UK
USA	USA
USD	US dollars
WB	World Bank
WHO	World Health Organization

## Executive summary

This third report from the European Society of Cardiology (ESC) Atlas Project updates and expands upon the 2019 report in presenting cardiovascular disease (CVD) statistics for the 57 ESC member countries.

Statistics pertaining to 2019, or the latest available year, are presented—2020 COVID-19 pandemic data will be detailed in a later report.

New material in this report includes:

- Sociodemographic determinants of CVD
  - Environmental determinants of CVD
  - Rheumatic heart disease
  - Out-of-hospital cardiac arrest
  - World Health Organization (WHO) 2025 targets for noncommunicable diseases
  - CVD advocacy roadmap
- (1) European Society of Cardiology Atlas of Cardiology. The CVD statistics that constitute this report are drawn from the ESC Atlas of Cardiology (henceforth called the ESC Atlas) that is compiled and regularly updated by the European Heart Agency in Brussels. Its key objectives are to:
    - Assess and compare CVD burden across ESC member countries;
    - Drive policy initiatives to help reduce inequalities in CVD burden;
    - Map European CVD healthcare delivery;
    - Provide a one-stop source of CVD statistics for academics, clinicians, and other stakeholders.
  - (2) Data sources and presentation. The ESC Atlas is a repository of CVD data collected by groups such as the WHO, the Institute for Health Metrics and Evaluation (IHME), and the World Bank (WB). It also includes novel ESC sponsored data on human and capital infrastructure and cardiovascular (CV) healthcare delivery obtained by bi-annual survey of the national CV professional societies of ESC member countries.

Throughout this report, ESC member countries are categorized according to 2020 WB definitions as high-income and middle-income (a composite of lower-middle-income and upper-middle-income countries that includes Syrian Arab Republic now designated as low-income) to permit stratified presentations of CVD statistics by national income status.

The data sources come with important limitations that include:

- adjustments to account for missing data applied by all data providers;

- differences in reporting practices causing variable precision of national data estimates;
- misclassification bias due to miscoding of diagnostic groups and death certificates;
- hidden within-country inequalities in disease burden and health-care delivery;
- aggregation of 2020 WB national classifications as detailed above.

The limitations as they apply to the quality, precision, and availability of the data emphasize the need for agreed, standardized data collection systems throughout the region. Meanwhile, cautious interpretation of the CVD statistics presented in this report is recommended.

- (3) National sociodemographic factors. Population ageing in high-income European countries, where fertility rates have fallen below replacement levels, leads to sustained high rates of CVD mortality. Populations are also ageing in many middle-income countries as life expectancy increases and this will exacerbate the growing burden of CVD. These epidemiological shifts are compounded by increasing urbanization across Europe which threatens CV health due to overcrowding, air pollution, social deprivation, and stress. The growth of the elderly population across ESC member countries increases the need for young immigrant groups to supplement national workforces. Socioeconomic deprivation is common in these groups and is associated with a range of health inequalities such as hypertension, diabetes, and premature coronary heart disease. Health inequalities are also associated with other deprivation metrics including unemployment and poor education which remain important drivers of ill health across all ESC member countries.
- (4) Financial and economic burden of cardiovascular disease. In order to meet the economic challenges of CVD, policymakers need access to reliable information about CVD healthcare costs and the broader impacts on national economies. Information is incomplete but shows that current healthcare expenditure (CHE) per capita varies widely, with high-income European countries spending four times more on healthcare than many middle-income countries. Expenditure for CVD represents the highest component of healthcare cost, and in 2016 accounted for ~16% of the spend in a selection of 11 high-income European countries. The European Heart Network has estimated that CVD costs the EU economy more than €200 billion a year.
- (5) Risk factors and health behaviours
  - Environmental risk factors. These include air pollution and noise which account for over 75% of the CVD burden attributable to the environment. In 2019, air pollution with particulate matter  $\leq 2.5 \mu\text{m}$  in diameter (PM<sub>2.5</sub>) exceeded the EU air quality standard in 14 middle-income countries while noise exposure was estimated to exceed recommended residential limits in up to 40% of people living in the EU.
  - Health behaviours. Declines in the prevalence of smoking have made major contributions to CVD mortality reductions across ESC member countries but in many middle-income countries, where the prevalence of smoking among males remains high, declines in CVD mortality have been smaller. Physical inactivity (<150 min of moderate physical activity

or,75 min of vigorous physical activity per week) affects an estimated one in three adults living in ESC member countries and is more common in high-income compared with middle-income countries. Dietary factors associated with heightened CVD risk include trans fatty acids and sugar, both of which are consumed in greater quantity in high-income compared with middle-income ESC member countries. High-income countries also consume larger amounts of sugar-sweetened beverages and lower amounts of vegetables and fruit.

- Clinical risk factors. Rates of elevated blood pressure ( $\geq 140/90$  mmHg) across ESC member countries have declined by 35% in the last 35 years, but almost one in four people remain affected. Systolic blood pressure is higher in males compared with females and in middle-income compared with high-income countries. During the last 40 years, declines in total and non-HDL cholesterol concentrations of about 15 and 20%, respectively, have been recorded in high-income countries but in middle-income countries, where concentrations remain lower, little change has occurred. The prevalence of obesity (BMI  $\geq 30$  kg/m<sup>2</sup>) has increased steeply across all ESC member countries during the last 40 years and now affects more than one in five adults. This has been associated with an increased prevalence of diabetes which, in 2019, affected 6.9 and 5.8% of adults in middle-income and high-income countries. Obesity and diabetes have been described as one of the biggest global health crises of the 21st century.
- (6) Cardiovascular disease morbidity. During the last 30 years, declines in the age-standardized incidence of CVD across ESC member countries have been small and in seven middle-income countries variable increases have been recorded. Age-standardized incidence estimates for the major components of CVD, ischaemic heart disease (IHD) and stroke, were twice as high in middle-income compared with high-income countries and for IHD were also twice as high in males compared with females. For stroke, incidence rates were similar by sex. Incidence estimates for both disorders have declined by 0.25% during the last 30 years, predominately in high-income countries, but the continuing impact of IHD and stroke on population health remains devastating for both females and males with these disorders accounting for an estimated 70 million disability-adjusted life years (DALYs) across ESC member countries in 2019. Rheumatic heart disease (RHD) is a disease of poverty driven by poor housing and overcrowding and although incidence rates across ESC member countries have declined by ~40%, in the last 30 years, they remain twice as high in middle-income compared with high-income countries. Unlike RHD, calcific aortic valve disease has been recorded with increasing frequency in recent years, especially in high-income countries where estimated incidence is four times higher compared with middle-income countries. The morbidity statistics recorded in the ESC Atlas confirm persisting inequalities in disease burden by sex and national income status. The statistics emphasize the need for concerted application of CVD prevention policies, particularly in middle-income countries where the need is greatest.

- (7) Cardiovascular disease mortality. Death is one of the most accurately ascertained CVD outcomes and provides a useful measure of disease burden. CVD is the most common cause of death in ESC member countries with IHD accounting for 45% of these deaths in females and 39% in males. The total number of CVD deaths across all ESC member countries far exceeds the number of cancer deaths for both sexes, but there are 15 ESC member countries in which cancer accounts for more deaths than CVD in males and five member countries in which cancer accounts for more deaths than CVD in females. All of these countries are classified as high income. There are large disparities between high and middle-income countries in the proportion of premature deaths (>70 years) caused by CVD. Disparity is greater for females, with a median of 36% of all premature deaths caused by CVD in middle-income countries compared with 16% in high-income countries. For males, the corresponding figures are 36 and 24% in middle and high-income countries, respectively. Age-standardized mortality rates (ASMRs) for CVD have been in decline since 1990 by 47% in males and 42% in females. In high-income countries, reductions in ASMRs have exceeded 50% in both sexes but in middle-income countries, declines have been smaller, not exceeding 15%, with some countries experiencing increases in ASMRs.
- (8) Cardiovascular healthcare delivery. This ESC ATLAS survey showed continuing heterogeneity in cardiological services in terms of human and capital resources and the delivery of high-quality healthcare. Variation in the availability of cardiologists suggests substantial under-provision in many countries, with a notable sex imbalance (females comprised fewer than a third of all cardiologists) potentially compromising care quality. Middle-income member countries were often under-resourced compared with high-income countries with numbers of cardiologists lower by a third, interventional cardiologists lower by nearly a half, 24 h/7 day catheter laboratory availability lower by a third and catheter laboratories for treatment of structural heart disease lower by nearly two-fold. This structural deficit affecting person power and facilities inevitably translated into a substantial procedural deficit in middle-income compared with high-income countries in terms of coronary intervention, device implantation, and cardiac surgical procedures. This mismatch between the therapeutic need of middle-income countries and the available therapeutic resource requires action through policy strategies to reduce the population burden of CVD while increasing spending on human and capital infrastructure.
- (9) World Health Organization noncommunicable disease targets. The WHO has set noncommunicable disease (NCD) targets relevant to global CV health to be achieved by 2025 (with reference to 2010). The period 2010–2018 has seen small declines in alcohol consumption across ESC member countries but our linear forecasts predict the WHO target for a 10% relative reduction in harmful use of alcohol is unlikely to be met. Longitudinal data for smoking in ESC member countries were patchy and incomplete but appeared to show a 20% decline in smoking prevalence across ESC member countries between 2010 and 2018. This was largely confined to high-income countries where our linear forecasts suggest the WHO smoking target will be achieved—yet, in middle-income countries, smoking prevalence was higher and appeared to show little change between 2010 and 2018. The WHO target for a 25% reduction in the prevalence of elevated blood pressure is unlikely to be met based on data for the period 2010–2015 when the median prevalence of elevated blood pressure across ESC member countries declined by only 3.4%. However, declines of  $\sim 0.10\%$  were recorded in females and males living in high-income countries where our linear forecasts suggest the WHO target is feasible if current trends continue. Analysis of paired 2010 and 2016 national data showed a continuing upward trajectory in the prevalence of obesity affecting  $\sim 0.20\%$  of people living in ESC member countries, making it very unlikely the WHO call for a halt in the rise of obesity will be met by 2025. The WHO call for a halt in the rise of diabetes will also not be met based on data showing a nearly 30% increase in prevalence between 2010 and 2015.
- (10) The CVD advocacy roadmap. One hundred and thirteen million people across ESC member countries continue to live with CVD. Notwithstanding declines in CVD mortality in many countries, CVD remains the most common cause of death within the region. Despite this, cancer is commonly perceived as a more important health concern and attracts more research funding compared with CVD. The ESC has called for advocacy programmes to inform policymakers of the societal harms of CVD and the need for targeted action to reduce the burden of disease in those ESC member countries where the burden is greatest. Five priorities have been identified in the ESC's advocacy roadmap:
- *Changing popular perceptions of CVD* to embrace the broad range of disorders, including degenerative valve disease and congenital heart disorders, in order to better understand the need for new therapeutic strategies in advocating for patients living with non-preventable CVD.
  - *Making CVD a health priority*, calling upon the voices of patients and all stakeholders to be heard in bringing CVD onto the policy agendas of national decision-makers.
  - *Getting involved with decision-makers* at the national level to establish regional advocacy structures aimed at improving CVD prevention and care.
  - *Promoting research and innovation* by advocating for increased CVD research funding and reductions in the complexities of regulatory processes in order to facilitate translation of innovative research findings for clinical benefit of patients with CVD.
  - *Coordinating and harmonizing ESC advocacy activities*, recognizing that the ESC is home to large numbers of dedicated scientists and clinicians with unique expertise in CV science and healthcare. Harmonization of this workforce provides huge potential for advocacy on behalf of the 113 million people living with CVD across ESC member countries.
- (11) Salient observations
- Females born in ESC member countries in 2018 are expected to live 80.8 years and males 74.8 years. Life expectancy is longer in high-income (81.6 years) compared with middle-income (74.2 years) countries.

- In 2018, high-income countries spent, on average, four times more on healthcare than middle-income countries.
- The median PM<sub>2.5</sub> concentrations in 2019 were over twice as high in middle-income ESC member countries compared with high-income countries and exceeded the EU air quality standard in 14 countries, all middle income.
- In 2016, more than one in five adults across the ESC member countries were obese with similar prevalence in high and low-income countries. The prevalence of obesity has more than doubled over the past 35 years.
- The burden of CVD falls hardest on middle-income ESC member countries where estimated incidence rates are ~30% higher compared with high-income countries. This is reflected in DALYs due to CVD which are nearly four times as high in middle-income compared with high-income countries.
- The incidence of calcific aortic valve disease has increased seven-fold during the last 30 years, with age-standardized rates four times as high in high-income compared with middle-income countries.
- Although the total number of CVD deaths across all countries far exceeds the number of cancer deaths for both sexes, there are 15 ESC member countries in which cancer kills more males than CVD and five member states in which this is the case for females. All of these countries were classified as high income.
- The under-resourced status of middle-income countries is associated with a severe procedural deficit compared with high-income countries in terms of coronary intervention, ablation procedures, device implantation, and cardiac surgical procedures.