Is Cardiovascular Disease Slowing Improvements in Life Expectancy?

OECD AND THE KING'S FUND WORKSHOP PROCEEDINGS

OECD

The King's Fund

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Foreword

Improvements in life expectancy at birth observed before the COVID-19 epidemic had slowed considerably in most OECD countries in recent years. Longevity gains fell on average 25%, when comparing the period between 2012 and 2017 to a decade earlier. One reason behind this is that cardiovascular disease (CVD) mortality improvements are now substantially lower than what they used to be in some countries. CVD is a major killer in OECD societies, causing many preventable deaths and large social inequalities. CVD mortality improvements recorded a reduction of over 50% in the United States, Italy, the Netherlands, Austria, Ireland, and Canada since 2010, relative to the prior decade. The same can be said for men in Portugal and women in Israel and Iceland.

Several reasons underpin this trend. For a start, the prevalence of underlying lifestyle risk factors that cause CVD is rising. Rising trends in obesity and diabetes are estimated to offset the mortality reductions attributed to favourable changes in smoking. OECD estimates that overweight-related diseases will reduce life expectancy by nearly three years by 2050, without further policy action. Furthermore, newly emerging risk factors are contributing to higher CVD mortality, like drug overdose and air pollution. Severe influenza outbreaks in some recent winters, as in 2014-15, could also have impacted on CVD mortality, as influenza and pneumonia can trigger cardiovascular events like heart attacks, and in turn, individuals with CVD may be more susceptible to dying from influenza or pneumonia.

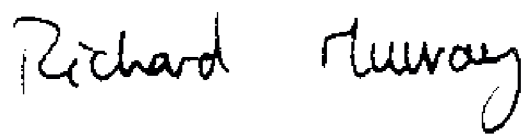
The decelerating improvement in CVD mortality is a major cause for concern with implications for policy and research. First, these trends send a warning call for further action in primary prevention, early detection and secondary prevention. Health systems must better balance priorities between prevention – now accounting for less than 3% of total health spending – and treatment. Policies focussed on prevention that stimulate lifestyle changes need to be a priority universally, but health systems must also do better at delivering more cost-effective early detection and diagnosis. Some 40 to 72% of avoidable deaths are attributable to risk factors such as smoking, blood pressure and cholesterol levels, while 23 to 55% are linked to access to acute care and secondary prevention.

Second, it remains urgent to address the large inequalities in CVD prevalence and mortality that penalise the most disadvantaged subgroups of the population. Reducing the unequal burden of CVD is likely to require a combination of targeted policies that go well beyond the health sector, such as housing, employment, and environmental policies, alongside strategies to improve diets, and reduce smoking and alcohol intake among these population groups. A move towards structural population-level prevention, such as fiscal and regulatory measures, can be effective and help to free resources to invest in other pressing areas, like the interface between health and social care. This would further help reduce inequalities, and tackle the pressures on health systems exerted by population ageing. Better understanding of which combination of strategies can offer the best overall approach for tackling the challenge of CVD in our populations over time is therefore an urgent research priority to support policy decisions.

Third, there is a pressing need to improve the underpinning data and monitoring processes, making health data infrastructures more fit-for-purpose for understanding these trends. Data to support timely and effective monitoring of CVD mortality and morbidity is lacking, and the same applies for monitoring of risk factors for CVD such as overweight, blood pressure, smoking, air pollution, and drug abuse. More efforts must be made to optimise the use of existing data systems through linkage of epidemiological surveillance, clinical and administrative datasets, including primary and hospital care records, clinical data and death records. This will be particularly critical in the current COVID-19 epidemic where people with CVD are amongst the population subgroups with the highest mortality risk.

The King's Fund and the OECD joined forces to raise awareness about the magnitude of these challenges and the need for an urgent policy response to address CVD mortality. This publication is the result of this collaboration. Based on discussions that took place in a joint workshop at OECD in Paris, it presents the evidence on trends in CVD mortality, and their contribution to the slowdown in improvements in life expectancy in some OECD countries. The workshop showed that there is still a long road to be travelled to better understand why we see these trends, and what action is needed to reverse them. Our hope is that this publication will help to shed some lights and support better policies in the future.

Stefano Scarpetta,
Director, Employment, Labour and Social Affairs,
OECD



Richard Murray,
Chief Executive,
The King's Fund

This report was produced in 2019, prior to the onset of the COVID-19 pandemic. The findings were designed to provide a meaningful interpretation of mortality trends prior to this pandemic. The COVID-19 pandemic could have an impact on life expectancy trends in 2020. The issues discussed in this report will nonetheless be relevant in the longer term when the effects of the pandemic subside.

Acknowledgements

This publication describes the proceedings and conclusions of a joint King's Fund and OECD workshop on trends in CVD mortality, their main drivers and the associated policy implications. The principal aims of the workshop were to:

- Raise international awareness of the recent slowdown in CVD mortality improvements in several high-income countries, and the contribution of these trends to the slowdown in improvements in overall life expectancy;
- Consider available evidence on the potential causes of this slowdown;
- Identify the key implications for policy and ongoing national and international monitoring; and
- Consider how further work on this important global policy issue can be fostered, including through international dialogue and collaboration.

This report was compiled by Eliana Barrenho (OECD) and Veena Raleigh (The King's Fund) and includes contributions by the invited speakers who generously offered their expertise in CVD and authored papers that comprise five chapters of this publication. They include:

- Ms Susanne Løgstrup, Director of the European Heart Network, Belgium, who presented material from the European Cardiovascular Disease Statistics – 2017 edition.
- Professor Jessica Ho, Assistant Professor of Gerontology and Sociology, University of Southern California, United States, who discussed the causes of gains and losses in life expectancy in OECD countries.
- Dr Catherine Johnson, Lead Research Scientist in Cardiovascular Disease, Institute of Health Metrics and Evaluation, University of Washington, United States, who presented the global trends in CVD mortality – an update from the Global Burden of Disease Study.
- Professor Anton Kunst, Professor of Social Epidemiology, Amsterdam UMC, University of Amsterdam, The Netherlands, who presented an overview of inequalities in CVD mortality and their determinants.
- Professor Martin O'Flaherty, Professor of Epidemiology, University of Liverpool, United Kingdom, who discussed the trends in CVD drivers and policy options for improving CVD health.

The authors are also grateful to members of the OECD Health Care Quality and Outcomes (HCQO) Working Party who attended the workshop for their time, preparation of the country factsheets, contributions to the discussions, and sharing of their country's experiences. HCQO members, and some other representatives, from the following 19 countries attended the workshop: Australia, Austria, Denmark, Finland, France, Ireland, Israel, Japan, Korea, Latvia, Luxembourg, Netherlands, Norway, Portugal, Romania, Singapore, Slovenia, Switzerland, and the United Kingdom. The authors would also like to acknowledge the case study material for France, Portugal and the United Kingdom included in this report, kindly provided by Professor Nicolas Danchin, Santé Publique France, Haute Autorité de Santé, the Portuguese Directorate General of Health and Public Health England, respectively.

The report benefited from valuable comments from Richard Murray, Stefano Scarpetta, Mark Pearson, Francesca Colombo, Frederico Guanais and Niek Klazinga. The authors are grateful to Lucy Hulett, Natalie Corry, Christina Kim and Gabriel Di Paolantonio for their respective editorial contributions. Finally, the assistance of several OECD staff during the workshop is gratefully acknowledged. The event was assisted by Hannah Whybrow, Christina Kim and Duniya Dedeyn. The event was chaired by Niek Klazinga and small groups discussions between the participants were facilitated by Michael Padget, Rie Fujisawa, Ian Brownwood and Yevgeniy Goryakin.

This report is organised in seven chapters.

- Chapter 1 provides an overview of the key findings resulting from the workshop in what regards international evidence on CVD mortality trends, its drivers and associated policy implications.
- Chapters 2, 3, 4, 5 and 6 present contributions authored by the five invited speakers, to supplement the material in their workshop presentations, which are also available online.
- Chapter 2 provides an overview of recent trends in CVD mortality in European countries (authored by Ms Susanne Løgstrup).
- Chapter 3 analyses the causes of gains and losses in life expectancy across OECD countries (Professor Jessica Ho).
- Chapter 4 outlines an update of global trends in CVD from the Global Burden of Disease Study (Dr Catherine Johnson).
- Chapter 5 provides an overview of patterns and determinants of socio-economic inequalities in CVD mortality (Professor Anton Kunst).
- Chapter 6 discusses the drivers of CVD mortality and policies for tackling them (Professor Martin O'Flaherty).
- Finally, Chapter 7 discusses the key messages and conclusions emanating from the workshop, and the OECD's and The King's Fund's analysis of their implications.
- There is also available supplementary material on the OECD webpage, namely: workshop agenda, list of attendees, presentations by the invited speakers, and biographies of the speakers. Please use the link to the webpage to access to this information: https://www.oecd.org/health/is-cardiovascular-disease-slowing-improvements-in-life-expectancy-47a04a11-en.htm.

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Executive summary

Recently published data in *Health at a Glance 2019* show that gains in life expectancy at birth across OECD countries have slowed considerably in recent years. Evidence of this slowdown and its drivers have been highlighted in an OECD Working Paper on trends in life expectancy in the European Union (EU) and some other high-income countries.

Other than in the United Kingdom and the United States, in many countries the underlying drivers of these trends have not been fully examined. While the underlying causes will doubtless vary between countries, the available evidence to date suggests there are also some common drivers. Collaborative international investigations can facilitate improved understanding of common drivers and inform appropriate policy action.

Decelerating rates of improvement in cardiovascular disease (CVD) mortality are a major contributor to the recent slowdown in improvements in life expectancy at birth observed in the United Kingdom and the United States. Although less is known about how much CVD contributes to the slowdown in overall mortality improvements in other countries, the pace of CVD mortality improvement is slowing also in many European countries. A joint OECD and King's Fund international workshop held in Paris on 6th November 2019 called for greater international awareness of this issue and further international collaboration to better inform policies. The workshop raised domestic and international awareness of the slowdown in CVD mortality improvements, against the background of slowing improvements in overall mortality, and initiated international dialogue about the potential causes. It drew attention to the need for effective monitoring and policies to reverse the slowdown. Key findings as reflected in these proceedings are as follows.

CVD is a leading cause of death contributing to the slowdown of life expectancy gains in several OECD countries

- CVD remains a leading cause of death in many OECD countries, despite the dramatic improvement in CVD mortality globally since the 1970s that delivered significant increases in life expectancy. In the European Union (EU), CVD is the leading cause of death accounting for 37% of all deaths and 22% of premature deaths, with a greater than six-fold variation in mortality between member states. The economic burden of CVD is estimated to cost the economies of the EU around EUR 210 billion per year (2015 figures), half of which is health care spending and 26% is lost productivity.
- Today, CVD mortality is about half of the levels in 1995, mostly because of reductions that occurred before 2010. Lower CVD mortality made the largest contribution to gains in life expectancy both before and after 2010. However, after 2010 CVD mortality has been plateauing or even increasing in several OECD countries.
- The magnitude of the slowdown of CVD mortality improvement is considerable in some countries. For example, in the United States the average annualised rate of reduction in CVD mortality among men fell from 13.63 deaths per 100 000 greater between 2000 and 2010 to 3.19 deaths since 2010 – a reduction of more than 70%. Also, Italy recorded significantly lower rates of reduction in CVD

mortality in both sexes of 66% since 2010, compared to the period between 2000 and 2010. Rates of reduction in CVD mortality greater than 50% since 2010 (when compared with the prior decade) were also recorded in some other OECD countries like the Netherlands, Austria, Ireland and Canada among men and women, Portugal among men, and Israel and Iceland among women.

- The main risk factors driving CVD mortality are potentially avoidable. Rising prevalence of several common risk factors for CVD, including elevated low-density lipoprotein cholesterol, systolic blood pressure, fasting plasma glucose and BMI, are contributing to decelerating improvements in CVD mortality.
- Inequalities in CVD mortality are wide even in European countries with generous welfare schemes. Such inequalities are associated with a socio-economic gradient in the major CVD risk factors. Biological and lifestyle factors are influenced by wider determinants such as social status and societal, economic, cultural and environmental conditions. For example, in England avoidable CVD mortality at ages under 75 years varies approximately four-fold between the most and least deprived groups.
- Recent trends in some European countries show that absolute inequalities in CVD mortality between socio-economic groups have narrowed since the 1990s, with improvements in equitable access and the quality of medical care. However, relative inequalities in CVD mortality have widened and reducing them further remains an important challenge for European health systems.

Reducing CVD mortality and socio-economic inequalities remains urgent: the economic costs of inaction are high

- CVD remains a major killer and the economic costs of inaction are high. For example, the cumulative health, social care and informal care cost of the slowdown in CVD mortality improvements in England and Wales over 2020-29 is estimated to total GBP 47.6 billion.
- There is a need to avoid complacency about CVD mortality and the assumption that falling trends would continue into the future. Lifestyle risk factors remain a major preventable contributor to deaths, including premature mortality. Evidence consistently shows that increases in obesity and diabetes offset a significant proportion (10-14%) of the mortality reductions attributed to favourable changes in other risk factors, including smoking. The OECD estimates that overweight will claim as many as 92 million lives and obesity and overweight-related diseases will reduce life expectancy by nearly 3 years by 2050.
- Stronger prevention measures and continued investment in earlier diagnosis and treatment of CVD are needed. Population-level policies, including fiscal and regulatory measures to stimulate lifestyle changes, and policy actions related to food policy, alcohol intake, physical activity and smoking can deliver large and rapid health and economic gains in terms of reducing CVD mortality. Evidence across OECD shows about 40 to 72% of falls in deaths can be attributed to risk factors declines in smoking, blood pressure and cholesterol levels, and 23 to 55% to access to acute care and secondary prevention.
- Such policies can be cost-effective, have a rapid impact and reduce pressures on the health care system, not requiring health care resources while reducing social inequalities in CVD. Reducing the unequal burden of CVD is also likely to require a combination of targeted policies beyond the health sector, in deprived communities, alongside structural policies to improve diets, increase physical activity and reduce smoking and alcohol intake. These policies need to address social constructs and the wider, “upstream” determinants of ill health beyond individual lifestyle and health-related behaviours, such as housing, employment, urban renewal and the environment. Evidence offers insights of health gains achieved by combining approaches to identify and manage high-risk individuals alongside population-level strategies on smoking and food.

More effective monitoring and better data are needed to inform policy action

- Several constraints in currently available data on CVD are obstacles to the timely and informative monitoring of levels and trends in CVD and its determinants. A number of improvements to data systems would make data flows more comprehensive, timely, efficient and relevant in the context of changing epidemiological patterns, and fit-for-purpose for monitoring and supporting appropriate service responses. This will facilitate more effective monitoring of mortality trends at national and sub-national levels, and internationally, and facilitate the early identification of slowing improvements and adverse trends.
- Improvements are also needed to harmonise coding practices over time and across countries. Current differences in coding practices for diagnostics, comorbidities and causes of death across countries and over time hamper trend analyses.
- More can be done to improve monitoring though linkage of different datasets (e.g. primary and hospital care records, clinical data and death records), which can greatly enhance monitoring capabilities for assessment of risk factors, health care needs and use of services across different population groups, and inform policy action.
- Better monitoring is also needed on the newly emerging risk factors for CVD such as air pollution and drug abuse. Rising mortality associated with drug use (prescribed and illicit) in the United States and several European countries, along with some severe influenza and pneumonia seasons in recent years, have contributed to CVD deaths and slowing improvements in life expectancy.

The case for action is strong: next steps

This publication presents the proceedings from a workshop on CVD mortality convened jointly by The King's Fund and OECD. It raises awareness about the decelerating improvements in CVD mortality rates in several OECD countries, and its implications for policy and monitoring. CVD remains a major killer and its risk factors continue to cause many preventable deaths and large socio-economic inequalities in mortality rates. In addition, there is a risk that the rising prevalence of obesity and diabetes globally could erode or even reverse the mortality gains made to date.

Such warning signs call for urgent action from policy makers and researchers. More is needed to better understand and implement a mix of appropriate policies targeting effective early detection, primary prevention, secondary prevention and treatment. Additional improvements in data and monitoring processes will be key to making data systems and data flows more comprehensive, timely, efficient, and relevant in the context of changing epidemiological patterns, and fit-for-purpose for policy responses. This publication discusses the evidence and priorities for taking further action.

1 Cardiovascular disease mortality: Key evidence

Cardiovascular mortality today is about half the level in 1995, but improvements have slowed significantly since 2010. Cardiovascular disease made the largest contribution to gains in life expectancy both before and after 2010, but its contribution to life expectancy gains in some OECD countries fell after 2010. There is a strong need to improve national and international data and monitoring to support more timely and effective policy responses for preventing, managing and treating cardiovascular disease and associated risk factors, and for tackling socio-economic and gender inequalities.

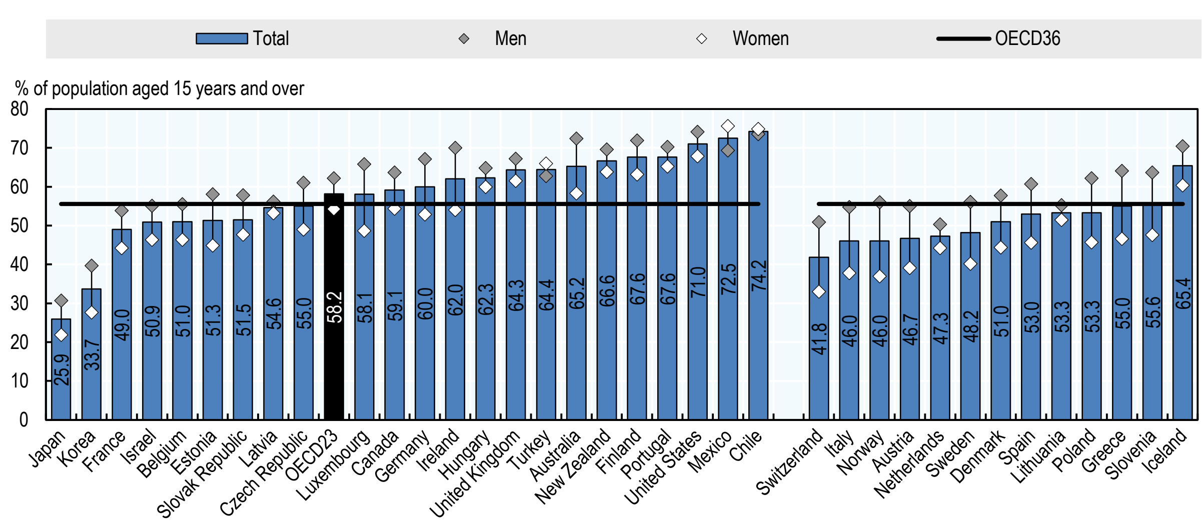
There is a strong need for international collaboration to support policy action given emerging evidence of the slowdown in improvements in life expectancy at birth in several OECD countries since 2010 (Raleigh, 2019[1]), and the need for better understanding of the contribution of CVD to this slowdown (Public Health England, 2018[2]; American Heart Association, 2018[3]). Available evidence to date suggests there are some common trends and drivers across countries and therefore collaborative international investigations can facilitate improved understanding of common drivers and inform appropriate policy action.

Mark Pearson, Deputy Director of the OECD Directorate of Employment of Labour and Social Affairs emphasised how the trend towards decelerating improvements in CVD mortality rates calls for a global response in terms of better and more timely evidence to inform decision-making in this area. This includes a better understanding of: (i) CVD risk factors and the drivers of the slowdown; (ii) cost-effective interventions for both prevention and treatment; (iii) attainable life expectancy gains from current medical technology; and, (iv) models of care delivery in different health systems. One of the main drivers of CVD – being overweight – is expected to result in an enormous economic burden: 3.3% of GDP on average in both OECD countries and EU member states between 2020 and 2050 (OECD, 2019[4]).

Richard Murray, Chief Executive of The King's Fund, described the increasing concerns about the slowdown in life expectancy improvements in the United Kingdom since 2011. International collaboration, including among countries and between institutions such as The King's Fund and OECD can help inform the national policy debate regarding best practice for timely monitoring of population-level mortality trends, and understanding of common trends and disease drivers of this phenomenon, including CVD mortality. The economic consequences of these trends, including on long-term forecasts of social care spending and pension expenditure, have been flagged in the United Kingdom.

Reductions in CVD mortality have driven significant increases in life expectancy globally since the 1970s. However, CVD remains one of the leading causes of death in most high-income countries, and evidence shows many of these deaths are potentially preventable. For example, although being overweight is a major risk factor for CVD, 58% of adults were overweight or obese in 2017 on average across 23 OECD countries with comparable data, and the prevalence of obesity is rising globally (Figure 1.1) (OECD, 2019[5]). Given the substantial potential for further reductions in CVD mortality in most countries, the recent slowdown in CVD mortality improvements in several countries is an unwelcome development that needs to be addressed.

Figure 1.1. Overweight including obesity among adults by sex, measured and self-reported, 2017 (or nearest year)



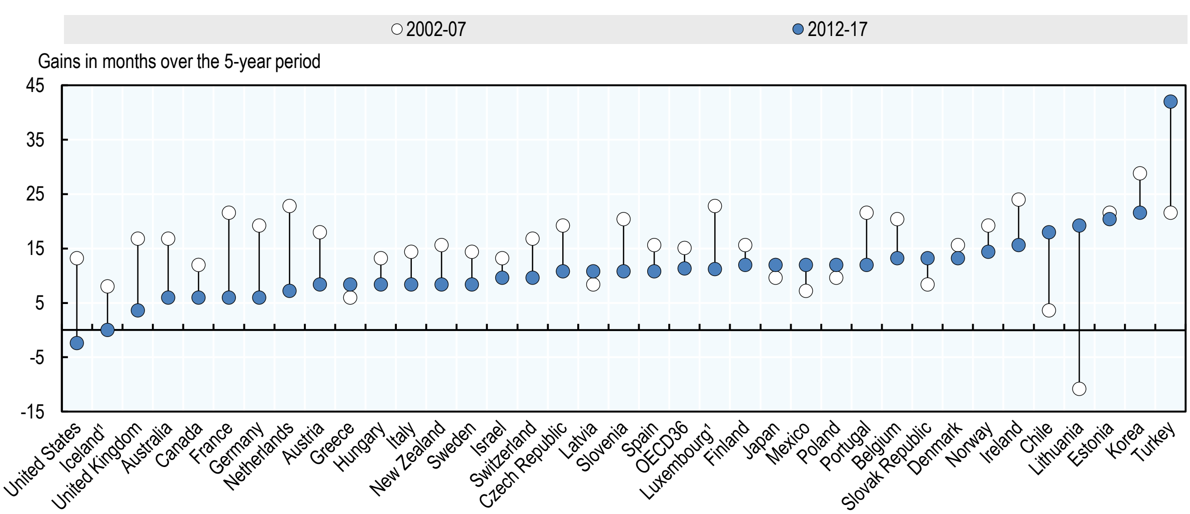
Note: Left- and right-hand side estimates utilise measured and self-reported data, respectively. OECD36 average includes both data types.
Source: OECD (2019[4]) *The Heavy Burden of Obesity*, https://doi.org/10.1787/67450d67-en.

Improvements in life expectancy are slowing in many high-income countries

Dr Veena Raleigh provided an overview of why current trends in CVD mortality in some countries are a cause for concern. Life expectancy at birth varies significantly in EU countries, although differences have narrowed somewhat over the years. In 2016, life expectancy at birth varied by 11.5 years in males and by 7.8 years among females, with levels generally being lower among the Eastern European countries. Although male life expectancy exceeds female life expectancy in all countries, the gender divide is wider among Eastern European countries. Life expectancy in the United States is below the EU average, whereas in Australia, Canada and Japan it is higher than the EU average. Japan has the highest female life expectancy globally (Raleigh, 2019[1]).

In several EU countries, the pace of improvement in life expectancy has slowed over the past decade (Figure 1.2). Improvements slowed also in Australia and Canada. Japan showed the reverse pattern, with little improvement in longevity in the 5 years prior to 2011, and a marked acceleration thereafter. Overall, the slowdown has been greatest in the United States, where life expectancy has fallen in recent years, but other countries such as the United Kingdom, France, Germany, Sweden and the Netherlands have also experienced significant slowdowns.

Figure 1.2. Slowdown in life expectancy gains, 2012-17 and 2002-07



1. Three-year average.
Source: OECD (2019[5]), *Health at a Glance 2019*, https://doi.org/10.1787/4dd50c09-en.

In some countries, CVD has been a significant contributor to the slowdown

Diseases of older ages are the main contributors to the slowdown in improvements in life expectancy. Improvements in CVD mortality have slowed in many countries, respiratory diseases (including influenza and pneumonia) claim excess lives in some winters, and deaths from dementia and Alzheimer's disease are rising. Although the impact on overall mortality is less than some of these other drivers, it is noteworthy that in some countries (notably the United Kingdom and the United States) mortality improvements have slowed or even reversed among working age adults, largely due to accidental deaths including drug-related deaths (Raleigh, 2019[1]; Public Health England, 2018[2]; Ho and Hendi, 2018[6]; Office for National Statistics, 2018[7]).

The focus of the workshop was to discuss the existing evidence about the contribution of CVD to the slowdown in life expectancy gains. Despite very significant falls in CVD mortality over the past 50 or so years, CVD remains a major killer in many high-income countries, and is the leading cause of death in the EU. CVD mortality rates vary significantly among the EU countries, with rates in Eastern European countries being over four times higher than in some other EU countries. In the United Kingdom, CVD is responsible for 1 in 4 premature deaths, and CVD is among the largest contributors to socio-economic inequalities in life expectancy.

An analysis by Public Heath England (PHE) concluded that the slowdown in CVD mortality improvements was a significant contributor to the slowdown in improvements in life expectancy in England since 2011 (2018[2]). CVD mortality improvements are slowing or plateauing also in some other European countries and the United States (Shah et al., 2019[8]; Shah et al., 2019[9]).

The risk factors driving CVD mortality are potentially avoidable

A significant proportion of the morbidity and mortality associated with CVD is preventable. A large body of evidence shows that there is significant potential for reducing CVD deaths further through primary and secondary prevention measures aimed, for example, at reducing the prevalence of smoking, obesity, diabetes, undiagnosed / untreated high levels of blood pressure, blood sugar and cholesterol.

OECD's 2015 report titled *Cardiovascular Disease and Diabetes* (2015[10]) outlines the remarkable decrease of more than 60% in CVD mortality rates achieved since 1960 across OECD countries. While describing the advances attained in the prevention and treatment of CVD, the report notes that CVD remains the leading cause of death in most OECD countries and that prospects for further CVD improvements are slowing. It points to several significant challenges faced by health systems in reducing the burden of CVD in coming decades. The report also assesses OECD health system performance along the care pathway by which CVD and diabetes are prevented, managed and treated, and draws key policy implications to reduce the burden of both diseases.

Also relevant to this topic is an OECD report which analyses the economic, social and health costs of the rising number of people who are obese or overweight in up to 52 countries, including the OECD, the EU and the Group of 20 (G20) countries (2019[4]). More than half the population is now overweight in 34 out of 36 OECD countries and almost one in four people is obese. The report estimates a reduction in life expectancy in OECD countries of 2.7 years caused by excessive weight. It makes an urgent economic case for scaling up investments in policies for tackling a mounting health problem across the world, since being overweight will account for over 8% of total health expenditure in OECD and EU countries between 2020 and 2050 (OECD, 2019[4]).

Overview of CVD mortality in Europe

The burden of CVD mortality is high and variable

Ms Susanne Løgstrup provided some background on the CVD statistics compiled by the European Heart Network (EHN). She described the health burden and economic costs associated with CVD in Europe. CVD is the leading cause of death in Europe, accounting for 3.9 million deaths in 2017, over 45% of all deaths, and 37% in EU countries. It is also the leading cause of premature mortality (i.e. deaths under age 65 years).

CVD has major economic costs as well as human costs for Europe. Overall CVD is estimated to cost the EU economy EUR 210 billion a year, of which 53% (EUR 111 billion) is due to direct health care costs, 26% (EUR 54 billion) to productivity losses and 21% (EUR 45 billion) to the informal care of people with CVD (Wilkins et al., 2017[11]).

However, there is significant variation in the burden of CVD across European countries. Age-standardised death rates for both ischaemic heart disease (IHD) and stroke (i.e. the major components of overall CVD mortality) are several times higher in Eastern Europe than in Western and Southern Europe.

CVD mortality is plateauing in some countries

Over the past five decades, mortality rates from CVD have fallen significantly in Northern and Western European countries in both males and females. Long-term mortality trends in Central and Eastern European countries have been less consistent, with early decreases followed by sharp increases in the 1990s, and a falling trend thereafter.

Box 1.1. Cardiovascular disease mortality trends in France

Evidence of slowdown in myocardial infarction mortality improvements amongst women

In France, between 1975 and 2010, population-wide myocardial infarction (MI) mortality rates decreased by 70%. Rates fell by almost one-quarter in both sexes, placing France among western countries with the lowest MI mortality rates. Almost half of the decrease in MI mortality was related to improved treatments of acute conditions, and the other half to reduced prevalence of cardiovascular risk factors (Gabet et al., 2016[12]). Similar findings were observed in the FAST-MI surveys, observational cohorts including patients with acute ST-elevation myocardial infarction (STEMI) or Non-ST-elevation myocardial infarction (NSTEMI) over one month every five years since 1995; six-month mortality decreased from 17.2% in 1995 to 5.3% in 2015 for STEMI patients, and from 17.2% in 1995 to 6.3% in 2015 in NSTEMI patients (Puymirat et al., 2017[13]).

However, the decline in MI mortality rates was less notable among the cohort born after World War II, particularly in women. This finding is consistent with data from the French MONICA registries, which reported no clear decline in CHD mortality rates between 2000 and 2007 in individuals aged under 54 years, especially women. These results may be due to unfavourable trends in some risk factors in the latter age group and call for a strengthening of primary prevention, targeting particularly younger women (Wagner et al., 2014[14]; Gabet et al., 2016[12]).

In fact, recent trends in the incidence of women hospitalised for MI showed a significant increase between 35 and 64 years mainly due to tobacco. The prevalence of daily smoking among women aged 45-54 increased from 21.5% in 2000 to 30.8% in 2017. Among women aged 55-64, the decrease observed in 2017 occurred after prevalence had doubled between 2000 (11.0%) and 2016 (21.1%). This increase relates to the women born after the Second World War, who were among the first generations widely adopting the smoking habit in the 1970s (Olié et al., 2019[15]; Gabet et al., 2017[16]).

The differences in stroke mortality trends

Stroke and MI mortalities showed some similar patterns, although no slowdown in stroke mortality rate reductions in recent birth cohorts was found, nor any clear difference between sexes. Stroke and MI share some risk factors such as hypertension, smoking and obesity. Thus, the greater slowdown in MI mortality rate reductions in women in recent birth cohorts may suggest either gender differences in MI management compared with stroke, or gender-differential profile changes of certain risk factors, which contributed more to MI than stroke incidence (Lecoffre et al., 2017[17]).

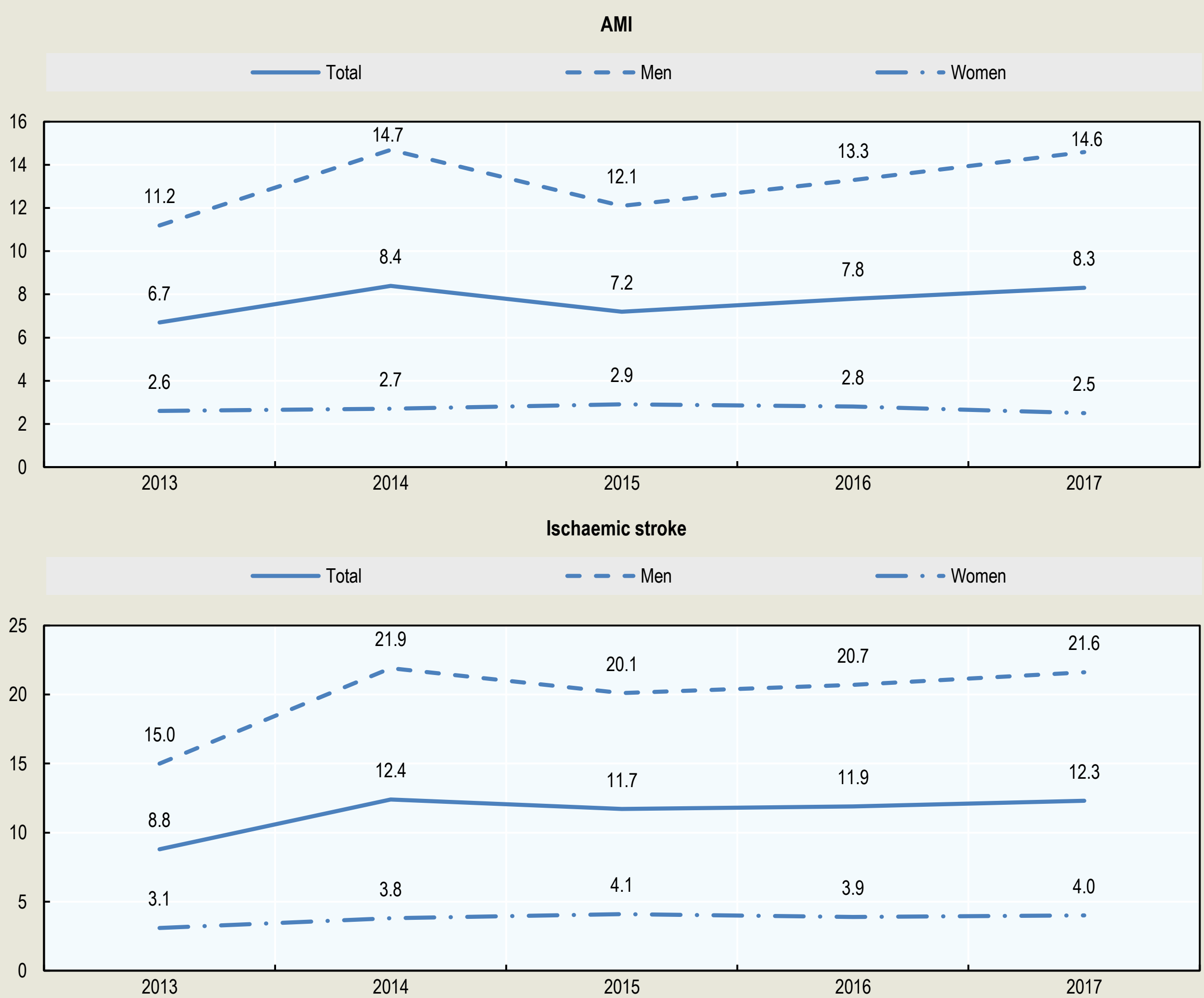
Source: Santé Publique France. Mortality data were obtained from the French Epidemiology Center on medical causes of death (CépiDc, Inserm). CépiDc collects and codes the two-part medical certificates for all deaths occurring in France.

However, there is evidence that, over the past two decades, IHD mortality rates are beginning to plateau in younger age groups in some countries – England, Wales, Scotland, the United States and Australia. This is also the case for AMI mortality rates in France (see Box 1.1). An analysis by EHN of data to 2009 did not find evidence of such a pattern occurring consistently across EU countries (Nichols et al., 2013[18]). However, more recent data for Greece, Spain and Portugal (Southern European countries with traditionally low CVD mortality) shows a plateauing of IHD and stroke mortality in the under 65s since 2010 (see Box 1.2 for Portugal). A slowdown or plateauing in IHD and/or stroke mortality at ages under 65 since 2010 is also observed for some Nordic and Western European countries. In the United Kingdom, CVD mortality improvements have slowed, especially at ages under 75, and CVD is a significant contributor to the slowdown in life expectancy improvement overall (see Box 1.3).

Box 1.2. Evidence of increase in CVD mortality amongst young Portuguese men

In Portugal, age-standardised mortality rates for AMI and stroke have plateaued in recent years. At ages under 65 years there are signs of rising mortality from AMI among men, and a flat-lining of AMI and stroke mortality among women.

Figure 1.3. Age-standardised AMI and stroke mortality rates per 100 000 population aged <65 years



Source: Statistics Portugal. Directorate-General of Health, Quality Department and Health System Central Administration.

Moreover, the incidence of coronary events among young adults has shown little or no change in several countries (France, Finland, Australia, United States) (Salomaa, 2020[19]). The fact that the incidence of coronary events in some countries is declining more slowly than mortality rates in recent years suggests that while declines in mortality are being driven by improvements in acute coronary care, the impact of preventive measures is more modest.

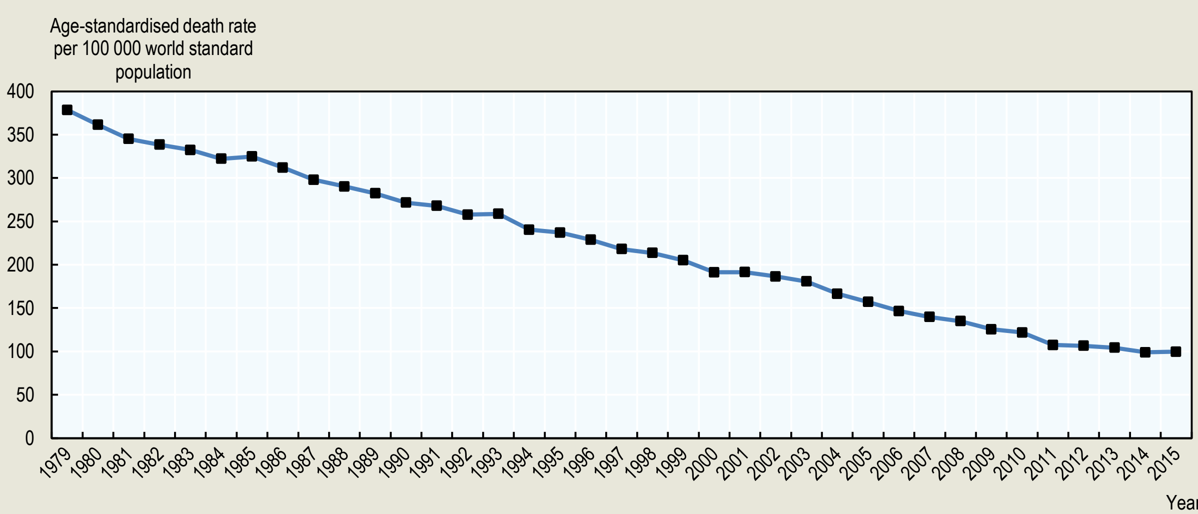
Ms Løgstrup warned against complacency about CVD mortality trends and that behavioural risk factors remain a major, preventable contributor to deaths, including premature mortality. She argued for stronger prevention measures and continued investment in the treatment of cardiovascular patients. Finally, she recommended that, given recent trends, the incidence of and mortality from CVD (overall and premature) should be closely monitored and the underlying causes identified.

Ms Løgstrup has documented these facts in a brief paper located in Chapter 3. Ms Løgstrup's presentation can be found in https://www.oecd.org/health/is-cardiovascular-disease-slowing-improvements-in-life-expectancy-47a04a11-en.htm.

Box 1.3. Evidence of CVD mortality improvement slowdown in the United Kingdom

The rate of improvement in CVD mortality in the United Kingdom has been slowing since 2011 (Figure 1.4). (Public Health England, 2019[20]; Northern Ireland Department of Health, n.d.[21]; National Records of Scotland, n.d.[22])

Figure 1.4. Age-standardised death rate from CVD per 100 000 world standard population, United Kingdom, 1979-2015



Source: World Health Organization, Mortality Database.

The rapid decline in heart disease since the 1980s can be attributed to two key factors (Unal, Critchley and Capewell, 2004[23]; Bajekal et al., 2012[24]):

- improved treatment uptake and medical therapies
- reduction in major risk factors, notably reduced smoking prevalence, but also reduced prevalence of high cholesterol and high blood pressure.

However, the increasing prevalence of diabetes, obesity and physical inactivity may be offsetting some of these gains. Some commentators also note that, following the concerted efforts over decades to identify and treat those at risk of CVD, the gains from these approaches may now be diminishing because of the smaller proportion of the population not yet identified and treated.

Public Health England notes that the reasons for the current slowdown are complex and due to factors operating across a wide range of areas. Further, that work is needed to understand the relative contribution of different drivers, requiring not only surveillance of mortality but also how this links to the disease burden and its many drivers. Further work to identify variation across the United Kingdom in diagnosis practices and optimal treatment rates for risk factors, (e.g. atrial fibrillation, hypertension and cholesterol) may be warranted. An increased focus on understanding the reasons for the persistent inequality gap and how it could be reduced is also required.

Source: Public Health England (2018[2]), *A review of recent trends in mortality in England*.

The contribution to life expectancy gains of CVD relative to other causes of death: past and present

Mortality patterns have changed significantly in recent years

Professor Jessica Ho analysed changes in life expectancy in OECD countries between 2000-10 and 2010-most recent year available, differences between countries in the rates of change, and the age groups and causes of death contributing most to these changes. The analysis covered 32 OECD countries for which recent mortality data by cause of death were available.

In most countries, the pace of life expectancy gains slowed significantly after 2010. The eight Central and Eastern European countries where baseline levels of life expectancy were considerably lower did not experience a slowdown. Hence, the analysis focused on the remaining 24 OECD countries, which were classified into three groups of eight based on their life expectancy gains during the most recent period: High, Medium and Low for countries experiencing high, medium and low gains in life expectancy respectively (see Table 1.1 for the countries in each group).

The key findings from Professor Ho's data analysis for this workshop were:

- **Life expectancy gains by age are changing**. Since 2010, in all three groups of countries the greatest contribution to life expectancy gains in both sexes came from ages 65-84, followed by ages 45-64. However, the lower life expectancy gains in the Low and Medium groups since 2010 were largely driven by smaller mortality reductions at ages 45-84 after 2010 than pre-2010.
- **Patterns of cause-specific mortality since 2010 are changing**. Since 2010, while mortality from most causes continued to fall, mortality from mental and nervous system diseases (including Alzheimer's disease) increased in 23 of the 24 countries, from accidental poisoning in 14 countries for males and 17 for females, and from respiratory disease in 15 countries for women. CVD mortality today is about half the level in 1995, but improvements have slowed significantly since 2010. In all three groups of countries, CVD made the largest contribution to gains in life expectancy both before and after 2010, but its contribution to life expectancy gains in Low and Medium group countries fell after 2010.
- **The drivers for the slowdown in life expectancy differ between the Low and High groups, and before and after 2010**. The three causes contributing most to differences between the Low and High groups were CVD, cancer, and external causes in men and CVD, cancer, and mental and nervous system disorders in women. The causes that contributed most to smaller life

expectancy gains in the most recent period compared with pre-2010 were the same for the Medium and Low groups. For men they were smaller improvements in mortality from CVD and external causes, combined with increased mortality from mental and nervous system disorders. For women, they were smaller improvements in CVD mortality, combined with life expectancy losses from influenza and pneumonia, and mental and nervous system disorders, especially in the Low group.

Table 1.1. Countries with high/medium/low gains in life expectancy since 2010

		Average Annualised Gain in Life Expectancy (years)			Average Annualised Gain in Life Expectancy (years)	
		Men			Women	
		2000-10	2010-Present		2000-10	2010-Present
High	Belgium	0.30	0.30	Belgium	0.21	0.20
	Denmark			Denmark		
	Finland			Finland		
	Japan			Japan		
	Luxembourg			Luxembourg		
	Norway			Norway		
	Switzerland			Switzerland		
	Ireland			Portugal		
Medium	Australia	0.28	0.20	Australia	0.22	0.12
	Austria			Austria		
	Spain			Spain		
	France			Canada		
	Iceland			Germany		
	Netherlands			Greece		
	Portugal			Ireland		
	Sweden			Israel		
Low	Italy	0.27	0.12	Italy	0.19	0.07
	New Zealand			New Zealand		
	United Kingdom			United Kingdom		
	United States			United States		
	Canada			France		
	Germany			Iceland		
	Greece			Netherlands		
	Israel			Sweden		

Note: Countries where men and women are not in the same group are shaded.
Source: Data from the Human Mortality Database and World Health Organization Mortality Database.

The quality and timeliness of available data needs to improve

In conclusion, Professor Ho cautioned that international comparisons can be impacted by differences in diagnostic practices, death certification and cause of death coding across countries and over time. For example, many deaths now coded to dementia, Alzheimer's disease and other mental and nervous system disorders would previously have been coded to CVD or other causes. There can also be associations between different causes of death – for example, people with CVD are more susceptible to influenza and pneumonia, likewise, the latter conditions increase the risk of a coronary event. In some recent years, there have been widespread outbreaks of influenza across many European countries. Likewise, the use of illicit drugs and opioids increases the risk of dying from CVD. Use of prescription opioids and illicit drugs is increasing in several high-income countries (including the United States but also Australia, Canada, the United Kingdom, and the Nordic countries), with death rates among young and middle-aged adults rising in some countries (Ho, 2019[25]). Interpreting trends in CVD mortality is therefore made more complex when there are interactions with other causes of death, and which may have varying trends.

Finally, Professor Ho stressed the importance of improving the quality and timeliness of vital registration systems and data releases used for monitoring contemporary trends in CVD mortality, and the broader drivers underlying these trends.

During the discussion participants queried the potential reasons why most Nordic countries (Norway, Finland, Denmark) "bucked the trend" of a slowdown in life expectancy gains in recent years. A slowdown in CVD mortality improvements was reported by participants from several countries, and especially among young adults in some countries (for example, Australia and Portugal). Potential reasons advanced for the slowdown in CVD mortality improvements among French women include an increase in the prevalence of some cardiovascular risk factors (tobacco, physical inactivity) and a decrease in treatment of other risk factors (hypertension and cholesterol particularly).

Professor Ho has documented these facts in a brief paper located in Chapter 4. Professor Ho's presentation can be found in https://www.oecd.org/health/is-cardiovascular-disease-slowing-improvements-in-life-expectancy-47a04a11-en.htm.

Trends in CVD mortality and risk factors – the Global Burden of Disease study

Dr Catherine Johnson described the aims, coverage and methods of the Global Burden of Disease (GBD) study in monitoring levels and trends in disease risk factors, incidence, prevalence and mortality. She noted that the decrease in CVD mortality seen in most high-income countries over the past few decades is levelling off, and mortality may be increasing in certain countries among the OECD, including Latvia, Estonia, Greece, and Portugal (Roth et al., 2018[26]).

The top risk factors for CVD are: dietary risk, high systolic blood pressure, high low-density lipoprotein cholesterol and high fasting plasma glucose. Overall, the top 11 major risk factors for CVD have remained unchanged in order of rank importance since 1990, with the exception of tobacco, which has dropped in rank because of the impact of public health policies in reducing smoking prevalence. However, GBD's assessments show rising prevalence of several common risk factors for CVD, including elevated low-density lipoprotein cholesterol, systolic blood pressure, fasting plasma glucose and BMI, and low physical activity in most, but not all, of the OECD countries. Results indicate that these risk factors are increasing across all quintiles of the socio-demographic index, a summary measure of development (http://ihmeuw.org/526l) (IHME, 2017[27]). For example, being overweight causes 9 to 27% of the CVD deaths in the OECD, depending on the country (http://ihmeuw.org/526m) (IHME, 2017[27]). These trends in key risk factors could contribute to decelerating improvements in CVD mortality, with the risk of mortality increasing if these trends continue.

Policies and interventions aimed at reducing the risk factors for and mortality from CVD need to be tailored locally to the target populations if they are to be effective.

The GBD can be used to monitor trends in both CVD mortality and common CVD risk factors over time.

During the discussion, participants raised various technical and methodological queries about the GBD methodology, relating to e.g. coding, data sources used for risk factors, and how changes in clinical guidelines over time are handled in interpreting the data.

Dr Johnson has documented these facts in a brief paper located in Chapter 5. Dr Johnson's presentation can be found in https://www.oecd.org/health/is-cardiovascular-disease-slowing-improvements-in-life-expectancy-47a04a11-en.htm.

Socio-economic inequalities in CVD mortality in Europe

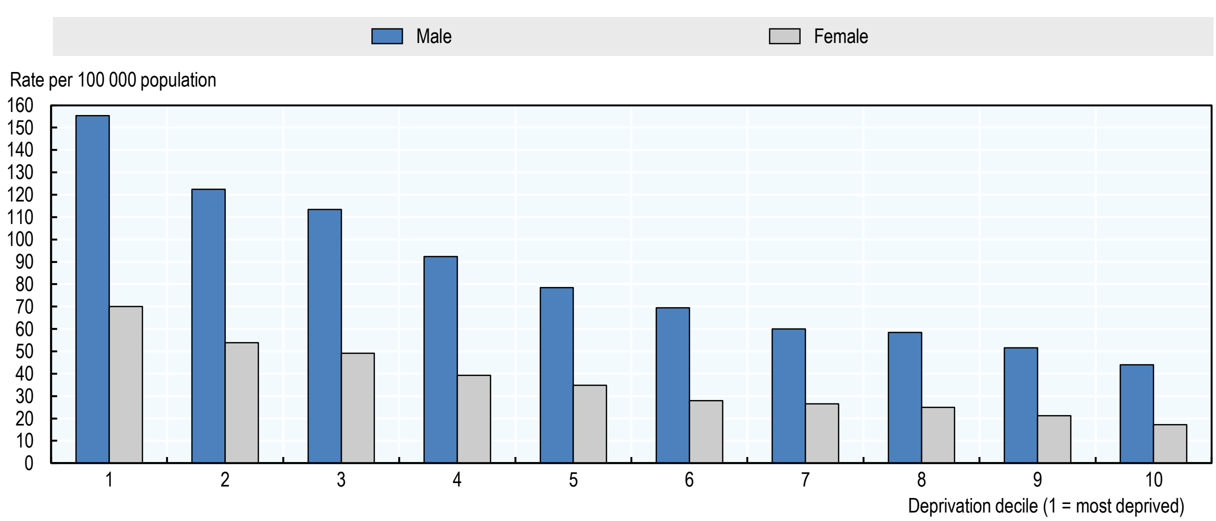
Inequalities in CVD mortality in Europe are wide

Like other speakers, Professor Anton Kunst noted the dramatic falls in CVD mortality since the 1970s, but also the decelerating improvements in recent years. He highlighted the need to distinguish between the two key determinants of CVD mortality trends: incidence i.e. the numbers of people who develop CVD (driven by exposure to biological and lifestyle risk factors) and case-fatality i.e. the numbers who die from it (the outcome of access to health care, medical technology and treatment).

Inequalities in CVD mortality in Europe are wide and strongly associated with behavioural and lifestyle factors. Risk factors such as smoking, physical inactivity and a poor diet show a socio-economic gradient in many countries. Professor Kunst noted that such biological and lifestyle factors are influenced by environmental conditions including physical exposures, socio-cultural influences, social networks and social status as determined by education, employment, wealth and attributes such as prestige and power. Dahlgren and Whitehead's rainbow model (2007[28]) illustrates how the wider societal and environmental context influences individual lifestyles and behaviours, and the mediating factors.

Professor Kunst noted that in Europe and the United States, IHD had changed over time from being a "manager's disease" to becoming a "disease of poverty". Wide socio-economic inequalities in CVD mortality are now characteristic of many European countries, including those with generous social welfare schemes (e.g. Finland, Denmark). For example, avoidable cardiovascular mortality at ages <75 years in England varies approximately four-fold between the most and least deprived groups (Figure 1.5). A recent study (Lewer et al., 2020[29]) found that if everyone in England had the same mortality rate as people living in the least deprived areas, there would have been almost 900 000 fewer premature (i.e. under 75 years) deaths between 2003 and 2018; IHD was among the largest contributors to inequalities in premature mortality.

Figure 1.5. Under 75 mortality rates from all cardiovascular disease considered 'avoidable' for deprivation deciles in England 2016



Source: Public Health England (reference). Data from Office for National Statistics.

Some trends in inequalities are not favourable

A recent study of trends in socio-economic inequalities in CVD mortality (Di Girolamo et al., 2019[30]) between the 1990s and the early 2010s in 12 European populations found that CVD mortality declined rapidly among all socio-economic groups. Relative declines (%) were faster among higher socio-economic groups; absolute declines (deaths per 100 000 person-years) were greater among lower socio-economic groups. Therefore, although relative inequalities widened over time, absolute inequalities often declined substantially. In the early 2010s, inequalities in CVD mortality were smallest in Southern Europe, of intermediate magnitude in Northern and Western Europe and largest in Central-Eastern European and Baltic countries. The authors conclude that lower socio-economic groups have experienced remarkable declines in CVD mortality over the last 25 years, and trends in inequalities are favourable. The evidence suggests that equitable access and the quality of medical care and treatments have contributed to these trends. Nevertheless, inequalities in CVD mortality remain wide and an important challenge for European health systems and policies.

Prevention policies can exacerbate inequalities and need to address also the broader determinants of ill health

Professor Kunst noted (as others have, for example Lewer and colleagues (2020[29]) and Lorenc and colleagues (Lorenc et al., 2013[31]; Brown, Platt and Amos, 2014[32]), that public health interventions such as smoking cessation that aim to change individual behaviour, although effective, can increase inequalities because of higher adoption among more affluent groups. Like Professor O'Flaherty, Professor Kunst argued that universal population-level measures to tackle the underlying causes, such as smoking bans in public places and structural interventions like taxation and minimum unit pricing, are likely to have a more progressive effect.

Policies and structural measures need to give consideration to social constructs beyond individual lifestyle and health-related behaviours, and also to extend beyond the health sector to address the "upstream" determinants of ill health. This approach to addressing health inequalities aligns with the landmark Marmot reviews of health inequalities in England in 2010 and the recently published ten year update (The Marmot Review, 2010[33]; The Marmot Review, 2020[34]).

Professor Kunst has documented these facts in a brief paper located in Chapter 6. Professor Kunst's presentation can be found in https://www.oecd.org/health/is-cardiovascular-disease-slowing-improvements-in-life-expectancy-47a04a11-en.htm.

Drivers of cardiovascular disease mortality and the cost of inaction

CVD mortality can change rapidly

While noting the unprecedented decline in CVD mortality in high-income countries since the 1970s, Professor Martin O'Flaherty also noted that some other parts of the world (for example Eastern European countries) are still in an earlier phase of the CVD mortality transition (Capewell and O'Flaherty, 2011[35]).

Key themes of Professor O'Flaherty's presentation were that CVD mortality trends can change rapidly in both directions, most such deaths are preventable, and their key drivers are largely concentrated in lifestyle risks. Most CVD events manifest at older ages; hence, the perception is of a process that develops slowly and that will reverse slowly, if at all. But O'Flaherty and colleagues note that this perception is incorrect, pointing to extensive evidence from clinical trials, natural experiments and policy interventions showing that changes in diet and lifestyle across entire populations can be quickly followed by dramatic declines in mortality (Capewell and O'Flaherty, 2011[36]; Capewell and O'Flaherty, 2011[35]). Trials on, for example, hypertension and blood lipid treatment can show effects within months. Population-wide policy interventions for CVD prevention aimed at changing lifestyles and diets (such as smoke-free legislation or reductions in dietary salt, transfats, or saturated fat) can be effective, cost-saving, and can achieve substantial and rapid reductions in disease, hospital admissions and mortality. Conversely, mortality can also increase rapidly after adverse changes in diet, lifestyle and other risk factors. The referenced publications provide several examples of rapid changes (declines and increases) in CVD mortality seen in various countries, in response to changes in lifestyle factors such as diet and smoking. Soft drinks manufacturers in the United Kingdom have reduced the sugar content of soft drinks following the introduction of the government's sugar levy in April 2018 (Scarborough et al., 2020[37]).

Modelling the impact of drivers of CVD mortality

O' Flaherty and colleagues have been studying the determinants of CVD mortality associated with lifestyle and treatment factors. The IMPACT family of models developed internationally uses epidemiological tools and mathematical models to analyse data on demographics, risk factors, and treatment trends to estimate the relative contributions of lifestyle risk factors and medical treatments to changes in the incidence of and mortality from CVD overall, and specific CVD conditions. The model can also estimate the future consequences of altering treatment strategies and changing population risk.

The IMPACT model consistently found that about 40 to 72% of the fall in deaths is attributable to risk factors changes and 23 to 55% to treatments (Mensah et al., 2017[38]). Particularly powerful drivers were population-wide declines in smoking, blood pressure and cholesterol levels, and provision of secondary prevention and acute care. Where CHD rates were increasing, it was primarily due to adverse population-level trends in behavioural risk factors. A consistent finding in most populations studied with IMPACT is that the almost universally observed increases in obesity and diabetes offset a significant proportion (10-14%) of the mortality reductions attributed to favourable changes in other risk factors.

Professor O'Flaherty speculates that population drivers of incidence (i.e. risk factors such as poor diet, smoking, low physical activity and increasing trends in obesity and diabetes) rather than worsening case-fatality rates are likely causes of the current slowdown in CVD mortality improvements in many countries. Key drivers of non-communicable diseases in the United Kingdom between 1990-2016 were diet (40%), smoking (19%), alcohol (9%) and lack of physical activity (2%) (Steel et al., 2018[39]). In their analysis of GDB data for the United Kingdom, Steele and colleagues (2018[39]) note that the continued dominance of CVD mortality argues for renewed efforts to deliver systematic programmes to reduce risk factors, such as high body-mass index, high fasting glucose, high blood pressure, and high cholesterol.

The costs of inaction can be high

As CVD remains a major killer, and is contributing to the slowdown in overall mortality improvements in many countries, it needs to be addressed urgently. Professor O'Flaherty noted that the key priorities should be to: reduce the burden of CVD, reduce inequalities, and reduce pressures on the health care system. Like Professor Kunst, he argued that this requires a combination of targeted policies in deprived communities alongside structural, population-level policies to, for example, improve diets and reduce smoking and alcohol intake – including by the use of fiscal and regulatory measures, although regulations and fiscal policies that impact on consumer choice can be politically controversial and face public resistance. Other policy instruments used in various countries include public information, food labelling, marketing and advertising control, and food reformulation.

In conclusion, CVD mortality trends can change rapidly in both directions, most such deaths are preventable, and their key drivers are largely concentrated in lifestyle risks. Evidence shows that population level policies, including fiscal and regulatory measures to stimulate lifestyle changes, can deliver large and rapid health and economic gains in terms of reducing CVD. Such policies have several advantages: they can be cost-effective, have a rapid impact, reduce inequalities, and reduce pressures on the health care system (e.g. fiscal and regulatory measures do not require health care resources).

The economic costs of inaction are high. For example, the cumulative health, social care and informal care costs of the future burden of dementia and disability in the CVD slowdown era in England and Wales over 2020-29 is estimated to total GBP 47.6 billion (Kypridemos et al., 2018[40]).

During the discussion participants queried the possibility of current trends being affected by cohort effects, and of newly emerging risk factors, such as pollution and climate change, in addition to the classical ones. In this context, illicit drug use and influenza outbreaks were also mentioned. In response, Professor O'Flaherty noted the WHO's view that 80% of CVD is associated with the classic risk factors. Other points noted were the importance of analysing not just mortality but also quality of life, and the importance of improved access to and timeliness of care in the context of acute events in some countries.

Professor O'Flaherty has documented these facts in a brief paper located in Chapter 7. Professor O'Flaherty's presentation can be found in https://www.oecd.org/health/is-cardiovascular-disease-slowing-improvements-in-life-expectancy-47a04a11-en.htm.

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2 Understanding recent trends in cardiovascular disease mortality in European countries

Ms Susanne Løgstrup on behalf of the European Heart Network

Cardiovascular disease is the leading cause of death in Europe. Previous declines in cardiovascular disease mortality have played a vital role in improving life expectancy in European countries. However, since 2010, several countries are experiencing a levelling out of the rate of decline in cardiovascular mortality in populations aged below 65, while a few countries are experiencing increases in mortality rates. This calls for urgent action in monitoring closely recent trends in mortality and incidence, and identifying the underlying causes. Currently, unhealthy diets make the largest contribution to the population-level CVD mortality burden, with over 40% of CVD deaths being attributed to dietary factors, and prevalence of overweight, obesity and diabetes is on the rise. In other words, we have not reached the point where no more gains can be achieved in cardiovascular mortality, and especially in premature mortality.

This article is based on a presentation made by Susanne Løgstrup, Director of the European Heart Network (EHN). All data presented are published in European Cardiovascular Disease Statistics, 2017 edition, published by the European Heart Network (Wilkins et al., 2017[1]).

European cardiovascular disease statistics

Since 2000, the European Heart Network (EHN) has published five editions of European Cardiovascular Disease Statistics. The most recent edition was published in 2017.

The report provides data on both mortality and morbidity. It also provides data on treatment and determinants of cardiovascular disease, including diet, smoking, physical activity, alcohol, blood pressure, blood cholesterol, overweight and obesity, and diabetes. These data are collected from international sources, including the World Health Organisation, the Global Burden of Disease Project (IHME) and the OECD.

In addition, the report includes a section on economic cost which is based on original research. It covers only the European Union (EU data in this chapter refers to EU28 member states).

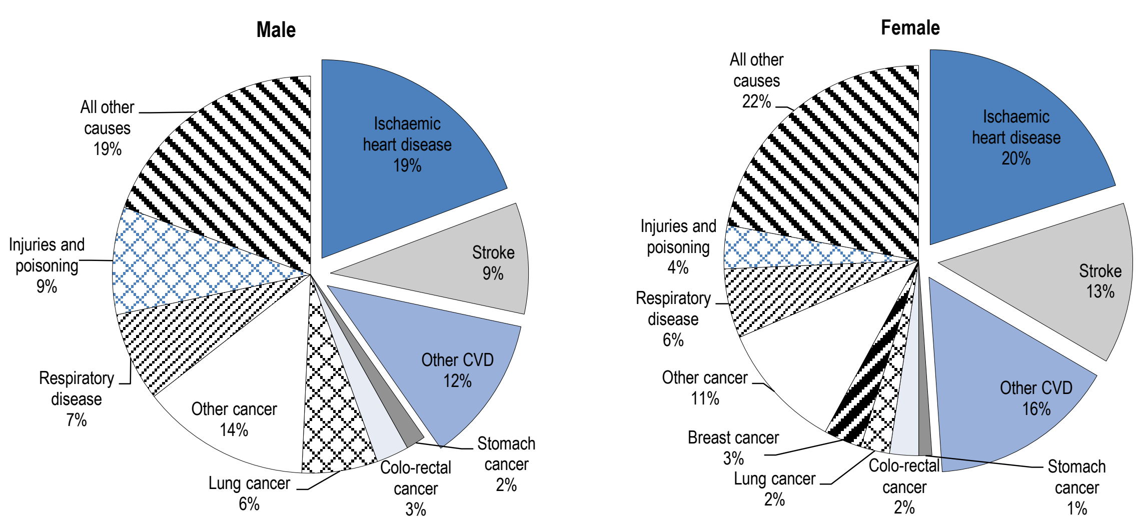
Burden of cardiovascular disease in Europe

Mortality

CVD is the leading cause of death in Europe[1] causing 3.9 million deaths every year, 45% of all deaths. In the EU, CVD is also the leading cause of death accounting for over 1.8 million deaths every year, which corresponds to 37% of all deaths (Figure 2.1 and Figure 2.2).

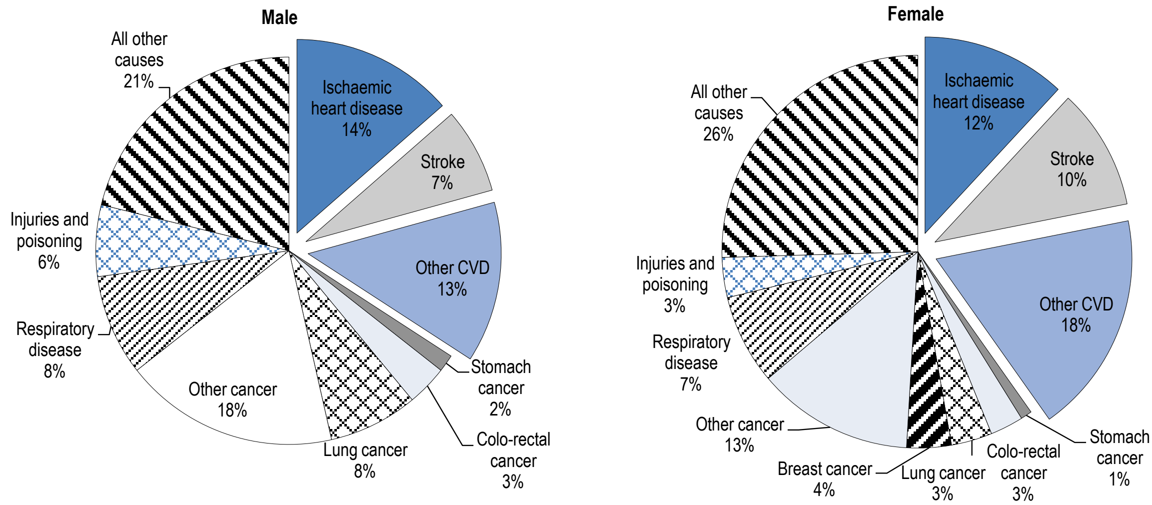
CVD is also the leading cause of premature death (death before age 65 years) in Europe, accounting for close to 670 000 deaths (29% of all deaths) every year. In the EU, CVD claims more than 190 000 deaths per year at ages under 65 years (22% of all deaths).

Figure 2.1. Deaths by cause, males and females, latest available year, Europe



Source: Wilkins et al. (2017[1]), European Cardiovascular Disease Statistics 2017, http://www.ehnheart.org/images/CVD-statistics-report-August-2017.pdf.

Figure 2.2. Deaths by cause, males and females, latest available year, European Union



Source: Wilkins et al. (2017[1]), European Cardiovascular Disease Statistics 2017, http://www.ehnheart.org/images/CVD-statistics-report-August-2017.pdf.

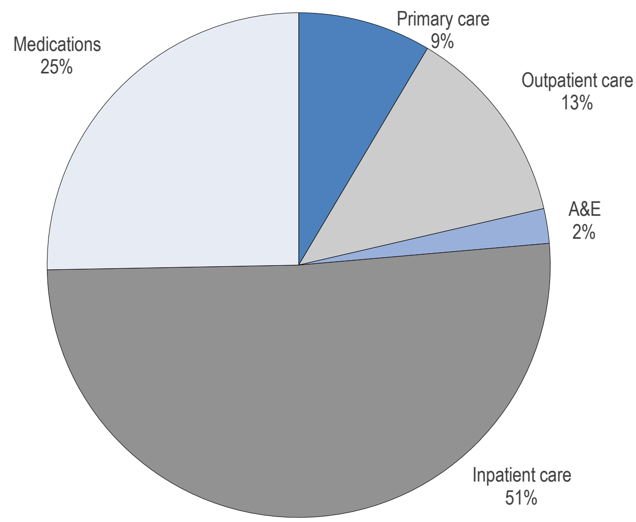
The main forms of CVD are ischaemic heart disease (IHD) and stroke. In Europe, IHD is the single largest cause of death, responsible for more than 860 000 deaths among men (19% of all deaths) and almost 880 000 (20% of all deaths) among women each year. Stroke is the second largest single cause of death in Europe, accounting for 405 000 deaths in men (9% of all deaths) and over 580 000 deaths in women (13%) each year.

As in Europe, IHD and stroke are, respectively, the first and second most common single causes of death in the EU. IHD is responsible for over 335 000 (14%) of all deaths among men and close to 300 000 (12%) among women. Stroke accounts for over 175 000 (7%) male deaths and just under 250 000 (10%) female deaths.

Costs

CVD is estimated to cost the economies of the EU around EUR 210 billion per year (2015 figures). Of this total cost, just over half (EUR 111 billion) is spent on health care (Figure 2.3). Lost productivity accounts for 26% of total costs, or EUR 54 billion; and informal care costs amount to EUR 45 billion (21% of total costs).

Figure 2.3. Health care costs associated with CVD, EU, 2015



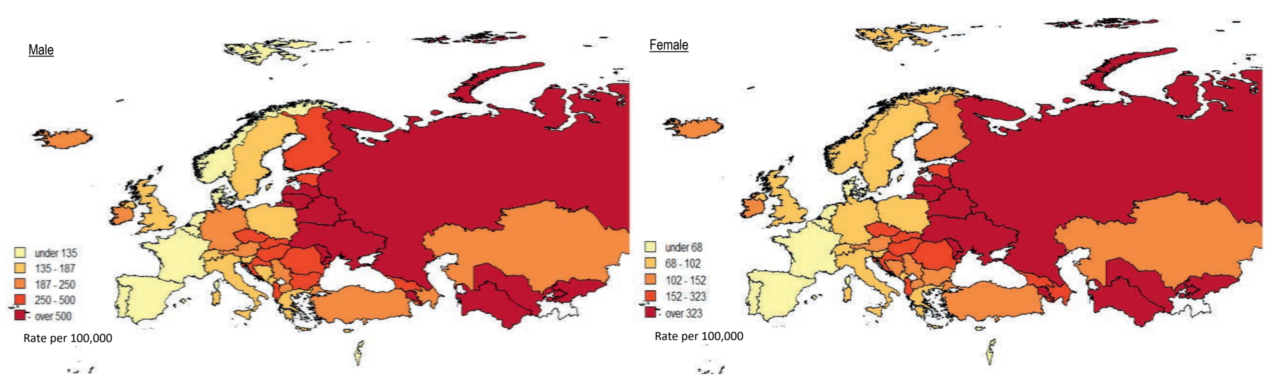
Source: Wilkins et al. (2017[1]), European Cardiovascular Disease Statistics 2017, http://www.ehnheart.org/images/CVD-statistics-report-August-2017.pdf.

Variations in cardiovascular disease mortality in Europe

There are wide geographical disparities across Europe in age-standardised mortality rates[2] for CVD.

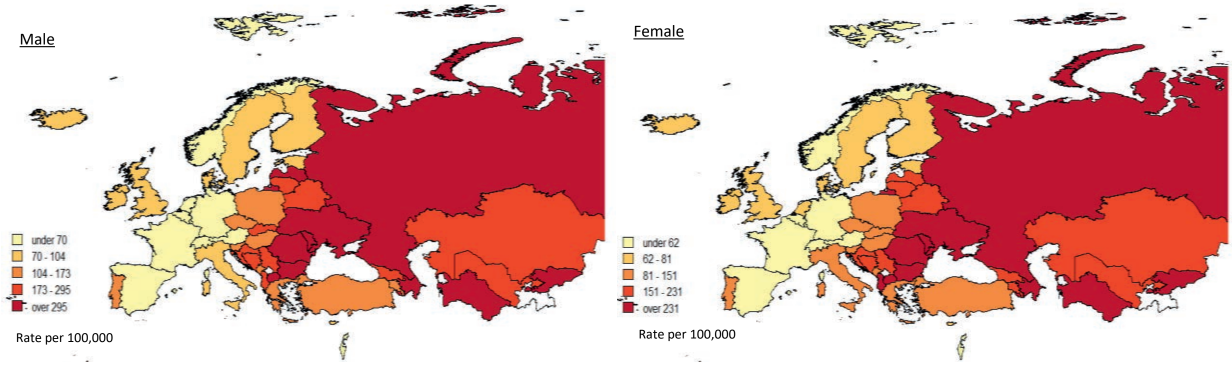
High rates are observed in Eastern and Central European countries, particularly post-Soviet states, compared to rates in Northern, Southern and Western regions of Europe. This pattern is observed for both IHD and stroke (Figure 2.4 and Figure 2.5).

Figure 2.4. Age-standardised death rates from IHD, males and females, (latest available year), Europe



Source: Wilkins et al. (2017[1]), European Cardiovascular Disease Statistics 2017, http://www.ehnheart.org/images/CVD-statistics-report-August-2017.pdf.

Figure 2.5. Age-standardised death rates from stroke, males and females, (latest available year), Europe



Source: Wilkins et al. (2017[1]), European Cardiovascular Disease Statistics 2017, http://www.ehnheart.org/images/CVD-statistics-report-August-2017.pdf.

In the EU, the lowest age-standardised mortality rate for IHD is found in France, with 77 deaths per 100 000 in males and 32 deaths per 100 000 in females, and the highest in Lithuania with 700 deaths per 100 000 in males and 429 deaths per 100 000 in females – a nine-fold difference in men and a 13-fold difference in women. The lowest age-standardised mortality rate for stroke in men in the EU is found in France and Luxembourg with 53 deaths per 100 000 and the highest in Bulgaria with 353 deaths per 100 000. In females, the lowest rate is also found in France with 42 deaths per 100 000, and the highest again in Bulgaria with 281 deaths per 100 000 – a six-fold difference in both men and women.

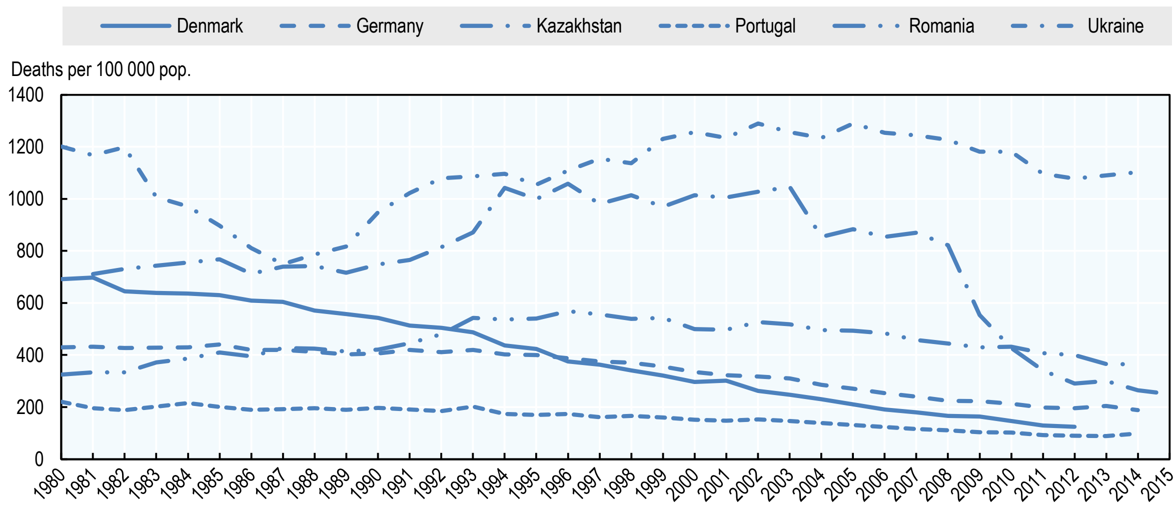
In European countries that are not members of the EU, the lowest age-standardised mortality rate for IHD is found in Israel, with 115 deaths per 100 000 in males and 67 deaths per 100 000 in females, and the highest in Ukraine with 1 102 deaths per 100 000 in males and 727 deaths per 100 000 in females – an almost 10-fold difference in men and an almost 11-fold difference in women. The lowest age-standardised mortality rate for stroke is found in Switzerland with 51 deaths per 100 000 in males and 47 deaths per 100 000 in females, and the highest in Macedonia with 383 deaths per 100 000 in males and 345 deaths per 100 000 in females – a 7-fold difference in both men and women.

Trends in CVD mortality in Europe

Historic

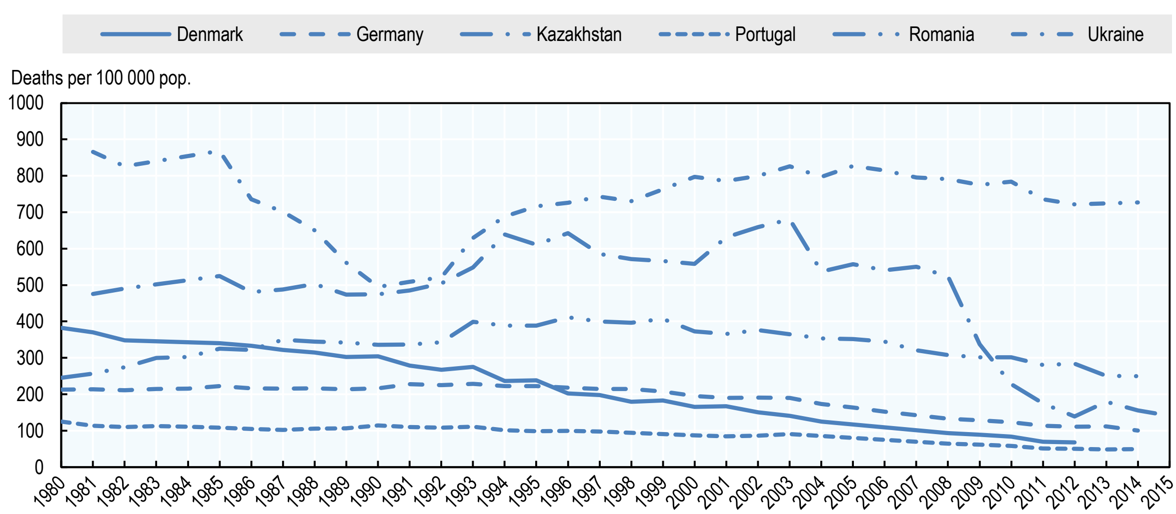
Over the past 30 to 50 years, mortality rates from IHD have been declining in most Northern and Western European countries in both males and females. Long-term trends in Central and Eastern European countries have been less consistent with sharp decreases followed by sharp increases and then further decreases in countries such as, for example, Ukraine.

Figure 2.6. Age-standardised death rates/100 000 from IHD, males, 1980 to 2015, selected European countries



Source: Wilkins et al. (2017[1]), European Cardiovascular Disease Statistics 2017, http://www.ehnheart.org/images/CVD-statistics-report-August-2017.pdf.

Figure 2.7. Age-standardised death rates/100 000 from IHD, females, 1980 to 2015, selected European countries



Source: Wilkins et al. (2017[1]), European Cardiovascular Disease Statistics 2017, http://www.ehnheart.org/images/CVD-statistics-report-August-2017.pdf.

However, since around the period 2000-2005, age-standardised mortality rates from IHD have been falling in the majority of European countries, including Central and Eastern European countries. Nevertheless, the rate of decline in mortality has been highly variable. In the EU, the percentage rate of decline from 2003 to the most recent year varied from 13% (Czech Republic) to 53% (The Netherlands) in men, and from 8% (Czech Republic) to 57% (Estonia) in women.

Recent evidence

In the first decade of the 21st century, evidence that IHD mortality rates were beginning to plateau in younger age groups had been demonstrated to varying extents and at differing time points in England, Wales, Scotland, United States and Australia (Nichols et al., 2013[2]).

On this basis, we analysed trends in age-specific IHD mortality in the EU over three decades (1980-2009). The results, which were published in 2013 (Nichols et al., 2013[2]), found little evidence to support the hypothesis that there had been a consistent pattern of recent plateaus in CHD mortality rates, or that any plateaus have occurred largely or exclusively in younger age groups. In the majority of countries, the research found that most recent reductions in average annual percentage changes in CHD mortality were as great as, or greater than, they had been previously.

It further found that substantial heterogeneity exists across the EU, and when individual countries were examined, there were some countries with cause for concern, where rates of decrease in IHD mortality appeared to have slowed, including in the United Kingdom. In addition, there were two countries, Greece and Lithuania, in which IHD mortality rates had begun to significantly increase at younger ages in recent years.

The trend from 1980-2009 in the United Kingdom seems to continue for individuals aged under 65. For men aged under 65, the death rate from IHD fell from 2010 to 2013 but remained the same in 2012 and 2013; the mortality rate from stroke flattened completely with no reductions between 2011 and 2013. For women in the United Kingdom, however, there has been no reduction in mortality rates from IHD between 2010 and 2013; and we see similar trends for stroke.

With respect to Greece, the findings from the 2013 study seem to be confirmed by more recent data. In men under 65, the mortality rate for IHD was fluctuating with the latest year (2012) showing an increase on the previous year. The mortality rate from stroke increased in men between 2010 and 2012. For women aged under 65 in Greece, mortality rates from both IHD and stroke are not decreasing.

The trends for Lithuania, however, have improved with reductions in mortality rates from IHD and stroke in both women and men under 65 since 2010.

In several Southern European countries, with traditionally low CVD mortality rates, we observe little to no reductions in mortality rates from IHD and stroke in people aged under 65 since 2010. In Spain, the mortality rate from IHD in men under 65 is vacillating between no reduction and an increase; and for stroke, there has been no reduction in mortality rates since 2010 until the latest year (2014). In Spain, in women aged under 65 there has been no reduction in mortality rates from either IHD or stroke since 2010 until the latest year (2014). In Portugal, mortality rates from IHD in men aged under 65 increased in 2013 and 2014; while for stroke mortality rates have fallen slightly following three years of no reduction in mortality rates. For Portuguese women aged under 65, mortality rates from IHD remained the same from 2010 to 2013 and an increase was observed in 2014. From 2011-14, there have been no reductions in mortality rates for stroke in women aged under 65 in Portugal.

Other countries in the EU where a slowdown has been observed in mortality rates from IHD in men aged under 65 since 2010 include Cyprus, Denmark, and France. In Luxembourg, we observe an increase in death rates from IHD in men under 65 in 2013 and 2014. In women under 65, a slowdown is observed in mortality rates from IHD in Denmark, Finland, France, Italy and Malta, the latter with increases in mortality rates in women since 2010.

With regard to stroke in men aged under 65, mortality rates have been at the same levels since 2010 in Austria, Belgium, the Netherlands and Sweden. In the Netherlands, mortality rates have also been at the same levels since 2010 in women aged under 65 and this is also the case for France.

We underline that the trends observed are over a three- to five-year period depending on countries. Some countries report their data more regularly.

Conclusion

The data available for Europe suggest that, since the beginning of the past decade (2010), several countries in the EU are experiencing a levelling out of the rate of decline in CVD mortality in people aged under 65 (based on data for IHD and stroke), and a few countries are experiencing increases in mortality rates. An in-depth analysis is beyond the scope of this article.

Given that CVD is the leading cause of death in Europe, and that previous declines in CVD mortality have played a vital role in improving life expectancy in European countries, we recommend monitoring closely recent trends in overall and premature CVD mortality, among men and women, and identifying the underlying causes.

It is also important to monitor incidence. It is noteworthy that in France, the declines in incidence rates of coronary events have been more modest than those in mortality and were driven mainly by strong downward trends in the oldest age group, 65-74 years, whereas no change was seen among younger men and women aged 35-64 years (Salomaa, 2020[3]; Gabet et al., 2017[4]). Similar findings are reported for Finland, Australia and United States, and suggest that preventive measures need to be strengthened. To monitor risk factor levels and incidence adequately, countries need to develop comprehensive morbidity surveillance systems, including the effective use of electronic health information systems.

Even if some countries have reached relatively low CVD mortality rates, especially in the younger populations, it should not be concluded that they cannot reduce mortality further. At least 50% of the reductions in mortality achieved in the past can be attributed to behavioural risk factors, including smoking and high salt intake. While smoking rates have gone down across Europe, prevalence of overweight, obesity and diabetes has increased.

Currently, unhealthy diets make the largest contribution to the population-level CVD mortality burden, with over 40% of CVD deaths being attributed to dietary factors. It is crucial to introduce policies that promote healthier diets and discourage unhealthy diets – including both the supply and the demand side, see for example EHN's 2017 paper on *Transforming European food and drink policies for cardiovascular health* (European Heart Network, 2017[5]).

There is also a need for continued investment in treatment of cardiovascular patients. There is a concern that few new treatment options are in the pipeline.

In other words, we have not reached the point where no more gains can be achieved in cardiovascular mortality, and especially in premature mortality.

Acknowledgements: EHN would like to thank Nick Townsend, Senior Lecturer, Department for Health, and University of Bath for his help in writing this paper.

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Notes

[1] When we refer to Europe, we refer to the 53 member states of the World Health Organization’s European Region.

[2] Rates are age-standardised to the 2013 European Standard Population.

3 Causes of gains and losses in life expectancy in OECD countries

Professor Jessica Y. Ho, University of Southern California

Cardiovascular disease is an important contributor to the slowing life expectancy improvements seen in some countries. This cause of death is strongly linked to behavioural factors operating over the life course including smoking, obesity, diet, and physical inactivity, as well as access to and the quality of health care. Going forward, it is very important that we maintain the quality and timeliness of our vital registration systems and timely data releases. For most countries, there is an at least four-year lag between the most recent cause-specific mortality data becoming available and the present year. These data are essential to identifying contemporary trends in cardiovascular disease mortality and their underlying drivers. Understanding the burden and causes of trends in cardiovascular disease mortality is further complicated by the linkages between cardiovascular disease and other causes of death, such as influenza and pneumonia, and drug overdose.

Life expectancy is one of the most commonly used summary measures of a country's health and well-being. With few exceptions, life expectancy at birth has increased worldwide since the 1950s, with many low- and middle-income countries achieving impressive gains. In high-income countries, life expectancy increases have generally been smaller in magnitude, in part because they have already attained relatively high life expectancy levels. As most high-income countries have reduced infant and child mortality to very low levels, their life expectancy increases in recent decades have largely been driven by mortality improvements at the older adult ages and were fairly robust through the decade of the 2000s.

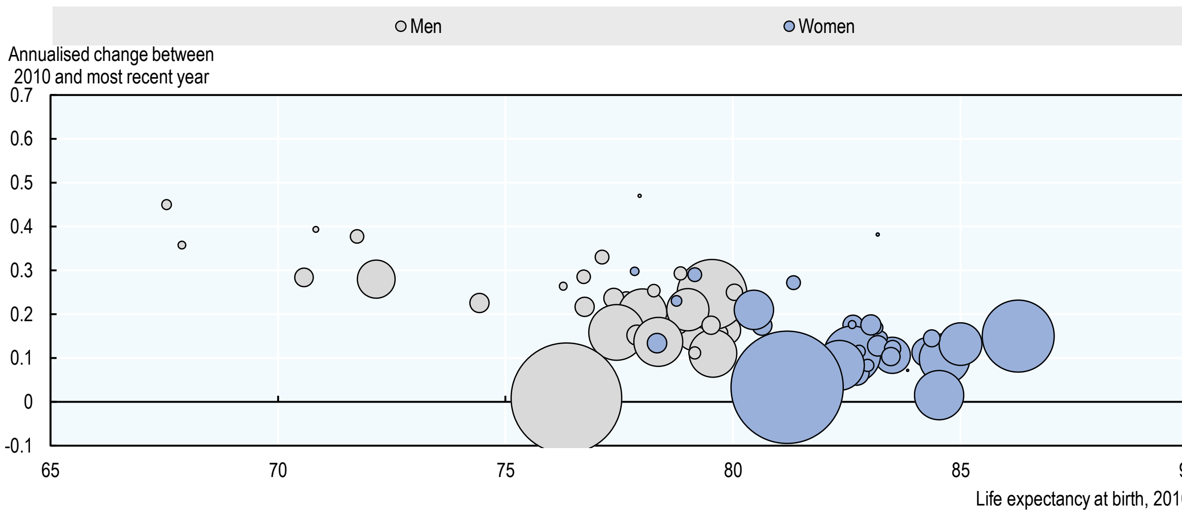
Since 2010, alarming trends in mortality have been observed for two high-income countries – the United States and the United Kingdom. Life expectancy at birth has declined for three consecutive years between 2014 and 2017 in the United States (Kochanek et al., 2016[1]; Xu et al., 2016[2]; Murphy et al., 2017[3]; Public Health England, 2018[4]), and improvements in life expectancy have virtually stalled in the United Kingdom in recent years (Public Health England, 2018[4]). Ho and Hendi (2018[5]) found that between 2014 and 2015, the majority of a set of 18 Organisation for Economic Cooperation and Development (OECD) countries experienced life expectancy declines for both men (11 countries) and women (12 countries). In most of these countries, the declines were related to increases in mortality at older ages (above age 65) following a particularly bad influenza year, and life expectancy recovered to its expected levels in the following year. The United States was an exception, with its declines strongly driven by increases in mortality at younger ages (below age 65) and drug overdose in connection with its ongoing opioid epidemic. Following the 2014-15 declines, life expectancy continued to decline in the United States. In the United Kingdom, life expectancy increased in 2016 and 2017, but showed no further gains between 2017 and 2018 for both men and women (Public Health England, 2019[6]). Raleigh (2019[7]) compared life expectancy trends in two periods, 2011-16 and 2006-11, for selected European Union (EU) and OECD countries. This report documented a slowdown in life expectancy improvements among several of these countries and suggested that contributory factors to these trends may include slower reductions in cardiovascular disease (CVD) mortality and increases in mortality from dementia and Alzheimer's disease, and in some countries, drug overdose.

This paper examines changes in life expectancy among a set of 32 OECD countries for which recent mortality data by cause of death are available. It aims to provide a comprehensive assessment of changes in life expectancy since 2010 and whether these trends have been similar or different across this set of countries. Trends between 2010 and the most recent year available for each country (ranging between 2014 and 2017) are compared to trends between 2000 and 2010. To account for differences in the observation window across countries, these changes are annualised for cross-country comparability. Data were sourced from the Human Mortality Database, the World Health Organization Mortality Database, and several countries' vital statistics agencies (Finland, Italy, Norway, and Portugal) in order to provide coverage of the most recent mortality trends possible.

Recent trends in life expectancy at birth in OECD countries

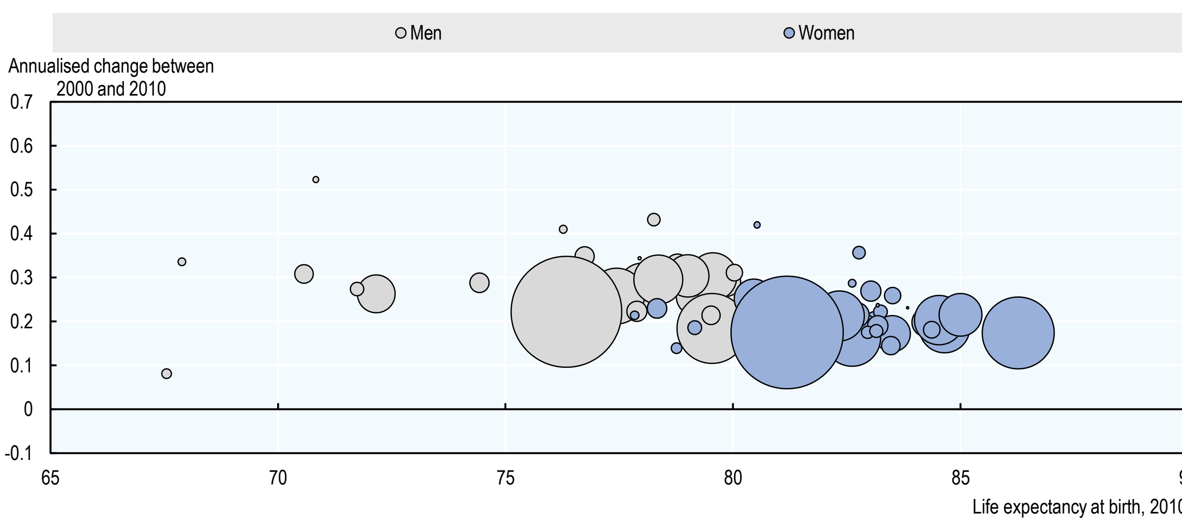
Figure 3.1 shows the annualised change in life expectancy at birth since 2010 plotted against the life expectancy level in 2010 for each of the 32 OECD countries. Each circle corresponds to men or women in each country, and the size of the circle is proportional to the country's male or female population size. The further a country lies above the x-axis, the larger the gains in life expectancy it has experienced since 2010. While some countries have made robust improvements, many are clustered very close to the x-axis.

Figure 3.1. Gains in life expectancy at birth since 2010 and levels of life expectancy at birth in 2010, men and women, 32 OECD countries



Source: Data from the Human Mortality Database and World Health Organization Mortality Database.

Figure 3.2. Gains in life expectancy at birth between 2000 and 2010 and levels of life expectancy at birth in 2010, men and women, 32 OECD countries

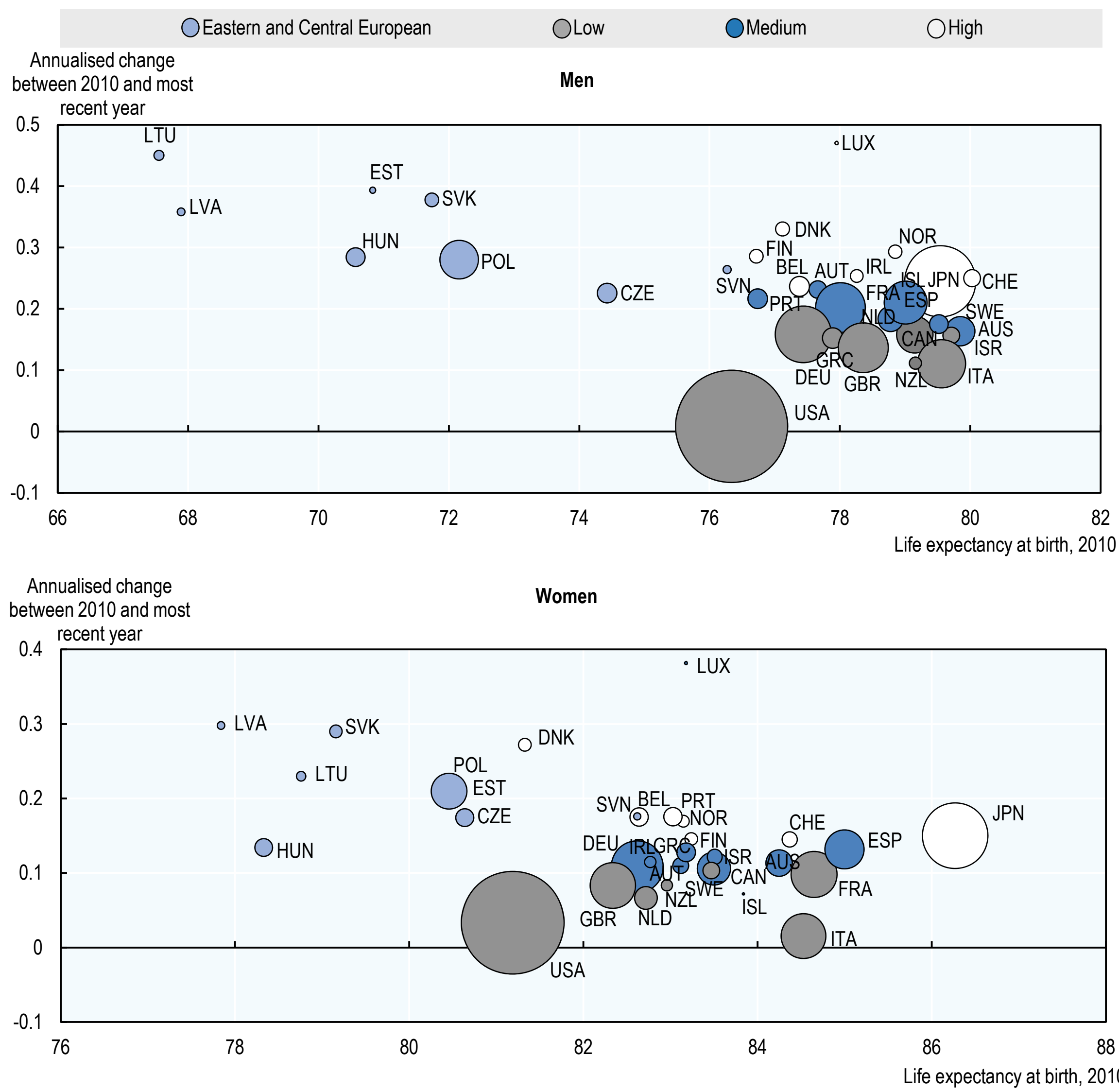


Source: Data from the Human Mortality Database and World Health Organization Mortality Database.

Figure 3.2 shows the life expectancy improvements these countries experienced in the preceding decade (i.e. the annualised change in life expectancy at birth between 2000 and 2010). In this figure, all the countries are located at much greater distances above the x-axis.

Figure 3.3 provides a more detailed look at the life expectancy trends since 2010 separately for men and women. The eight Central and Eastern European countries (Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovak Republic, and Slovenia) rank among the best performing countries for both men and women. However, these countries started out at considerably lower baseline levels of life expectancy. The bulk of this chapter focuses on the remaining 24 OECD countries, which have more similar mortality levels and histories. We can classify the remaining countries into three groups of eight: High, which consists of countries making the largest gains in life expectancy since 2010; Medium, which consists of countries making mid-sized gains; and Low, which consists of countries making the smallest gains since 2010. Most of these countries fall into the same groups for men and women, but for ten of the countries, men and women are classified into different (although adjacent) groups. The country groupings, and the average gains in life expectancy for each group, are shown in Table1.1 in Chapter 1. While the number and exact composition of these groups is somewhat arbitrary, the essence of the main point is clear – some countries have made fairly strong gains in life expectancy since 2010, while others have made almost none.

Figure 3.3. Gains in life expectancy at birth since 2010 and levels of life expectancy at birth in 2010, men and women, 32 OECD countries



Source: Data from the Human Mortality Database and World Health Organization Mortality Database.

For example, men in the countries in the Low group gained 0.12 years on average since 2010, compared to 0.27 years on average between 2000 and 2010. Countries in the Medium group gained 0.20 and 0.28 years since 2010 and between 2000 and 2010, respectively. In contrast, countries in the High group performed just as well since 2010 as in the prior decade (0.30 years in each period). For women, the pattern is highly similar, but the magnitudes of the average gains in both periods and all three country groups are somewhat smaller in size compared with men.

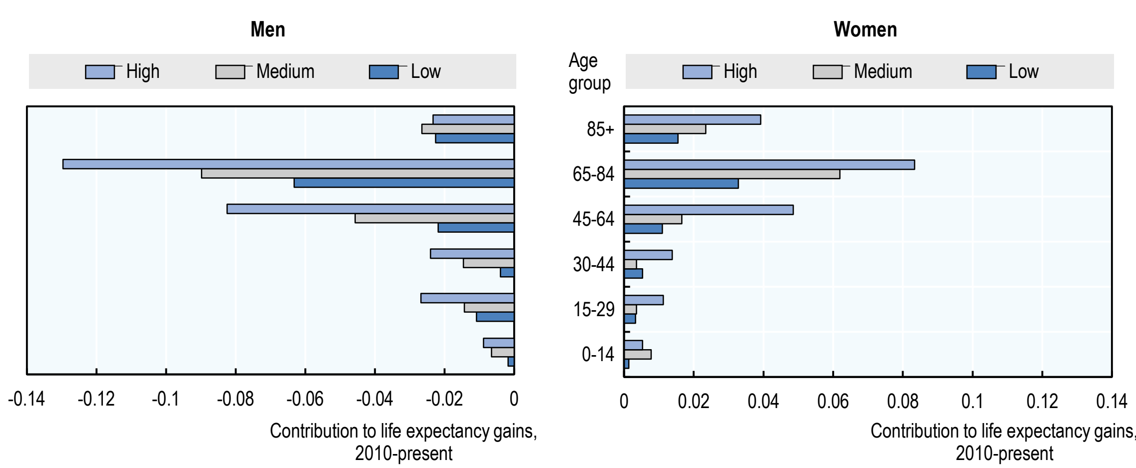
What is particularly striking is that Japan and Switzerland, two of the countries in the High group, had very high levels of life expectancy to begin with, consistently ranking among the world leaders in life expectancy. This would suggest that these countries are not approaching a limit to life expectancy and that stagnation in mortality improvements is not concentrated among countries with little possibility of achieving higher life expectancy levels (in other words, the High group is not composed of the countries with the lowest life expectancy levels, and the Low group is not composed of the countries with the highest life expectancy levels). In fact, the United States, which is often ranked last in terms of life expectancy among its high-income peer countries (Crimmins, Preston and Cohen, 2011[8]; Ho, 2019[9]; Ho and Preston, 2010[10]; Woolf and Aron, 2013[11]), falls into the Low group for both men and women.

In the subsequent sections, we focus on making two sets of comparisons. The first is between groups in the most recent period (e.g. what differentiates High-performing countries from those that were Low- or Medium-performing?). The second is within groups across time (e.g. for countries in the Low group, which age groups and causes of death contribute most to slower gains since 2010 compared to a decade ago?).

Age group contributions

Figure 3.4 displays the contribution of broad age groups to gains in life expectancy at birth for men and women in each of the three groups of countries (Low, Medium, and High) since 2010. The longer the length of the bar, the more that age group is contributing to improvements in life expectancy. First, across the board – for all three groups and for both men and women – mortality reductions at ages 65-84 have been the most important source of gains in life expectancy (accounting for 40-50% of these gains), followed by mortality reductions at ages 45-64. Second, greater reductions in mortality in these two age groups explain the majority (about 74-78% among men and 63-67% among women) of the High group's larger gains compared to the Medium and Low groups. The rest of the difference was driven by younger age (i.e. below age 45) mortality among men (25%) and by older age (i.e. at ages 85+) mortality among women (about a tenth).

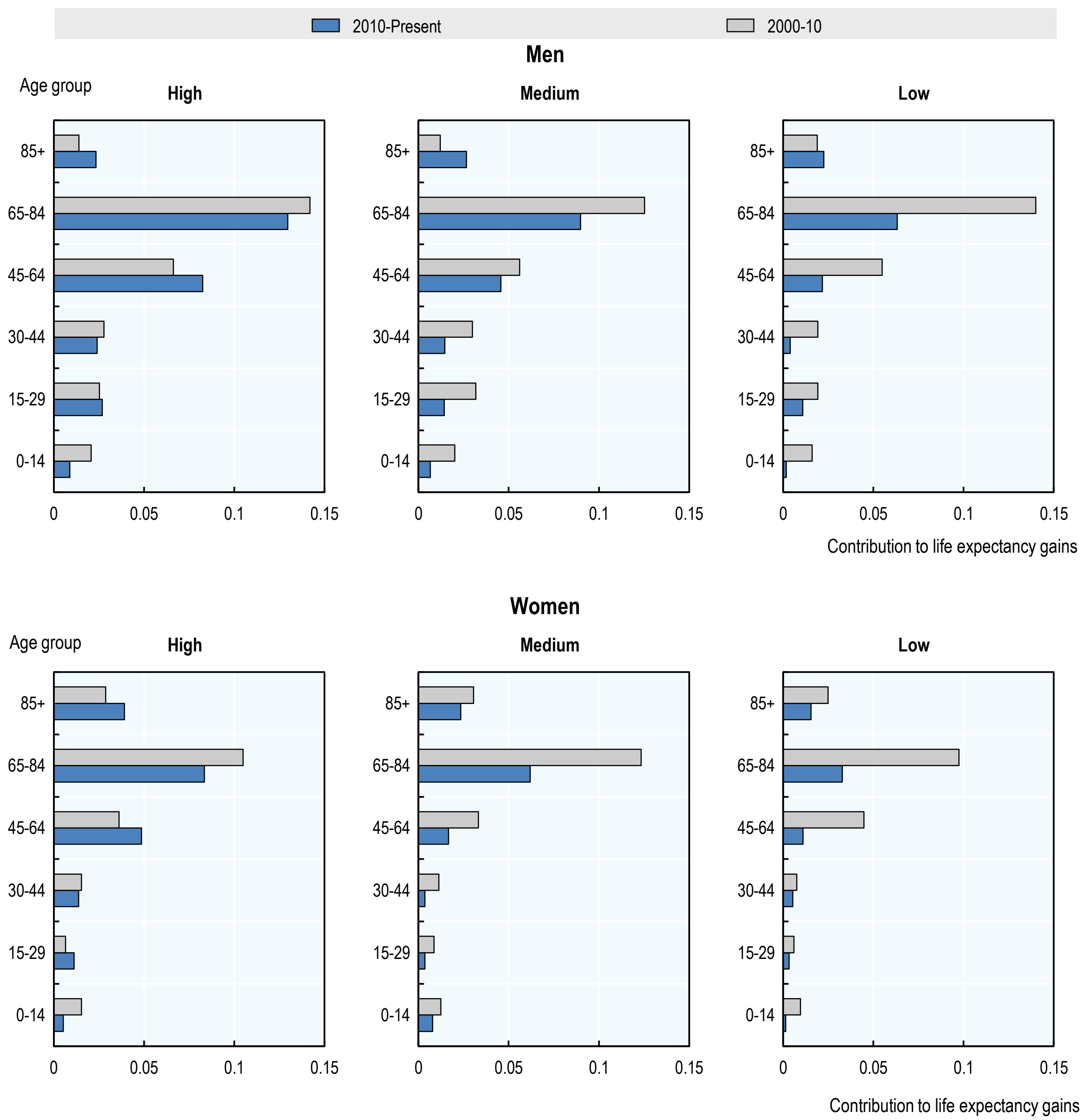
Figure 3.4. Contribution of age groups to gains in life expectancy at birth since 2010, men and women, 24 OECD countries



Source: Data from the Human Mortality Database and World Health Organization Mortality Database.

Figure 3.5 demonstrates the importance of mortality reductions in each age group for life expectancy gains since 2010 and between 2000 and 2010. Focusing on the Medium and Low groups, which both achieved much slower progress in the recent period, we see that the bars for the 65-84 and 45-64 age groups are much shorter in the recent period than they were in the earlier period. In other words, much of the reason why life expectancy gains have been slower since 2010 is that mortality reductions have been considerably smaller between ages 45-84 for these two groups of countries.

Figure 3.5. Contribution of age groups to gains in life expectancy at birth between 2000 and 2010 and since 2010, men and women, 24 OECD countries



Source: Data from the Human Mortality Database and World Health Organization Mortality Database.

Cause of death contributions

Mortality rates for most causes of death have continued to decline since 2010. However, we have seen notable increases in mortality from a few causes of death: accidental poisoning (a key component of drug overdose), mental and nervous system diseases (including Alzheimer's disease), and perinatal conditions. For two causes – respiratory diseases (other than influenza and pneumonia) and infectious diseases – mortality increased only among women. Mortality from influenza and pneumonia also increased among women after 2010 in 5 out of 8 countries in the Low group and 6 out of 8 countries in the Medium group, contributing to losses in life expectancy. These mortality increases are not limited to a select, small set of countries. For example, 23 out of the 24 countries experienced increases in mortality from mental and nervous system disorders, and 14 (58%) and 17 (71%) experienced increases in accidental poisoning death rates for men and women, respectively (Table 3.1).

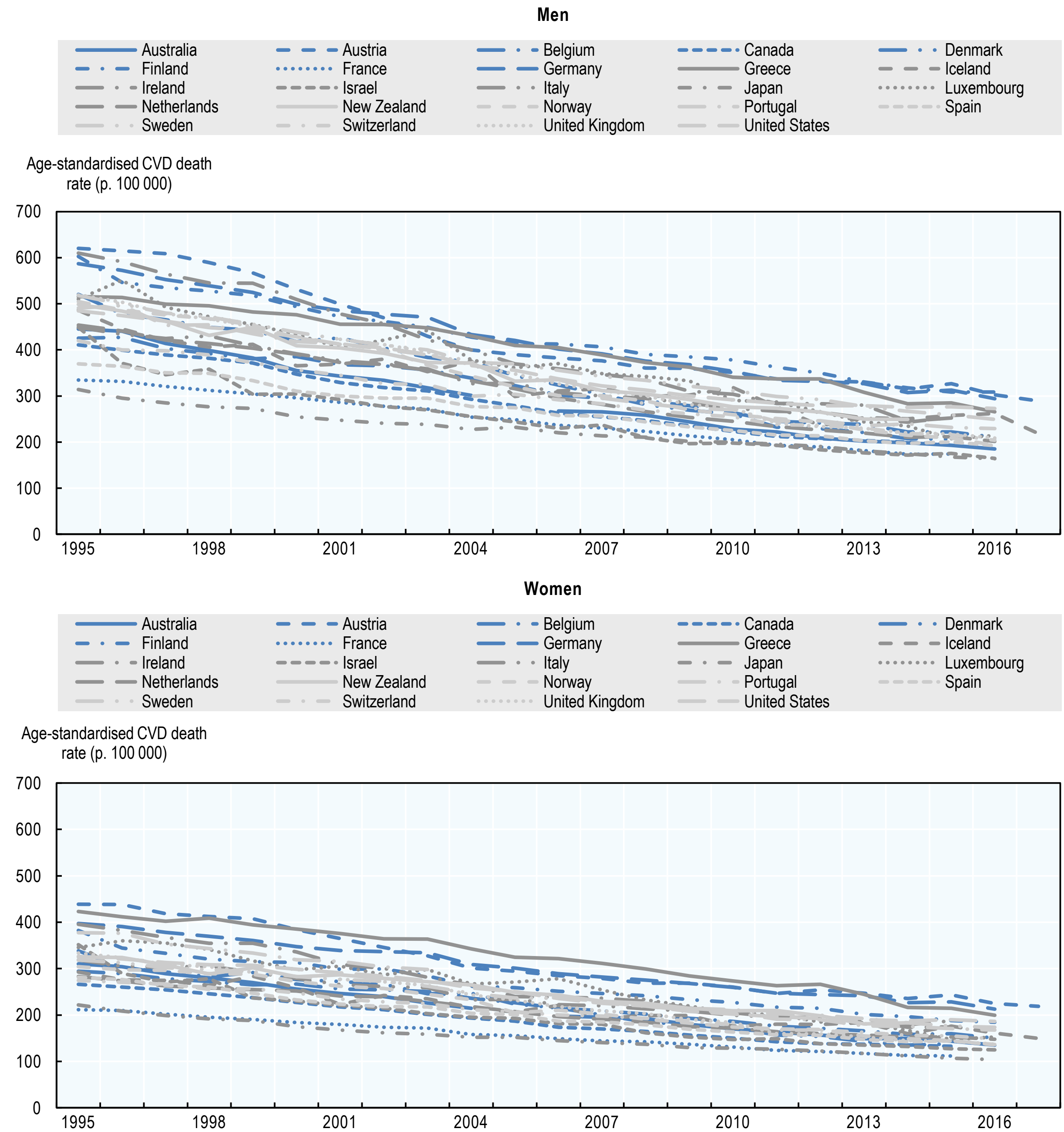
Table 3.1. Countries (number and %) experiencing increases in mortality from specific causes of death since 2010, men and women, 24 OECD countries

Cause	Men		Women	
	#	%	#	%
Accidental poisoning	14	58	17	71
Mental and nervous system diseases	23	96	23	96
Other respiratory diseases	4	17	15	63
Perinatal conditions	10	42	11	46
Infectious diseases	9	38	11	46

Source: Data from the Human Mortality Database and World Health Organization Mortality Database.

Cardiovascular disease (CVD) has been implicated in the general slowdown in life expectancy improvements (Raleigh, 2019[7]) and particularly in the United Kingdom (Public Health England, 2018[4]; Office for National Statistics, 2018[12]; Steel et al., 2018[13]). Figure 3.6 shows trends in CVD mortality since 1995 among men and women in these 24 countries. Compared to about a quarter century ago, these countries have experienced enormous reductions in CVD mortality. On average, CVD mortality today is roughly half of what it was in 1995. However, it is important to note that the bulk of those reductions occurred before 2010. Countries that experienced particularly slow reductions in CVD mortality for both men and women since 2010 (relative to the rates experienced between 2000 and 2010) include the United States, Italy, Canada, Ireland, Austria, and the Netherlands.

Figure 3.6. CVD mortality, 1995 to most recent year, men and women, 24 OECD countries



Source: Data from the Human Mortality Database and World Health Organization Mortality Database.

This is more apparent in Table 3.2, which shows each country's annualised rate of reduction in CVD mortality since 2010 compared to the prior decade. All countries achieved reductions in CVD mortality during both periods, but for nearly all of them (the exceptions being Japanese and Icelandic men and Greek women), progress was greater in the earlier than the most recent period. The larger the value in the Difference column, the greater the discrepancy in reducing CVD mortality between the two periods. These differences tended to be larger for the Low and Medium groups than for the High groups. For example, the average annualised rate of reduction in CVD mortality among men in the Low group was about 5.99 deaths per 100 000 greater on average between 2000 and 2010 than since 2010; this number was 3.59 for the

Medium group and 3.33 for the High group. For women, the corresponding figures were 3.34 (Low), 3.39 (Medium), and 2.26 (High).

Table 3.2. Reductions in CVD mortality between 2000 and 2010, and since 2010, men and women, 24 OECD countries

		Annualised change in age-standardised CVD death rate				Annualised change in age-standardised CVD death rate		
		Men				Women		
Group	Country	2000-10	2010-Present	Difference	Country	2000-10	2010-Presen	Difference
High	Belgium	12.17	8.89	3.28	Belgium	8.03	6.0	1.98
	Denmark	15.68	10.94	4.74	Denmark	10.24	7.3	2.93
	Finland	11.58	11.56	0.02	Finland	8.56	7.1	1.41
	Ireland	20.55	10.27	10.28	Japan	4.68	4.1	0.57
	Japan	5.53	5.98	-0.45	Luxembourg	9.35	8.4	0.85
	Luxembourg	14.27	12.71	1.56	Norway	9.83	6.2	3.57
	Norway	16.64	11.12	5.51	Portugal	11.35	6.4	4.95
	Switzerland	10.24	8.52	1.72	Switzerland	6.87	5.0	1.82
	Average	**13.33**	**10.00**	**3.33**	**Average**	**8.61**	**6.3**	**2.26**
Medium	Australia	12.71	7.16	5.54	Australia	8.58	5.84	2.7
	Austria	18.01	8.85	9.16	Austria	12.39	5.91	6.4
	France	9.10	6.15	2.95	Canada	7.72	3.44	4.2
	Iceland	4.74	14.21	-9.47	Germany	8.77	7.82	0.9
	Netherlands	14.52	7.23	7.29	Greece	11.15	12.35	-1.2
	Portugal	14.84	6.83	8.01	Ireland	13.11	6.15	6.9
	Spain	8.54	5.47	3.07	Israel	8.31	3.69	4.6
	Sweden	12.62	10.45	2.17	Spain	6.90	4.62	2.2
	Average	**11.88**	**8.29**	**3.59**	**Average**	**9.62**	**6.2**	**3.39**
Low	Canada	12.43	5.73	6.69	France	5.25	3.87	1.3
	Germany	14.59	9.83	4.75	Iceland	8.21	3.84	4.3
	Greece	13.53	12.51	1.02	Italy	7.91	2.40	5.5
	Israel	10.62	5.54	5.08	Netherlands	7.99	3.99	4.0
	Italy	11.77	4.03	7.74	New Zealand	7.37	6.3	1.03
	New Zealand	13.26	6.84	6.42	Sweden	7.14	6.2	0.85
	United Kingdom	16.57	10.83	5.74	United Kingdom	10.35	7.7	2.59
	United States	13.63	3.19	10.45	United States	9.67	2.6	7.02
	Average	**13.30**	**7.31**	**5.99**	**Average**	**7.99**	**4.6**	**3.34**

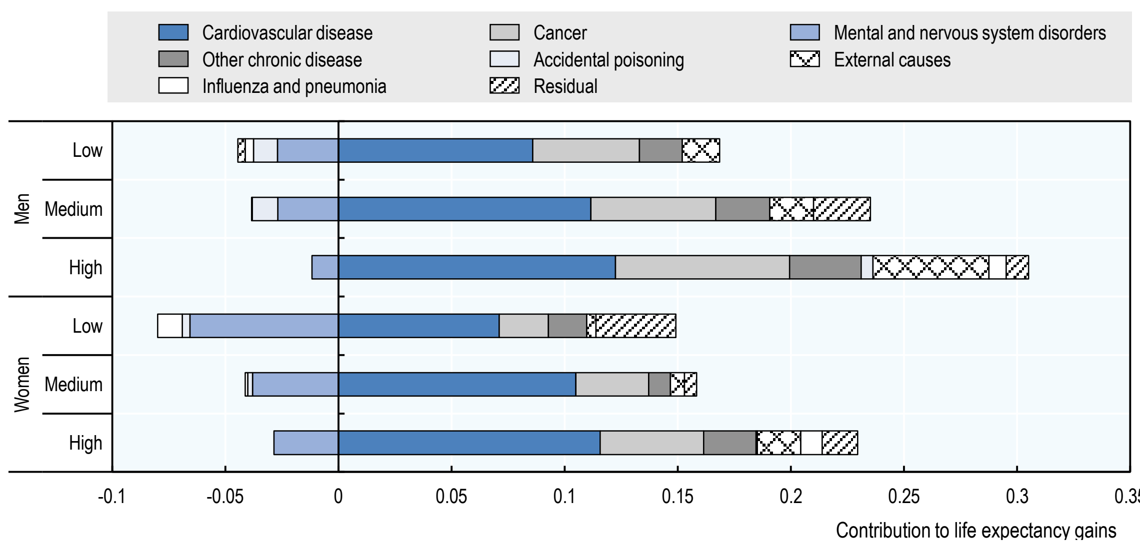
Source: Data from the Human Mortality Database and World Health Organization Mortality Database.

CVD is one among several important cause of death categories. Next, we identify how several major causes of death have contributed to changes in life expectancy at birth using Arriaga's decomposition (Arriaga E, 1989[14]). The results from this analysis are shown in Figure 3.7 and Figure 3.8. Figure 3.7 focuses on comparisons between groups in the most recent period, while Figure 3.8 make comparisons within groups across time. The length of each bar is the total average gain in life expectancy experienced by the countries in a given group, and each of its components is a cause of death category. Causes of death to the right of the zero line contributed to gains in life expectancy, while causes of death to the left of zero line contributed to losses in life expectancy.

Beginning with men (Figure 3.7), we see that for all groups, CVD made the largest contributions to life expectancy improvements, followed by cancer. Mental and nervous system disorders, on the other hand, contributed to life expectancy losses. The three causes of death contributing most to differences between the Medium and High groups were: cancer, accidental poisoning, and external causes. Countries in the High group made larger reductions in cancer and external cause mortality than countries in the Medium group. CVD, cancer, and external causes were the three causes contributing most to difference between the Low and High groups, with each accounting for about 20% of this difference. It is notable that countries in the High group continued to experience reductions in mortality from accidental poisoning, but countries in both the Low and Medium groups experienced mortality increases from this cause of death.

Among women, CVD was also the cause of death contributing most to gains in life expectancy, followed by cancer. Mental and nervous system disorders played an even more important role in the substantial slowdowns in life expectancy gains for women than they did for men. Cancer, other chronic diseases, and external causes were the top three contributors to the difference between the Medium and High groups. For the difference between the Low and High groups, these were CVD, cancer, and mental and nervous system disorders. Influenza and pneumonia were also important contributors to these differences, accounting for 15% and 13% of the smaller life expectancy gains among women for countries in the Low and Medium groups, respectively, compared to countries in the High groups.

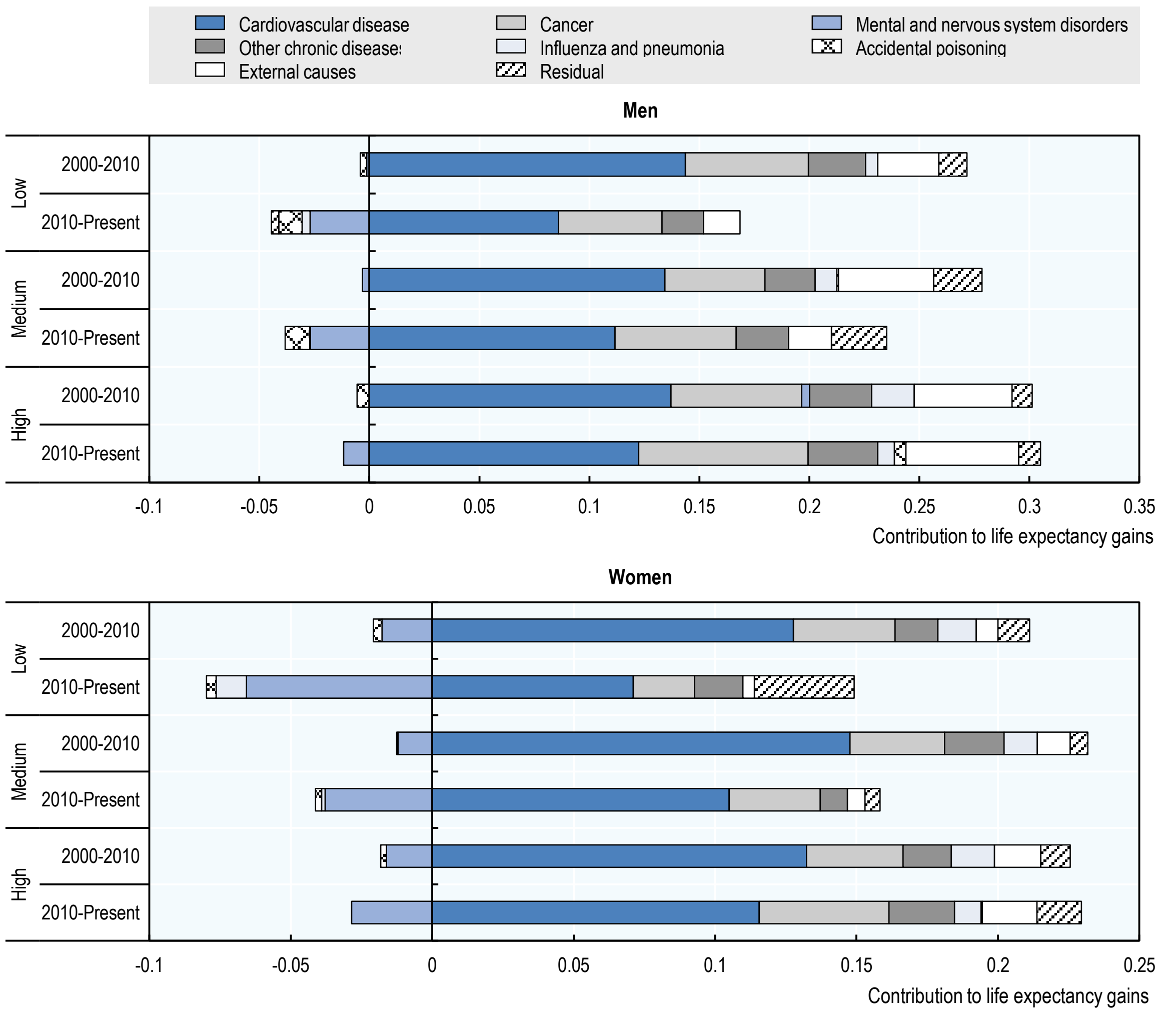
Figure 3.7. Contributions of causes of death to gains in life expectancy at birth since 2010, men and women, 24 OECD countries



Source: Data from the Human Mortality Database and World Health Organization Mortality Database.

Finally, we turn our attention to which causes of death each group of countries has been less successful in reducing mortality from since 2010 compared to a decade ago (Figure 3.8). As we saw earlier, gains have been smaller in the most recent period than in the earlier period for Medium and Low countries, but similar in magnitude in both periods for the High group. The causes that contribute most to the smaller gains in the most recent period are the same for the Medium and Low groups. For men, countries in these groups are now making much smaller reductions from CVD and external causes compared to a decade prior, and they are experiencing substantial increases in the burden of mortality from mental and nervous system disorders. For women, countries in the Medium and Low groups are now making much smaller reductions from CVD. They are experiencing losses rather than gains in life expectancy from influenza and pneumonia, especially in the Low and Medium groups, and even larger losses from mental and nervous system disorders. Among women, smaller reductions in influenza and pneumonia since 2010 accounted for 20% of the difference in life expectancy gains between the two periods for countries in the Low group and 13% of the difference for countries in the Medium group.

Figure 3.8. Contributions of causes of death to gains in life expectancy at birth between 2000 and 2010 and since 2010, men and women, 24 OECD countries



Source: Data from the Human Mortality Database and World Health Organization Mortality Database.

Conclusions

This paper has illustrated which age groups and causes of death explain why some high-income countries are not experiencing the robust life expectancy gains enjoyed by others, and also why countries are not performing as well as they did a decade ago. The middle (45-64) and older (65-84) adult ages are currently the age groups that constitute the key sources of life expectancy improvements since 2010. However, these are also the age groups in which mortality reductions have slowed in Low- and Medium-performing countries. In contrast, High-performing countries have continued to post strong mortality reductions in these age groups. Furthermore, they have continued to experience stronger mortality improvements at the younger ages (below age 45) for men and at the oldest ages (above age 85) for women, which is not the case for their counterparts in the Low and Medium groups.

CVD is both an important source of life expectancy gains and an area where some countries are struggling to make reductions, including matching their progress from a decade ago. The same can be said of cancer. Other causes of death that have emerged as important contributors to the slowing of life expectancy gains include: accidental poisoning (drug overdose), mental and nervous system disorders (including Alzheimer's disease), external causes, and, among women, influenza and pneumonia. Two key features of these trends are that countries in the Low and Medium groups are experiencing heavy burdens of mortality from mental and nervous system disorders, both compared to a decade prior and compared to countries in the High groups; and that while countries in the Low and Medium groups are losing years of life to accidental poisoning, the countries in the High groups appear to be largely exempt from this adverse trend.

As with any cross-national and over time comparison, we must interpret these results with caution and acknowledge that differences in cause of death coding across countries and over time may be present. It is likely that there have been considerable changes in diagnostic practices, death certification, and cause of death coding over the past two decades. It is most likely that an increasing number of deaths now being assigned to dementia, Alzheimer's disease, and other mental and nervous system disorders would have been coded as due to CVD, respiratory disease, or influenza and pneumonia in the past. These cause of death categories are also showing up as key areas where mortality reductions have slowed.

Clearly, CVD is an important contributor to the stalled life expectancy improvements seen in some countries. This is a cause of death that is strongly linked to behavioural factors operating over the life course including smoking, obesity, diet, and sedentary lifestyle, as well as access to and quality of health care. Going forward, it is very important that we maintain the quality and timeliness of our vital registration systems and timely data releases. For most countries, there is an at least four-year (and often greater) lag between the most recent cause-specific mortality data becoming available and the present year. These data are essential for identifying contemporary trends in CVD mortality, as well as the broader drivers underlying these trends.

Understanding the burden and causes of trends in CVD mortality is further complicated by the linkages between CVD and other causes of death, particularly influenza and pneumonia, and also drug overdose. Worldwide, there have been a series of severe influenza years since 2010. As populations' age and deaths become increasingly concentrated at the older ages, the influence of elevated influenza mortality on life expectancy may become more evident. For example, the majority of high-income countries experienced declines in life expectancy between 2014 and 2015, and influenza and pneumonia, along with respiratory and cardiovascular diseases, were key contributors to these life expectancy declines (Ho and Hendi, 2018[5]). Differentiating among these causes of death is often a complicated process. Influenza and pneumonia can trigger cardiovascular events like heart attacks, and in turn, individuals with CVD may be more susceptible to dying from influenza or pneumonia. Thus, the underlying cause of death on the death certificate may end up being assigned to any one of these categories – influenza, pneumonia, CVD, or respiratory diseases, and studying trends in CVD mortality alone will not give us the full picture if a large proportion of those deaths are related to influenza.

Drug use and overdose are also linked to CVD, which is the leading cause of death among users of illicit drugs. Illicit drug use has been linked to several cardiovascular conditions including atrial fibrillation, cardiomyopathy, endocarditis, stroke, cardiac arrest, myocardial infarction (De Los Ríos et al., 2012[15]; Kadri et al., 2019[16]; Kevil et al., 2019[17]; Tseng et al., 2018[18]). Some of these deaths may be coded as CVD deaths, while others may be coded as drug overdose. Without understanding these connections, we may be arriving at an incomplete picture of why CVD mortality is no longer declining so rapidly. This is particularly important since mortality from drug overdose is increasing in several high-income countries (Ho, 2019[9]). While this epidemic is most advanced in the United States, high levels of drug overdose mortality have also been observed in other OECD countries, including several Nordic and Anglophone countries. Many of these countries are experiencing substantial increases in drug overdose mortality between the ages of 45 and 85 (Ho, 2019[9]) – which, as we saw earlier, is exactly the age range where mortality gains are failing to keep pace with prior decades.

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4 Global trends in cardiovascular disease – an update from the Global Burden of Disease Study

Dr Catherine O. Johnson, PhD MPH, Lead Research Scientist, IHME Cardiovascular Group

The results of the Global Burden Disease study suggest that the decrease in cardiovascular mortality seen in most high-income countries over the past few decades is levelling off in countries like South Korea, France, Australia, Germany, Austria, Japan, and the United States among those aged 70 years, and is increasing in Latvia, Estonia, Greece and Portugal. Similar patterns were observed among those aged 50- 69, with some exceptions – for example, rates in South Korea and Austria among younger ages continue to decrease even in more recent years. Evidence suggests that the prevalence of common risk factors for cardiovascular disease, including elevated low-density lipoprotein cholesterol and systolic blood pressure, is increasing, leading to expected increases in mortality burden. Locally targeted population interventions are needed in order to appropriately assess and intervene with groups at risk; together with timely monitoring of both cardiovascular mortality and common risk factors over time.

History of the GBD

The Global Burden of Disease Study (GBD) generates global estimates of death and disability from over 300 causes. The list of causes is based largely on the International Classification of Diseases (ICD) reporting system, now in its 11th iteration (WHO, 2018[1]). The results produced are comprehensive, using methods that are consistent from country to country to enable comparisons across locations, between different types of health loss, and over time. The GBD began in the early 1990s, in collaboration with the World Bank. Today, it is an annual process, generating consistent, reliable results used by health departments, policy makers, and other stakeholders worldwide to guide decision-making around health policy and spending. The core estimation processes are run by researchers at the Institute for Health Metrics and Evaluation at the University of Washington in Seattle, Washington, working in concert with a collaborator network of over 3 600 investigators from around the world. The process is overseen by a management team at IHME and an Independent Advisory Council. Full details of the history of the GBD, the protocols and processes, and persons involved can be found at http://www.healthdata.org/gbd/about.

Methods and metrics

Four key components of disease burden are estimated as part of each GBD cycle: 1) estimates of all-cause mortality, population, and fertility; 2) estimates of cause-specific mortality; 3) estimates of prevalence and incidence of nonfatal disease processes; and 4) estimates of attributable burden for a variety of risk factors. The full time series is re-estimated with each GBD cycle to reflect updates to methods, data, and data processing. Details of the various estimation processes can be found in the capstones and associated appendices (Murray et al., 2018[2]; Dicker et al., 2018[3]; James et al., 2018[4]; Stanaway et al., 2018[5]; Roth et al., 2018[6])

Using these estimates, the GBD computes a number of summary measures of disease burden. These include years of life lost due to premature mortality (YLL), which is calculated from the sum of each death multiplied by the standard life expectancy for that age group. The standard life expectancy is determined from the lowest observed risk of death for each age group in all populations with more than 5 million people. Years lived with disability are calculated by taking the sum of the prevalence of each condition multiplied by the associated disability weight after accounting for the results of the comorbidity simulation process. Disability-adjusted life years (DALYs) are calculated as the sum of YLLs and YLDs for a specific age/sex/location/year combination.

Input data

All input data used in the GBD can be accessed via the Global Health Data Exchange website (IHME, 2017[7]). Data can be queried by component, location, and cause or risk.

Cardiovascular diseases

Cause-specific mortality is estimated for a number of cardiovascular diseases, including ischemic heart disease and stroke. Causes are estimated at a number of different levels. For example, we estimate deaths due to stroke as a level 3 cause, while also estimating the subtypes of ischaemic stroke, intracerebral haemorrhage and subarachnoid haemorrhage separately. In order to not double-count the deaths; we scale the three subtypes such that the sum equals the total number deaths for stroke for each age/sex/location/year combination. The total number of cardiovascular deaths is thus the scaled total of all causes at the lowest level of the hierarchy (Table 4.1).

Table 4.1. Cardiovascular disease cause list

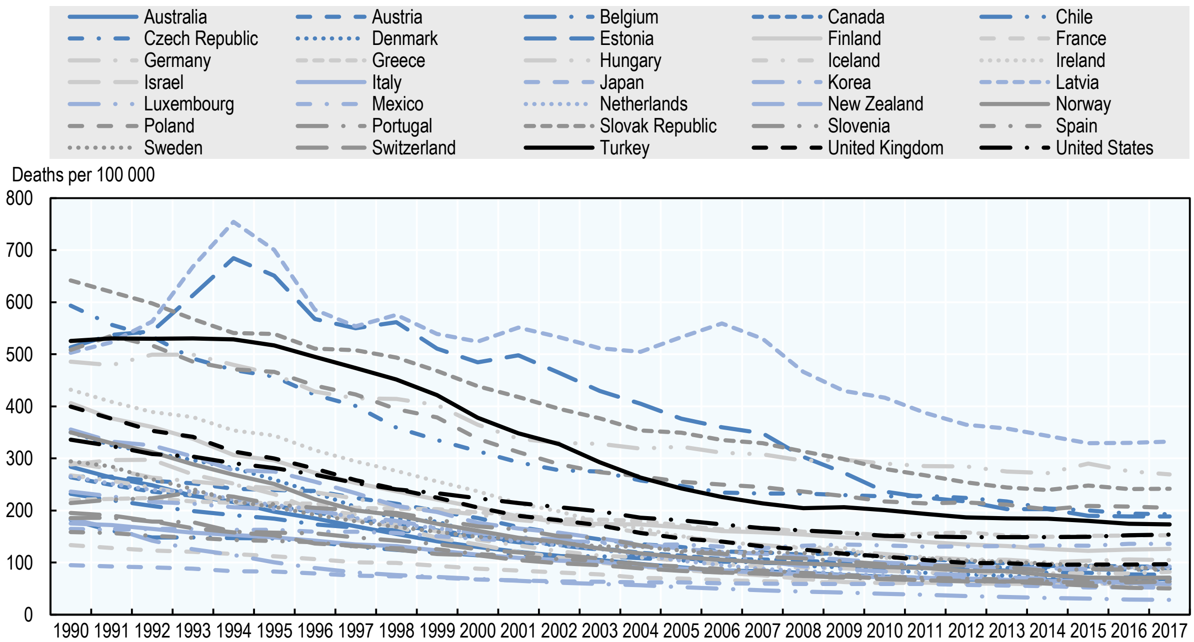
Cause	Level
Cardiovascular diseases	2
Rheumatic heart disease	3
Ischaemic heart disease	3
Stroke	3
Ischaemic stroke	4
Intracerebral haemorrhage	4
Subarachnoid haemorrhage	4
Hypertensive heart disease	3
Non-rheumatic valvular heart disease	3
Non-rheumatic calcific aortic valve disease	4
Non-rheumatic degenerative mitral valve disease	4
Other non-rheumatic valve diseases	4
Cardiomyopathy and myocarditis	3
Myocarditis	4
Alcoholic cardiomyopathy	4
Other cardiomyopathy	4
Atrial fibrillation and flutter	3
Aortic aneurysm	3
Peripheral arterial disease	3
Endocarditis	3
Other cardiovascular and circulatory diseases	3

Source Roth et al: (2018[6]), "Global, regional, and national age-sex-specific mortality for 282 causes of death in 195 countries and territories, 1980-2017: a systematic analysis for the Global Burden of Disease Study 2017', http://dx.doi.org/10.1016/S0140-6 736(18)32203-7.

Results

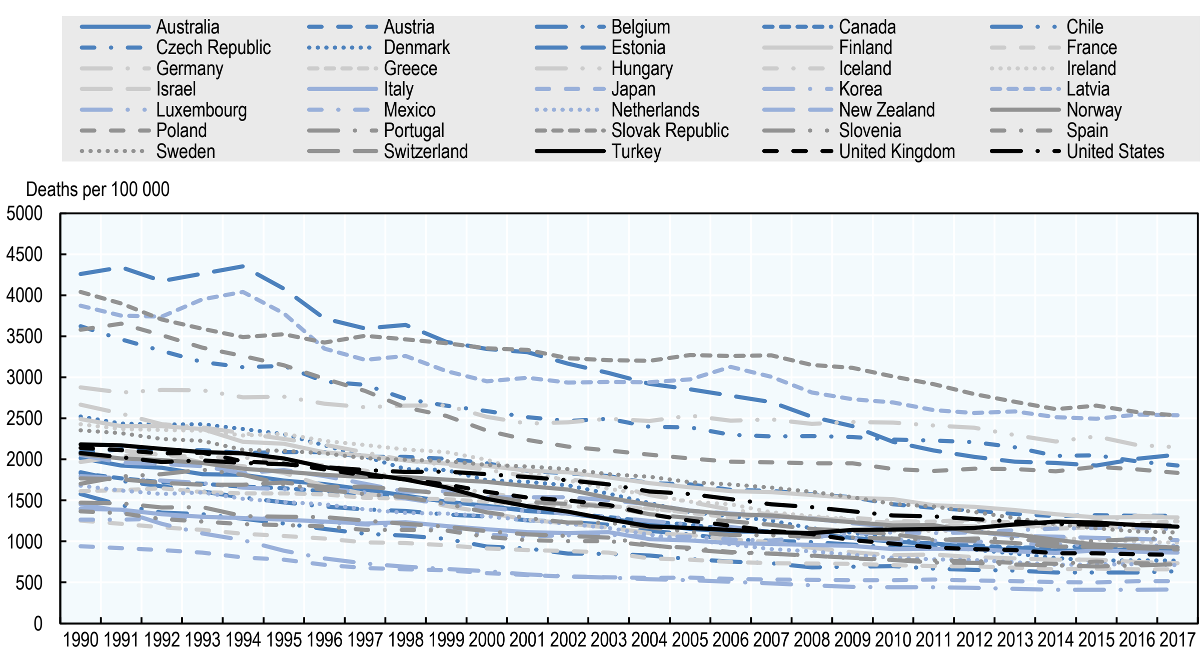
All results for the current cycle of the GBD can be viewed via the GBD Compare website (IHME, 2017[7]), including a custom grouping for member countries of the Organisation for Economic Co-operation and Development. The estimates can also be downloaded from the GBD results tool: http://ghdx.healthdata.org/gbd-results-tool. Information on additional visualisations and commonly used terms and abbreviations can be found here: https://www.healthdata.org/sites/default/files/files/Data_viz/GBD_2017_Tools_Overview.pdf.

Figure 4.1. GBD Compare visualisation, both sexes, ischaemic heart disease mortality rates among those 50 to 69 years of age



Source: Institute for Health Metrics and Evaluation (IHME). GBD Compare. Seattle, WA: IHME, University of Washington, 2015. Available from http://vizhub.healthdata.org/gbd-compare (accessed 27 February 2020).

Figure 4.2. GBD Compare visualisation, both sexes, ischaemic heart disease mortality rates among those 70 or more years of age



Source: Institute for Health Metrics and Evaluation (IHME). GBD Compare. Seattle, WA: IHME, University of Washington, 2015. Available from http://vizhub.healthdata.org/gbd-compare (accessed 27 February 2020).

With regard to cardiovascular mortality, ischaemic heart disease and stroke are the main drivers; many of the other causes included in the cardiovascular grouping contribute relatively few deaths. The detailed cause list also allows for exploration of atherosclerotic vs non-atherosclerotic causes (e.g. ischemic heart disease vs. endocarditis).

Interpretation and conclusions

The results of the GBD estimation process are consistent with other findings that the decrease in cardiovascular mortality seen in most high-income countries over the past few decades is levelling off, and may be increasing in certain countries (Shah, Roberts and Shah, 2013[8]; Menotti et al., 2019[9]; Regidor et al., 2019[10]; Shah et al., 2019[11]). Countries where results indicate that cardiovascular mortality may be increasing among those aged 70 years or more include Latvia, Estonia, Greece and Portugal, while rates in many countries including South Korea, France, Australia, Germany, Austria, Japan, and the United States appear to be levelling off. Similar patterns were observed among those aged 50 to 69 years of age, with some exceptions – for example, rates in South Korea and Austria among younger ages continue to decrease even in more recent years.

Our assessment of common risk factors for cardiovascular disease, including elevated low-density lipoprotein cholesterol, systolic blood pressure, and fasting plasma glucose indicates that while many countries (e.g. United Kingdom and Denmark) have seen improvements in their cardiometabolic risk profile, prevalence of these risks is increasing in a number of countries (e.g. Netherlands, Belgium, Chile, Mexico), resulting in the changes seen and pointing to increased mortality burden if these increases continue.

Local interventions specific to the target population are needed in order to appropriately assess and intervene with groups at risk; however, the comprehensive, consistent, and comparable methods of burden estimation employed by the GBD can be used to monitor trends for both cardiovascular mortality and common cardiovascular risk factors over time.

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5 Socio-economic inequalities in CVD mortality: an overview of patterns, secular changes and their determinants

Professor Anton E. Kunst, Department of Public Health, Amsterdam UMC, University of Amsterdam

Numerous studies have documented large differences in cardiovascular risk between people with higher and lower socio-economic status. Typically, there is an about two-fold difference in cardiovascular mortality between those at the upper and lower ends of the social hierarchy – a difference that is much larger than for cancer mortality. With much of the population burden of cardiovascular disease concentrated in lower socio-economic groups, we should take the perspectives of these groups when searching for explanations and policy solutions when cardiovascular mortality rates fail to decline. In this search for explanations and solutions, we should look beyond individual-level factors and preventive actions focussed on "life styles", and consider the role of wider policy areas such as urban renewal, employment and social welfare.

The secular decline in mortality from cardiovascular disease (CVD) mortality has been one of the greatest successes in modern medicine and public health. Between 1980 and 2005, CVD mortality rates have halved in several European countries. The persistence and omnipresence of these declines suggested that further substantial decreases may be expected in forthcoming decades. Yet, recent reports of stagnation in mortality declines have cast doubts on this optimistic view and prompted us to identify the causes of these unexpected trends.

Trends in CVD mortality can be understood as resulting from two components: changes in the incidence of CVD and changes in their case-fatality. Whereas the latter is driven by changes in medical technology and improvement in the organisation and quality of health care services, the former is driven by changing prevalence of a variety of risk factors. These include biological risk factors (e.g. BMI, hypertension, blood composition) and risk factors related to behaviour and psychosocial stress (e.g. smoking, diet, sleep patterns).

At the population level, changes in the prevalence of risk factors are not just driven by individual-level drivers such as values, attitudes and self-efficacy, they also reflect changes in the social and physical environments in which people live. Commercial exposures and novel fashions may change people's taste for specific foods and activities. Environmental stressors and economic uncertainty may increase the occurrence of unhealthy habits such as smoking and excessive alcohol use, in as much as these constitute ways to cope with increased stress.

Not all people are influenced in the same way by their social and physical environments. This influence may vary according to, for example, a person's age and gender. Another characteristic with strong moderating capacity is a person's socio-economic position or 'socio-economic status' i.e. the position of a person on the social hierarchy or ladder, with higher positions implying greater access to scarce societal resources. 'Socio-economic status' is a multidimensional concept, as it depends on the educational level, employment history and position at work, income from gainful employment, wealth and housing conditions, and less tangible resources such as power and prestige.

Inequalities in CVD mortality: patterns and trends

Numerous studies have documented large differences in CVD risk between people with higher and lower socio-economic status. Typically, there is an about two-fold difference in CVD mortality risk between those at the upper and lower ends of the social hierarchy – a difference that is much larger than for cancer mortality risk. Notably, CVD risk is often found to increase in a linear fashion when moving from higher towards lower socio-economic positions. This linear gradient is observed in relationship to educational level, occupational class position, income level and area-level deprivation. Commonly, about the same gradient is observed among women and men.

Once, ischemic heart disease (IHD) was regarded as a "manager's disease". This view was supported by reports up to the 1950s and 1960 that IHD incidence and mortality was higher among men with higher educational levels or occupational position. However, the gradient has reversed since then, first in the United States, and later in northern Europe. The reversal occurred latest, in the 1980s or 1990s, in southern parts of Europe. As a result, IHD has now become a "disease of poverty", like so many other diseases. In contrast to IHD, the incidence and mortality of cerebrovascular disease has always been higher in socio-economically disadvantaged population groups.

A recent overview of socio-economic inequalities in CVD mortality in 12 European countries by Di Girolamo et al (2019[1]) analysed changes in CVD mortality between the 1990s and the early 2010s by gender, educational level and occupational class. CVD mortality rates were found to be higher in those with low education as compared to those with high education in all 12 countries included in the analysis. The differences were relatively small in southern European countries, possibly as a consequence of a relatively late reversal of IHD from a manager's disease towards a disease of poverty. Inequalities in CVD mortality were large, in both relative and absolute terms, in Central and Eastern European countries – a pattern that was already seen in the 1990s.

For the same European countries, Di Girolamo et al (2019[1]) also documented trends in inequalities in CVD mortality between about 1990 and 2014. During this period, CVD mortality declined considerably in all 12 countries. This decline occurred in those with lower education as well as those with higher education, for men and women alike. Generally, in both genders, absolute declines were larger among the low educated, while relative declines were larger among the high educated. There were only a few situations where lower educated groups fared worse than those with high education – Estonia in the early 1990s and Lithuania in the early 2000s. In both genders, absolute inequalities in CVD mortality mostly decreased since the 1990s, while relative inequalities generally increased. The results were similar for the different measures used (IHD, cerebrovascular disease and total CVD mortality) and for analysis by occupational group. In the early 2010s, inequalities in CVD mortality were smallest in southern Europe, of intermediate magnitude in Northern and Western Europe, and largest in Central-Eastern European and Baltic countries.

Factors that operate as mediators of inequalities

Many studies and commentaries have addressed the question of how we can understand the persistent nature of socio-economic inequalities in health outcomes, including CVD risk. This understanding is commonly sought for by identifying factors that 'mediate' the causal relationship between socio-economic status and CVD risk. In a typical explanatory study, such 'mediators' are included in statistical models that aim to quantify their contribution to the observed association between socio-economic status and CVD outcomes.

Several mediators have been found to play a role. These include factors that are related to relevant exposure in early life (e.g. intra-uterine growth rate), housing conditions and the living environment (e.g. neighbourhood social disorder), working conditions (e.g. lack of autonomy and control), and health care (e.g. poor access to adequate services). Each of these factors has been found to play a role. Their exact role is found to vary between settings (periods, countries, regions) and population groups (generation, sex, ethnic group). There is no single set of explanations that applies everywhere in the same way.

Particular attention is given to the role of health-related behaviours such as smoking, alcohol abuse, lack of physical activity, and diet. Many descriptive studies have documented that socio-economic differences in the prevalence of such factors are commonly large. Dozens of mediation studies have demonstrated that these factors contribute to inequalities in CVD risk, with explained percentages up to about 50%. Smoking has been found to be the largest single contributor in many studies, but its role varies strongly according to sex (larger for men), time (diminishing role) and country (smaller in Southern Europe).

Smoking, drinking, diet or other behavioural factors are often labelled as "lifestyle factors", with the suggestion that they are a matter of "lifestyle" that is voluntary and consciously adopted in different ways by people from different socio-economic groups. However, several studies have contested this view, by showing that people's behaviour is influenced by their socio-economic status in several ways, and often involuntary and unconsciously. Increasingly more studies have tried to understand these influences, in order to identify how those in socio-economically disadvantaged positions can be protected or helped so that healthy choices are easier to make.

Take the example of smoking. The higher prevalence of smoking among those with low education largely stems from higher risks to start smoking by adolescents who have problems at school and at home. They are more likely to be tempted to smoke, to persist smoking and to become addicted because of pro-smoking norms in their families, greater peer pressure to smoke, need for "a break" to be able to cope with their problems, and the social stigmatisation of those who had become smokers. Similarly, when adults, they face greater difficulty in quitting smoking and remaining smoke-free due to external factors such as the many problems and stressors that they face in daily life, pro-smoking norms in their social networks, and poorer access to smoking services attuned to their needs.

Policies for reducing inequality

Preventive policies can exert an important influence, for better or for worse. In tobacco control strategies, early policies commonly brought most benefits to the rich and more educated. Early publicity campaigns were designed from a middle-class perspective, early smoke-free policies were mostly implemented in white-collar work settings on a voluntary basis, and smoking services were affordable only to those with sufficient income. However, not all preventive policies widen inequalities. In tobacco control strategies, more equitable impacts were achieved in policies implemented later, e.g. through publicity campaigns focussed on less educated groups, comprehensive and compulsory smoke-free policies, and cessation services affordable and acceptable to the socio-economically disadvantaged.

It is widely recognised that socio-economic inequalities in health, including CVD risk, cannot only be addressed by preventive policies focussed on single risk factors, and that we also need to consider the wider ‘structural’ policies and systems. It has often been discussed whether socio-economic inequalities in health are smaller in countries with smaller income inequalities and/or generous welfare systems. There is no clear verdict on this issue, other than the recognition that welfare systems and income do play a role (see e.g. the large inequalities in Central and Eastern European countries) but that this role may be more limited than once hoped for (see e.g. the persistent inequalities in Nordic countries).

There is however increasing evidence about the important role of specific structural policies in fields such as employment, housing and urban renewal, protection of youth, and integration of ethnic minorities. In the EU-funded SOPHIE project, the available evidence regarding the potential impact of such policies has been evaluated and complemented with novel studies from different European countries. For example, systematic reviews of urban renewal programs have outlined the many ways in which these could benefit health behaviour (e.g. physical activity) and psychosocial wellbeing of residents of deprived neighbourhoods. Some of these positive effects were identified in additional evaluations of new ‘natural experiments’ in Barcelona, Turin and the Netherlands.

Conclusion

How could the available evidence on socio-economic inequalities in CVD risk, as summarised above, be used in our attempt to understand recent national-level trends in CVD mortality? In countries where CVD mortality is stagnating, how does such a trend relate to the socio-economic position of the residents? We should recognise that a clear link might not be established. Determinants of time trends in population health (including a stagnation in CVD mortality decline) may be quite different from determinants of cross-sectional differences (including inequalities in CVD mortality). The two phenomena may not be influenced by the same factors. For example, while inequalities in CVD mortality are attributable in part to higher smoking prevalence in lower socio-economic groups, it is unlikely that a stagnation in CVD mortality decline could be attributed to a secular increase in smoking rates.

Yet, at a more general level, we may draw two messages. First, given that much of the population burden of CVD is concentrated in lower socio-economic groups, we should take the perspectives of these groups when searching for explanations and policy solutions when CVD mortality rates fail to decline. Second, in this search for explanations and solutions, we should look beyond individual-level factors and preventive actions focussed on “life styles”, and consider the role of wider policy areas such as urban renewal, employment and social welfare.

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6 Contributors to CVD mortality and policy options for improving CVD health

Professor Martin O'Flaherty, Department of Public Health and Policy, University of Liverpool, United Kingdom

The urgency for tackling cardiovascular disease is evident as the long-standing decline in mortality could be at risk. Policies at the population level can deliver rapid, large and equitable health and economic gains, with large returns on investments. The policy areas include improving food policy, reducing alcohol intake, smoking and air pollution. Prevention policy should aspire to achieve three main goals: reduce the cardiovascular disease burden, reduce the equity gap and reduce stress in the health care system to make it economically sustainable. Reducing the unequal burden of cardiovascular disease is likely to require a combination of targeted policies in deprived communities alongside structural policies to improve diets, smoking and alcohol intake.

Western countries experienced a unique epidemiological phenomenon, with massive reductions in ischemic heart disease mortality of more than 60% over four decades in the second half of the 20th century (Moran et al., 2014[1]). Some countries – particularly Central European countries – have shown dramatic declines after increases that lasted until the 1990s. However, many countries are currently experiencing rising trends, including China and Mexico.

Trends are not set in stone. They can vary substantially over relatively short time scales. The recent slowing down in reduction in CVD mortality reported in this report points towards an undesirable change in the direction of the drivers of CVD mortality. Thus, understanding what drives those trends continues to be relevant and urgent.

Cardiovascular disease (CVD) is eminently preventable, and modifiable risk factors can explain 90% of its incidence (Moran et al., 2014[1]). Changes in risk factors at the population level and treatments are the two main drivers of CVD, as was clearly shown for coronary heart disease (CHD) by observational studies like MONICA and modelling studies.

Observational and modelling evidence on what drives CHD mortality

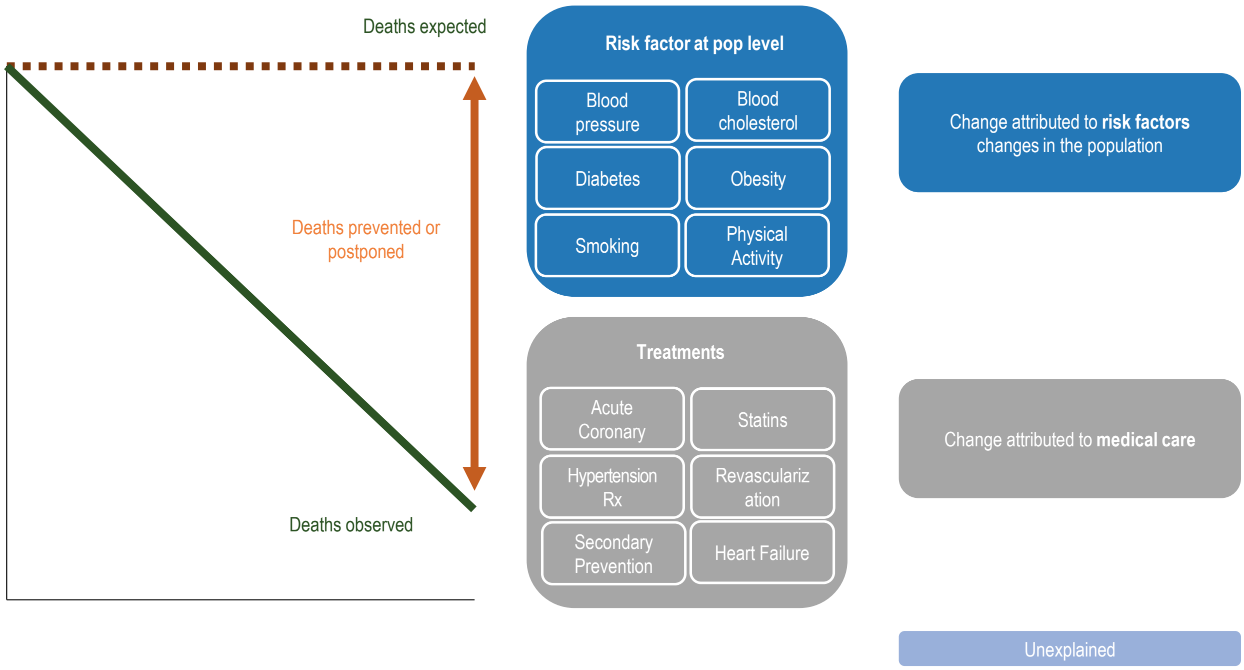
During the 1980s and 1990s, the MONICA study, using carefully designed and detailed protocols and methods, was able to explore more precisely the contribution of risk factors and treatments to mortality trends in over 20 diverse populations (Tunstall-Pedoe et al., 2000[2]; Kuulasmaa et al., 2000[3]). The MONICA project's goals were to measure trends in CVD mortality, and CHD and cerebral-vascular disease morbidity, and to assess the extent to which these trends are related to changes in known risk factors, health care, and significant socio-economic characteristics measured simultaneously in defined communities in different countries. Its principal findings were that about one-third of the change in CHD mortality rates could be attributed to health care and two-thirds to changes in risk factors (Tunstall-Pedoe et al., 2000[2]; Tunstall-Pedoe et al., 1999[4]).

Another approach to answering the question is by using modelling approaches. Epidemiological models are a way to synthesise demographics, risk factors and treatment evidence to provide a quantitative summary of the contributions of these drivers to changes in incidence or case fatality. Two models have been designed to answer this question: the US CHD policy model and the IMPACT model.

The US CHD Policy model is a state-transition model developed in the 1980s. It was initially used to examine trends in CHD mortality (Goldman et al., 2001[5]; Hunink et al., 1997[6]) and expected gains in life expectancy from risk factor modifications (Tsevat et al., 1991[7]). This model was also used to evaluate the cost-effectiveness of specific medical interventions for primary and secondary prevention of CHD (Gaspoz et al., 2002[8]; Phillips et al., 2000[9]; Prosser et al., 2000[10]), salt reduction policies (Bibbins-Domingo et al., 2010[11]) and health promotion activities (Tosteson et al., 1997[12]). The model showed that in the US population between 1980-1990 risk factor changes contributed 50% to the mortality decline, while treatments contributed 43%.

The IMPACT model has been used in more than 20 countries globally to explore the proportion of the change in deaths in terms of contributions of risk factors and evidence-based treatments. IMPACT is a spreadsheet model initially developed by Capewell and colleagues in 2000 (Capewell et al., 2000[13]). This model combines data sources on patient numbers, treatment uptake, treatment effectiveness, risk factor trends and consequent mortality effects. The deaths prevented or postponed over a specified period are then estimated (Unal, Capewell and Critchley, 2006[14]). The model can be used to estimate the proportion of change in mortality attributable to specific treatments or risk factor changes. It can also estimate the future consequences of altering treatment strategies and changing population risk. The model also estimates life-years gained and cost-effectiveness for specific interventions.

Figure 6.1. Schematic representation of the IMPACT model



Source: Image courtesy of Professors Capewell and O'Flaherty.

To estimate the contribution of medical and surgical treatments to the reductions in CHD mortality, the model integrates information on the number of patients eligible for a specific treatment, the case fatality rate of that group of patients, the relative risk reduction offered by the treatment, and the uptake of the treatment amongst those patients.

Box 6.1. IMPACT CHD methodology examples

Example 1. Estimating the contribution of evidence-based treatments

Men aged 55-64 given aspirin for acute myocardial infarction: In the Antithrombotic Trialists' Collaboration meta-analysis, aspirin reduced relative mortality in men with acute myocardial infarction by 15%. In England and Wales in 2000, 10 699 men aged 55-64 were eligible with a case fatality rate of 17%, and 95% were given aspirin. One year case fatality in men aged 55-64 admitted with an acute myocardial infarction was approximately 17%. The deaths prevented or postponed for at least a year were therefore calculated as: Patient numbers x treatment uptake x relative mortality reduction x one-year case fatality = 10 699 x 95% x 15% X 17% = 259 deaths prevented or postponed.

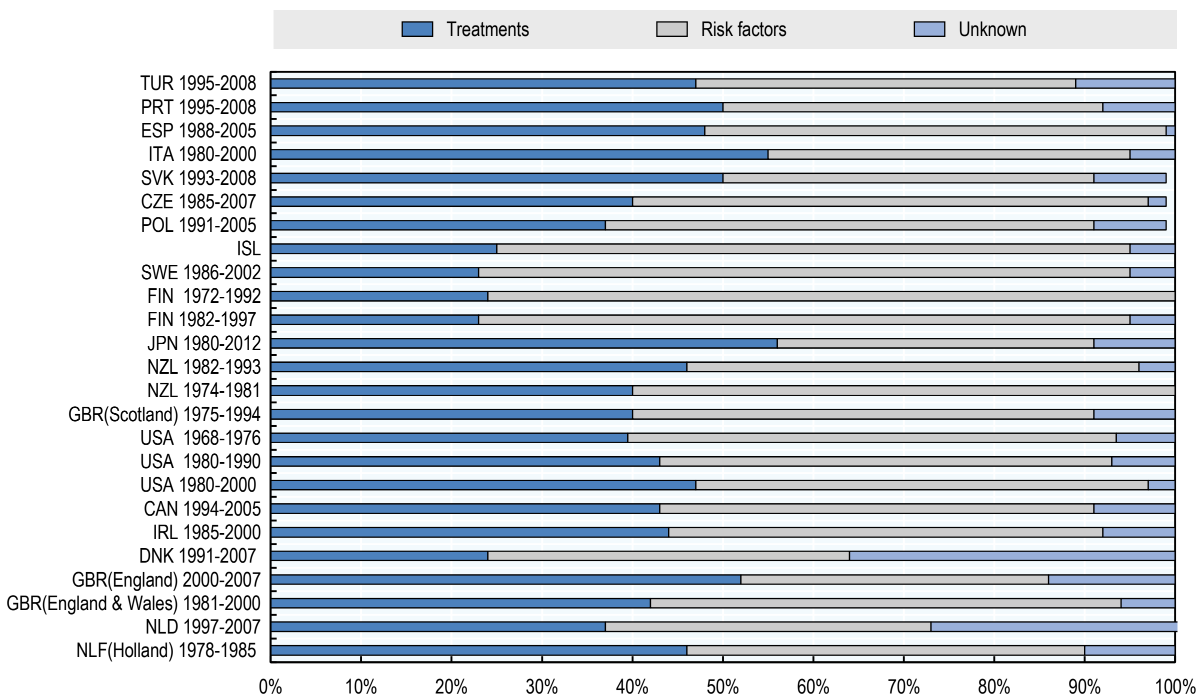
Example 2. Estimating the contribution of risk factors

In England and Wales, the diabetes prevalence in men aged 75-84 was 4% in 1981 and 7% in 2000, obtained from the Health Survey for England. Using a population attributable risk fraction approach (PARF), we estimated that about 12% respectively of CHD deaths were attributable to diabetes in 1981 and 18% in 2000. The number of actual deaths attributed to diabetes was then calculated by multiplying the PARF times the deaths observed in 1981 and expected in 2000: 2 865 in 1981 and 3 916 in 2000. The difference between these (1 051) represented the change in the number of deaths attributable to the change in diabetes prevalence in the population between 1981 and 2000.

The IMPACT model consistently found that about 40 to 72% of the fall in deaths was attributable to risk factor changes, and 23 to 55% to treatments (Mensah et al., 2017[15]). Particularly powerful drivers were population-wide declines in smoking, blood pressure and cholesterol levels, and acute care and secondary prevention, including heart failure treatments. In countries where chronic heart failure rates were increasing, adverse population-level trends in smoking, cholesterol and blood pressure drove mortality upwards – as in Beijing or Tunisia (Critchley et al., 2004[16]; Critchley et al., 2016[17]).

The models for OECD countries show the patterns observed in western countries. Interestingly, although different modelling approaches have been used in some countries, these approaches found similar insights, strengthening our confidence in the knowledge of what is driving changes in CVD mortality.

Figure 6.2. The proportion of CHD deaths explained and postponed by changes in risk factors and treatments using IMPACT and other models: Selected OECD countries



Note: All results relate to IMPACT model except Finland 1982-97 (Vartianineen), New Zealand 1978-1981 (Beaglehole), United States 1968-1976 (Goldman), United States 1980-1990 (Hunink), Holland 1978-1985 (Bots).
Source: Image courtesy of Professors Capewell and O'Flaherty.

Risk factors, particularly changing at the population level, seem to be an essential driver. Importantly, risk factors can react rapidly to changes in their determinants (Capewell and O'Flaherty, 2011[18]). An interesting illustration is Poland in the 1990s, after the socio-economic transformation. The halving of CHD mortality rates in Poland was driven by risk factors, explaining about 54% of the decline and 37% by the increased use of evidence-based treatments (Bandosz et al., 2012[19]). These massive, population-level changes were possibly linked to widespread changes in Polish diets at the population level (Zatonski and Willett, 2005[20]). Furthermore, in populations with rising trends (e.g. China and Mexico), adverse risk factors trends are likely explanations for most of the increase in mortality.

One of the most constant findings in most populations studied with IMPACT is that the almost universally observed increases in obesity and diabetes offset a significant proportion (10-14%) of the mortality reductions attributed to favourable changes in blood pressure, tobacco smoking, cholesterol levels and physical activity.

Tackling the drivers of CVD mortality in populations

We can only speculate on the causes of the current slowdown in CVD mortality. It is likely that the factors are mostly related to changes in population drivers of incidence including diet, smoking, physical activity and alcohol and increasing trends in obesity and diabetes, rather than worsening of case-fatality rates. The OECD recently reported improvements in acute case-fatality rates in several countries that are experiencing the slowdown (OECD, 2019[21]), although less is known about case-fatality rates for later complications of ischemic heart disease, like heart failure patients living in the community or people living long-term with stroke and other forms of vascular disease.

The urgency to tackle CVD is evident as the long-standing decline in mortality could be at risk. We are now facing a slowdown in mortality improvements in several countries and a reversal of mortality decline in the United States, with CVD mortality slowdowns playing a significant role (Sidney et al., 2016[22]; Public Health England, 2018[23]). Furthermore, this is associated with persistent and continuing disparities and, in the United Kingdom, the slowdown in mortality improvements overall is most marked in more deprived populations (Public Health England, 2019[24]).

Policies at the population level can deliver the gains that are needed. They essentially affect the environment in which we live, can be shaped by policy tools such as regulations, trade, legal and fiscal policies and, crucially, can deliver rapid, large and equitable health and economic gains, with large returns on investments (Masters et al., 2017[25]; Capewell and O'Flaherty, 2011[18]). The policy areas include improving food policy, for example in relation to salt and sugar reduction, and reducing alcohol intake, smoking and air pollution. All of this will have a substantial impact on CVD, and will also favourably affect diseases caused by the same risk factors, resulting in cascade effects in reducing the overall burden of non-communicable diseases (NCDs).

However, not all this policy effect will be instantaneous. While CVD trends are likely to respond quickly, longer lag times for other diseases will mean that it will take longer to realise the overall health gains that we can expect. For example, tackling obesity to reduce diabetes prevalence will result in a reduction of dementia prevalence over the medium and long term, while CVD will be reduced faster (Bandosz et al., 2020[26]).This will then create additional pressures on the health care system and society that will continue to respond while the full impact of prevention across the board unfolds. Crucially, the recent slowdown in CVD mortality will compound the problem, resulting in about a 15% increase in health care costs, with social care costs increasing twice as fast (Collins et al., 2019[27]).

To recover the lost ground, we need a rethink of prevention. The drivers are likely to be the same as in the earliest stages of the CVD epidemic. We need to leverage this knowledge to reduce both the overall burden and the inequalities. Prevention policy goals should aspire to achieve three main goals: reduce the CVD burden, reduce the equity gap and reduce stress in the health care system to make it economically sustainable.

Reducing the unequal burden of CVD is likely to require a combination of targeted policies in deprived communities alongside structural policies to improve diets, smoking and alcohol intake. For example, there is evidence from the United States that the most substantial health gains and disparities reduction can be achieved by making fruit and vegetables more affordable for Supplemental Nutrition Assistance Program (SNAP) participants, alongside a fiscal policy to tax sugar-sweetened beverages for the whole population, resulting in substantial numbers of cases prevented (Pearson-Stuttard et al., 2017[28]). Similar insights were gained in the United Kingdom, combining approaches to identify and manage high-risk individuals alongside population-level strategies on smoking and food; for example, the recently reported reduction in sugar intake after the successful implementation of the sugary drinks tax, resulting in a reduction of about a third of the volume of sugars from soft drinks per capita and per day, equivalent to a reduction of sugar intake of more than 4 grams a day (Kypridemos et al., 2018[29]; Kypridemos et al., 2016[30]; Bandy et al., 2020[31]). Furthermore, this will result in substantial reductions in demands faced by the health care system.

As many population-level prevention strategies do not rely on health care budgets, a move towards structural, population-level prevention might free resources to invest in other pressing areas, like the interface of health and social care, reducing inequalities, and tackling the pressures on health systems exerted by population ageing. Thus, an urgent research priority should be to help policy-makers decide which combination of strategies over time can offer the best overall approach for tackling the challenge of CVD in our populations.

Inaction in addressing CVD prevention will have profound social, economic and equity costs, costs that are avoidable with our current knowledge about the prevention of CVD and NCDs.

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7 Conclusions and implications for policy, data improvements and monitoring

Evidence shows that since 2010 several countries are experiencing a slowdown in the rate of decline in cardiovascular disease mortality, while a few countries are experiencing increases in mortality rates. For some countries, incidence rates of coronary events are declining less than mortality rates, suggesting that the impact of preventive measures has been more modest than improvements in acute coronary care. Socio-economic inequalities in cardiovascular disease mortality are a major contributor to overall inequalities in mortality, and illustrate the scope for tackling potentially avoidable morbidity and mortality. Improvements in national and international data and monitoring to support more timely and effective policy responses for preventing, managing and treating cardiovascular disease, and for tackling socio-economic and gender inequalities, are needed urgently.

Raising international awareness about the slowdown in CVD mortality improvements

The slowdown in CVD mortality has received some prominence in the United Kingdom and the United States in the context of slowing improvements in life expectancy overall. However, it has received little or no consideration in most other countries affected. Nor has there, until now, been any international move to examine and comment on a phenomenon affecting several European and other high-income countries.

This report starts an international dialogue about the potential causes of the slowdown in CVD mortality improvements, policy interventions that could help to reverse the slowdown, and international collaboration and learning from what appears to be a growing phenomenon.

The case for action is strong

The slowdown of improvements in CVD mortality in some high-income countries in recent years is a cause for serious concern, for several reasons. As Ms Løgstrup's presentation to the workshop showed, large historical declines notwithstanding, CVD remains among the leading causes of death in European and other high-income countries. It accounts directly for large numbers of deaths among older people and those of working ages, and also indirectly by increasing susceptibility, for example, to respiratory diseases such as influenza and pneumonia. CVD-related mortality is higher among those using illicit drugs. CVD risk factors and heart disease are also associated with the development of dementia later in life, so early prevention and treatment could potentially mitigate the onset of dementia and costs associated with it (Hakim, Ng and Turek, 2013[1]). Many countries have wide socio-economic differentials in CVD mortality, which contribute to large inequalities in overall mortality and evidence from some countries (e.g. France, United Kingdom) points to gender differences in treatment and survival.

Several speakers warned against complacency: trends in younger age groups suggest that the decline in CVD mortality may be stalling in some European countries, or even turning to an increase. Given Professor O'Flaherty's warning that CVD mortality rates can change rapidly – for better or for worse – with changes in risk factors, these trends need to be monitored closely.

While improvements in CVD mortality continue to contribute most to improvements in life expectancy, Professor Ho's analysis for this workshop shows clearly that in the countries that have experienced the greatest slowdown in life expectancy improvements since 2010, this slowdown has been driven by distinct condition-specific trends. CVD has been a significant contributor to the slowdown, along with mental and nervous system disorders (which largely reflects changes in coding of deaths to dementia); other, major but less significant contributors being deaths from external causes among males and from respiratory disease including influenza and pneumonia among females.

Strategies for reducing the burden of CVD need to target both primary prevention (i.e. reduced incidence of CVD through public health action to tackle the risk factors, the use of fiscal and regulatory measures etc.) and improvements in secondary prevention and case-fatality (i.e. ensuring people who develop CVD or its risk factors receive timely, equitable and evidence-based clinical care). Clearly, the optimal policy mix will be country-specific and depend on the specific context, epidemiological trends, health system, policies and priorities, etc.

The cost of inaction or inappropriate action in tackling the significant morbidity associated with CVD can be high, including the indirect costs associated with, for example, higher levels of dementia and disability. We discuss below some of the high-level policy implications of discussions at the workshop. This overview is not designed to be comprehensive or prescriptive.

Preventing CVD is key

In line with wider evidence, several speakers and workshop participants highlighted that many CVD deaths are preventable; hence, risk reduction through strengthening preventive measures should be a priority. The GBD analysis presented by Dr Johnson shows that, overall, the leading risk factors for CVD remain largely unchanged, and all are amenable to intervention. Good progress has been made in some areas, such as tobacco control, but adverse trends in obesity and diabetes are widespread, and there is scope to do more in almost all areas of primary prevention.

The case for prevention is strong, especially given the evidence from some countries that incidence rates of coronary events are declining less than mortality rates, suggesting that the impact of preventive measures has been more modest than improvements in acute coronary care. The rising prevalence of obesity and diabetes could be a contributory factor, including in stagnating mortality declines at young age groups in some countries.

Public health policies and prevention strategies have long targeted some of these CVD risk factors with, in past decades, great success in achieving their aim of reducing CVD mortality. However, CVD remains a major killer and these risk factors continue to cause many preventable deaths, added to which is the risk that the rising prevalence of obesity and diabetes globally could erode or even reverse the mortality gains made to date.

Professor O'Flaherty argues that CVD mortality trends can change rapidly in both directions, and their key drivers are largely concentrated in lifestyle risks. Reducing the burden of CVD must be a priority, to be delivered not just by health care systems acting in isolation, but also via appropriately designed, population-level government policies, such as fiscal and regulatory measures designed to promote lifestyle changes such as reductions in sugar, salt, fat and tobacco consumption. Evidence shows that such policies can deliver large and rapid health and economic gains in terms of reducing CVD, are cost-effective, and reduce cost and demand pressures on the health care system.

Likewise, Professor Kunst argued for population-level strategies aimed at changing lifestyle risk factors and addressing the wider determinants of health beyond the health sector, as the approaches most likely to be effective in reducing inequalities in CVD mortality.

The OECD has also shown that policies aimed at tobacco and obesity control can have a widespread impact on promoting healthy lifestyles, and more can be done to integrate regulations and public health programmes (OECD, 2015[2]). The OECD report on the obesity epidemic (OECD, 2019[3]) discusses several policy options for addressing this growing public health problem, including food and menu labelling, regulation of advertising of unhealthy foods to children and the promotion of exercise, including by doctors and schools. The report discusses the opportunities, and the challenges in implementation, of policies that are innovative, or have been demonstrated to be effective, including policies that aim to: influence lifestyle choices through information and education, expand healthy choice options, modify the costs of health-related choices, and regulate or restrict unhealthy options.

The GBD and other evidence also points to the considerable scope for improvements in secondary prevention. Recognising the role of late diagnosis and under-treatment in preventing CVD, for example, the recently published NHS Long Term Plan for England (NHS, 2019[4]) lays down specific ambitions to reduce the number of strokes, heart attacks and dementia cases over the next ten years through the detection and management of atrial fibrillation, high blood pressure and high cholesterol.

Finally, an emerging and potentially preventable contributory factor to CVD deaths noted by Professor Ho is the rising trend in use of opioids (prescribed and illicit) in some countries e.g. the United States, the United Kingdom, Canada, Norway and Sweden. Targeted policies are needed to tackle this growing public health problem which is causing mortality among young adults to stall, and even rise, in some high-income countries.

Improvements in the management and treatment of CVD are also called for

The workshop did not focus on the clinical management of CVD, except to note that improvements may be called for in some countries depending on the specific circumstances, and unequal access to good quality of care means there is still considerable scope to reduce the burden of CVD and deaths from it. Advances in the prevention and treatment of CVD in high-income countries over recent decades have been dramatic and have outpaced those for many other diseases, contributing to longer, healthier lives and reduced inequalities. Medical and technological innovations have enabled the control of risk factors such as high cholesterol and blood pressure, improved management of diabetes, and effective clinical care in the event of an acute episode such as a heart attack or stroke, have transformed outcomes for people with CVD. Timely access to high quality, evidence-based health services and technologies has facilitated this transformation in CVD care.

Despite these gains, the OECD's report on CVD and diabetes (OECD, 2015[2]) noted several challenges in reducing the heavy, residual burden of CVD and mortality from it, such as delays in diagnosis of CVD risk factors and diabetes, lack of adherence to clinical guidelines, ageing populations with increasingly complex care needs, and gaps in timely access to specialist care. The report called for improvements in access to high quality primary and secondary care services, compliance with clinical guidelines, standards of emergency care, integration and coordination with other parts of the health care system, and continuity of care. It also noted the need to address variations in access to and the quality of care.

Workshop participants noted that the balance of priorities between prevention and treatment would vary between countries, depending on the context, the country-specific drivers and the characteristics of their health care systems. While prevention clearly needs to be a priority universally, improvements in early detection, diagnosis and timely, evidence-based care will also be important for some countries.

The OECD's 2012 review of the quality of health care in Korea (OECD, 2012[5]) was cited as the trigger for the significant improvements in CVD mortality outcomes that followed. The IHD mortality rate had been rising from its previous low levels, case-fatality was high, and stroke mortality was among the highest among OECD countries. The review identified the improvements needed across the CVD pathway, from prevention through to emergency care and post-hospital rehabilitation, in order to improve outcomes.

Reducing inequalities must be a priority

All the speakers at the workshop noted the imperative to reduce inequalities in the burden of and mortality from CVD. In many countries, socio-economic inequalities in CVD mortality are a major contributor to overall inequalities in mortality. While it is encouraging that absolute inequalities in CVD mortality are falling in several European countries, the widening of relative inequalities is less welcome and illustrates the scope for tackling potentially avoidable morbidity and mortality. Policies to address stalling in life expectancy improvements and a slowdown in CVD mortality improvements would have more traction and impact if they included strategies for narrowing differentials between different population groups.

Professor Kunst noted that, given that much of the population burden of CVD is concentrated in lower socio-economic groups, policies to accelerate declines in CVD mortality and reduce inequalities should be tailored to these groups. Interventions also need to look beyond individual-level factors and preventive actions focussed on "life styles", to the role of policy areas beyond health, such as urban renewal, employment and social welfare, and policies should be evaluated for their impact on equity.

The experience of England from 1997 to 2010 shows that ambitious, cross-governmental strategies can be effective in reducing health inequalities (Barr, Higgerson and Whitehead, 2017[6]). Since 2010 when this approach was dropped, health inequalities have widened, as detailed in the recently published Marmot Review (The Marmot Review, 2020[7]), ten years on from the original review in 2010 (The Marmot Review, 2010[8]). Differentials in life expectancy between local areas now stand at about 9 years for males and 7 years for females. Marmot et al. (2020[7]),) call urgently for a cross-government "ambitious and world-leading health inequalities strategy" aimed at reducing inequalities in the wider socio-economic determinants of health, and supported by targets and strengthened accountability mechanisms. The King's Fund's Vision for Population Health (Buck et al., 2018[9]) outlines a framework for population health in England centred on four pillars: the wider determinants of health; our health behaviours and lifestyles; the places and communities we live in; an integrated health and care system. It calls for ambitious and binding national goals to drive progress, and a cross-government strategy for reducing health inequalities. Like speakers at the workshop, it recommends that the government builds on the lessons from the Soft Drinks Industry Levy by using taxation and regulation to support health improvement.

Improvements in data and monitoring processes are needed to support more timely and effective policy responses

Our invited speakers pointed to a variety of constraints applying to currently available data on CVD, which are obstacles to the timely and informative monitoring of levels and trends in CVD and its determinants:

- Data on risk factors and incidence is scarce and patchy; workshop participants from several countries noted that survey data on lifestyle risk factors is often only available at intervals of several years, and there can be restrictions on linking the data;
- There is a significant time lag in the availability of vital statistics data;
- The interactions between deaths from CVD and other causes, for example, influenza and pneumonia, and illicit drug use, add to the challenges of interpreting trends in CVD mortality and identifying the underlying drivers;
- Interpreting trends is also made more challenging with changes in coding conventions and practices, such as the increased recording in many countries of deaths to dementia, Alzheimer's disease and other mental and nervous system disorders, deaths which previously would have had CVD or another condition coded as the underlying cause of death.

Participants also highlighted the importance of:

- Linkage between different data sets e.g. primary and hospital care records, or clinical audit data and death records, which can greatly enhance monitoring capabilities for assessment of risk factors, health care needs and use of services across different population groups, and inform policy development; some participants noted that their countries already routinely link hospital administrative data and data from disease registers to mortality;
- Monitoring not just CVD but also the other conditions associated with it, for example, influenza and pneumonia, illicit drug use, dementia, and consideration of the consequent implications for policy action – for example, the impact of changing CVD trends on the prevalence of other conditions such as dementia;
- Monitoring the impact of policies on health equity;
- Monitoring mortality patterns and trends at national and international level for disaggregated population groups (e.g. by age, gender, region, socio-economic groups) in order to better understand how the burden of CVD is distributed and interactions between the factors associated with CVD mortality;
- Some workshop participants raised the possibility of OECD doing modelling work to identify optimal prevention policies, and undertaking country-specific policy analyses.

The data issues highlighted call for changes to make data systems and data flows more comprehensive, timely, efficient, relevant in the context of changing epidemiological patterns, and fit-for-purpose for monitoring and supporting appropriate service responses. The OECD report on trends in life expectancy in EU countries made recommendations relating to data for national and international agencies that are relevant here (Raleigh, 2019[10]).

Recent trends suggest that we should be cautious about assuming that historical declines in CVD mortality rates will continue. Timely monitoring of risk factor levels, disease incidence and mortality rates is essential for detecting rising public health threats at an early stage and for informing an efficient, appropriate response.

Looking forward

The workshop on CVD mortality convened jointly by The King's Fund and OECD was a unique collaborative venture designed to highlight one of the contributors – CVD – to the slowing improvements in life expectancy seen in many European and other high-income countries.

Francesca Colombo, Head of OECD Health Division, provided closing remarks for the workshop and called attention to deliberations at the workshop, the contributions of the invited speakers, and the insights provided by the country representatives attending. This report should help to raise awareness of the slowdown in CVD mortality improvements seen in many countries, and its implications for policy and monitoring.

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Is Cardiovascular Disease Slowing Improvements in Life Expectancy?

OECD AND THE KING'S FUND WORKSHOP PROCEEDINGS

Evidence that cardiovascular disease is contributing to the slowdown in improvements in life expectancy in some OECD countries prompted OECD and The King's Fund to convene an international workshop to examine this issue. Invitees included members of OECD's Health Care Quality and Outcomes Working Party and five international experts. This publication describes the workshop proceedings and conclusions about the evidence on trends in cardiovascular disease mortality, their drivers and the policy implications. The report includes contributions by the plenary speakers, Susanne Løgstrup (European Heart Network), Jessica Ho (University of Southern California), Catherine Johnson (Institute of Health Metrics and Evaluation), Anton Kunst (Amsterdam AMC) and Martin O'Flaherty (University of Liverpool). It shows cardiovascular disease is an important contributor to slowing life expectancy improvements in some countries, and flags some measurement problems such as international differences and changes in diagnostic practices and cause of death coding, and the complex linkages between cardiovascular disease and other causes of death. The report calls for improvements in national and international data and monitoring to support more timely and effective policy responses for preventing, managing and treating cardiovascular disease, and for tackling socio-economic and gender inequalities.

Consult this publication on line at ***https://doi.org/10.1787/47a04a11-en***.

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