The economics of healthy and active ageing series

LIVING LONGER, BUT IN BETTER OR WORSE HEALTH?

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About the series

Population ageing is often perceived negatively from an economic standpoint. Yet taking a more balanced view, it becomes evident that a growing older population is not necessarily very costly to care for, and that older people provide significant economic and societal benefits – particularly if they are healthy and active. This is the broad perspective of the *Economics of Healthy and Active Ageing* series: to inspire a 're-think' of the economic consequences of population ageing.

In this series we investigate key policy questions associated with population ageing, bringing together findings from research and country experiences. We review what is known about the health and long-term care costs of older people, and consider many of the economic and societal benefits of healthy ageing. We also explore policy options within the health and long-term care sectors, as well as other areas beyond the care sector, which either minimize avoidable health and long-term care costs, support older people so that they can continue to contribute meaningfully to society, or otherwise contribute to the sustainability of care systems in the context of changing demographics.

The outputs of this study series take a variety of brief formats that are accessible, policy-relevant and can be rapidly disseminated.

About this brief

People in Europe tend to live much longer than they used to, but in what state of health are these additional years spent? Are the aims of policies promoting healthy and active ageing being achieved or is an increasing share of life years being spent in poor health? These questions matter not only to the older people concerned, but have wider implications for health systems and expenditure. This policy brief explores available information on the health and disability of older people in Europe and how it relates to increases in life expectancy. It considers the main theories on health and ageing, explores the latest evidence on health and disability measures, and considers policy options to support healthy and active ageing.

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Acronyms

ADL	activities of daily living
COPD	chronic obstructive pulmonary disease
DALY	disability-adjusted life year
DFLE	disability-free life expectancy
EEA	European Economic Area
EU	European Union
EU-SILC	EU Statistics on Income and Living Conditions
GARS	Groningen Activity Restriction Scale
GBD	Global Burden of Disease
HALE	healthy (or health-adjusted) life expectancy
HLY	healthy life year
IADL	instrumental activities of daily living
OECD	Organisation for Economic Cooperation and Development
SHARE	Survey of Health, Ageing, and Retirement in Europe
SMPH	summary measures of population health
WHO	World Health Organization
YLD	years lived with disability

Boxes and figures

Key messages

- Longer lifespans can be due to additional years of life being spent in good or poor health, or some combination of the two.
- The 'health' of older people can be measured in many ways, including using data on disease prevalence or self-reported health status, but it is perhaps best captured by measures of disability or functional impairment.
- Assessments of whether people in Europe are living longer in better or worse health depend to a large degree on the measure used.
- Most surveys on ageing measure functional independence in activities of daily living (ADLs) and instrumental activities of daily living (IADLs), which are then used to quantify health states and measure changes over time.
- Studies using comparative data from the Survey of Health, Ageing, and Retirement in Europe (SHARE) generally find increases in functional limitations in some countries and decreases in others.
- One overarching finding is that later cohorts of older people have much better cognitive functioning than earlier cohorts.
- There are major health inequities at older age across and within countries.
- While a definitive answer of whether older people in Europe are in better or worse health is impossible to obtain, what is clear is that health systems are important contributors to increases in life expectancies, decreases in severe disability, and better coping and functioning with chronic disease.

Executive summary

Background

This policy brief explores whether increasing life expectancies in Europe are accompanied by more years lived in better or worse health. It considers the main theories on health and ageing, explores the latest evidence on health and disability measures, and considers policy options to support healthy and active ageing.

There are three general scenarios for health and ageing. Increasing life expectancies can be accompanied by spending larger or smaller shares of life years in poor health, often called expansion or compression of morbidity, respectively. Alternatively, the severity of morbidity may change, known as dynamic equilibrium.

Measures of health and disability

Assessments of the health of older people in Europe depend to a large degree on the measure of health used. The 'health' of older people can be measured in many ways, including using data on disease prevalence or self-reported health status, but it is perhaps best captured by measures of disability or functional impairment. The most commonly used measure for gauging how well older people age is to establish their functional independence in activities of daily living (ADLs), such as getting dressed, walking across a room, bathing or showering, and instrumental activities of daily living (IADLs), such as preparing a hot meal, shopping for groceries or taking medications.

What does the academic literature suggest?

One of the most important comparative sources of information on these limitations in Europe is the Survey of Health, Ageing, and Retirement in Europe (SHARE), covering people aged 50 and over. Studies using this data source have come to conflicting findings, with some finding increasing ADL and IADL limitations and other studies finding decreases. There are major differences between countries, which makes it difficult to identify overall trends. There are also major health inequities in old age within countries. However, one overarching finding is that older people of more recent cohorts had substantially better cognitive functioning than those in cohorts born earlier.

What do international datasets suggest?

Information on the health of older people in Europe is available from World Health Organization (WHO) and Eurostat datasets on health-adjusted life expectancy (HALE) at age 60, healthy life years (HLYs) at age 65, and healthy life expectancy at age 65, all of which can be compared to life expectancy. However, some of these datasets use a very small indicator set on health in old age (in the Eurostat datasets based on answers to only one question on self-perceived general health or self-perceived activity limitations, respectively), only one (HLYs) considers functional limitations, and their comparability is limited. Considering changes in these three indicators in relation to life expectancy yields conflicting results in terms of compression or expansion of disability in many countries.

Importantly, the international datasets illustrate that the absolute number of years spent in good health in old age differs greatly between countries in Europe. In terms of HLYs, for example, 65-year-old females in Slovakia in 2017 could only expect to live 4.1 years in good health, whereas those in Norway could expect 15.9 years. For 65-year-old males, the expectation was 3.8 HLYs in Slovakia compared to 15.9 HLYs in Norway.

Determinants of trends and policy implications

Importantly, health systems can (but not always do) contribute to increases in life expectancies, decreases in disability and functional limitations, and better coping and functioning with chronic disease. A combination of healthier lifestyles and advances in medical care and prevention can also decrease morbidity. Overall, health systems can enable people to postpone functional limitations and disability, even when there might be increasing prevalence of chronic disease.

The findings presented in this brief illustrate that, if the right conditions are in place, people in Europe can not only live longer, but also spend a smaller share of their lives in poor health, if policies can achieve compression of morbidity. This is likely to require the promotion of healthy lifestyles, as well as advances in treatment and prevention, that can mitigate many of the challenges that may arise as a result of population ageing. It will be important to support healthy ageing, including measures that better coordinate and integrate curative care and scale up health promotion and disease prevention interventions. As risk factors for many conditions affecting older people are similar, interventions can achieve substantial co-benefits. There is a need for programmes targeted at older people, as well as broader prevention programmes that benefit all age groups, so that future cohorts have the greatest chances of ageing in good health. This will require policy action to address the major inequities that exist in the health of older people between and within countries.

Introduction

Across Europe, life expectancy has increased in recent decades, although the rate of improvement and the absolute gains vary among countries and, in some, the rate of improvement has slowed markedly since about 2010 (Hiam et al., 2018). Nevertheless, by 2070, average life expectancy in the European Union (EU) is expected to increase for males from 78.3 years in 2016 to 86.1 years in 2070 (7.8 additional years), and from 83.7 in 2016 to 90.3 in 2070 for females (6.6 additional years) (European Commission, 2018).

The European Observatory on Health Systems and Policies' Economics of Healthy and Active Ageing series aims to improve understanding of the impacts of ageing on health, health and long-term care needs and costs, paid and unpaid work, income security in older age and economic growth. A key question in that context is whether people are spending their longer lifespans in better or worse health (Rechel et al., 2013). If longer survival is associated with the potential to live an active and fulfilling life, it would suggest that concerns about an ageing crisis are to a large extent overblown. However, if it is associated with a longer period of illness and limited activity, there could be major economic, health care and societal costs as a greater share of the population reaches older ages.

This policy brief explores available information on the health and disability of older people in Europe and how it relates to increases in life expectancy. It considers the main theories on health and ageing, explores the latest evidence on health and disability measures, and considers policy options to support healthy and active ageing.

Key concepts

A crucial question in determining the impact of longer life expectancies on economies, public finances, health and long-term care systems, and society more broadly is whether and the extent to which there may be delays in the onset of functional limitations and disability as people age (European Commission, 2018). This is often discussed in terms of three basic theories or scenarios first set out in the late 1970s and early 1980s that considered the health of older people in view of increasing life expectancies: 'expansion of morbidity', 'compression of morbidity' and 'dynamic equilibrium'. The scenarios have very different implications, because they suggest that people will potentially spend either longer or shorter periods of time in ill health. It is therefore important to understand which of the scenarios occurs in a given country and population.

Expansion of morbidity

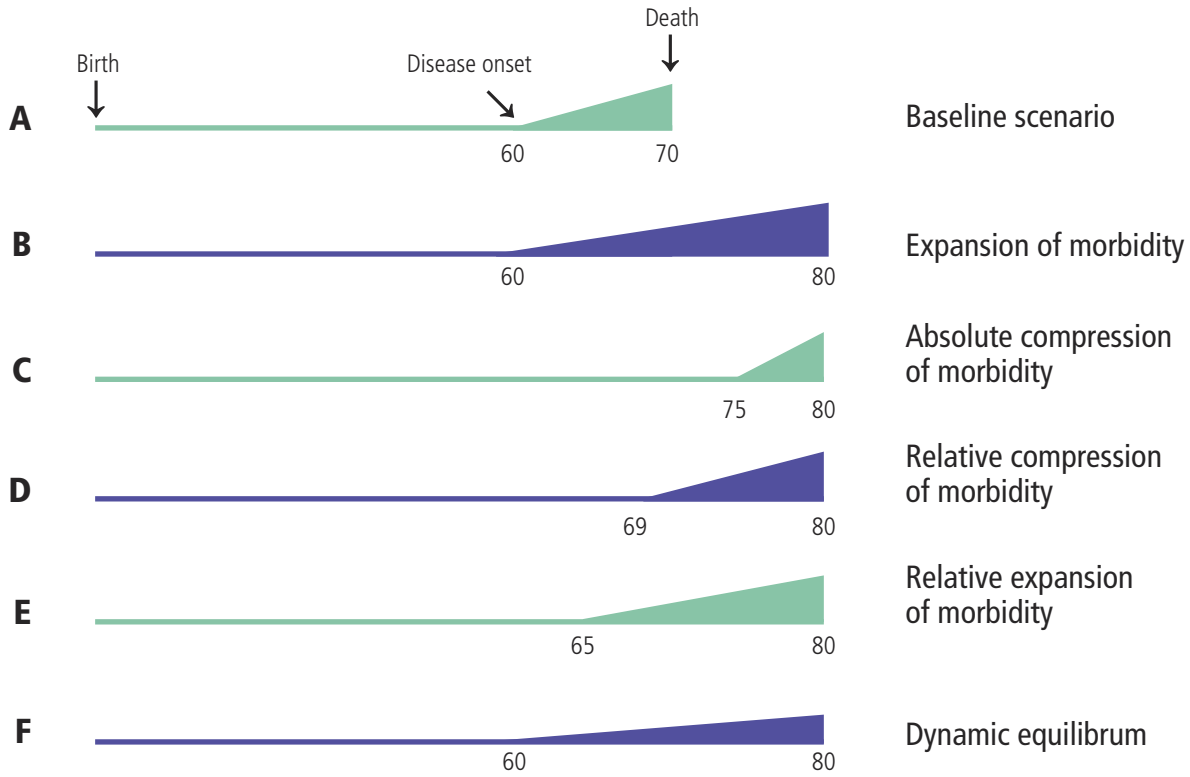
The '**expansion of morbidity**' theory was the first of the three theories to be put forward. It argues that increasing life expectancy will be accompanied by increased time spent in ill health (Scenario B in Figure 1), leading to so-called 'failures of success' (Gruenberg, 1977). According to this theory, medical progress will increase the survival of frail older people, such as those with dementia, so that falling mortality is associated with an increase in morbidity, leading to people living more years in poor health (Gruenberg, 1977; Kramer, 1980; Olshansky et al., 1991). This scenario would likely result in increased health care needs and expenditures.

Another related scenario is possible, in which life expectancy increases and the onset of disease occurs at a later age, but where the proportion of years lived in ill health as a percentage of life expectancy increases (Scenario E in Figure 1). We can call this '**relative expansion of morbidity**'. In this case, years of life in good health are gained, but there are also more absolute and relative years as a share of total life expectancy spent in bad health. The implications for health and long-term care systems are unclear, but this scenario may well be associated with increased health care utilization and expenditure. Value judgements have to be made about the various implications, but this scenario may still be desirable, as it implies increased life expectancy and increased years in good health.

Compression of morbidity

The second theory, '**compression of morbidity**', argues that increasing life expectancies can be accompanied by a later onset of disease and an overall shorter period spent in ill health. In its simplest form, it states that 'compression of morbidity occurs if the age at first appearance of aging manifestations and chronic disease symptoms can increase more rapidly than life expectancy' (Fries, 1983). This posits that gains in healthy life years can be greater than gains in life expectancy, reducing the absolute number of years spent in ill health. Fries further clarified that '[a]bsolute compression of morbidity occurs if age-specific morbidity

Figure 1: Scenarios of ageing



Source: Authors' compilation.

rates decrease more rapidly than age-specific mortality rates' (Fries, 1983). The resulting reduction in the absolute number of years spent in ill health is one possible understanding of the 'compression of morbidity' theory. It is illustrated in Scenario C in Figure 1 and we shall call it here '**absolute compression of morbidity**'. This scenario would likely result in reduced overall health care needs and expenditure.

Another related scenario is possible in which life expectancy increases and the onset of disease occurs at a later age (Scenario D in Figure 1). In this scenario, the absolute number of years in ill health increases slightly, but the proportion of years lived in ill health as a percentage of life expectancy decreases. We can call this '**relative compression of morbidity**'. This interpretation of the compression of morbidity scenario can also be found in the literature (GBD 2016 DALYs and Hale Collaborators 2017; Steensma, Loukine & Choi, 2017). Indeed, Fries himself noted in 1983 that '[r]elative compression of morbidity occurs if the amount of life after first chronic morbidity decreases as a percentage of life expectancy' (Fries, 1983). Since the years spent in ill health only increase very slightly (by 1 year in Scenario D), compared to a major increase in years spent in good health (by 9 years in Scenario D), this scenario is also likely to be associated with a decrease in costs to the health system, presuming the years spent in good health are spent productively.

Dynamic equilibrium

The final scenario, 'dynamic equilibrium', points to the importance of the severity of morbidity (Scenario F in Figure 1). However, it was never formally defined and several versions have been used, all corresponding to thoughts set out by Manton (Manton, 1982; Manton, Corder & Stallard, 1997; Manton, 1998). One version of the scenario considers it to be the 'intermediate' between an expansion and a compression of morbidity, where mortality and morbidity decrease in proportion (Robine et al., 2020). A second version, and one which we use here for Figure 1, argues that there would be an increased prevalence of chronic diseases but that this would be counterbalanced by a decrease in the severity of these diseases. The overall prevalence of disability increases, but mainly as a consequence of increased mild or moderate disability, so the average level of disability among those affected falls (Chatterji et al., 2015). This scenario would result in decreased health care utilization and costs when compared to the expansion of morbidity scenario.

How to make use of these scenarios?

The three (and more) scenarios of ageing are useful in considering the ways in which changes in mortality and morbidity can be interlinked, and in highlighting the potential implications this has for health systems. They also illustrate in a fairly rudimentary way the difficulties in understanding the extent to which people age in good or bad health, as there can be changes in both absolute and relative terms, as well as in the severity of ill health.

However, the scenarios also come with some obvious simplifications. In Figure 1, morbidity is depicted as increasing linearly over time until death, where in reality trajectories tend to be more complicated (Fries, Bruce & Chakravarty, 2011). Furthermore, it is quite likely that a combination of scenarios occurs. The lower severity of morbidity illustrated in the 'dynamic equilibrium' scenario could be observed in the 'compression of morbidity' or the

'relative expansion of morbidity' scenarios. It is also important to be aware of potential differences between countries and between population groups within countries. As Fries argued, there is nothing inevitable about 'compression of morbidity' (Fries, Bruce & Chakravarty, 2011), as the health of older populations depends on wider societal developments, as well as health system measures to prevent, treat and manage diseases. Furthermore, even where we see an 'expansion of morbidity', this should not be dismissed out of hand, but may still be a worthwhile health policy objective, as it can be associated with an increase in life expectancy and the absolute number of years in good health. A final challenge with the scenarios of ageing concerns the notion of 'morbidity', as will be discussed in the next section.

How to measure health and disability?

Any judgement on whether people are living longer in better or worse health depends on the measure of health and disability used. While it is of interest to know about changing patterns of diagnosed disease, it is more important to understand how the health of older people affects their ability to enjoy an active and productive life. We therefore discuss the different ways in which the health status of older people can be measured.

Morbidity and the associated concept of what constitutes good or bad health are not easily defined (Fries, Bruce & Chakravarty, 2011). Morbidity in particular is an 'imprecise term often defined in different ways' (Fries, 2012). Changes in the ways in which diseases are measured make it difficult to assess changes over time, and the importance of disease depends to a large extent on how well symptoms can be managed and effects on capacities mitigated. Box 1 explains some of the key concepts and indicators used to measure morbidity and mortality that are discussed in greater detail throughout this brief.

Box 1: Key concepts and indicators of morbidity

ADL – activities of daily living. An indicator of an individual's basic capacity to care for themselves. ADL limitations include having problems getting dressed, walking across a room, bathing or showering, eating, getting out of bed, and using the toilet.

IADL – instrumental activities of daily living. An indicator of an individual's capacity to care for themselves. IADL limitations involve more complex tasks than ADLs. They include having problems preparing a hot meal, shopping for groceries, making telephone calls, taking medications, doing work around the house or garden, and managing money.

YLD – years lived with disability. This is the burden of physical and mental illness due to one or more causes in an age–sex group of the population. It equals the prevalence of the condition times a disability weight for that condition, times the number of years the individual is in that state.

DALYs – disability-adjusted life years. These are the sum of years of life lost due to both early death and YLDs, and are an overall metric of the burden of disease.

HALE – healthy (or health-adjusted) life expectancy. HALE estimates the expected number of 'healthy' years of life in a given population. It is calculated by subtracting from life expectancy the number of YLD, multiplied by a weighting representing the severity of the disability.

HLY – Healthy life year (Eurostat). HLYs are defined as the number of years a person is expected to continue to live in a healthy condition. They are calculated using mortality statistics and data on self-perceived long-standing activity limitations.

Healthy life expectancy (Eurostat). This indicator is similar to HLY above but is based on data on self-perceived general health.

All measures of health are either subjective, objective or a combination of the two. Subjective measures of health rely on self-reporting, while objective measures are based on physical examinations and tests. Objective measures have the advantage of delivering arguably more comparable results but are more resource-intensive to collect and as a result are used less frequently. Additionally, a single assessment may not capture the effects of a condition that fluctuates over time (Stolz, Mayerl & Freidl, 2019) and may not capture the extent to which the objectively measured disease is effectively managed and effects mitigated. Self-reporting has the advantage of easy administration and of capturing how people themselves perceive their health status but can reduce comparability of data over time, and across groups or countries.

Three main strategies have been used to collect information on self-reported or 'self-perceived' health status or activity limitations of older people (Chatterji et al., 2015).

- Asking respondents about their overall health status using a 5-point rating scale, commonly termed self-rated (general) health or self-reported (general) health. An example is the question on self-perceived general health included in Eurostat's measure of healthy life expectancy (see Box 1). This strategy does not capture the details of the different dimensions of health, nor any information on functional limitations.
- Asking detailed questions across several domains of health.
- Asking questions that aim to measure functional independence in ADLs and IADLs, which are then used to quantify health states and measure changes over time (Chatterji et al., 2015). An example are the self-perceived long-standing activity limitations captured for Eurostat's measure of HLYs, but also (in a more detailed way) many surveys on ageing. Using both ADL and IADL measures (see Box 1) together can allow a meaningful measure of functional disability (Spector & Fleishman, 1998).

Distinct but related concepts: impairment, disability and handicap

The concept of disability is referred to throughout this policy brief. However, it is often confused with other terms, especially impairment and handicap, each with its own specific meaning. An **impairment** is any loss or abnormality of psychological, physiological or anatomical structure or function. An example might be the loss of a limb. A **disability** is any restriction or lack (resulting from an impairment) of ability to perform an activity in the manner or within the range considered normal for a human being. A person having lost a leg, for example, might not be able to walk without support, but the use of mobility aids can considerably decrease their level of disability. A **handicap** is a disadvantage for a given individual that limits or prevents the fulfilment of a role that is considered normal or typical. A person having lost a leg might only be marginally handicapped. The importance of differentiating these three concepts is that an impairment need not necessarily lead to a disability, if the individual concerned can achieve the relevant tasks in other ways. Similarly, a disability need not necessarily be a handicap, but often becomes one because of a failure by society to make necessary adjustments, for example, by enabling people with disabilities access to buildings.

Presence of chronic diseases as a measure of health?

The prevalence of chronic diseases typically rises with increasing age (Barnett et al., 2012), but there are questions over whether this is a useful indicator of poor health. There are two commonly used comorbidity (multimorbidity) scoring systems which have been developed to assist in care planning (Charlson et al., 1994, Elixhauser et al., 1998). In both, people are asked whether they have been diagnosed with a chronic disease; this information is used to generate a score. This type of measure relies on self-reporting, including self-report of diagnosis made by health professionals. There are several problems with using chronic disease diagnoses to measure health status. These include:

- People in different countries or in different socioeconomic groups within the same country may have different levels of access to diagnosis and treatment, as well as different levels of health literacy, so comparisons may be difficult.
- Diagnostic thresholds change over time, so we may see more people being diagnosed, without any underlying increase in prevalence. For example, international guidelines have recently lowered the threshold for diagnosing hypertension (Narita, Hoshide & Kario, 2018) while the introduction of testing for troponin, a highly sensitive marker of myocardial damage, has increased the number of acute myocardial infarctions diagnosed (Meier et al., 2002).
- Patients may not be aware of their diagnoses or report them incorrectly.
- Diagnoses of chronic conditions are a poor measure of disability and functional limitations (Fries, Bruce & Chakravarty, 2011). An individual's health, irrespective of having a chronic illness, is better defined by being able to execute a series of day-to-day actions and tasks (Chatterji et al., 2015). If the disease is well controlled (which it may be in some health systems but not in others), there may be no impact on other dimensions of health. If the disease is not well controlled, other health problems may follow, lowering self-assessed health and resulting in ADL limitations (Lindgren, 2016).

Finally, trends in the overall prevalence of disease can only provide limited information on whether there is a compression or expansion of disability. The reason for this is that, as populations age, more people survive into the oldest age groups. Overall prevalence of some health conditions might therefore increase, even while age-specific prevalence might be falling. In England and Wales, for example, the overall number of people with care needs was estimated to increase by 25% by 2025, but this reflected shifts in the population age structure rather than an increase in the age-standardized prevalence of poor health (Guzman-Castillo et al., 2017).

Compression of functional decline

Overall, we argue that the existence of functional limitations is a more appropriate measure of health in old age than the prevalence of chronic diseases. This is also in line with how the WHO has defined healthy ageing as 'the process of developing and maintaining the functional ability that enables well-being in old age' (WHO, 2015). It is therefore perhaps more appropriate to speak of '**compression of disability**' than 'compression of morbidity'. Even more accurately, we can speak of '**compression of functional decline**'.

While much research about ageing has used aggregate disability scores based on ADLs and IADLs, such as the Barthel scale and the Groningen Activity Restriction Scale (GARS), age-related functional decline tends to follow a hierarchy of loss of functions from those functions which are more complex (e.g. driving a car) to those that are basic for survival, such as eating (Bendayan et al., 2017). Accounting for this hierarchical order of loss could potentially help to better quantify functional decline and to inform strategies for prevention and early intervention (Gore et al., 2018).

Figure 2 shows a hypothetical model of the compression of functional decline, where the goal is to shift Trajectory 1 towards the rectangular ideal, resulting in Trajectory 2. In the new trajectory, higher levels of capability are maintained for longer, although life expectancy only increases slightly. If this aim could be achieved on a population level, a compression of functional decline would occur (Gore et al., 2018).

Summary measures of population health

Several aggregated population level indicators combine information on mortality and non-fatal health outcomes in a single number. These are commonly called summary measures of population health (SMPH) or health expectancies. They combine information on life expectancy and prevalence of good health, and thus provide hints on whether the period of disability at the end of life is increasing or shortening (Christensen et al., 2009).

Figure 2: Compression of functional decline (CFD)

Source: Gore et al., 2018.

Two of the most widely used SMPHs are HALE and its converse DALYs, both developed by the WHO (see Box 1). Both measures are used in the Global Burden of Disease (GBD) study, led by the Institute of Health Metrics at the University of Washington, which provides annually updated estimates of the worldwide burden of disease from major disease and injuries (GBD 2017 DALYs and HALE Collaborators, 2018).

HALE estimates the expected number of 'healthy' years of life in a given population, if current disability and mortality patterns in that population continue. It is obtained by subtracting from life expectancy the number of years lived with a disability multiplied by a weighting that represents the severity of each condition. DALYs express the years of healthy life lost by being in a state of poor health or disability as well as those lost due to premature death. The sum of DALYs across a population represents the burden of disease. It measures the gap between the current health status and an ideal health status where the entire population lives to an advanced age, free of disease and disability. The morbidity components of HALE and DALYS, as calculated in the GBD study, are based on disability weights estimated for the sequelae of, in the most recent version, 354 diseases and injuries (GBD 2017 Disease and Injury Incidence and Prevalence Collaborators, 2018).

A comparison of gains in life expectancy and in HALE has been used to make statements about compression or expansion of morbidity, such as in Canada (Steensma, Loukine & Choi, 2017) or globally (GBD 2016 DALYs and HALE Collaborators, 2017), but HALE, although using health-related quality of life measures to determine disability weights, captures the extent of the burden of disease and disability generally and not the extent of functional limitations as such, which, as discussed above, are a more relevant measure of healthy ageing.

Eurostat publishes data on HLY, based on answers to one question on self-perceived activity limitations (Bogaert et al., 2018), and on healthy life expectancy, based on one question on self-perceived general health. Similar to the concepts of HALE and DALY, both comprise a combination of mortality and self-reported health or disability. HLY is the number of years that a person is expected to continue to live free of self-perceived long-standing activity limitations as captured by data collected for the EU Statistics on Income and Living Conditions (EU-SILC) (Eurostat, 2018b). The relevant EU-SILC question concerning the long-standing activity limitation is: 'For at least the past six months, to what extent have you been limited because of a health problem in activities people usually do? Would you say you have been: severely limited?, limited but not severely?, not limited at all?' (Eurostat, 2018b). Since the underlying measure of health used to calculate HLY is activity limitation, it is a disability-free life expectancy (DFLE), similar to HALE, although without considering the presence of disease as such. As argued above, the measure of activity limitations is most appropriate for capturing how well people age, and HLYs, although they are based on a global activity limitation measure, can give an approximate indication of compression or expansion of morbidity. They have been used in projections of EU targets taking into account the different ageing scenarios (Lagiewka, 2012).

Eurostat's indicator on healthy life expectancy is based on self-perceived general health and combines data on mortality and self-perceived general health. The latter is based on a 5-point scale (How is your health in general? Is it ... [very good] [good] [fair] [bad] [very bad]). Self-rated general health has been used in studies that assess the extent of healthy ageing, such as in Germany (Sperlich, Tetzlaff & Geyer, 2019) or Switzerland (Remund et al., 2019). However, it is a rather broad measure and does not allow for distinguishing between people's perceptions of their somatic and mental health (Remund et al., 2019), nor does it capture the extent of functional limitations.

Latest evidence on subjective and objective health and disability measures

What does the academic literature suggest?

In a systematic review published in 2015, authors concluded that the judgement as to whether there had been compression or expansion of morbidity or dynamic equilibrium depended mainly on the health indicator used (Chatterji et al., 2015). A similar conclusion was reached by other authors, such as in an analysis of health expectancies over two decades in England (Jagger et al., 2016).

The authors of the 2015 systematic review (which covered patterns across the world rather than in Europe alone) noted that disability-related or impairment-related measures (such as ADL or IADL) tend to support the theory of compression, whereas chronic disease morbidity tends to support the expansion hypothesis. The likely reason for this is that there may be more chronic diseases among older people, but these do not always lead to impairments or disability (Chatterji et al., 2015).

Trends in disability prevalence and functional limitations

Evidence on disability trends of older people in Europe is mixed, with major variations between countries, time periods covered and studies.

An analysis of three large longitudinal surveys of older adults using a harmonized assessment of disability based on limitations in ADL and IADL showed that Italy, Spain and Greece seemed to have much larger proportions of people who were disabled across all ages, compared with countries such as the Netherlands, Sweden and Switzerland, irrespective of the measure used. Different patterns can be observed between ADL limitations (which have fallen consistently between 1995 and 2008) and IADL limitations (which have not) (Chatterji et al., 2015).

An OECD study reviewing trends in ADL limitations at age 65 and over in 12 Organisation for Economic Co-operation and Development (OECD) countries during the 1990s also found different trends across countries, with clear evidence of a decline in disability among older people in only 5 of the 12 countries studied: Denmark, Finland, Italy, the Netherlands and the United States (Lafortune & Balestat, 2007). The greatest decline was observed in the United States during the 1980s and 1990s (Manton, Gu & Lamb, 2006; Manton, 2008), where a reduction was found in terms of both ADL or IADL limitations, although disease rates have not been improving (Cutler, Ghosh & Landrum, 2013). Many authors note that reporting of diagnosed chronic diseases may increase in parallel with a decline in the reporting of functional limitations or disability. Fewer functional limitations can result from improvements in the management of chronic diseases, as well as an increased use of assistive technologies or more accessible buildings.

There are also important differences in the health of older people within countries. An analysis of seven waves (2002–2014) of the European Social Survey found that functional

limitations among people aged 60 years and older were more prevalent among those with low incomes than among those with high incomes. These differences were more pronounced among men than among women (von dem Knesebeck, Vonneilich & Lüdecke, 2017). Another study, using data from SHARE and covering the population aged 50 years and older for nine countries, found that there is also a clear educational gradient in frailty (measured with a 40-item Frailty Index of accumulated deficits) for both genders, with higher levels of frailty among those with lower levels of education. The educational gradient was strongest for women living in southern European countries, less strong in western European countries, and smallest in northern European countries (Uccheddu, et al., 2019). Similarly, major inequalities within countries have been found in the prevalence of non-communicable diseases and behavioural risk factors among older people across Europe, with poorer people and those with lower levels of education at a disadvantage (Bono & Matranga, 2019).

There are also major differences between men and women. For example, in the United States in the period 1982–2011, trends in mortality and disability differed substantially between men and women. While men experienced rising longevity, postponements and declines in disability, and an increased percentage of life years spent active, women only experienced small increases in longevity, small postponements in the onset of disability, increases in mild disability, and a stagnation of active life as a percentage of life expectancy (Freedman, Wolf & Spillman, 2016).

A number of studies have been undertaken using the SHARE dataset, covering the population aged 50 years and older, with wave 1 (2004–2005) being conducted in seven European countries. Using longitudinal data from SHARE for the period 2004–2011, an analysis of disability levels (measured in ADL and IADL) in older people in 10 European countries, by age and proximity to death, found slightly increasing disability levels (Heger & Kolodziej, 2016). In contrast, a study of the cognitive and physical functioning of Europeans aged 50 in 2004–2005 and 2013, based on SHARE waves 1 and 5, found no overall differences in ADL, but small improvements in IADL in northern and southern Europe, with an improvement in both ADL and IADL for the oldest age groups (from age 70) in northern Europe (Ahrenfeldt et al., 2018). The study also found that Europeans born later had substantially better cognitive functioning than those born earlier, with those surveyed in 2013 having the same level of cognitive function as people 8 years younger in 2004–2005 (Ahrenfeldt et al., 2018). A postponement of functional limitations was found in a study using data from the Swedish Surveys of Living Conditions for the period 1980–2011. The study found that limitations in ADL and mobility occurred at a higher age and that the number of years lived with functional limitations declined, in line with the compression of morbidity theory (Lagergren et al., 2017).

Trends in summary measures of population health

An examination of trends in SMPH or health expectancies suggested that, except for Switzerland, there was no strong evidence of compression of morbidity or disability in the low-mortality countries (Jagger & Robine, 2011). The three advanced economies that most clearly displayed a compression of disability among older people during the 1990s according to the previously mentioned OECD study (Denmark, the Netherlands and the United States) are those where life expectancy at age 65 had increased least, in large part as a consequence of their exposure to the 20th century smoking epidemic (Robine, Saito & Jagger, 2009). This means that healthy life expectancy increased most in countries with a low overall life expectancy at age 65.

Trends in chronic disease prevalence

A 2016 review of the international literature found strong evidence that the prevalence of chronic disease among older people has increased over time, probably because of survivorship bias, whereby people are being kept alive longer by modern medicine despite having health issues. This medical progress has also been associated with a reduction in the consequences of disease, making the time with disease (and health care treatment) longer but less troublesome than before. The review also found evidence to suggest the postponement of functional limitations and disability (Lindgren, 2016). These findings were largely confirmed in a study of the SHARE dataset, covering 10 European countries between 2006–7 and 2015. The study found an increase in the prevalence of multimorbidity (defined as two or more coexisting chronic conditions) from 38.2% in 2006–2007 to 41.5% in 2015, but that its impact on primary care visits and functional capacity declined slightly, although without a reduction of its impact on hospital admissions and quality of life (Palladino et al., 2019).

Overall numbers of people with age-related conditions will increase due to increasing numbers of old people. Some of the most prevalent conditions are dementia, stroke, chronic obstructive pulmonary disease (COPD) and vision impairment. In the United Kingdom, the number of cancers in people over 65 years of age is expected to increase between 2007 and 2030 by 76.2% for men and 67.5% for women, due to a combination of population growth and ageing (Mistry et al., 2011). In England, the prevalence of multimorbidity is expected to increase, with the proportion of people living with four or more diseases projected to almost double between 2015 and 2035, from 9.8% to 17.0% (Kingston et al., 2018).

In surveys conducted in western Europe between 1990 and 2005, the average prevalence of diabetes among those aged 70–79 years was about 25% (Rathmann et al., 2005). Due to the combination of ageing populations and the obesity epidemic that is affecting many European countries, the number of older patients with diabetes is likely to increase markedly.

There are also likely to be increases in the overall number of people with cognitive impairment or mental health problems. Lower performance in cognitive abilities and memory complaints are common with increasing age (Lourenco et al., 2018), although there is now growing evidence that the age-specific rates of dementia are falling in some countries, probably because those at older ages in

successive generations are generally healthier, with fewer risk factors (Wu et al., 2016). However, the overall number of people with dementia is projected to more than double in Europe between 2010 and 2050, reaching 14.5 million, equivalent to 3.3% of the total population and 10.1% of the population over 65 years (Mura, Dartigues & Berr, 2010).

Musculoskeletal problems are also becoming more prevalent with age. A cross-sectional study of 14 European countries using wave 5 of SHARE found an overall prevalence of chronic musculoskeletal pain of 35.7% (28.8–31.7), ranging from 18.6% (17.1–20.1) for Switzerland to 45.6% (43.3–47.8) for France (Cimas et al., 2018), although some of this variation may be due to cultural differences in reporting pain.

What do international databases suggest?

Healthy life years based on activities of daily living (Eurostat)

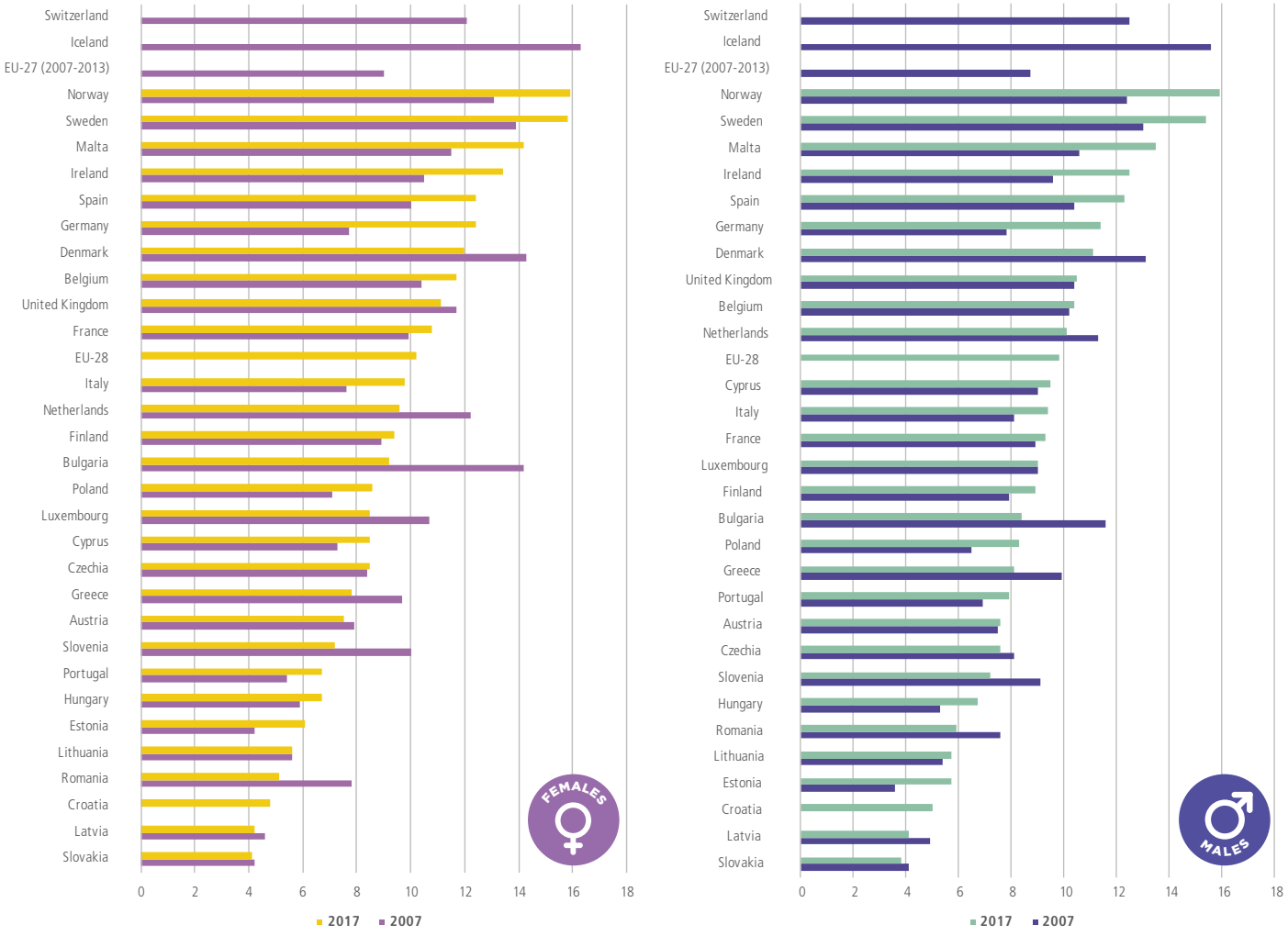
Eurostat data on healthy life years for the years 2007–2017 show variation in trends across countries, and for both males and females (Figure 3). Some countries have seen improvements but in others there was a decline in healthy life years.

What is striking are the major differences between countries in terms of how many healthy life years 65-year-olds can expect to live, with many more healthy life years in some of the Nordic countries and far fewer in some central and eastern European countries. The large fluctuations in some countries however raise some questions about the comparability of data across years, which is sometimes due to a change in the way the indicators were defined at the national level.

Considering healthy life years at age 65 as a percentage of life expectancy (Figure 4), developments between 2007 and 2016 also differ widely among countries and there are major variations across countries in terms of the share of healthy life years as a percentage of life expectancy at age 65. Older people in some countries in northern and western Europe (such as Sweden, Norway, Ireland and Malta) live a far larger share of their remaining years healthily than their counterparts in some countries in eastern Europe (such as Slovakia, Latvia, Croatia and Lithuania).

When looking at percentage point changes of healthy life years at age 65 as a percentage of life expectancy at age 65 (Figure 5), roughly half of the countries show improvements and thus a relative compression of morbidity, but a break in series in many countries means that data are not comparable across years.

Figure 3: Healthy life years at age 65 in EEA countries, 2007 and 2017



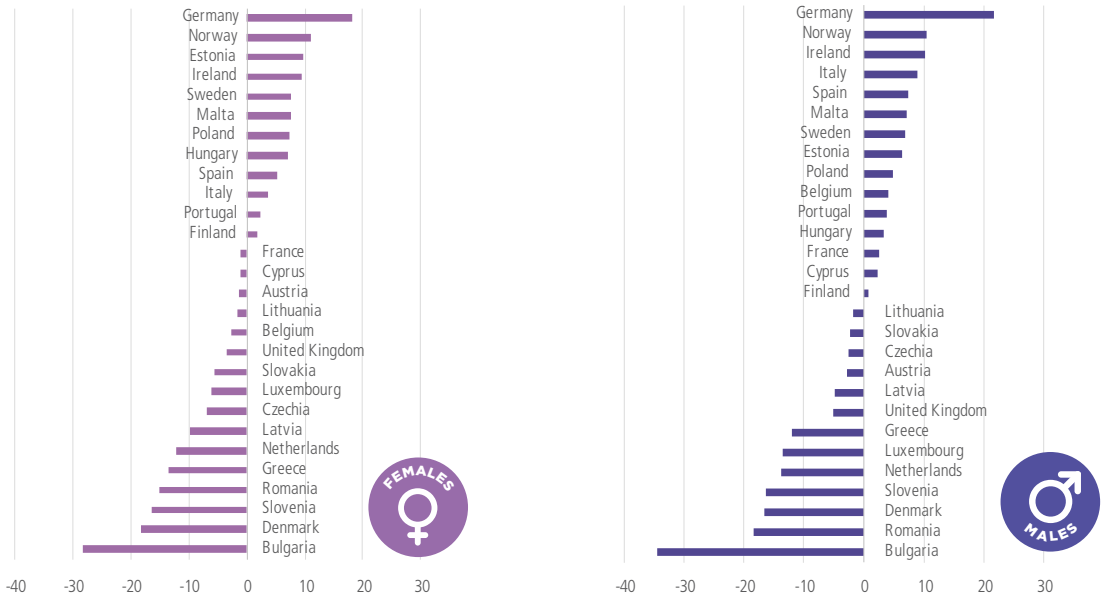
Note: Break in series in Austria, Bulgaria, Czechia, Denmark, Estonia, Germany, Greece, Italy, Latvia, Luxembourg, Netherlands, Norway, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden and United Kingdom.
Source: Eurostat, 2020.

Figure 4: Healthy life years at age 65 as a percentage of life expectancy at age 65 in EEA countries, 2007 and 2017, ordered by 2017 value

Note: Break in series in Austria, Bulgaria, Czechia, Denmark, Estonia, Germany, Greece, Italy, Latvia, Luxembourg, Netherlands, Norway, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden and United Kingdom.

Source: Eurostat, 2020.

Figure 5: Percentage point change of healthy life years at age 65 as a percentage of life expectancy at age 65 in EEA countries, 2007 and 2017



Note: Break in series in Austria, Bulgaria, Czechia, Denmark, Estonia, Germany, Greece, Italy, Latvia, Luxembourg, Netherlands, Norway, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden and United Kingdom.

Source: Eurostat, 2020.

Healthy life expectancy based on self-perceived general health (Eurostat)

Eurostat data on healthy life expectancy based on self-perceived general health at age 65 in 2007 and 2016 (Figure 6) display improvements in almost all countries for which data were available, the sole exception being females in Luxembourg. Healthy life expectancies are highest in some countries in western and northern Europe (such as Switzerland, Sweden and Malta) and lowest in some countries in eastern Europe (such as Latvia, Slovakia, Lithuania and Croatia).

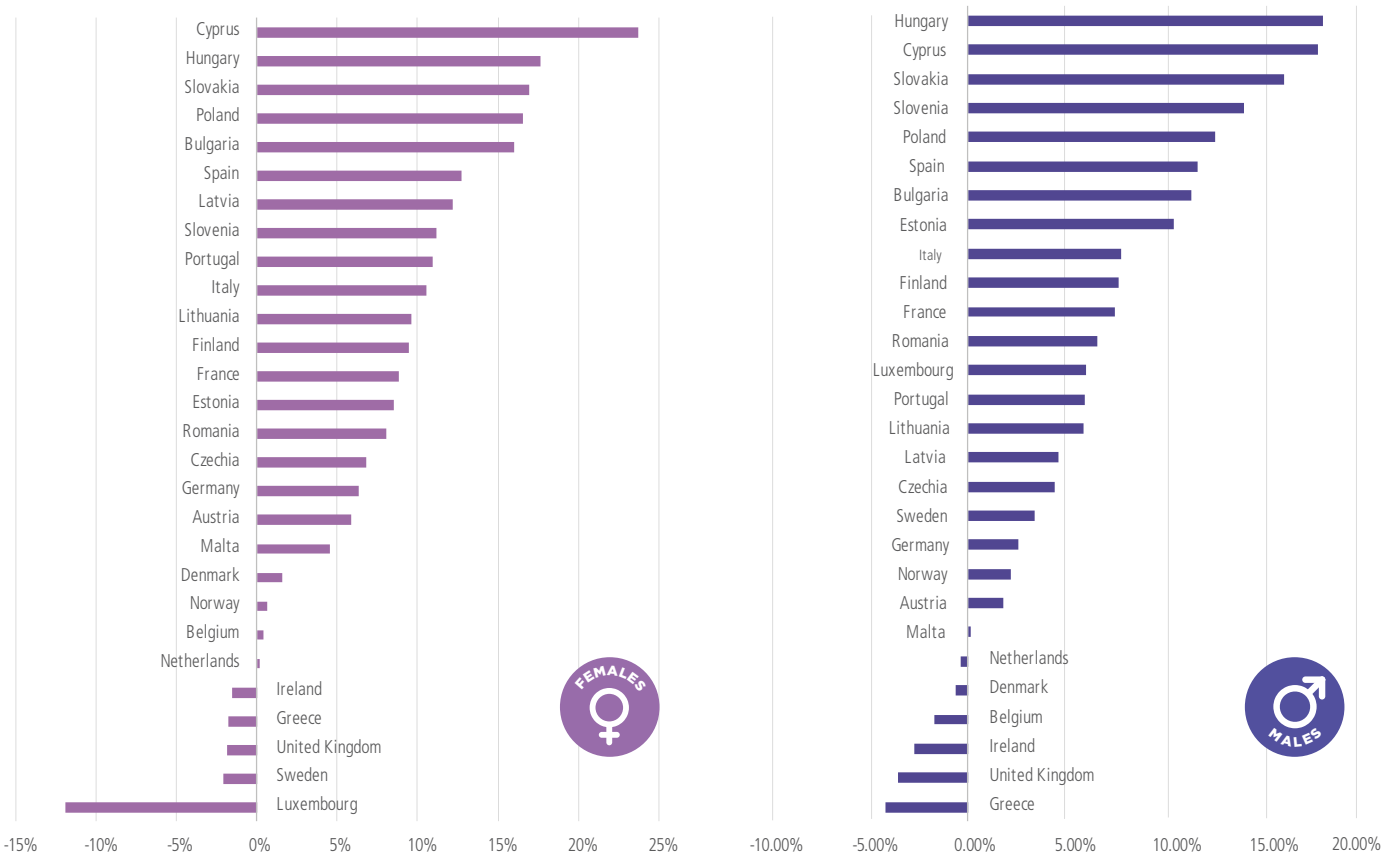
There were greater improvements in healthy life expectancy than in life expectancy in many of the countries. Between 2010 and 2016, healthy life expectancy at birth in the EU increased by 1.6 years, from 62.6 to 64.2, whereas life expectancy at birth increased by 1.1 years in the same period, from 79.9 to 81.0 years (Eurostat, 2018a).

Considering percentage point changes of healthy life expectancy based on self-perceived health at age 65 as a percentage of life expectancy at age 65 (Figure 7), improvements can be seen in the vast majority of countries, pointing to a relative compression of disability, although with the caveats pointed out above about the single indicator of self-perceived general health as a measure of health in old age.

Figure 6: Healthy life expectancy based on self-perceived general health at age 65 in EEA countries, 2007 and 2016, ordered by 2016 value

Note: Break in series in Bulgaria, Italy, Luxembourg and Netherlands.
Source: Eurostat, 2020.

Figure 7: Percentage point change of healthy life expectancy based on self-perceived health at age 65 as a percentage of life expectancy at age 65 in EEA countries between 2007 and 2016



Note: Break in series in Bulgaria, Italy, Luxembourg and Netherlands.
Source: Eurostat, 2020.

WHO's healthy life expectancy

WHO data on HALE at age 60 in countries of the WHO European region are available for the years 2000–2016. They indicate increases in HALE between 2000 and 2016 for both males and females (Figure 8) in all of the countries of the WHO European region.

However, while life expectancy has also increased in all countries of the WHO European region between 2000 and 2016, the rate of improvement has differed from changes in HALE:

- Considering **life expectancy and HALE at birth**, the share of HALE as a percentage of life expectancy actually decreased for most European countries for both males and females between 2000 and 2016. For the 50 countries for which data are available, the share of HALE as a percentage of life expectancy at birth only increased in 9 countries for males and in 13 countries for females, while decreasing in the remaining countries.
- Considering **life expectancy and HALE at age 60**, the share of HALE as a percentage of life expectancy increased in 30 countries and decreased in 20 countries for males, while for females it increased in 36 countries and decreased in 14 countries (Figure 9). In those countries that saw an increase in the share of HALE as a percentage of life expectancy at age 60, HALE data thus indicate a relative compression of disability, while for those countries that saw a decrease in HALE as a percentage of life expectancy at age 60 they indicate a relative expansion of disability.

Figure 8: HALE at age 60 in countries of the WHO European region, 2000 and 2016

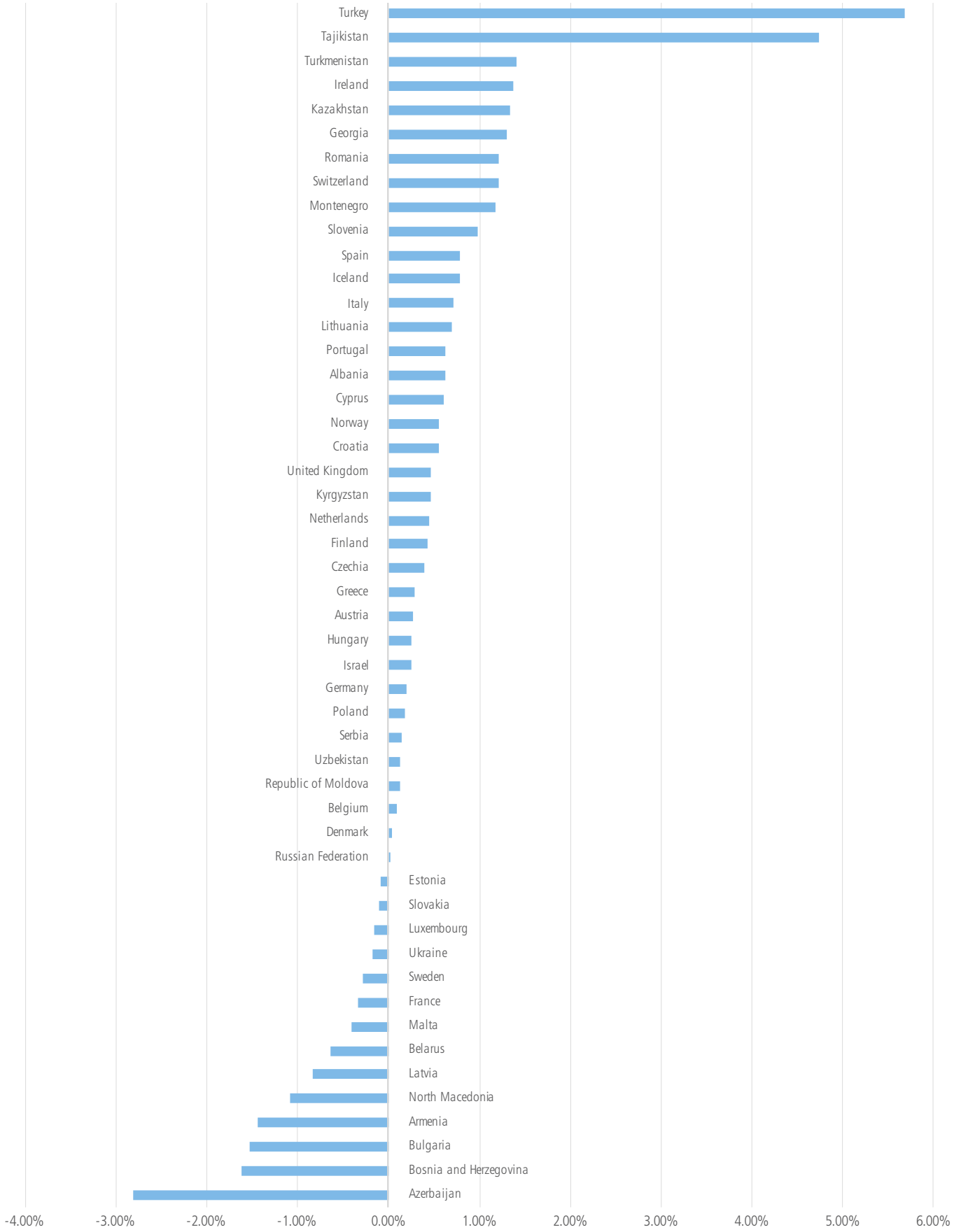
Source: WHO, 2020

Comparison of HALE, healthy life years based on activities of daily living and healthy life expectancy based on self-perceived general health

It is difficult to compare the information on health in old age derived from Eurostat and WHO databases, since they cover different indicators, samples, years and countries. Diverging results in terms of compression or expansion of disability underline the influence of the choice of indicators. There are some additional limitations that have to be borne in mind too. The Eurostat indicators are based on self-reporting, so rely on subjective perceptions that may be shaped by the social and cultural backgrounds of respondents. There are also sizeable breaks in series, which greatly limits comparability of data across years.

Perhaps most importantly, the absolute number of years spent in good health differs greatly between countries, illustrating the inequities that exist across Europe, as was pointed out in previous work on healthy life years (Jagger et al., 2008). These differences may be a much more immediate challenge to healthy ageing in Europe than any (small) proportional changes within countries related to life expectancy.

Figure 9: Percentage point change of HALE as a percentage of life expectancy at age 60 between 2000 and 2016



Source: Authors' calculations, based on: WHO, 2020.

What explains historical trends and what are the policy implications?

There is overwhelming evidence that policy interventions that promote healthy behaviours can result in an increase in healthy life years and a healthy and active older population (Fries, Bruce & Chakravarty, 2011). These policies can help both to prolong lives and improve health at older ages, since fatal and non-fatal outcomes tend to be correlated (Fries, 2012).

Health systems are important contributors to increases in life expectancies, decreases in severe disability and better coping and functioning with chronic disease (Nolte & McKee, 2011; GBD 2016 Healthcare Access and Quality Collaborators, 2018). The declining mortality among older people in Europe is largely a consequence of declining mortality from cardiovascular disease (Glei, Meslé & Vallin, 2010), which can be attributed to a combination of improved lifestyles, prevention and treatment (Laatikainen et al., 2005).

A combination of improved lifestyles and advances in medical care and prevention can also explain decreases in morbidity. A review of the causes of declining morbidity in the United States concluded that substantial reductions in old-age disability between the early 1980s and early 2000s are likely due to advances in medical care as well as changes in socioeconomic factors. The timing of the improvements in heart and circulatory conditions, vision and musculoskeletal conditions corresponds to the expansion in medical procedures and pharmacological treatment for cardiovascular disease, increases in cataract surgery, increases in knee and joint replacements, and expansion of medications for arthritic and rheumatic conditions. Greater educational attainment, declines in poverty and declines in widowhood also appear to have contributed (Schoeni, Freedman & Martin, 2008).

In Europe too, the reduction in (severe) disability observed in some countries can be attributed to improvements in treatment of chronic diseases, as well as to the increased use of assistive technology, accessibility of buildings, etc. (Lindgren, 2016). Advances in rehabilitative medicine, modifications to physical living environments and improvements in education and early-life experiences could also contribute to reduced loss of functioning and disability. Health systems enable people to postpone functional limitations and disability despite increasing prevalence of chronic disease (Lindgren, 2016). Improvements in the cognitive functioning of older Europeans have been observed between 2004–2005 and 2013, which may reflect better education, different starting levels in their youth, or improvements in general living conditions (Ahrenfeldt et al., 2018).

Functional impairment in older people, as assessed by ADL and IADL, has been linked to the occurrence of depression, cognitive impairment, the number of chronic conditions, and living without a spouse or partner (Hajek & König, 2016). The profile of lifestyle-related risk factors is much the same across the most burdensome disorders for older people. Dyslipidaemia, hypertension, diabetes, smoking and obesity are the major modifiable risk factors for cardiovascular diseases. Smoking is also a major modifiable risk factor for cataract and age-related macular degeneration, COPD and lung cancer. A review of risk factors for Alzheimer's disease identified consistent evidence from cohort studies indicating causal roles for smoking, physical inactivity, midlife hypertension, obesity and diabetes. The prevalence of most of these risk factors (except smoking) rises with increasing age (Prince et al., 2015). Similarly, cognitive decline is influenced by nutrition, physical activity, education and other metabolic and vascular risk factors (Lehtisalo et al., 2017; Lourenco et al., 2018). Interventions addressing cognitive impairment, for example, include improved nutrition, increased physical and social activity, and the provision of visual and hearing aids (Maharani et al., 2018; Shakersain et al., 2018). These interventions will also help to improve successful ageing more generally (Lehtisalo et al., 2017). Employment might also play a positive or negative role in cognitive decline (Celidoni, Dal Bianco & Weber, 2017), although the evidence so far is weak (Meng, Nexo & Borg, 2017).

Crucially, interventions to prevent functional decline should begin before the onset of old age as some functions can be lost much earlier than previously thought (Wloch, Kuh & Cooper, 2016). Interventions to prevent functional decline can be informed by the hierarchy of loss of function (Gore et al., 2018). They should aim to:

- delay loss of function (e.g. through physical activity and structured exercise that targets endurance, strength, balance and flexibility)
- reactivate lost functions (e.g. through targeted exercise)
- compensate lost functions (e.g. through technologies such as walking aids or home modifications)
- provide personal support (to make up for lost functions).

Conclusions

This policy brief has reviewed how to assess whether older people spend their longer lifespans in better or worse health, in terms both of the presence of disease and measures of disability or impairment, and has considered the latest available evidence for Europe. The findings illustrate that assessments of the health of older people in Europe depend to a large degree on the measure used. Furthermore, there are substantial differences between and within countries, which makes it difficult to identify overall trends.

The crucial point from a policy perspective is that health systems, among other factors, can contribute to increases in life expectancies, decreases in severe disability, and better coping and functioning with chronic disease. A combination of improved lifestyles and advances in medical care and prevention can help to explain decreases in morbidity and its consequences. Improvements in mortality and morbidity in recent decades are likely to be due to a combination of improvements in prevention and healthy lifestyles, as well as improvements in medical care. It will be important to continue on this path to improve the functioning and healthy ageing of older adults, so that they can realize their full potential to their own benefit and that of society at large.

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