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ΔΙΠΛΩΜΑΤΙΚΗ ΕΡΓΑΣΙΑ

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Master Thesis

**‘Evaluation of health prevention and wellbeing programs for the
society and the healthcare system.’**

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Η παρούσα διπλωματική εργασία εκπονήθηκε στο πλαίσιο σπουδών
για την απόκτηση του Μεταπτυχιακού Διπλώματος Ειδίκευσης στο

ΒΙΟΕΠΙΧΕΙΡΕΙΝ

που απονέμει το Τμήμα Βιοχημείας και Βιοτεχνολογίας του
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INDEXES

Abbreviations.....	3
Abstract.....	4
1. Introduction.....	5
1.1 Demographic change.....	8
1.2 Life expectancy.....	10
1.3 Health expenditure.....	15
2. Definitions.....	17
2.1 Definition of aging-factors that influence biological aging.....	17
2.2 Definition of Healthy Aging.....	21
Purpose of thesis.....	24
Main subject.....	25
3. Mortality factors.....	25
3.1 Death rates.....	25
3.1.1 Standardised deaths in Europe.....	26
3.1.2 Deaths from non-communicable rising.....	27
3.2 The 3 biggest causes of death.....	27
3.3 Cardiovascular diseases.....	31
3.3.1 Ischemic heart disease.....	32
3.3.2 Cerebrovascular disease or stroke.....	34
3.4 Cancer.....	36
3.5 Respiratory diseases.....	39
3.5.1 Chronic Obstructive Pulmonary Disease (COPD).....	39
3.5.2 Influenza.....	43
3.5.3 Pneumococcal disease.....	45
4. Risk factors of diseases.....	47
4.1 Tobacco.....	48
4.2 Nutrition & lifestyle.....	49
4.3 Physical activity.....	51
4.4 Obesity.....	54
5. The importance of prevention.....	55
6. Prevention actions.....	58
6.1 Behavioral.....	58
6.1.1 Physical exercise.....	60
6.1.2 Healthy eating.....	61
6.1.3 Obesity.....	62
6.1.4 Tobacco.....	64
6.2 Vaccination.....	65
6.2.1 Vaccines for therapeutic uses.....	70
6.2.2 Recommendation for vaccines promotion.....	70
6.2.3 Costs of vaccination.....	73
6.3 Diagnostics.....	74
6.3.1 Screening tests for heart diseases.....	75

6.3.2 Screening tests for cancer.....	78
6.3.3 Screening tests for COPD.....	79
7. European projects support promotion of healthy aging.....	82
8. World Health Organisation actions.....	87
Discussion	91
Conclusion	94
Bibliography.....	95

ABBREVIATIONS

WHO: World Health Organisation

DALYs: Disability-Adjusted Life Years

OECD: Organisation for Economic Co-operation and Development

CDC: Centers for Disease Control and Prevention

CVDs: Cardiovascular Diseases

NCDs: Non-communicable Diseases

IHD: Ischemic Heart Disease

COPD: Chronic Obstructive Pulmonary Disease

SHARE: Survey of Health, Ageing and Retirement in Europe

SAATI: Supporting Active Ageing Through Immunisation

NICE: The National Institute for Health and Care Excellence

CAPiTA: Community-Acquired Pneumonia Immunisation Trial in Adults

ABSTRACT

The importance of prevention is indisputable. The primary goal of prevention is to reverse or terminate, wherever possible, the pathogenetic mechanism during the exposure of an organism to hazardous factors or the symptoms of a disease are manifested.

In latest years because of the rapidly increase of ageing population, the WHO European Region has developed many actions to promote prevention focusing in median ages, thus preventing diseases in older ages. Prevention of illness is acknowledged as a critical means of limiting the impact of disease as people get older. For this reason, WHO devised the 'Healthy aging' project. That promotes opportunities for optimizing physical, social and mental health to enable people of all ages to enjoy a healthy, safe and independent lifestyle, as well as to take an active part in society. The median age is already the highest in the world, while the proportion of people aged above 65 is forecast to double between 2010 and 2050. Allowing more people to lead active and healthy lives in later age requires investing in a broad range of policies for healthy ageing, spanning from prevention to the control of non-communicable diseases. Three of the most prominent non-communicable diseases (CVDs, cancer, COPD) are linked by common risk factors related to lifestyle, such as poor diet, nutrition, tobacco use and physical inactivity. The incidences of these diseases can be reduced through health promotion and prevention. By contrast, communicable diseases, such as influenza and pneumococcal disease, can be reduced or prevented using immunisation programmes that are practical and easy to implement. Among such programmes, vaccination is an effective preventive public health strategy that many societies promote to the elderly people.

Societies try to strengthen their health systems, in order to increase older people's access to affordable high quality health and social services. Investing in healthy aging has become key for the sustainability of health on social policies in Europe.

1. Introduction

The world is facing a situation without precedent: we soon will have more people at extreme old age than ever before. It is said that we are on the bridge of a demographic milestone as older people are living longer and healthier than ever before. In 2002, older people constituted 7% of the world's population and this figure is expected to rise to 17% globally by 2050. The most dramatic increases in proportions of older people are evident in the oldest old section of society (people up to 80 years) with an almost fivefold increase from 69 million in 2000 to 377 million in 2050 (*Global Health of aging, WHO 2011*). WHO also suggests that populations in developing countries will become elderly before they become rich, while those in industrialised countries will become rich before they become elderly, emphasising that worldwide all countries need to be prepared to address the consequences of aging populations (*Australian Institute of Health and Welfare, 2014*). As both the proportion of older people and the length of life increase throughout the world, key questions arise. Will population aging be accompanied by a longer period of good health, a sustained sense of well-being and extended periods of social engagement and productivity or will it be associated with more illness, disability and dependency? How will aging affect healthcare and social costs?

Life expectancy at the Member States of EU has increased more than 6 years after 1990. In 2004 it increased in 80,9 years, an increase of around seven years since 1990, but there are till now inequalities among Member States of EU, which exist because of the different rate of exposition in risks and inequalities in access to healthcare. Millions of people lose their life because of illness that could have been avoided with more effective public health policies aimed at prevention, early detection and healthcare (*Health at a Glance, 2016*).

Prevention is a combined total of procedures that can prevent the appearance or the uncontrolled growth of an illness and intend in risk's reduction. Drinking alcohol, smoking, bad eating habits and choices, lack of exercising, obesity and stress are only some of the factors that cause diseases responsible for the highest number of deaths both in developed and developing communities. Nowadays, it is known that the mentioned factors cause cancer, cardiovascular diseases as well as other chronic diseases, thus, life quality's degradation. However, less than few people take act when it comes to their health's protection. This happens partly mainly because the knowledge about health issues is not always connected to people's respective behavior and attitude to protect and improve their health but also because, apart from

individuals' personal changes regarding health issues, measures in Public Health Systems should be taken and, by extension, they should be implemented on a large scale, too.

Among them, vaccination is a measure that its efficiency and contribution is proved regarding the improvement of the population's general health standard. Nevertheless, vaccination is highly connected with children while adults are not aware of vaccination as a preventive measure against diseases. Since human lifespan has been significantly raised over the past years, there is a need of promoting healthy life.

Based on this perception, a society's top priority needs to be citizens' awareness about prevention based on correct planning as well as direct implementation for people aged from 45 plus who ought to include a healthy way of living in their daily routine, a vaccination schedule as well as diagnostic tests in order to avoid diseases at a later age. Besides that, the state ought to promote prevention so as to preserve the elderly's good health level not only to eliminate lives' loss from diseases but also to enable these citizens to contribute to the community without being taken into account as a costly social group. Actually, financial consequences due to lost living years because of premature death or DALY'S [a life with disabilities] have been highly increased over the last years. To give an illustration, the highest percentages of these financial losses are associated with cancer and cardiovascular diseases, as it is obvious in **Chart 1** below. Especially, cancer causes the highest economic loss of all of the 15 leading causes of death worldwide. Using DALYs, the burden of diseases that cause premature death but little disability (such as drowning or measles) can be compared to that of diseases that do not cause death but do cause disability due to blindness (<http://www.cancer.org/aboutus/globalhealth/global-economic-cost-of-cancer-report>).

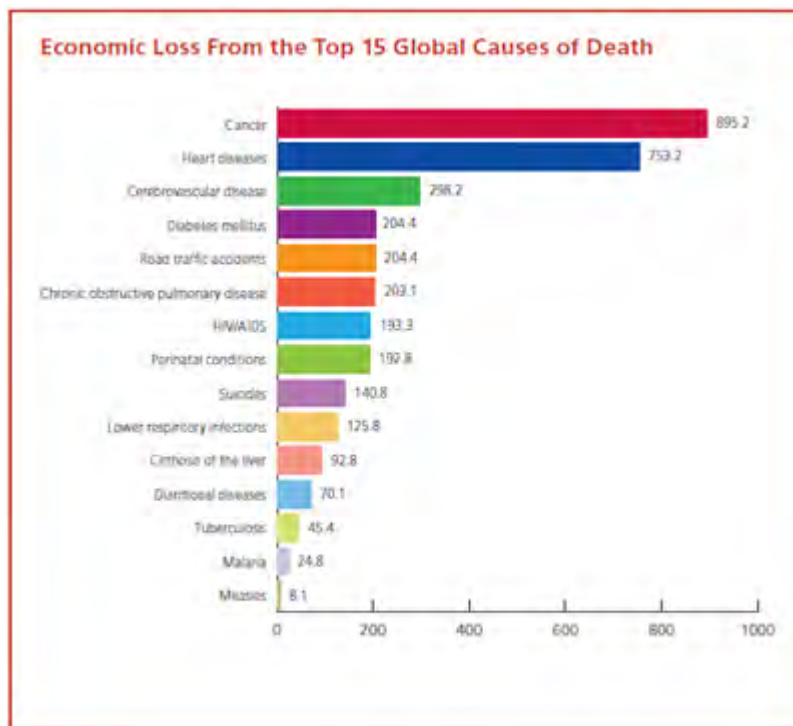


Figure 1. Economic value of DALY'S lost (US\$ billion) in 2008. Source: *The Global Economic Cost of Cancer. LIVESTRONG | American Cancer Society, 2010.*

In Greece, the perception of prevention has been identified with annual diagnostic tests (*The Economist Intelligence Unit Limited, 2012*). Although the diagnostic check is useful, especially when it is conducted according to a schedule and each individual's personal health profile, yet it is just one part of prevention, called secondary. Primary prevention, which concerns both cure and avoidance of any threat against human health, rarely is implemented even though it is of great importance to people. Of course, adopting healthy habits and attitudes is not as easy as it sounds. It requires regular attempts and usually professional assistance. For this reason, a particular scientific field called Health Education, has been created with organised schedules, about intervening and consultancy services with a view to fighting unhealthy behaviors and encouraging healthy habits which promote and protect hygiene instead. Regarding secondary prevention, the early diagnosis based on running special diagnostic tests able to ascertain a disease before clinical symptoms, it does provide the ability for direct, effective cure for certain common form of cancer and better addressing of chronic diseases.

The population aging will put unsustainable pressure on public spending, with particular concerns about rising health costs and the ability of the health system to serve the increasing numbers of older people needing care. Aging is associated with increased risk of many health conditions, disability and dependency. Research

indicates, however, that the association between health status and age is more variable than often assumed, as many chronic conditions are preventable and are not an inevitable consequence of aging (*Khaw, 1997*). Global efforts are required to understand and find cures or ways to prevent such age-related diseases as Alzheimer's and frailty and to implement existing knowledge about the prevention and treatment of heart disease, stroke, diabetes and cancer. Postponement of disease involves 4 strategies: prevention of risk factors for disease, reduction of the prevalence of risk factors before disease develops, prevention of progression of disease after onset and reduction of morbidity from disease that have already developed. Encouraging well-being across the lifespan is an important means of improving the health of future generations of older people. The primary health care sector plays a vital role in promoting and supporting healthy aging with GPs and other allied health professionals instrumental in providing lifestyle advice, managing disease risks and avoiding or averting complications of disease before the onset of old age, as well as during old age. Other targets for preventive health care among older people might include programs to prevent falls and fractures, as these are relatively common among older people and add considerable costs to the health system (*Bradley, 2013*). One way to mitigate increased health costs associated with the aging population is to improve productivity in health care. Along with broader efforts to improve the efficiency of health system there is scope for specific efforts focused on the care of older people (*Australian Institute of Health and Welfare, 2014*).

1.1 Demographic change

Population aging is a long-term trend which began several decades ago in the EU as well as in the rest of the world. This aging is visible in the development of the age structure of the population and is reflected in an increasing share of older persons and a declining share of working-age persons in the total population. It is estimated that by 2020 around 25% of the EU population will be over 65, while the number of people aged from 65 to 80 will rise by nearly 40% between 2010 and 2030. The strongest pressure is expected during the period 2015-35 when the so-called baby-boom generation will enter retirement (*National Institute on Aging, October 2011*).

By 2050, one-third of Europe's population will be over 60, compared to 13% who will be under 16. The number of 'oldest old' aged 80+ is expected to grow by 180%. Europeans enjoy amongst the highest levels of life expectancy in the world: 75.1

years for men and 81.4 for women. Life expectancy has been rising on average by 2.5 years per decade in Europe (*Centre UK and The Merck Company Foundation. June 2006*). The percentage of population aged 60+ in Greece, it was estimated about 27.0% in 2015 and it is estimated to increase in 33.2% in 2030 and 40.8% in 2050 (*Global Agewatch, Index 2015*).

The population of Europe is aging because of increasing life expectancy and a declining fertility rate. There will be fewer people of working age to support those in retirement. The number of working-age people per pensioner will nearly halve by the year 2050, from 3.5 to 1.8 at EU level. **(Figure 2)**. In other words, because of the declining birth rate of the past 20 years, there will be a problem in recruiting qualified workers, and more workers will leave working life than will enter it (*He, et al, 2016*). With fewer children entering the population and people living longer, older people are making up an increasing share of the total population. In more developed countries, fertility fell below the replacement rate of two live births per woman by the 1970s, down from nearly three children per woman around 1950. Even more crucial for population aging, fertility fell with surprising speed in many less developed countries from an average of six children in 1950 to an average of two or three children in 2005. In 2006, fertility was at the two-child replacement level in 44 less developed countries (www.who.int/ageing/publications/global_health.pdf).

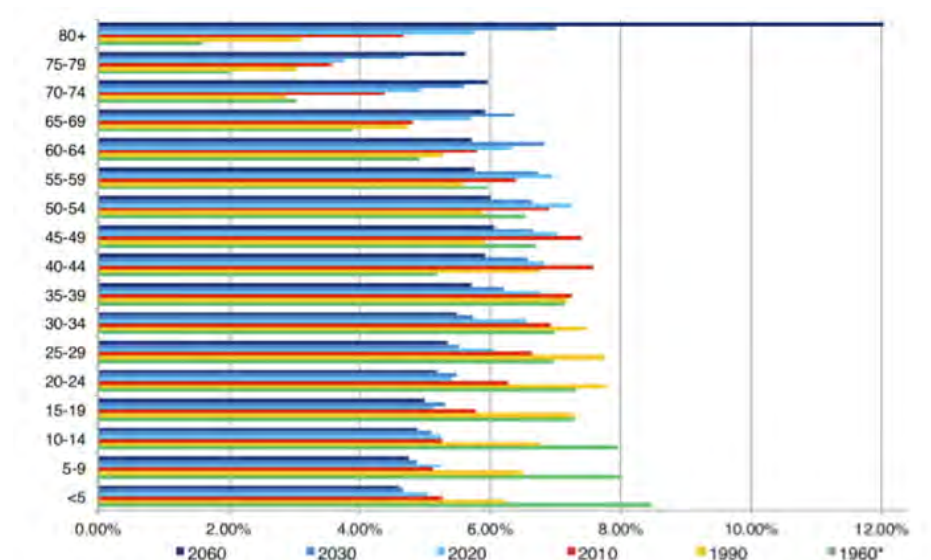


Figure 2. Age pyramid-EU27 actual and projected aging. Source: (www.aal-europe.eu).

The transition from high to low mortality and fertility that accompanied socioeconomic development has also meant a shift in the leading causes of disease and death.

Demographers and epidemiologists describe this shift as part of an 'epidemiologic transition' characterized by the waning of infectious and acute diseases and the emerging importance of chronic and degenerative diseases. High death rates from infectious diseases are commonly associated with the poverty, poor diets and limited infrastructure found in developing countries (www.aal-europe.eu). Evidence from the multicountry Global Burden of Disease project and other international epidemiologic research shows that health problems associated with wealthy and aged populations affect a wide and expanding swath of world population. Over the next 10 to 15 years, people in every world region will suffer more death and disability from such non-communicable diseases as heart disease, cancer and diabetes than from infectious and parasitic diseases. By 2030, non-communicable diseases are projected to account for more than one-half of the disease burden in low-income countries and more than three-fourths in middle-income countries. Infectious and parasitic diseases will account for 30% and 10%, respectively, in low- and middle-income countries. Among the 60 and over population, non-communicable diseases already account for more than 87 percent of the burden in low-, middle-, and high-income countries. But the continuing health threats from communicable diseases for older people cannot be dismissed, either. Older people account for a growing share of the infectious disease burden in low-income countries. Infectious disease programs, including those for HIV/AIDS, often neglect older people and ignore the potential effects of population aging (www.who.int/ageing/publications/global_health.pdf).

1.2 Life expectancy

Life expectancy has been increasing in most developed countries worldwide over very long time periods. In the EU, life expectancy at birth for males is expected to increase by 7.2 years over the projection period, from 77.6 in 2013 to 84.7 in 2060. In the coming decades the age structure of the EU population will change dramatically due to the dynamics in fertility, life expectancy and migration. The overall size of the population is projected to be slightly larger by 2060 but much older than it is now. The population pyramids presented in **figure 3** show that the age structure of the EU population is projected to change dramatically. While in 2013 the most numerous cohorts for both males and females are around 45 years old, in 2060 the number of elderly people is projected to account for an increasing share of the population, due to the combination of the numerous cohorts born in life expectancy. At the same time, the base of the age pyramid becomes smaller due to below replacement fertility

rates. As a consequence, the shape of the age-pyramids gradually changes from pyramids to more evenly sized pillars. A similar development is projected for the euro area (people aged 65 or above relative to those aged 15- 64) is projected to increase from 27.8% to 50.1% in the EU as a whole over the projection period. This implies that the EU would move from having four working-age people for every person aged over 65 years to only two working-age persons. The increase in the total age-dependency ratio (people aged 14 and below and aged 65 and above over the population aged 15-64) is projected to be even larger, rising from 51.4% to 76.6%. The difference is noticeable among individual EU Member States (*European Union, 2014*).

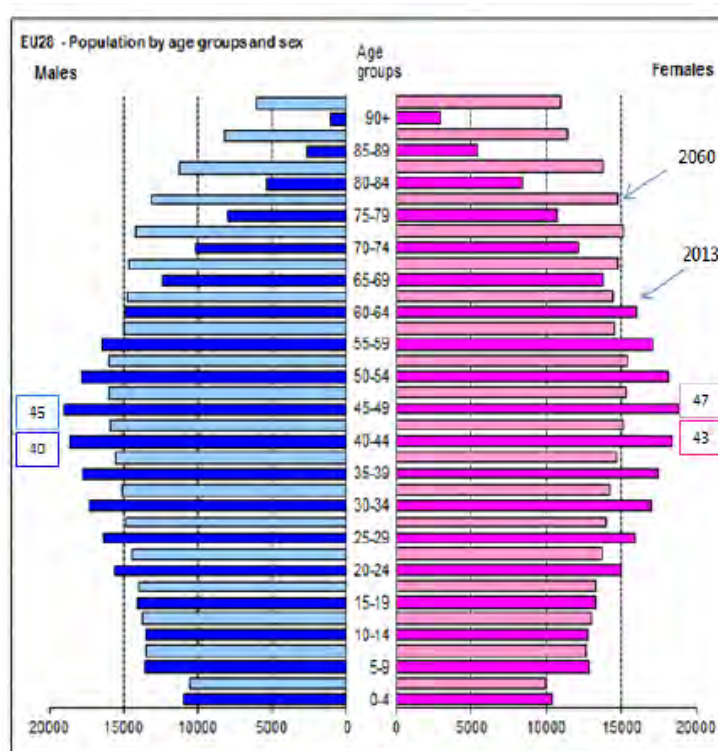


Figure 3. Population pyramids (in thousands), EU in 2013 and 2060. Source: (*European Union, 2014*).

Life expectancy is a good summary measure of population mortality levels. Increasing life expectancy at birth and at older ages suggests healthier populations overall in most countries. However, because of the population aging and the accompanying morbidity, a summary measure that also incorporates functioning, disease, and ill health may better describe population health across the life span. Healthy life expectancy (HALE) is one such measure. It provides an indication of overall health for a population, representing the average equivalent number of years of full health that a newborn could expect to live if they were to pass through life subject to the age-specific death rates and average age-specific levels of health

states for a given period. If it could be measured reliably, HLE would be an ideal indicator that captures both mortality and years of life lived in less than good health – that is, in the case of disability, “years lost due to disability” (YLD). There is increasing interest in the accurate measurement of health, disability and well-being, particularly given the context of aging populations and the growing prominence of chronic diseases as causes of disability and premature mortality. Regional and global average life expectancies and HLE at birth for 2015 are shown in **Figure 4**. The total height of the bar represents life expectancy at birth and the bottom part of the bar represents HLE at birth. The gap between life expectancy and HLE are the equivalent healthy years lost through morbidity and disability. The contributions of each of the major causes of this loss of healthy years are also shown. The main contributors are musculoskeletal disorders (with back and neck pain being a major contributor), mental and substance-use disorders (particularly depression and anxiety disorders), neurological disorders, vision and hearing loss, and cardiovascular diseases and diabetes. The prevalence of most of these conditions rises with age, and, for most conditions, the age-standardized rates are not declining. As life expectancy increases, the proportion of the life span spent with these conditions increases – HLE thus increases more slowly than life expectancy (*WHO 2016, World Health Statistics*).

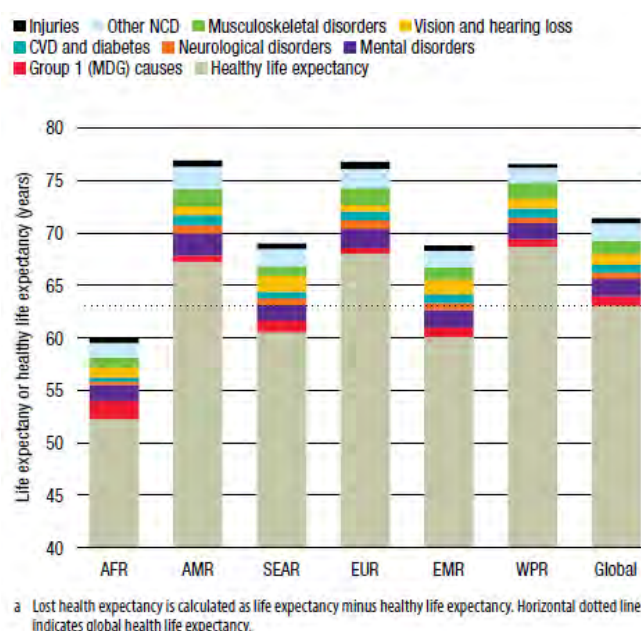


Figure 4. Regional and global life expectancy and healthy life expectancy at birth, with cause decomposition of lost health expectancy, 2015. Source: (*WHO 2016, World Health Statistics*).

Nowadays, non-communicable diseases that more commonly affect adults and older people impose the greatest burden on global health. In developing countries, the rise of chronic non-communicable diseases such as heart disease, cancer and diabetes reflects changes in lifestyle and diet, as well as aging. The potential economic and societal costs of non-communicable diseases of this type rise sharply with age and have the ability to affect economic growth. Because many adults and older-age health problems were rooted in early life experiences and living conditions, ensuring good child health can yield benefits for older people. The largest gains in life expectancy at age 60 have come from the reduction in CVD and diabetes mortality contributed a gain of 3.0 years in life expectancy for men and 4.3 years for women and for men reductions in tobacco-caused mortality contributed to another 20 years of gain in life expectancy. On the other hand, an increase in tobacco-related deaths among women has limited their gains in life expectancy at age 60 in high-income countries. The burden of simultaneous communicable and non-communicable diseases, higher tobacco use, and lower effective healthcare coverage has contributed to slower improvements in older age mortality in middle-income countries than in high-income countries (*WHO 2016, World Health Statistics*). However, aging populations and shifting infectious disease epidemiology mean that older adults are likely to account for a larger share of communicable disease morbidity and mortality in low- and middle-income countries. Meanwhile, dementia and obesity are underlying factors for the small losses in life expectancy and may limit progress in older age mortality in the coming decades (*He, 2016*).



Figure 5. Loss of 3.4 million potential productive life years in EU countries among people aged 25–64, from non-CVDs. Source: OECD estimates based on Eurostat data (*Health at a Glance*, 2016).

Current questions about whether or not limits to human life span exist and whether healthy life expectancy will keep pace with increasing average life expectancy are just two of the scientific issues being robustly debated about our aging world. Despite considerable interest in the negative impact of aging on population health and public coffers, the contributions to society would likely outweigh burdens if adults reach older age healthier. However, the current evidence about whether older adult cohorts are physically and cognitively healthier than preceding generations is mixed (*He et al*, 2016). Better health for those reaching older age could be realized through addressing the social determinants of health, minimizing health risks and reconfiguring health and social support systems to maximize well-being in an aging population; and these efforts could simultaneously sustain the growth in life expectancy seen since the mid-1800s and lead to more rational use of resources (*He et al*, 2016).

1.3 Health spending

In 2009 the world spent a total of US\$ 5.97 trillion on health at exchange rates or I\$ 6.6 trillion (International dollars). OECD countries spend a larger share of their GDP on health (12.4%), as compared to 6.5% to the African and 3.7% in South East Asian regions of WHO respectively. Linking this to epidemiology, **figure 7** shows that though the poorer WHO regions like Africa and South East Asian account for the largest share of the global burden of disease (over 50% of global disability-adjusted life years lost) and 38% of the world's population, they spend only 2.5% of global health resources. Richer countries with smaller populations and lower disease burden use more health resources than poorer countries with larger populations and higher disease burden. Trends between 2004 and 2009 show significant increases in total expenditures on health in the group of low-income countries (WHO, Geneva, March 2014).

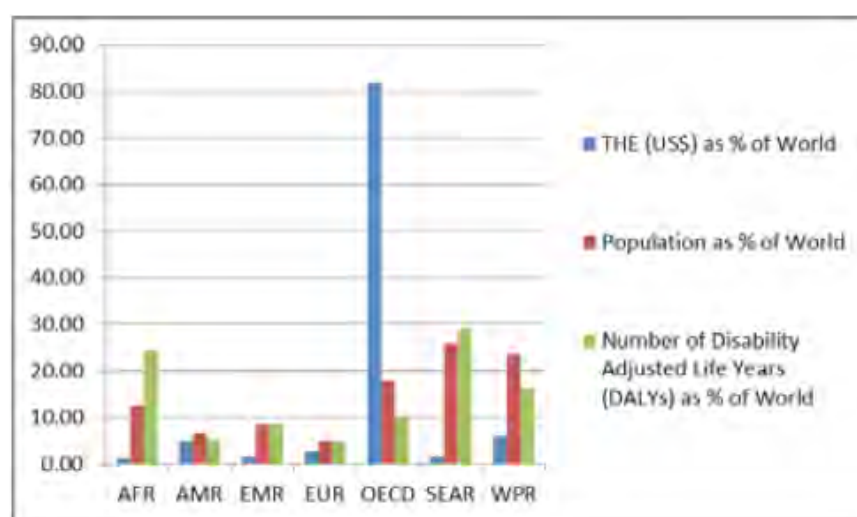


Figure 7.Percentage distribution of Population, DALYs, and Total health expenditure by WHO regions and OECD, 2011 data(Disability Adjusted Life Years (DALYs) are from 2004, WHO regions exclude OECD countries). Source: (World Health Organisation, 2014).

As **figure 8** shows, health expenditure as a share of GDP tend to increase among the years 2006-2015 (OECD Health Statistics 2016).

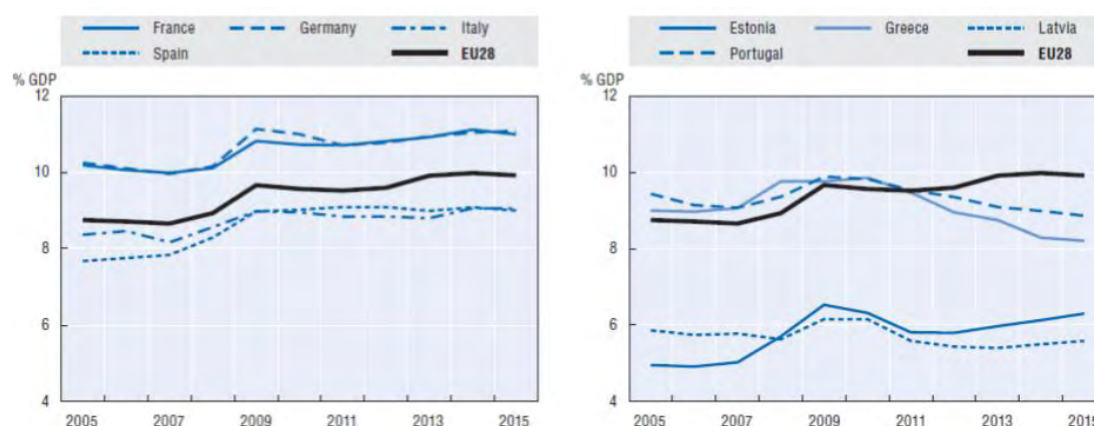


Figure 8.Health expenditure as a share of GDP, in selected European countries, 2005-15. Source: (OECD Health Statistics 2016).

In 2013, per capita health spending in Greece dropped by a further 2.5% in real terms. The drop was a result of a 5.9% decrease in government spending on health, which was partly offset by an increase in private out-of-pocket spending. Overall, per capita spending on health in Greece in 2013 was more than 25% below the levels in 2009, in real terms. The Greek health system was one of the priority areas for reforms and cuts in public spending. Annual government spending on health (**Figure 9**) has reduced by more than 5 euros billion in 2013 compared with 2009- a reduction of almost a third in real terms. Health spending in Greece (excluding investment expenditure in the health sector) was 9.2% of GDP in 2013, above the OECD average of 8.9%. During the 2000s health spending-both public and private-steadily outpaced economic growth leading to a rapidly growing share of GDP, such that by the time of the recession in 2008 the share of GDP on health spending stood at 9.8%. In per capita terms (adjusted for different price levels using economy-wide purchasing power parities), Greece spent USD 2366 per head in 2013. This compares with an OECD average of USD 3453. Public sources accounted for 66% of overall health spending, below the OECD average of 73%, while the share of GDP allocated to health spending (excluding capital expenditure) in Greece was 9.2% in 2013, compared with an OECD average of 8.9% (OECD Health Statistics 2015).

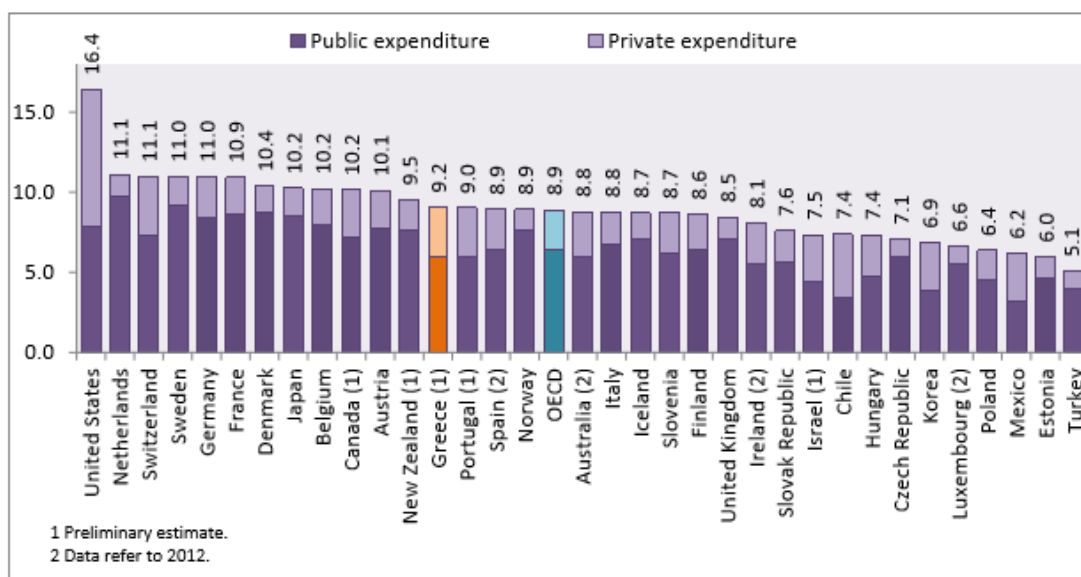


Figure 9. Health spending* as a share of GDP, 2013 Source: (OECD Health Statistics 2015).

2.Defintions

2.1 Definition of aging-factors that influence biological aging

Aging is the process of becoming older and is referred in human being and animals. In humans, aging represents the accumulation of changes in a human being over time encompassing physical, psychological and social change. The causes of aging are unknown; current theories are assigned to the damage concept, whereby the accumulation of damage (such as DNA breaks or oxidized DNA) may cause biological systems to fail, or to the programmed aging concept, whereby internal processes (such as DNA telomere shortening) may cause aging (en.wikipedia.org/wiki/ageing). The body goes through changes in composition, physical strength and physiological functioning; from infancy to childhood (intrinsic aging process itself) into adolescence and puberty (indirectly associated with age such as physical inactivity and degenerative disease) and so until old age. During the last decade aging shifted from being the hot issue of 1990s to a major mainstream issue. This mainstreaming of the issue of aging has important contextual implications for aging research in the coming decade. In particular, it has to deal on equal terms with other fields with the key drivers of research and funding, for example:

- aging research has to become more competitive in a mainstream research funding environment

- scale will become more important for competitive funding so we need to move away from cottage industry research while supporting individual development
- healthy aging and its corollaries are now more important than sick aging.

First, health is perhaps the most essential aspect of what constitutes well-being as we age. As people live longer, it is important whether those increased years of life are characterized by poor health and functional disability or by good health and functional independence. Second, health affects one's ability to work at older ages, and is strongly associated with financial well-being. And third, health has societal implications, such as for labor markets, government finances, and health care costs (Wise, 2014). An important dimension in "Active Ageing" policies of the WHO is maintaining functional capacity over an individual's lifetime as illustrated by **Figure 10**, which indicates the degree of functional capacity. The degree of functional capacity progressively widens across individuals over their lifespan.

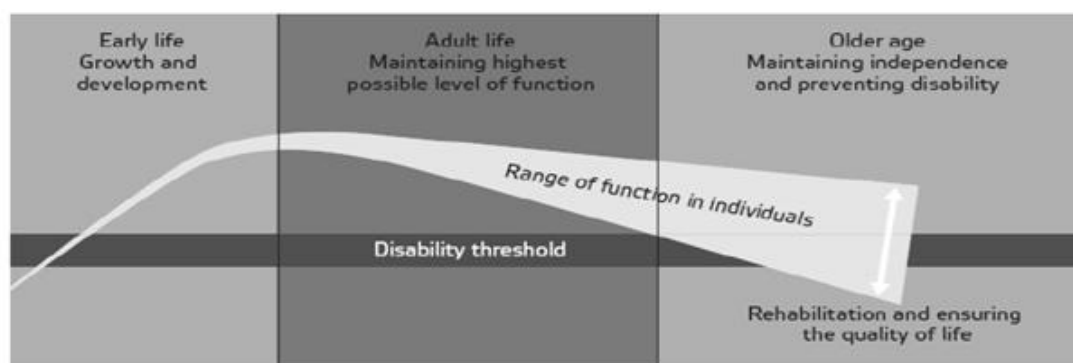


Figure 10. A life course approach to active aging. Source: (Papadopoulos A., 2010).

At present, researchers are only just beginning to understand the biological basis of aging even in relatively simple and short-lived organisms such as yeast. Factors that are proposed to influence biological aging fall into two main categories, *programmed* and *damage-related*. Beginning with programmed ones, follow a biological timetable, perhaps a continuation of the one that regulates childhood growth and development. This regulation would depend on changes in gene expression that affect the systems responsible for maintenance, repair and defense responses. These factors may be the following:

- Telomeres: in humans and other animals, cellular senescence has been attributed to the shortening of telomeres at each cell division; when telomeres

become too short, the cells senesce and die or cease multiplying (*Mikhelson, Victor;2013*).

- A variation in the gene FOXO3A has a positive effect on the life expectancy of humans, and is found much more often in people living to 100 and beyond – moreover, this appears to be true worldwide. FOXO3A acts on the sirtuin family of genes which also have a significant effect on lifespan in yeast and in nematodes. Sirtuin in turn inhibits mTOR (*Ghosh, H. S.; 2010*).
- Caloric restriction leads to longer lifespans in various species, an effect that is unclear, but probably mediated by the nutrient-sensing function of the mTOR pathway (*Fontana L, 2010*).
- mTOR, a protein that inhibits autophagy, has been linked to aging through the insulin signalling pathway. mTOR functions through nutrient and growth cues leading scientists to believe that dietary restriction and mTOR are related in terms of longevity. When organisms restrict their diet, mTOR activity is reduced, which allows an increased level of autophagy. This recycles old or damaged cell parts, which increases longevity and decreases the chances of being obese (*Johnson, Simon C.; 2013*).
- A decreased Growth hormone/Insulin-like Growth Factor 1 signalling pathway has been associated with increased life span in various organisms including fruit flies, nematodes and mice (*Junnla, RK; 2013*).
- DNA methylation: The strong effect of age on DNA methylation levels has been known since the late 1960s. Horvath hypothesised that DNA methylation age measures the cumulative effect of an epigenetic maintenance system but details are unknown. The fact that DNA methylation age of blood predicts all-cause mortality in later life (*Marioni, R; 2015*).

Damage-related factors include internal and environmental assaults to living organisms that induce cumulative damage at various levels. Some of the targeted genes have homologues across species and in some cases have been associated with human longevity. These factors are the following:

- DNA damage theory of aging: DNA damage is thought to be the common basis of both cancer and aging, and it has been argued that intrinsic causes of DNA damage are the most important drivers of aging. Genetic damage (aberrant structural alterations of the DNA), mutations (changes in the DNA sequence), and epimutations (methylation of gene promoter regions or alterations of the DNA scaffolding which regulate gene expression), can

cause abnormal gene expression. DNA damage causes the cells to stop dividing or induces apoptosis.

- Accumulation of waste: This waste accumulates in the cells as small granules, which increase in size as a person ages
- Free-radical theory: Damage by free radicals, or more generally reactive oxygen species or oxidative stress, create damage that may give rise to the symptoms we recognize as aging
- DNA oxidation and caloric restriction. Thus, reduction of oxidative DNA damage is associated with a slower rate of aging and increased lifespan (en.wikipedia.org/wiki/ageing).

Aging is not necessarily a burden, and it does not necessarily decrease a person's ability to contribute to society: older people can make valuable and important contributions to society, and enjoy a high quality of life. But this depends on treating aging as an opportunity rather than a burden, and taking a so-called 'assets-based approach'. Only by concentrating on what people can do, rather than what they cannot, can strategies and political decisions be taken which help create the right conditions to promote healthy behaviors amongst older people and provide the necessary opportunities for regular physical activity, healthy diets, fulfilling social relations, participation in meaningful activities and financial security. It consists an integral, natural part of life but the way in which we grow old, our health and functional ability all depend not only on our genetic make-up, but also on the lifestyle choices we have made over our lifetime. Evidence linking dietary and lifestyle factors throughout the life course with healthy aging is emerging. In the UK, lifespan is increasing at the rate of 2 years for each decade and over 16% of the population is now aged 65 years or over (*Swedish Institute of Public Health 2006: Healthy Ageing*).

The world is aging rapidly, which means that people are living longer and recovering more frequently from acute diseases. But it also poses a grave challenge: a world that is barely able to meet the healthcare needs of its existing population is having to take on the costlier healthcare needs of hundreds of millions of older people. Government policymakers will have to find new ways to promote healthy aging. Nevertheless, age is the greatest risk factor for nearly every major cause of mortality. As a consequence, people are living longer but often suffering from multiple diseases or disabilities of aging. For this reason many scientists have been doing efforts to find new treatments for helping people live longer today than ever before (*Kaeberlein, 2015*). These efforts consist a part of basic research on the biology of aging, known

as geroscience. By this term, we infer to an interdisciplinary field that aims to understand the relationship between aging and age-related diseases. Because aging is the major risk factor for most non-genetic chronic diseases, an understanding of the role of aging in the onset of disease should open up new avenues for disease prevention and cures (en.wikipedia.org/wiki/ageing).

2.2 Definition of healthy aging

In this paragraph, healthy aging is described by explaining first health status and subsequently by discussing health status in relation to the aging process. Health is a multidimensional concept and is defined by the WHO (1948) as ‘a state of complete physical, mental and social well-being, and not merely the absence of disease or infirmity’. Other definitions emphasize that health is a dynamic and hypothetical concept without a direct empirical representation. Five levels of health outcomes were distinguished: biological and physiological health parameters, symptoms, functioning, general health perceptions, and overall quality of life. Health status is closely related to the aging process. The biological process of aging reflects the interactions between our genetic inheritance and environmental influences, which also includes progressive and irreversible biological changes, resulting in a growing risk of chronic diseases, cognitive impairments, impairment of functions, and an increased probability of dying (Steen B., 2003).

Healthy aging is a concept promoted by WHO, that considers the ability of people of all ages to live a healthy, safe and socially inclusive lifestyle. It recognises the factors beyond health and social care that have a major effect on health and well-being, and the contribution that must be made by all sectors with an influence on the determinants of health. It also embraces a life course approach to health that recognises the impact that early life experiences have on the way in which population groups age (www.who.int). For healthy aging, we need safe physical environments and communities that support attitudes and behaviors leading to health and well-being and effective use of health services and community programs to prevent or minimize the effects of acute and chronic disease.

Originally established in 2001 as a collaboration of the CDC Prevention Research Centers Program, the CDC Healthy Aging Research Network (HAN) brought together diverse communities and multi-disciplinary expertise from across the country to identify and address health promotion needs for healthy aging, with particular focus on populations that bear a disproportionate burden of illness and disease. HAN's core

academic centers were funded by the CDC Healthy Aging Program (now called the CDC Alzheimer's Disease and Healthy Aging Program) through September 2014. Strong partnerships at local, regional and national levels were fundamental to HAN's successes. Through these partnerships, HAN delivered on a mission to:

- better understand the determinants of healthy aging in diverse populations and settings;
- identify, develop and evaluate programs and policies that promote healthy aging; and translate and disseminate research into effective and sustainable public health programs and policies throughout the nation (<http://depts.washington.edu/hprc/resources/products-tools/healthy-aging-research-network-archives/>).

Healthy aging is most likely to be achieved when communities are safe, promote health and well-being, and use health services and community programs to prevent or minimize disease (**Figure 11**). A framework was identified that includes four components: (1) Addressing basic needs and (2) Optimizing health and well-being. Work group members further developed each of these dimensions:

1. **Addressing basic needs** of an aging population is no different than addressing basic needs of any population. An elder-friendly community strives to provide appropriate and safe housing, access to basic services and goods, transportation, and accessible health services. Additional concepts such as resource allocation, use of technology to support basic needs, protection from exploitation, affordable food, land use and planning, and cultural and/or linguistic appropriate services were noted as important additions to the framework.
1. **Optimizing health and well-being** for healthy aging requires community supports ranging from preventive services to appropriate and affordable health care. A healthy aging community encourages people to live healthy and active lives, supports and values caregivers, and maintains a health care infrastructure able to serve the needs of elders. Additional concepts such as the importance of disease prevention through physical activity and nutrition, coordination of health resources and related information, and technology as an emerging support for health services were added to this component of the framework.

The following **figure 11** represents the discussion regarding the common themes that emerged to support the four dimensions of healthy aging.

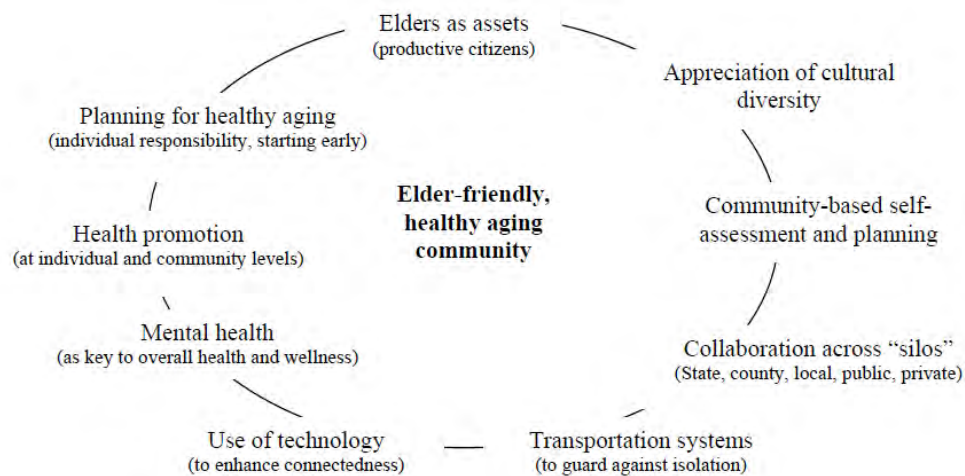


Figure 11. Health services and community programs to prevent or minimize disease. Source (*Minnesota Department of Health, May 2006*).

Technology can enhance connectedness and reduce isolation. The need for communities to develop technology in a number of areas was identified as a significant factor in creating healthy communities for an aging population (*Minnesota Department of Health, May 2006*).

Purpose of this research

The purpose of this thesis is the bibliographic research regarding the best prevention methods in order to decrease the percentage of illnesses in ages up to 65 years old. Prevention is the best way to tackle chronic and other diseases affecting a lot of many elderly people, who, therefore, become unable to live well or work. Based on the main mortality and risk factors of diseases, we sought the best prevention ways as well as strategies already implemented at European level in order to promote them. It is important to urge people that early prevention, almost up to the age of 50s, can lead to a better quality of life and 'Healthy Aging'.

Main subject

3.Mortality factors

3.1Death rates

Statistics on deaths remain one of the most widely available and comparable sources of information on health. Registering deaths is compulsory in all European countries, and the data collected through this registration process can be used to monitor diseases and health status and to plan health services. In order to compare levels of mortality across countries and over time, the data need to be standardized to remove the effect of differences in age structure.

Cardiovascular diseases (including ischemic heart disease, stroke and other diseases of the circulatory system) were the leading cause of death in Europe in 2013, accounting for 34% of all deaths among men and 40% of all deaths among women across all EU countries. Cancer was the second leading cause of death, accounting for 30% of all deaths among men and 24% of all deaths among women in EU countries in 2013. Lung cancer, colon cancer and prostate cancer were the main causes of cancer death for men, while breast cancer, colon cancer and lung cancer were the main three causes of cancer death among women. After cardiovascular diseases and cancer, respiratory diseases were the third most common cause of death in EU countries, accounting for 9% of all deaths among men and 8% among women in 2013. Chronic obstructive pulmonary disease (COPD) was the most cause of mortality among respiratory diseases followed by pneumonia. The vast majority of deaths from respiratory diseases are among people aged over 65. External causes of death were responsible for around 6% of all deaths among men and 3% of deaths among women in EU countries in 2013. Most deaths (around 80%) in EU countries occur after the age of 65. While the main cause of death for people aged over 65 is circulatory diseases, the main cause of death for people under 65 is cancer (*Health at a Glance, 2016*).

ELSTAT announced that in 2013, circulatory diseases caused 46.342 deaths, then cancers with 28.857 deaths and 10.924 were deaths from respiratory diseases. The percentage of deaths caused by circulatory diseases was about 10% in 1938 and rose to 25% in 1956 and 41,5% in 2013 (*Mortality factors 2013*).

3.1.1 Standardised deaths in Europe

- Standardised death rates for cancer, ischaemic heart disease and followed a downward path between 2004 and 2013. Between 2004 and 2013, there was an 11.0 % reduction in EU-28 standardised death rates relating to cancer for men and a 5.9 % reduction for women. Larger declines were recorded in relation to deaths from ischaemic heart disease, where death rates fell by 30.6 % for men and 33.4 % for women. The standardised death rate for breast cancer fell by 10.1 % for women, also in excess of the overall change for cancer. By contrast, death rates for diseases of the nervous system increased for men by 18.9 % and for women by 25.1 %. Lung cancer (including also cancer of the trachea and bronchus) shows diverging trends: for men the standardised death rate decreased by 20.8 % while for women it increased by 71.9 %.
- The standardised death rate for ischaemic heart disease in the EU-28 was 132 deaths per 100 000 inhabitants in 2013. Diseases of the circulatory system include those related to high blood pressure, cholesterol, diabetes and smoking; the most common causes of death from diseases of the circulatory system are ischaemic heart diseases and cerebrovascular diseases. The EU Member States with the highest standardised death rates from ischaemic heart disease were Lithuania, Latvia, Slovakia, Hungary, and the Czech Republic — all above 350 deaths per 100 000 inhabitants in 2013. At the other end of the range, France, Portugal, the Netherlands, Spain, Belgium, Denmark, Luxembourg and Greece, as well as Liechtenstein, had the lowest standardised death rates from ischaemic heart disease — below 100 deaths per 100 000 inhabitants in 2013.
- Hungary recorded, by far, the highest standardised death rate from lung cancer among EU Member States in 2013 (89 deaths per 100 000 inhabitants), followed by Denmark (72 deaths per 100 000 inhabitants) Poland (68 per 100 000 inhabitants) and the Netherlands (68 per 100 000 inhabitants); Serbia also reported a standardised death rate of 70 per 100 000 inhabitants. The highest standardised death rate for colorectal cancer was also observed in Hungary, 56 deaths per 100 000 inhabitants, while Slovakia and Croatia also recorded standardised rates of 50 or more deaths per 100 000 inhabitants.

- Respiratory diseases were the third most common cause of death in the EU-28, with an average of 83 deaths per 100 000 inhabitants in 2013. Within this group of diseases, chronic lower respiratory diseases were the most common cause of mortality followed by pneumonia. Respiratory diseases are age-related with the vast majority of deaths from these diseases recorded among those aged 65 or more. The highest standardised death rates from respiratory diseases among the EU Member States were recorded in the United Kingdom (144 per 100 000 inhabitants), Ireland (131 per 100 000 inhabitants), Denmark (128 per 100 000 inhabitants) and Portugal (124 per 100 000 inhabitants) (<http://ec.europa.eu/mortalityfactors>).

3.1.2 Deaths from non-communicable rising

The leading causes of death are shifting, in part because of increasing longevity. Between 1990 and 2013, the number of deaths from non communicable diseases (NCDs) has increased by 42 percent; and the largest increases in the proportion of global deaths took place among the population aged 80 and over (*Global Burden Disease, 2013*). An estimated 42.8 percent of deaths worldwide occur in the population aged 70 and over, with 22.9 percent in the population aged 80 and over. These same regions are also facing a significant burden from NCDs and injuries. Deaths and disability from NCDs are rapidly rising in less developed countries and yielding worse outcomes than in more developed countries; some diseases that are preventable or treatable in more developed countries are leading to deaths in less developed countries (*WHO, 2013*). Age-standardized mortality rates due to communicable diseases in 2012 show a clear gradient by country income grouping. While these differences contribute to considerable changes in the mean age at death between 1970 and 2010 across different WHO regions, all regions have had increases in mean age at death, particularly East Asia and tropical Latin America (*Global Burden Disease, 2013*).

3.2 The 3 biggest causes of death

The most important factors that are responsible for mortality are very common diseases, such as cardiovascular diseases, and cancer. The main causes of death in older people, over 65, cancer and cardiovascular disease together account for around three quarters of all deaths in nearly every European country.

Taken from a study by WHO and the OECD, the 5 biggest causes of death worldwide are the following below (**Figure 12, 13, 14**):

- 1) Cardiovascular diseases: are the biggest cause of death globally. Especially ischemic heart diseases and strokes. Ischemic heart disease also known as coronary diseases, causes over seven million deaths globally each year and hypertensive heart disease causes around 1.1 million deaths globally per year, while strokes are causing 6.7 million deaths yearly.
- 2) Cancer: at number two is cancer and especially lung cancer, which causes around 1.6 million deaths worldwide. Cigarette smoking causes around 80-90% of all cases.
- 3) Respiratory diseases and especially chronic obstructive pulmonary diseases and lower respiratory diseases, such as pneumonia, bronchitis and influenza, which are killing 3.1 million people annually (*Health at a Glance, 2016*).

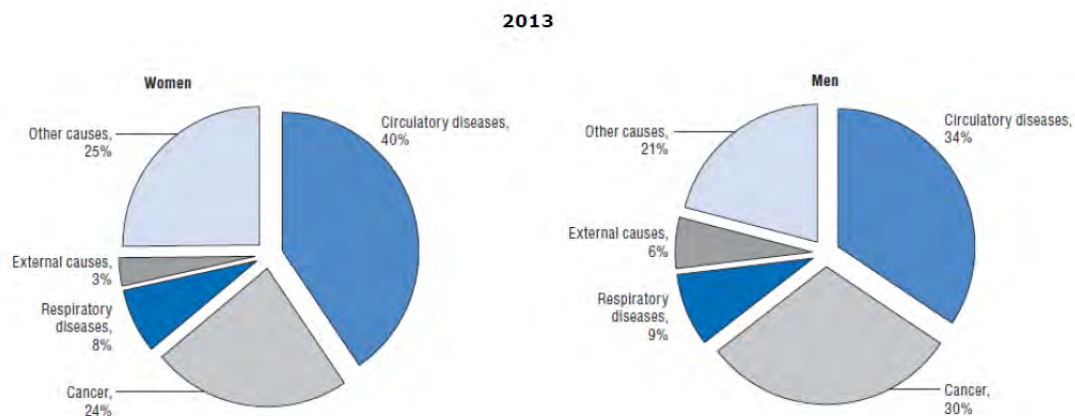


Figure 12. The main causes of deaths in EU countries are circulatory diseases, cancer and respiratory diseases. Source: (*Health at a Glance, 2016*); Eurostat Database.

For persons aged 65 and over there are two main disease groups of the circulatory system, namely ischaemic heart diseases (also known as coronary heart disease, including heart attacks) and cerebrovascular diseases (such as strokes); four groups of malignant neoplasms, namely lung cancer (including cancers of the trachea and bronchus), colorectal cancer, breast cancer and prostate cancer and respiratory diseases (which include chronic lower respiratory diseases or asthma as well as infectious diseases such as influenza or pneumonia). The leading causes are smoking, genetics, high blood pressure, lack of exercise and stress (*Eurostat Statistics explained, 2016*).

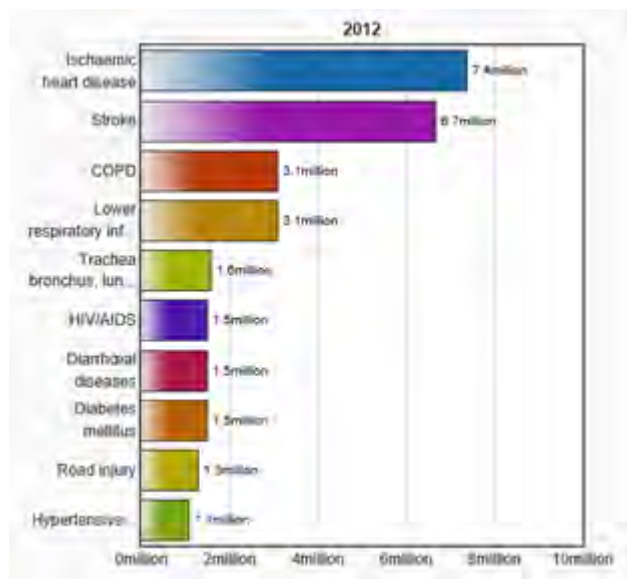


Figure 13. The top leading causes of death in the world. Source: (WHO, Fact sheet N°310, 2014)

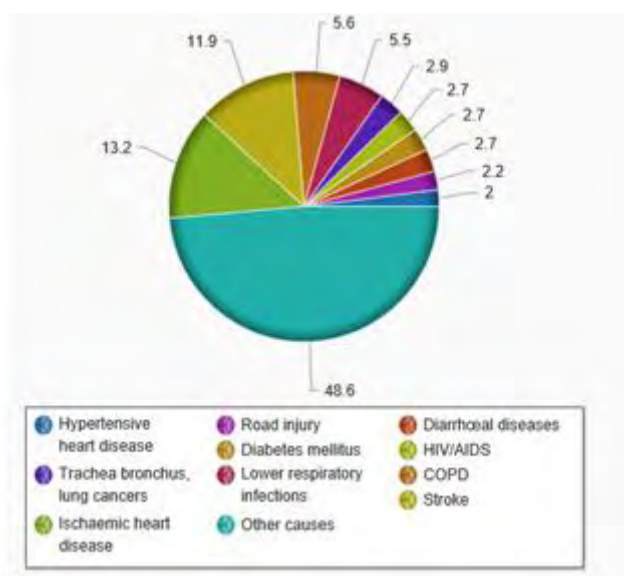


Figure 14. The top leading causes of death in the world by percentage. Source: (WHO, Fact sheet N°310, 2014)

Wherever, the leading causes of death are based on the financial statement of each country. For this reason the classification of diseases cause deaths are different among the countries, based on the income. Especially, in low-income countries the first cause of death is low respiratory infections (**Figure 15**), in low-middle, upper-middle and high income countries the leading cause is cardiovascular diseases (**Figure 16, 17, 18**).

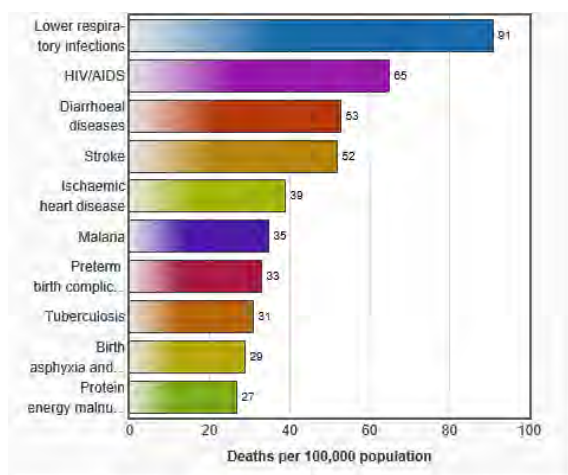


Figure 15.Top 10 leading causes of death in low-income countries. Source: (WHO, Fact sheet N°310, 2014)

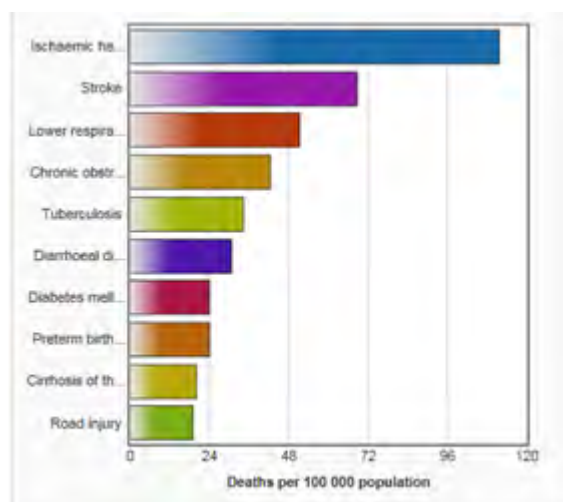


Figure 16.Top 10 leading causes of death in lower-middle income countries. Source: (WHO, Fact sheet N°310, 2014)

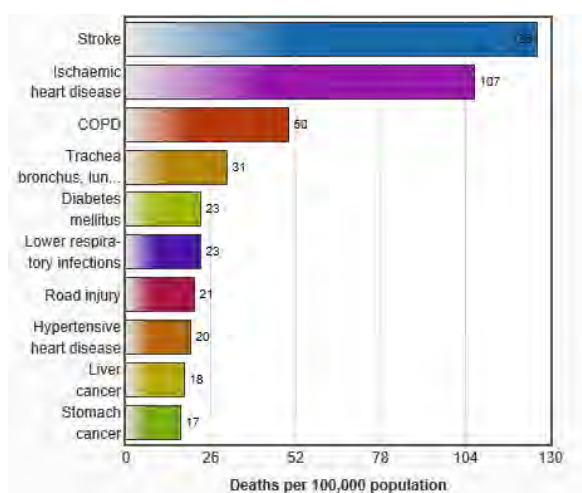


Figure 17.Top 10 leading causes of death in upper-middle income countries. Source: (WHO, Fact sheet N°310, 2014)

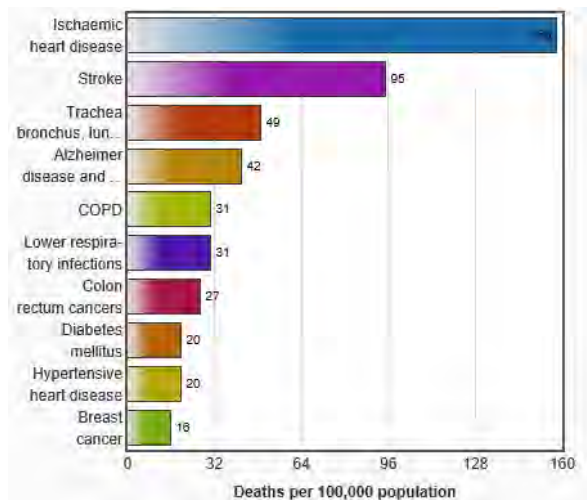


Figure 18. Top 10 leading causes of death in high income countries (*WHO, Fact sheet N°310, 2014*)

3.3 Cardiovascular diseases

They are a group of disorders of the heart and blood vessels and includes coronary heart disease (heart attacks), cerebrovascular disease (stroke), raised blood pressure (hypertension), peripheral artery disease, rheumatic heart disease, congenital heart disease and heart failure. Heart attacks and strokes are usually acute events and are mainly caused by a blockage that prevents blood from flowing to the heart or brain. The most common reason for this is a build-up of fatty deposits on the inner walls of the blood vessels that supply the heart or brain (*www.who.int*). They remain the main cause of mortality, accounting about one third of all deaths in 2013 in nearly all EU member states, accounting for almost 40% of all deaths across EU countries in 2013. Together, ischemic heart diseases and strokes comprise around 60% of all cardiovascular deaths, and caused more than one fifth of all deaths in EU member states in 2013. Every year an estimated 17 million people globally die of cardiovascular diseases, particularly heart attacks and strokes. Over 3 quarters of CVD deaths take place in low and middle income countries. Out of the 16 million deaths under the age of 70 are due to noncommunicable diseases, 82% are in low and middle income countries and 37% are caused by CVDs (*Cardiovascular diseases, WHO, Fact sheet September 2016*). Cardiovascular disease is responsible for half of total mortality of European men and women over the age of 60.9 out of 10 deaths due to cardiovascular disease occur in the over 65s. Most are due to ischaemic heart disease. It is a fallacy that CVD only affects men. In fact, CVD kills more men but disables more women: 1 in 3 women with heart disease between the

ages of 55-64 is disabled, and this rates goes up to 1 in 2 in women over the age of 75.

Cardiovascular diseases are one type of NCDs, also known as chronic diseases. NCDs are also cancers, chronic respiratory diseases and diabetes. CVDs account for most NCD deaths or 17.5 million people annually, followed by cancers (8.2 million) and respiratory diseases (4 million). These four groups of diseases account for 82% of all NCD deaths (*Global Burden Disease, 2013*).

Risk factors for CVDs: The most important behavioral risk factors of heart disease and stroke are unhealthy diet, physical inactivity, tobacco use and harmful use of alcohol. The effects of behavioral risk factors may show up in individuals as raised blood pressure, raised blood glucose, raised blood lipids, overweight and obesity. These intermediate risk factors can be measured in primary care facilities and indicate an increased risk of developing a heart attack, stroke, heart failure and other complications. Cessation of tobacco use, reduction of salt in the diet, consuming fruits and vegetables, regular physical activity and avoiding harmful use of alcohol have been shown to reduce the risk of CVD. In addition, drug treatment diabetes, hypertension and high blood lipids may be necessary to reduce cardiovascular risk and prevent heart attacks and strokes. Health policies that create conducive environments for making healthy choices affordable and available are essential for motivating people to adopt and sustain healthy behavior. There are also a number of underlying determinants of CVDs. These are a reflection of the major forces driving social, economic and cultural globalization, urbanization and population aging. Other determinants of CVDs include poverty, stress and hereditary factors (*Cardiovascular diseases. WHO, Fact sheet September 2016*).

It is proposed that a healthy lifestyle can reduce the risk of these diseases. People with cardiovascular disease or who are at high cardiovascular risk (due to the presence of one or more risk factors such as hypertension, diabetes, hyperlipidaemia or already established disease) need early detection and management using counselling and medicines, as appropriate.

3.3.1 Ischemic heart disease

Ischemic heart diseases (IHD) are caused by the accumulation of fatty deposits lining the inner wall of a coronary artery, restricting blood flow to the heart. IHD alone were responsible for 644 000 deaths across EU countries in 2013, accounting for around

13% of all deaths. Mortality rates from IHD are highest in Lithuania, Latvia, the Slovak Republic, Hungary and the Czech Republic, with over 350 deaths per 100 000 population (**Figure 19**). The countries with the lowest IHD mortality rates are France, Portugal, the Netherlands, Spain and Belgium. Death rates for IHD are much higher for men than for women in all countries. The gender gap was greatest in France, Belgium, Spain, Cyprus, the Netherlands, Luxembourg, Greece, Slovenia and the United Kingdom, with the rates for men being two times higher than for women. Since 2000, IHD mortality rates have declined in all countries, although the decline has been quite modest in countries like Lithuania and Hungary (**Figure 20**). The decline has been particularly strong in countries such as the Netherlands and the United Kingdom, with rates being cut by more than half. Declining tobacco consumption has contributed significantly to reducing the incidence of IHD, and consequently the mortality rates (*Health at a Glance, 2016*).

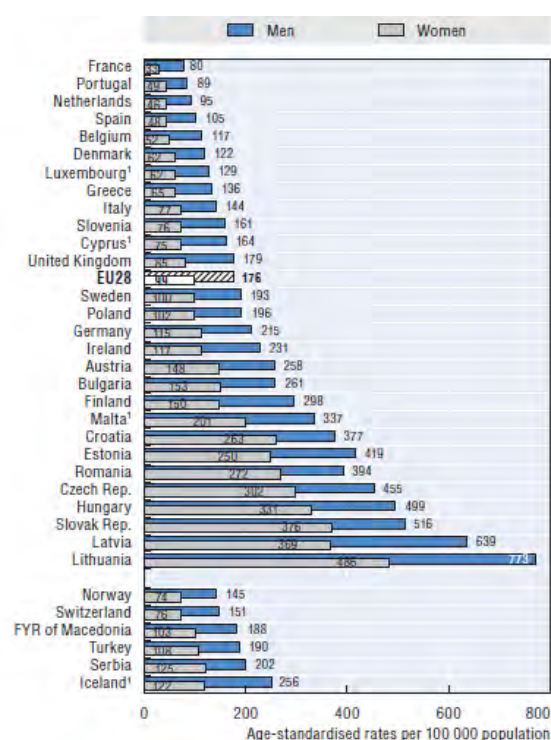


Figure 19. Ischemic heart disease, mortality rates, 2013. Source: (*Health at a Glance, 2016*); Eurostat Database

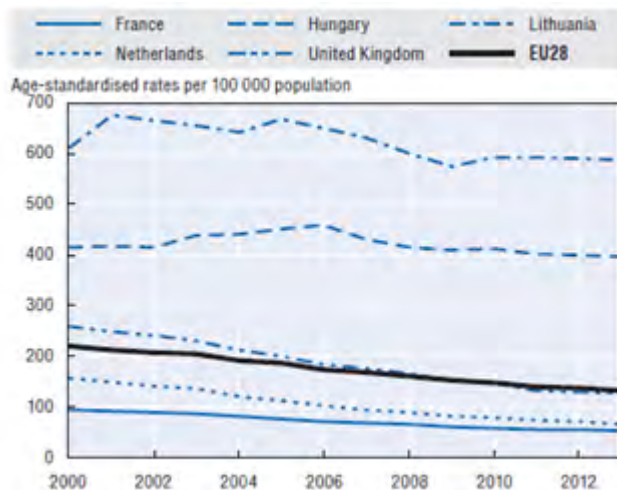


Figure 20. Trends in ischemic heart disease mortality rates, selected EU countries, 2000-13. Source: (*Health at a Glance, 2016*); Eurostat Database

3.3.2 Cerebrovascular disease or stroke

Stroke occurs if the flow of oxygen-rich blood to a part of the brain is blocked. Without oxygen, brain cells start to die after a few minutes. Sudden bleeding in the brain also can cause a stroke if it damages brain cells. If brain cells die or are damaged because of a stroke, symptoms occur in the parts of the body that these brain cells control. A stroke can cause lasting brain damage, long-term disability or even death. The 2 main types of stroke are ischemic and hemorrhagic. Ischemic is the more common type of stroke (WHO). Annually, 15 million people worldwide suffer a stroke leading to 5 million deaths and 5 million people permanently disabled (http://www.who.int/cardiovascular_diseases/en/cvd_atlas_16_death_from_stroke.pdf?ua=1). Strokes were responsible for 433 000 deaths in EU countries in 2013, accounting for about 9% of all deaths (*Health at a Glance, 2016*).

As with IHD, there are large variations in stroke mortality rates across countries (**Figure 21**). The rates are highest in Bulgaria, Romania, Latvia and Lithuania with more than 200 deaths per 100.000 population. They were the lowest in France and Spain. Since 2000, stroke mortality has decreased in nearly all EU member states (**Figure 22**). Mortality rates have declined rapidly in Estonia, but about half of this large decrease was due to changes in death registration practices, with an increased selection of hypertension as the cause of death rather than stroke (*Health at a Glance, 2016*). The decline in stroke mortality has been more modest in countries such as Lithuania and Bulgaria. As with IHD, the reduction in stroke mortality can be

attributed at least partly to a reduction in risk factors as well as improvements in medical treatments. However, rising obesity and diabetes threatens the progress in tackling cerebrovascular diseases (*Health at a Glance, 2015*).

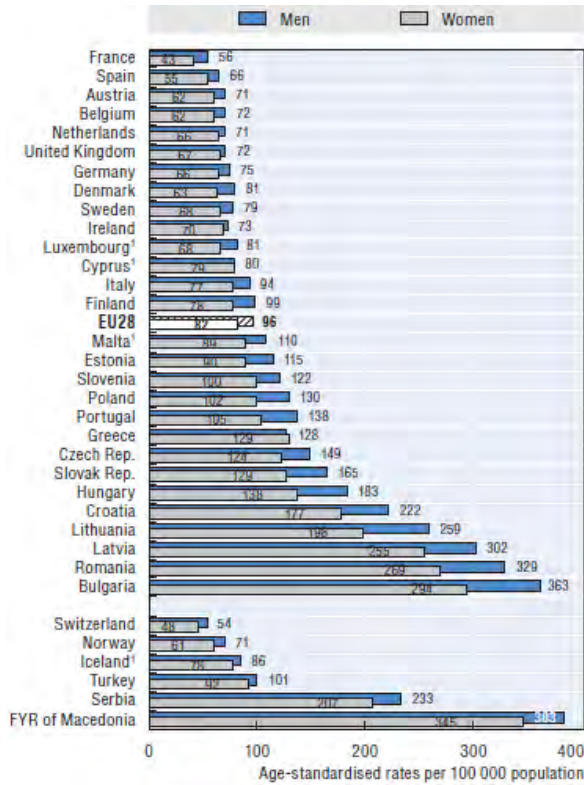


Figure 21. Stroke, mortality rates, 2013. Source: (*Health at a Glance, 2016*);Eurostat Database

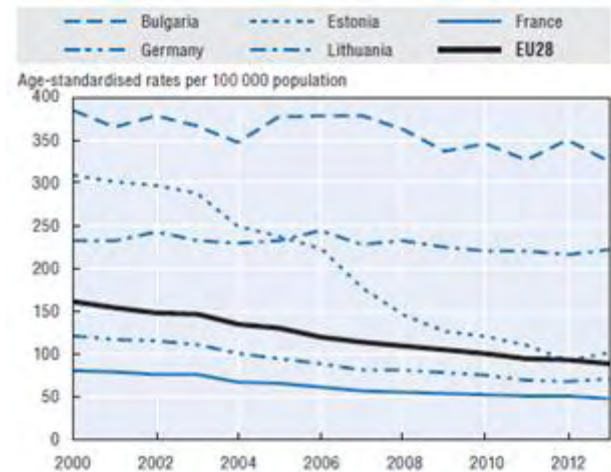
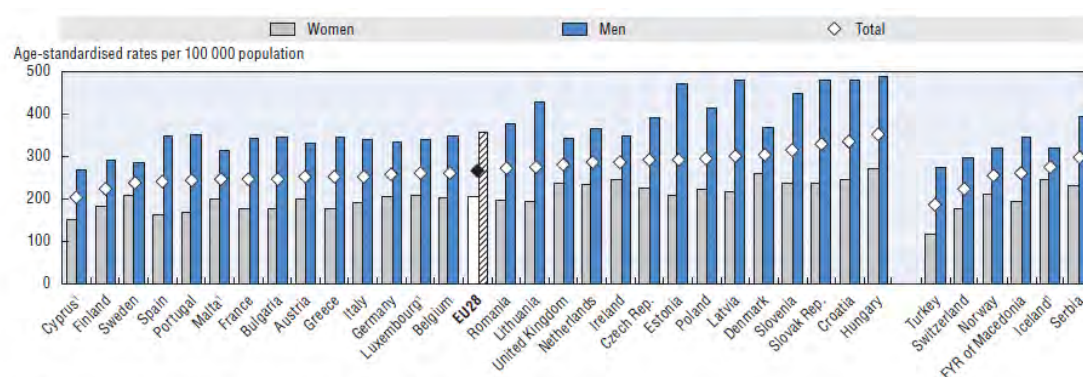


Figure 22. Trends in stroke mortality rates, selected EU countries, 2000-13. Source: (*Health at a Glance, 2016*);Eurostat Database

3.4 Cancer

It is the second important cause of mortality accounting for 25% of all deaths in 2013 and it has a major impact on society in the United States and across the world. More than 1.300.000 people died of cancer in 2013 across the 28 EU states. Cancer mortality rates were lowest in Cyprus, Finland, Sweden and Spain, with rates at least 10% lower than the EU average (**Figure 23**). They were highest in Hungary, Croatia, the Slovak Republic, Slovenia and Denmark, with rates at least 10% higher than the EU average. For a large number of cancer types, the risk of developing the disease rises with age. Mortality rates are based on numbers of deaths registered in a country in a year divided by the size of the corresponding population. The rates have been directly age-standardised to the 2010 OECD population to remove variations arising from differences in age structures across countries and over time. Moreover, cancer mortality rates are higher for men than for women in all countries. In 2013, the gender gap was particularly wide in Latvia, Estonia, Lithuania and Slovak Republic, Spain and Portugal with mortality rates among men more than twice those among women. This part can be explained partly by the greater prevalence of risk factors among men, as well as the lesser availability or use of screening programmes for cancers affecting men, leading to lower survival rates after diagnosis (*Health at a Glance, 2016*).



1. Three-year average (2011-13, except for Iceland: 2007-09).

Figure 23. Cancer mortality rates in 2013. Source: *Eurostat Database*

In 2012 (latest year available), an estimated 2.7 million new cases of cancer were diagnosed in EU member states, 54% (around 1.5 million) occurring in men and 46% (around 1.2 million) in women. The most common cancer site was breast cancer (13.8% of all new cancer cases), followed by prostate cancer (13.6%), colorectal cancer (13%) and lung cancer (11.8%). These four cancers represented more than half of the estimated overall burden of cancer in the European Union (*Ferlay J.,*

2013). The risk of getting cancer before the age of 75 years was 27% (31% for men and 24% for women) and the risk of dying from cancer also before the age of 75 was 12% (14% for men and 9% for women). Large variations exist in cancer incidence across EU countries. Cancer incidence is highest in Northern and Western European countries, with Denmark, France, Belgium and Norway registering more than 300 new cancer cases per 100 000 population in 2012 (**Figure 24**). The lowest rates were reported in Greece and Cyprus, at around 200 new cases per 100 000 population. These variations reflect not only variations in the prevalence of risk factors for cancer, but also national policies regarding cancer screening and differences in quality of reporting. Cancer incidence rates were higher for men in all EU member states in 2012, although the gender gap varies widely across countries. In Estonia, Spain and Latvia, incidence rates among men were around 60% higher than among women, whereas in the United Kingdom, Denmark and Cyprus, the gap was less than 10% (*Health at a Glance, 2016*). The most common cancers in 2016 are projected to be breast cancer, lung and bronchus cancer, prostate cancer, colon and rectum cancer, bladder cancer, melanoma of the skin, non-Hodgkin lymphoma, thyroid cancer and leukemia. The number of new cases of cancer (cancer incidence) is 454.8 per 100.000 men and women per year (based on 2008-2012 cases). The number of cancer deaths (cancer mortality) is 171.2 per 100.000 men and women per year (based on 2008-2012 deaths). The number of people living beyond a cancer diagnosis reached nearly 14.5 million in 2014 and is expected to rise to almost 19 million by 2024. Approximately 39.6 percent of men and women will be diagnosed with cancer at some point during their lifetimes (based on 2010-2012 data). In 2014, an estimated 15,780 children and adolescents ages 0 to 19 were diagnosed with cancer and 1,960 died of the disease. National expenditures for cancer care in the United States totaled nearly \$125 billion in 2010 and could reach \$156 billion in 2020 (www.cancer.gov).

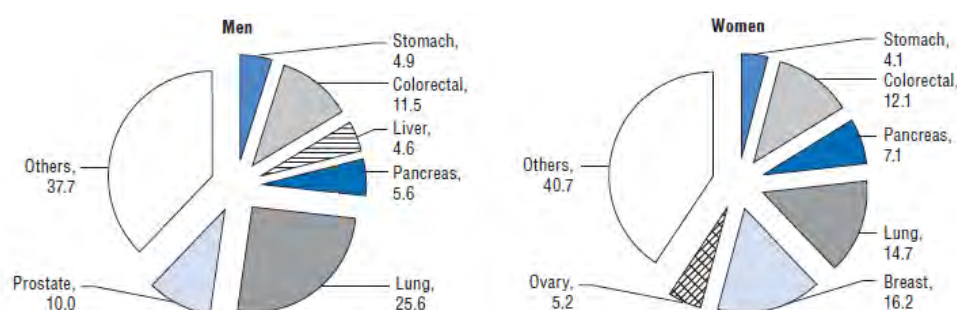


Figure 24. Main causes of cancer deaths among men and women in EU countries, 2013. Source, Eurostat Database

Lung cancer is still by far the most common cause of death from cancer among men (25.6% in the EU as a whole), followed by colorectal cancer (11.5%) and prostate cancer (10.0%). Breast cancer is the leading cause of death from cancer among women (16.2%) followed by lung cancer (14.7%) and colorectal cancer (12.1%). Comparing prevalence data between countries may be deceiving, as higher incidence and case-fatality rates may paradoxically result in lower prevalence of cancer in certain countries or populations. The reverse is true as well, with better detection and better access to care as well as better survival boosting prevalence rates. As a case in point, Sweden has amongst the highest prevalence rates of cancer in Europe, whereas Estonia has the lowest (*Health at a Glance, 2016*). Breast cancer is the most prevalent malignancy in women.

Death rates from lung cancer are almost three times higher among men than among women in the European Union as a whole. Smoking is the main risk factor for lung cancer. In 2013, death rates from lung cancer among men were highest in Hungary, Poland, Croatia, Greece and Latvia. These are all countries where smoking rates among men were in the past and are still today relatively high (**Figure 25**). Death rates from lung cancer among men are lowest in Sweden and Finland among EU countries, and relatively low also in Switzerland and Norway (*Health at a Glance, 2016*). Death rates from all types of cancer among men and women have declined at least slightly in most EU member states since 2000, although the decline has been more modest than for cardiovascular diseases, explaining why cancer now accounts for a larger share of all deaths. Mortality rates are based on numbers of deaths registered in a country in a year divided by the size of the corresponding population. The rates have been age-standardised to the revised European standard population adopted by Eurostat in 2012 (Including EU countries and EFTA countries), to remove variations arising from differences in age structures across countries and over time.

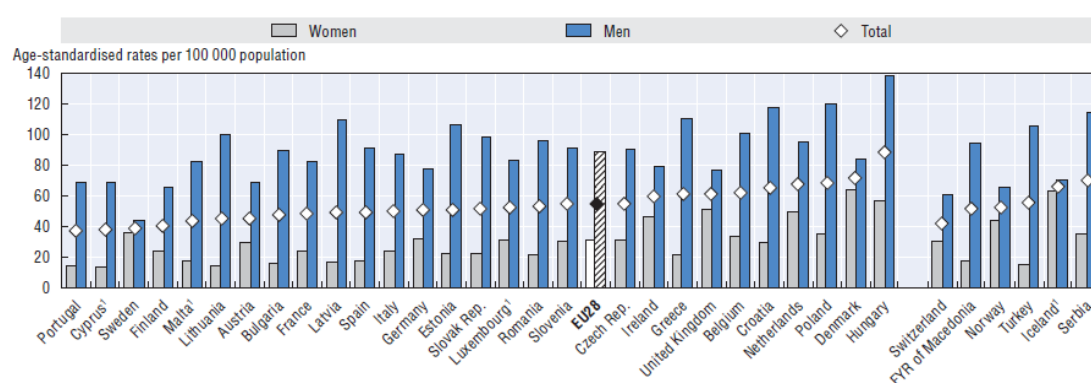


Figure 25. Lung cancer mortality rates, 2013. Source: *Eurostat Database*

Cancer is a generic term for a large group of diseases that can affect any part of the body. Other terms used are malignant tumours and neoplasms. One defining feature of cancer is the rapid creation of abnormal cells that grow beyond their usual boundaries and which can then invade adjoining parts of the body and spread to other organs. This process is referred to as metastasis. Metastases are the major cause of death from cancer.

What causes cancer? : cancer arises from one single cell. The transformation from a normal cell into a tumour cell is a multistage process, typically a progression from a pre-cancerous lesion to malignant tumours. These changes are the result of the interaction between a person's genetic factors and 3 categories of external agents, including:

- physical carcinogens, such as ultraviolet and ionizing radiation
- chemical carcinogens, such as asbestos, components of tobacco smoke, aflatoxin and arsenic
- biological carcinogens such as infection from certain viruses, bacteria or parasites

Risk factors for cancers: around one third of cancer deaths are due to the 5 leading behavioral and dietary risks, as high body mass index, low fruit and vegetable intake, lack of physical activity, tobacco use, alcohol use. Tobacco use is the most important risk factor for cancer causing around 20% of global cancer deaths and around 70% of global lung cancer deaths. Tobacco use, unhealthy diet and physical inactivity are the main cancer risk factors worldwide. Some chronic infections are risk factors for cancer and have major relevance in low- and middle- income countries. Hepatitis B, C and some types of Human Papilloma Virus increase the risk for liver and cervical cancer respectively. Infection with HIV substantially increases the risk of cancer such as cervical cancer.

3.5 Respiratory diseases

3.5.1 Chronic obstructive pulmonary diseases

It is projected to be the third leading cause of death by 2020. It is a lung ailment that is characterized by a persistent blockage of airflow from the lungs and belongs to the group of chronic respiratory diseases. These are diseases of the airways and other structures of the lung. Some of the most common are COPD, asthma, occupational

lung diseases and pulmonary hypertension. About COPD, is an under-diagnosed, life-threatening lung disease that interferes with normal breathing and is not fully reversible. The more familiar terms of chronic bronchitis and emphysema are no longer used, they are now included within the COPD analysis. It is a progressive life-threatening lung disease that causes breathlessness (initially with exertion) and predisposes to exacerbations and serious illness. COPD is characterized by difficult breathing that is not fully reversible and usually progressive. Patients are often smokers or ex-smokers, and their symptoms rarely develop before age 40. COPD is among the leading causes of chronic morbidity and mortality in the European Union. Daily activities, such as walking up a short flight of stairs or carrying a suitcase and even daily routine activities can become very difficult as the condition gradually worsens. It can be confirmed by a breathing test called spirometry. While it is not a curable disease, there are available medical and physical treatments that can help relieve symptoms, improve exercise capacity and quality of life and reduce the risk of death. The most effective and cost-effective available treatment for COPD in people who continue to smoke is smoke cessation (*COPD WHO, Fact sheet, November 2016*).

Nearly 170.000 people died in EU countries in 2013 because of COPD while globally, it is estimated that about 3 million deaths were caused by the disease in 2015 (that is, 5% of all deaths globally in that year). More than 90% of COPD deaths occur in low and middle-income countries. In most countries, more men than women die from respiratory diseases. This is partly due to higher smoking rates among men, which is an important risk factor for many respiratory diseases. (COPD) – the term now used mainly to describe chronic bronchitis and emphysema – was responsible for nearly 170 000 deaths in EU member states in 2013, accounting for more than 40% of all respiratory disease mortality in that year. Mortality from COPD varies considerably across countries: Denmark, Hungary, Ireland and the United Kingdom have the highest COPD mortality rates, whereas France, Latvia, Greece and Estonia have the lowest rates (**Figure 26**). The main risk factor for COPD is tobacco smoking, but other risk factors include occupational exposure to dusts, fumes and chemicals, and air pollution more generally. People with COPD are also more susceptible to colds, influenza and pneumonia. A large number of people with COPD are undiagnosed or only diagnosed at a late stage. Greater efforts are needed to diagnose people with COPD earlier to improve their health outcomes and survival (*Health at a Glance, 2016*).

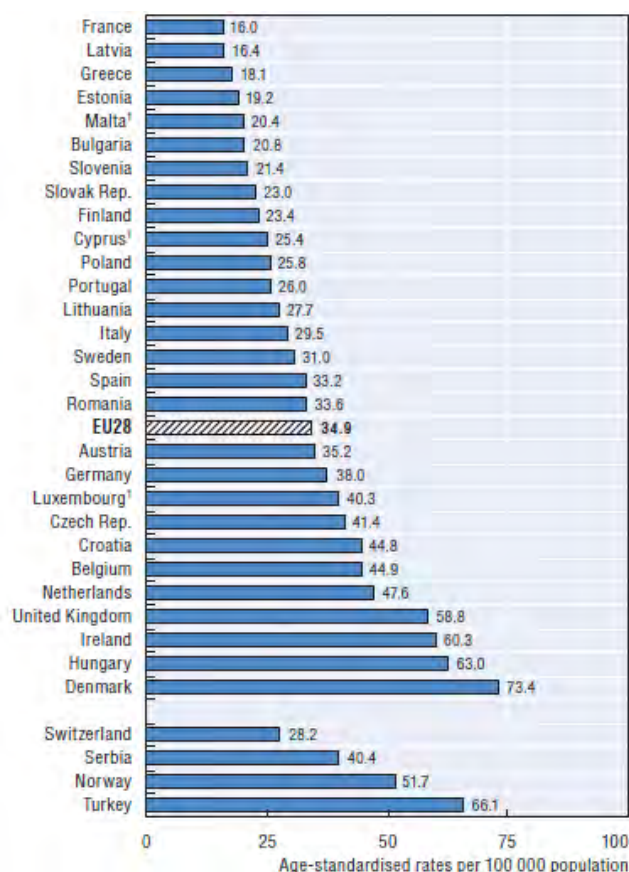


Figure 26. COPD mortality rates, 2013 (or nearest year). Source: *Eurostat Database*

Proper management of both asthma and COPD in primary care settings can reduce exacerbation and costly hospitalization. The data on asthma and COPD prevalence presented in this section come from the second wave of the European Health Interview Survey which was conducted in EU countries in (or around) 2014. Based on this survey, the average prevalence rate of asthma among adults across EU countries in 2014 was just over 6%. This ranged from more than 9% in Finland and the United Kingdom to less than 3% in Romania, Lithuania and Bulgaria. Lower reported prevalence of asthma among new EU member states in all likelihood reflects higher levels of under-diagnosis and under-treatment. In most countries, asthma is more commonly reported by women. The reported prevalence of COPD among adults ranged from less than 2% in Malta and Sweden, to over 6% in Lithuania. Across EU member states, the average prevalence of COPD was 40% in 2014. People with the lowest level of education are more than twice as likely to report having COPD than those with the highest level. While this may be due partly to the fact that a higher proportion of people with low education are in older population groups, another reason is that lower-educated people are more likely to smoke, which is the main risk factor for COPD. A new study on Aging Lungs in European Cohorts (ALEC), funded by the EU Horizon 2020 project, aims to identify which

behavioral, environmental, occupational, nutritional and modifiable lifestyle factors, and genes, affect lung function decline and increase the risk of COPD.

Risk factors: the primary cause of COPD is tobacco smoke (including second –hand or passive exposure). WHO estimated that in 2005 5.4 million people died due to tobacco use and it is estimated to increase to 8.3 million deaths per year 2030. The causes for COPD have opposite patterns according to the geographic areas. Other risk factors may include:

- indoor air pollution
- outdoor air pollution
- occupational dusts and chemicals
- frequent lower respiratory infections during childhood

In high and middle income countries exposure to indoor air pollution, such as the use of biomass fuels for cooking and heating, causes the COPD burden. Almost 3 billion people worldwide use biomass and coal as their main source for energy for cooking, heating and other household needs. In these communities, indoor air pollution is responsible for a greater fraction of COPD risk than smoking or outdoor air pollution. Biomass fuels used by women for cooking account for the high prevalence of COPD among non smoking women in parts of the Middle East, Africa and Asia. Indoor air pollution resulting from the burning of wood and other biomass fuels is estimated to kill two million and children each year.

Previously COPD was more common in men, but because of comparably high levels of tobacco smoking among women in highincome countries and the higher risk of exposure to indoor air pollution (such as solid fuel used for cooking and heating) for women in low-income countries, the disease now affects men and women almost equally. More than 90% of COPD deaths occur in low and middle-income countries, where effective strategies for prevention and control are not always implemented or accessible.

Burden of COPD: according to WHO estimates 65 million people have moderate to severe chronic obstructive pulmonary disease. More than 3 million people died of COPD in 2005, which corresponds to 5% of all deaths globally. Most of the information available on COPD prevalence, morbidity and mortality comes from high-income countries. Even in those countries, accurate epidemiologic data on COPD are difficult and expensive to collect. At one time, COPD was more common in men

but because of increased tobacco use among women in high-income countries and the higher risk of exposure to indoor air pollution in low income countries, the disease now affects men and women almost equally. In 2002 COPD was the fifth leading cause of death. Total deaths from COPD are projected to increase by more than 30% in the next 10 years unless urgent action is taken to reduce the underlying risk factors, especially tobacco use. Estimates show that COPD becomes in 2030 the 3rd leading cause of death worldwide (*COPD WHO, Fact sheet, November 2016*).

3.5.2 Influenza (Lower respiratory diseases)

It is an acute respiratory disease caused by human influenza viruses, which circulate in all parts of the world. It is a common infectious disease affecting 5-10% of adults and 20-30% of children. There are 3 types of seasonal influenza viruses, types A, B and C. Influenza type A viruses are further classified into subtypes according to the combination of 2 different proteins, the haemagglutinin (H) and the neuraminidase (N), located on the surface of the virus. The subtypes of influenza A viruses currently circulating among humans are influenza A (H1N1) and A (H3N2) subtypes. The circulating influenza A is also written as A (H1N1) pdm09 as it caused the pandemic in 2009 and subsequently replaced the seasonal influenza A (H1N1) virus which had circulated prior to 2009. Only influenza type A viruses are known to have caused pandemics (*Influenza seasonal, Fact sheet November 2016*). Seasonal influenza causes 4-5 million symptomatic cases in the UE/EEA each year, and 15 000-70 000 European citizens die every year of causes associated with influenza. In 2013 more than 3.000 people died from influenza. Most of these deaths were concentrated among people aged 65 and over. Epidemics of influenza can result in high rates of worker absenteeism and place high demands on health systems from increases in medical visits, hospitalisations, and medication usage including antibiotics. Vaccination has proven to be an effective tool in reducing the burden of seasonal influenza and is usually managed at the primary level of health care. Older people are at high risk for serious illness from influenza and WHO recommends vaccination in this group. A review of vaccination drivers and barriers found that among elderly populations, personalised postcards or phone calls were effective in increasing vaccination coverage while barriers included social disadvantage, smoking, and lack of social support. In addition to older people, the European Council recommends influenza vaccination for persons with chronic medical conditions and health care workers.

In 2003, countries participating in the World Health Assembly committed to attaining influenza vaccination coverage among the elderly population of 50% by 2006 and 75% by 2010. A 2009 EU Council Recommendation also set a goal of 75% vaccination coverage of older age groups by the winter of 2014-15 or as soon as possible (*Gauci AJ.,2010*). All EU countries have recommendations for influenza vaccination among older people although the ages vary across countries. A handful of EU countries also recommend vaccination for children or adolescents. **Figure 27** shows that in 2014, the EU average influenza vaccination rate for people aged 65 and over was 49.5%. There was very high variation across countries with over a 50-fold difference between the highest and lowest rates.

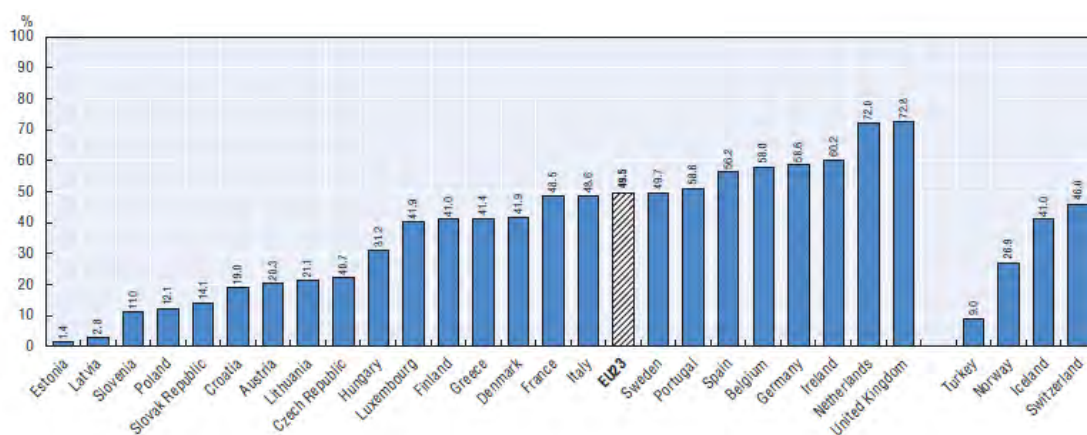


Figure 27. Influenza vaccination coverage, population aged 65 and over, 2014 (or nearest year). Source Eurostat Database.

Vaccination rates were as low as 1.4% in Estonia, where influenza vaccination is recommended but not free. Latvia also showed low rates at 2.8%. None of the EU countries met the 2010 target of 75% coverage in 2014, with only the United Kingdom (72.8%) and the Netherlands (72.0%) coming close. Overall vaccination coverage has decreased across the European Union from 57.4 in 2004 to 53.5 in 2014. Notable drops in coverage were seen in Slovenia, with rates of 30% in 2004 dropping to 11% in 2014 (*Health at a Glance, 2016*). The Slovak Republic, Luxembourg, France, Croatia and Italy also showed declines of over 20% during this time period. These decreases may be related to changing vaccination behaviour following the 2009 flu pandemic. Following the increased rates of vaccination across Europe during the pandemic, overall rates lowered to below pre-pandemic levels in subsequent years (*Caille-Brillet, 2013*). Significant increases were seen in the Czech Republic, Denmark and Portugal with increases over 30% between 2004 and 2014. The largest increase was seen in Lithuania where rates jumped from 1.8% to 21.1%.

Changes over time should be interpreted with some caution because of changes to the way vaccination rates were calculated in some countries. Progress toward 75% coverage among older adults has been heterogeneous across the European Union and met with a number of issues including a low perception of risk, fear of side effects, and issues of cost among others (*Gauci AJ, 2010*). An important aspect in improving vaccination coverage is monitoring, which is necessary to identify gaps and ensure appropriate coverage. Reinforcing this aspect of national programmes is important to guide and improve future efforts.

Who is at risk? : yearly influenza epidemics can seriously affect all populations, but the highest risk of complications occur among pregnant women, children aged 6–59 months, the elderly, individuals with specific chronic medical conditions such as HIV/AIDS, asthma, and chronic heart or lung diseases, and health-care workers (*Influenza seasonal, Fact sheet November 2016*).

3.5.3 Pneumococcal Disease

It is a group of illnesses caused by the bacterium *Streptococcus pneumoniae* or pneumococcus, which can attack different parts of the body. It can also be caused by *Haemophilus influenzae* type b (Hib) – the second most common cause of bacterial pneumonia, respiratory syncytial virus is the most common viral cause of pneumonia and also in infants infected with HIV, *Pneumocystis jirovecii* one of the most common causes of pneumonia, responsible for at least one quarter of all pneumonia deaths in HIV-infected infants.

Pneumococcus is spread from person to person by contact with respiratory droplets containing the bacteria, such as through coughing or sneezing. The viruses and bacteria that are commonly found in nose or throat, can infect the lungs if they are inhaled. In addition, pneumonia may spread through blood, especially during and shortly after birth. More research needs to be done on the different pathogens causing pneumonia and the ways they are transmitted, as this is of critical importance for treatment and prevention (*Pneumonia WHO, Fact sheet, September 2016*).

Pneumococcal disease can be broadly grouped into two categories of invasive disease (bacteremia, bacteremic pneumonia, meningitis) and noninvasive disease

(pneumonia, acute otitis media, sinusitis). Pneumococcal infections include serious diseases such as meningitis (infection of the tissues surrounding the brain and spinal cord), bacteraemia (bacteria in the blood) and pneumonia (acute lower respiratory infection affecting the lungs), as well as milder but more common illnesses, such as sinusitis. Pneumococcal infections occur throughout life, but young children and the elderly are at the highest risk for severe pneumococcal disease. *Streptococcus pneumoniae* causes significant morbidity and mortality worldwide. Pneumococcal infections are common in western European countries, accounting for a large number of hospitalizations and deaths each year, especially among persons aged >65 years (*Pfizer, 2016*). The WHO estimates 1.6 million cases of fatal pneumococcal disease occur worldwide annually, mostly in infants and the elderly. In 2013, there were about 34,000 cases of invasive pneumococcal disease and 125,000 deaths in EU countries, accounting for 30% of all respiratory disease mortality (*Health at a Glance, 2016*). As with COPD, there are large variations in mortality rates from pneumonia across EU countries. Portugal, the Slovak Republic and the United Kingdom had the highest rates of pneumonia mortality in 2013, whereas Finland, Croatia and Austria had the lowest rates (**Figure 28**). In England and Wales in 2011, 25,696 people died of pneumonia (5.3% of all deaths), compared to 109 with influenza and 316 with pandemic influenza. Wide variations in mortality rates are seen between some countries; in 2009 there was a six-fold difference in rates between Slovakia and Hungary (31 vs. 5 per 100,000, respectively), partly due to reporting methods. Whereas Finland, Croatia and Austria had the lowest rates (*Pfizer, 2016*). It is a major cause of death and hospitalisation, but is not required by law to be reported to government authorities in most EU countries.

Risk factors for Pneumococcal

Although all age groups may be affected, the WHO states the highest rates of pneumococcal disease occur among young children and the elderly. In addition, it notes people suffering from a wide range of chronic conditions and immune deficiencies are at increased risk. This risk increases with age. As people age, the functionality of their immune systems starts to decline and they become more susceptible to infections.

Burden of Pneumonia Disease in adults

Pneumonia should be treated with antibiotics. The antibiotic of choice is amoxicillin dispersible tablets. Most cases of pneumonia require oral antibiotics, which are often prescribed at a health center. These cases can also be diagnosed and treated with

inexpensive oral antibiotics at the community level by trained community health workers. Although, it has been seen that there is a growing resistance of pneumococcus to conventional antibiotics underlines the urgent need for vaccines to be used to control antibiotic resistance against pneumococcal disease. Patients with antibiotic-resistant disease may require longer hospitalization, more expensive therapy or may experience treatment failure. Even in industrialized countries, the overall cause fatality rates for pneumococcal bacteremia may reach 15 to 20 percent among adults and 30 to 40 percent among elderly patients, despite appropriate antibiotic therapy and intensive care (*Pneumonia WHO, Fact sheet, September 2016*).

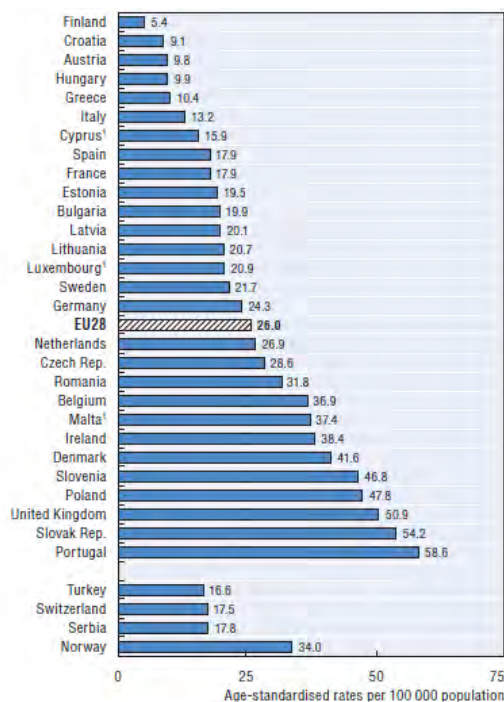


Figure 28. Pneumonia mortality rates, 2013 (or nearest year). Source: Eurostat database.

4. Risk factors of diseases

The procedure of aging has some physical effects. First of all, the body goes through changes in composition, physical strength and physiological functioning; from infancy to childhood into adolescence and puberty and so on until old age. Alerts that happen may be the result of intrinsic aging prosecute itself or indirectly associated with age such as physical inactivity and degenerative disease. The three major causes of cellular damage are metabolic stress, oxidative stress and inflammation. These processes can be modified by diet, lifestyle and exercise, thus it can be said that

aging to some extent is modifiable by environmental factors. Modest diet and lifestyle changes, such as increased fruit and vegetable consumption, reduced salt, saturated fat, alcohol intakes, increased physical activity and weight loss can all help to lower both blood pressure and cholesterol levels (*Rahelu, 2009*).

Efforts to modify lifestyle behaviours should be targeted over the entire lifecourse. Four main factors stand out as allowing people to enjoy better health in older age: a healthy diet, non-smoking and physical exercise. Good nutrition is of critical importance to people as they age. The risk of obesity in particular may accumulate over the lifecourse of individuals. An often neglected facet to nutrition is malnutrition. Malnutrition in older people is prevalent across all clinical and community settings. Persons over 80 admitted to hospital have a 5 times higher prevalence of malnutrition than those under 50 (*Centre UK and The Merck Company Foundation. June 2006*).

The factors are presented more extensively as follow:

4.1 Tobacco

Smoking remains the leading cause of preventable death and disease, responsible for 1/5 deaths globally. It is proved that for every person who dies from a smoking-related disease, 20 more suffer with at least one serious illness from smoking. It is a major risk factor for at least two of the leading causes of premature mortality – circulatory disease and cancer. It was estimated that the total cost of smoking exceeds \$193 billion each year. Tobacco kills nearly 6 million people each year, of whom more than 5 million are from direct tobacco use and more than 600.000 are non-smokers exposed to second-hand smoke (*Tobacco, WHO Fact sheet, Updated June 2016*). Smoking is also an important contributory factor for respiratory diseases such as chronic obstructive pulmonary disease (COPD), while smoking among pregnant women can lead to low birth weight and illnesses among infants. The proportion of daily smokers among adults varies greatly across European countries (**Figure 29**). Twelve out of 28 EU countries had less than 20% of the adult population smoking daily in 2014. Rates were lowest in Luxembourg, Portugal and the Nordic countries (Sweden, Finland, Denmark, as well as in Iceland and Norway) (*Health at a Glance, 2016*).

Smoking rates have a dramatic impact on life expectancy at birth. In Poland for example, about one third of increases in life expectancy at birth in the late 1990s (4

years in men and 3 years in women) are thought to be due to the reduced incidence of smoking. Tobacco smoking is the single most important risk factor of lung cancer. Different rates of smoking over time have a lagged effect on lung cancer prevalence across the EU, which is decreasing in most countries but at very different rates. Smoking decreases with age for both men and women. Older men smoke more than older women. One in 4 men over 65 reported smoking compared to 1 in 10 older women (EU-15 data only). Denmark stands out as having very high smoking rates among both older men (40%) and women (34%) (*Health at a Glance, 2016*).

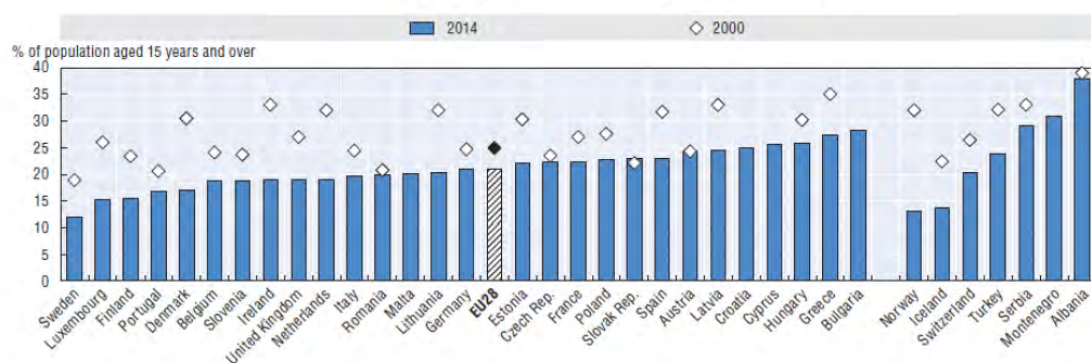


Figure 29.Smoking among adults has also declined across EU countries, but still one-fifth of adults smoke daily. Adults smoking daily, 2000 and 2014 (or nearest year) (*Health at a Glance, 2016*).

4.2 Nutrition & lifestyle

It is an important reason in conjunction with the lifestyle and it is going hand in hand with the well-being (OECD). Dietary intake and nutritional status through outlife can have an impact on health and well-being in old age. Inadequate consumption of fruit and vegetables is one factor that can play a role in increased morbidity. Proper nutrition assists in preventing a number of chronic conditions, including hypertension, cardiovascular disease, stroke, diabetes and certain cancers. Poor intake of nutrients has been associated with chronic diseases, for example calcium and vitamin D with osteoporosis, overweight and obesity in adulthood as a risk factor for hypertension and cardiovascular disease. Evidence from studies suggest that nutritional status in older people may increase susceptibility to disease and the severity of illness, in addition to being a corollary of the disease process itself. For this reason, the consumption of fruits and vegetables decrease the mortality risk. After research was proved that Mediterranean diet is the most appropriate for good health, which is adopted mainly in rural regions and it is proved that promotes the longevity. The Greek variant of the traditional Mediterranean diet is low in saturated fat, high in monounsaturated fat (mainly from olive oil), high in complex carbohydrates (from

grains and legumes) and high in fiber (mostly from vegetables and fruits). These entail to the high ratio of monounsaturated:saturated fat and for this reason this type of diet is the most appropriate for illnesses' treatment (*Trichopoulou A., M.D., 2003*).

More women than men reported eating vegetables daily in all countries. The percentage of adults reporting to consume fruit daily varied from less than 40% in Bulgaria, Latvia and Romania, to more than 70% in Italy and Portugal (**Figure 30**). On average across EU member states, 57% of adults reported eating fruit daily. Women are eating fruit more often than men in all countries, with the largest gender gaps in Austria, the Czech Republic, Denmark, Finland and Sweden, as well as Iceland and Switzerland. In many Mediterranean countries (Cyprus, Greece, Italy, Malta, Portugal, Spain and Turkey), the gender gap is much smaller. Daily vegetable consumption ranged from less than 30% in Romania, to nearly 80% in Belgium. The average across the 28 EU countries was just over 50%. Again, more women reported eating vegetables daily (**Figure 31**). The gender gap is greatest in Denmark, Germany, Luxembourg and Sweden. Patterns of vegetable consumption among age groups and educational groups are similar to those for fruit. Older people more commonly eat fruit and vegetables daily. About 12% of adults report to eat at least five fruit and vegetables per day across the European Union as a whole, ranging from about 4% in Romania and Bulgaria to 25% in Denmark and the Netherlands. People with a higher level of education also tend to eat fruit and vegetables more often compared to those with lower level of education. Fruit and vegetable availability also tends to be higher in families where household heads have a higher level of education (*Health at a Glance, 2016*).

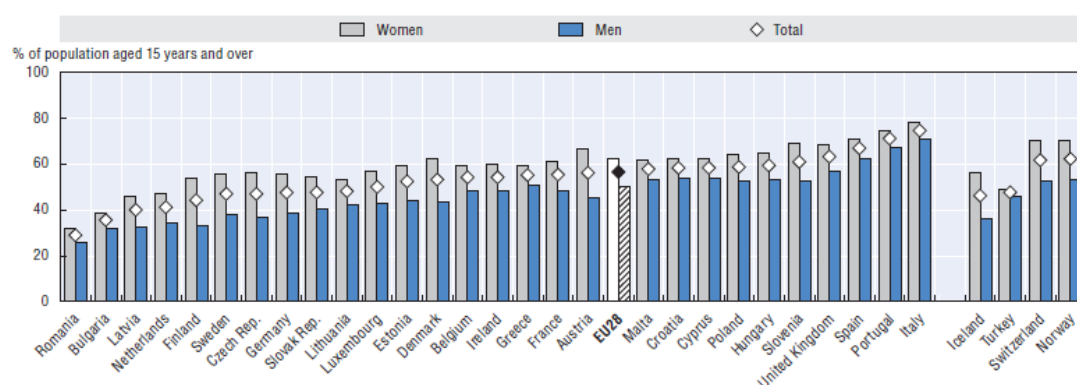


Figure 30. Daily fruit eating among adults, 2014 (or latest year). Source: Eurostat, EHIS 2014; OECD Health Statistics 2016 for non-EU countries, Ireland and Italy.

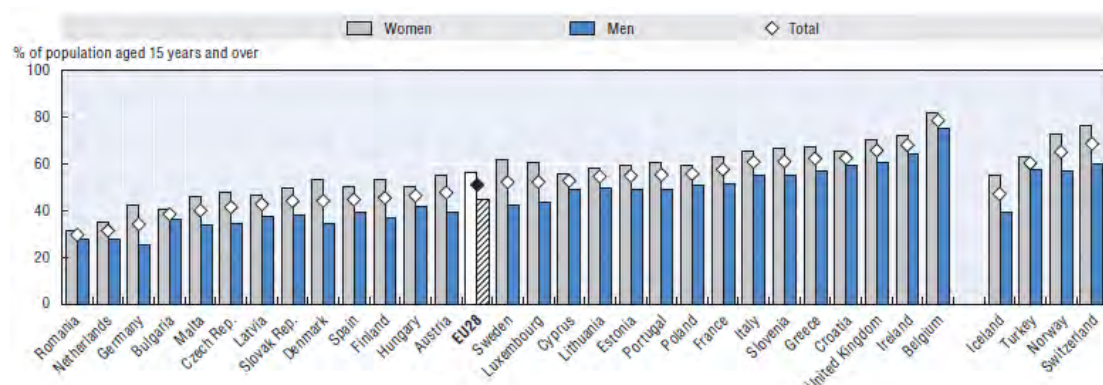


Figure 31. Daily vegetable eating among adults, 2014 (or latest year).Source : Eurostat, EHIS 2014; OECD Health Statistics 2016 for non-EU countries, Ireland and Italy.

Older persons are more likely to eat vegetables daily. Highly educated persons eat vegetables more often (OECD). Activities to improve the nutrition of today's children and even of today's pregnant women will have an impact on aging in the population in 70-100 years time. Nutrition has direct effects on the underlying cause of aging and can profoundly alter healthy life expectancy. The increasing trend toward obesity and a sedentary lifestyle is the greatest threat to the continuing increase in life expectancy and improvements in health in old age (*Kirwood et al, 2006*).

4.3 Physical activity

About half of the physical decline associated with aging may be due to a lack of physical activity. Physical inactivity is a risk factor for cardiovascular disease, as well as a number of other chronic diseases including diabetes, certain types of cancer, obesity and hypertension (*Knight, et al., 2012*). For people up to 50 years old it is important the regular exercise because in this age they are under the threat of many health problems, such as reduced muscle mass, joint flexibility, increased blood pressure and increased body fat levels. Increasing physical activity in older persons is not only an effective intervention for better health, it is a cost-effective one. Yet only a third of persons aged 65+ perform moderate exercise at least twice a week –with huge regional differences. Older European men are more likely to exercise than older women. The SHARE study estimated that 9% of older men and 15% of older women were physically inactive. Physical activity among adults varies two-fold across the EU, from 38% in Romania to 80% in Sweden (**Figure 32**). In 2014, less than 60% of adults in Bulgaria, Portugal, Romania and Spain took part in the recommended amount of physical activity, compared with over 70% in Austria, Denmark, Finland, France, Slovenia and Sweden. Overall, 64% of the EU adult population meet the recommended amount. Gender gaps also differ by country. They are low (under 2

percentage points) in Finland, Greece, Sweden and the United Kingdom. In the Czech Republic, Latvia, Romania and Spain, there is a gap of over 15 percentage points in the proportion of men doing regular moderate physical activity compared to women. Denmark is the only country where women exercise more than men (3 percentage points' difference). The average gender gap across the EU is 8 percentage points.

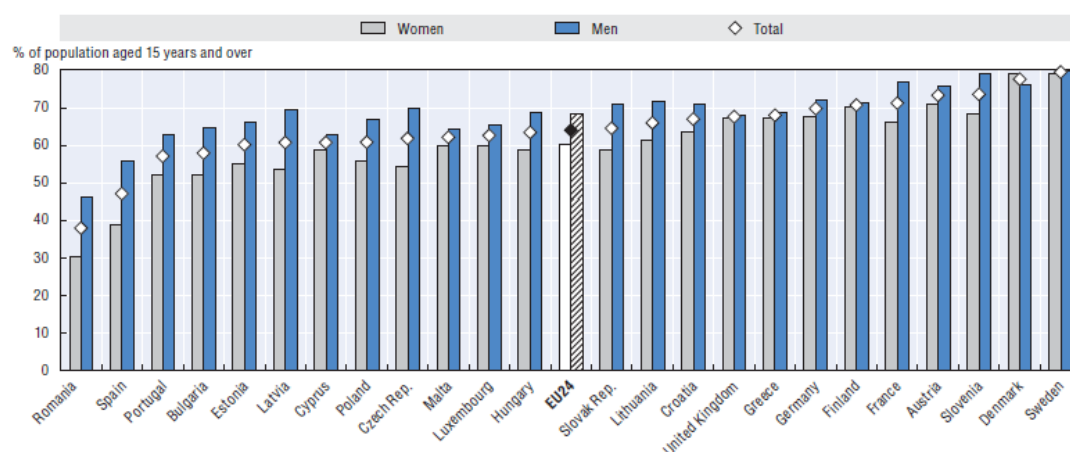


Figure 32. Moderate weekly physical activity among adults in EU countries, 2014. *Source:* Eurostat, EHIS 2014.

There is also a gap in many countries between adults with lower and higher levels of education. People with a lower level of education do more physical activity than those with a higher level of education. These differences are most prominent in Bulgaria, France and Romania (over 10 percentage points). On the other hand, in Austria, the Czech Republic, Finland, Greece, the Slovak Republic, Spain and the United Kingdom, people with a higher level of education undertake physical activity more often than those with lower education. Across the European Union, an average of 62% of people with lower levels of education, and 59% of those with higher levels, meet the weekly recommended level of physical activity (**Figure 33**)(*Health at a Glance, 2016*).

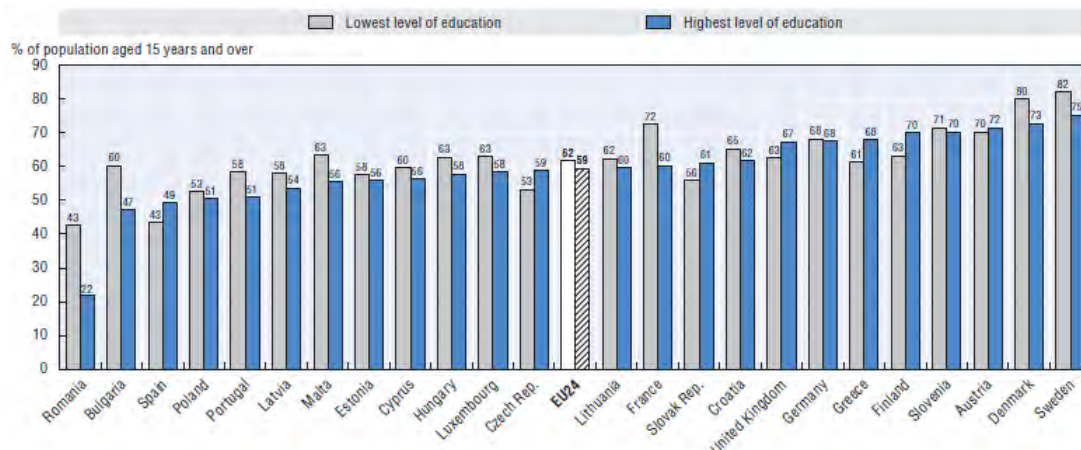


Figure 33. Moderate weekly physical activity among adults in EU countries, by level of education, 2014.
Source: Eurostat, EHIS 2014.

There are many benefits that older people can have if they do regular exercise. First of all, about their muscles it is true that in older people the amount and size of muscle fibers decreases with age so after regular exercising muscle mass can be increased. Secondly, the bone's density begins to decline after the age of 40 but this loss accelerates around the age of 50 years (*National Association of Chronic Disease Directors; 2009*). Exercise may help them to reduce the risk of bone loss and osteoporosis. Especially, weight-bearing exercise, in particular, helps to keep bones healthy and strong. Thirdly, studies show that cardiorespiratory fitness takes longer to achieve in an older person than a young one but can be improved by regular exercise. Regular exercise helps an older person maintain an appropriate weight for their height and build. Physical activity may also protect against osteoporosis via effects on muscle strength, flexibility and balance. Supplementary to exercise, everyone and especially elderly people must take calcium and vitamin D so, as to prevent poor skeletal health.

It was proved that regular physical activity can reduce the risk for developing depression, diabetes, heart disease, stroke and certain types of cancer. It also prevents people from obesity, high blood pressure, osteoporosis and any other risk factor that may have old people. Less than half of all adults do exercise and especially obese people between the age of 45 to 64 deny to include exercise in their daily life. The associated health-related cost that can be attributed to physical inactivity ranges from \$109 to \$1,305 per person (*Kathleen B. Watson et al., 2016*). By exercise old people can advance their basal metabolic rate, which has a decline especially after the age of 70 while it is proved that the lack of physical activity and prolonged time of sedentary behavior are closely related to the aging process and

represents a state of inflammation and metabolic derangements (*Nick Cavill et al., 2006*).

4.4 Obesity

Among young people, psychosocial problems such as poor self-esteem, eating disorders and depression can result from being obese. So as it is logical, the deficiency of normal diet and the sedentary life conduct even young and older people to become obese. Obesity is known risk factor for numerous health problems, including hypertension, cardiovascular diseases, musculoskeletal diseases or diabetes. Between 2005-2006 over 72 million people or more than one-third of all adults were obese. In 2000, obesity-related healthcare costs totaled an estimated \$117 billion. Approximately 39 million work days are lost to obesity-related illnesses each year, costing the employers \$13 billion annually (*Cynthia L. Ogden et al., 2015*). It is estimated that about three-fourths of adults aged 60 and older are overweight or obese. Obesity is related to type 2 diabetes, cardiovascular disease, breast and high blood pressure. More than 40% of adults 60 and older have a combination of risk factors known as metabolic syndrome, which puts people at increased risk for developing diabetes, cardiovascular disease and cancer. The overweight or obese population is defined as the inhabitants with excessive weight presenting health risks because of the high proportion of body fat. The most frequently used measure is based on the body mass index (BMI), which is a single number that evaluates an individual's weight in relation to height (weight/height^2 , with weight in kilograms and height in metres). Based on the WHO classification, adults with a BMI from 25 to 30 are defined as overweight, and those with a BMI of 30 or over as obese. This indicator is presented both for "self-reported" data (estimates of height and weight from population-based health interview surveys) and "measured" data (precise estimates of height and weight from health examinations) and is measured as a percentage of the population aged 15 years and older. Older people report a greater awareness of the importance of healthy diets than younger Europeans. Yet obesity is a problem for older adults as well as for younger ones. It affects older men more than older women, leading to a greater risk of diabetes and cardiovascular disease. At a population level, the unprecedented rise in obesity, coupled with poor nutrition, stress and environmental pollutants may mean that, for the first time ever, future generations may live shorter lives than current ones. Obesity varies three-fold among EU countries, from 9% in Romania to 26% in Malta, although some of the variations across countries are due to different methodologies in data collection. On average

across EU member states, 16% of adults were obese around the year 2014, an increase from 11% in 2000 (**Figure 34**).

On average across EU countries, 21% of adults with a lower level of education are obese compared to 11% of those with a higher level of education. The gap in obesity rates between low- and high-educated people is largest (above 15 percentage points) in Luxembourg and Slovenia. Rates of obesity vary by education level and socio-economic status, and these disparities are found to be significant in women while less clear-cut in men (*Devaux M, 2013*). A number of behavioural and environmental factors have contributed to the long-term rise in overweight and obesity rates in industrialized countries, including the widespread availability of energy-dense foods and more time spent being physically inactive. These factors have created obesogenic environments, putting people, and especially those socially vulnerable, more at risk.

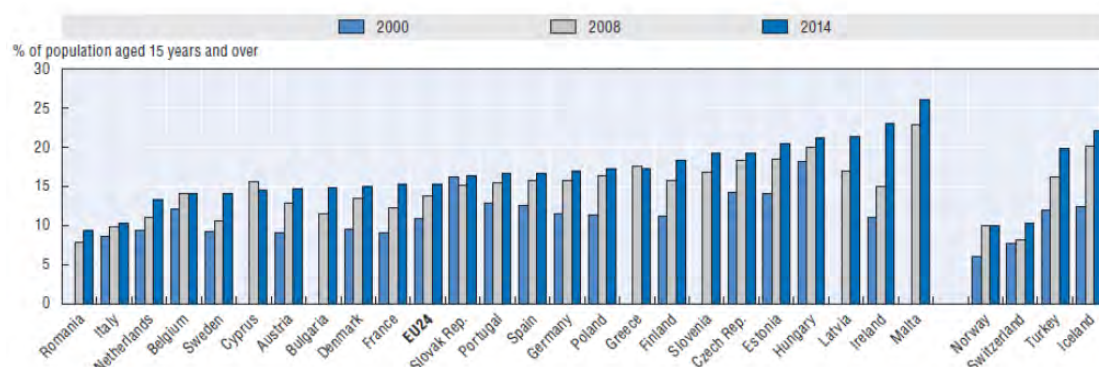


Figure 34. Trends in self-reported obesity among adults in EU countries, 2000, 2008 and 2014 (or latest years). Source: Eurostat, EHIS 2014; *OECD Health Statistics 2016* for non-EU countries.

5. The importance of prevention

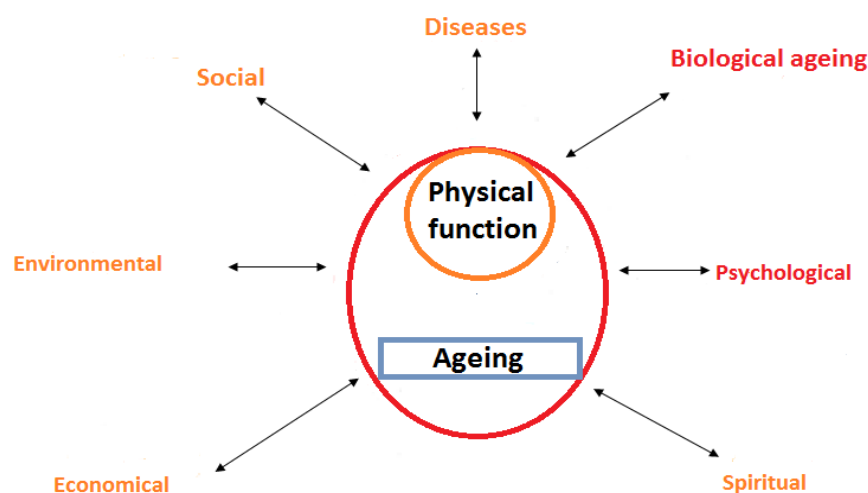
The definition given by WHO is: ‘the condition of complete physical, mental and social well-being and not just absence of any disease or disability.’ A disease is a result of a harmful interaction between a person and a pathogenetic mechanism as well as the environment. These three factors create a dynamic system in which there is total balance when we refer to absolutely healthy people. When the above situation is disordered, then the disease is developed. The major threat against people’s health and, consequently, healthy aging procedure is cardiovascular diseases, cancer and some infectious diseases. Prevention, meaning the set of measures implemented so as to reduce the danger of a diseases’ development, is addressed to

people, society and the surroundings via special health educational schedules. The highly – salient connection between health education and cure is determined since: 1) health is essential for human productivity, 2) it is the first line of humans' organism defense, 3) health has long – lasting positive financial advantages and 4) the disease itself is a source of distress (*Papadopoulos, 2010*).

Prevention is implemented successfully on most of the infectious diseases nowadays while it can be also implemented on non- infectious fatal diseases, malignant neoplasms and cardiovascular diseases. Cardiovascular diseases and cancer are associated with specific lifestyle in which smoking, lack of physical activity and exercise, drinking alcohol and the negative environmental impacts upon the reporting population are included. The rise of fatality due to chronic diseases as well as the first epidemiological research's results which have associated diseases' development with particular daily routines, has led to educational, informative programs with a view to preventing diseases. In highly – developed countries, intervening programs are implemented in order to create appropriate behavior which aims to chronic diseases' prevention.

The main purpose of these actions is the promotion of healthy aging, namely the process of optimizing opportunities for physical, social and mental health to enable older people to take an active part in society without discrimination and to enjoy an independent and good quality of life.

As the scheme below shows many factors such as social, environmental, psychological, spiritual, economical as well as diseases contribute to aging. By interfering in these factors it can be promoted healthy aging.



Healthy aging is likely to be of most importance for the costs of aging. Many studies at the OECD have stressed the need to adapt policies in the face of accelerated population aging over coming decades. Recent projections foresee an increase in overall age related public spending (pensions, health and long-term care) of approximately four to five percentage points of GDP between 2004 and 2050 for the EU-15 and around 6% for the EU-10 (*European Union, 2014*). Latest OECD projections for health and long-term care suggests spending increases of around three and a half percentage points of GDP and around six percentage points if current trends in non-demographic drivers of health care spending continue.

Policies for healthy aging may also have a broader role to play in mitigating future aging related pressures on public finance. A healthy older workforce could be less inclined to withdraw from the labour force, under existing age-pension or disability arrangements. This would reduce transfer spending, increase the labour force and raise government revenues. The number of working days lost through sick leave may also be reduced (*Health at a Glance, 2016*). Nonetheless, the overall impact on spending will depend on whether aging-related programmes are cost-effective. Healthy aging policies can encompass a range of programmes. Some of these imply costs that, in certain cases, may exceed the potential savings. In these cases, governments will need to consider whether the benefits to the elderly, for example in terms of better health, clearly outweigh the net costs for individual programmes (*Oxley, H., 2009*).

The key to healthy aging is the promotion of good health and prevention of illness, as well as the effective management of those illnesses that do occur. Biology and genetics, social factors such as education, incomes and social status, social supports, the physical environment, behavioural factors such as lifestyle choices, and access to health services all interact to determine health or illness. Health-related lifestyle choices are in turn influenced by people's social and economic circumstances, as well as the social and physical environment. To achieve the vision of an additional ten years of healthy life expectancy will require changes in the population in relation to smoking, poor diet, physical inactivity and alcohol misuse that contribute substantially to the preventable chronic diseases associated with aging: heart disease, stroke, cancer and diabetes and their complications.

It is widely accepted that the foundations for healthy aging can be divided into 4 distinct components:

1) Promoting health and preventing illness, disease and injury-enabling people to increase control over and improve their health. Health promotion focuses on enhancing the capabilities and capacities for individuals, families and communities to make healthy choices and develop healthy and supportive environments.

2) Optimising mental and physical function-as people age, most people want to remain independent. To achieve that they need to maintain physical and mental functions. Research shows that not only can functional loss in seniors be prevented, but that many functional losses can be regained (*Rowe, et al, 1997*).

3) Managing chronic conditions-health promotion and disease prevention have substantial benefits for individuals and society as a whole. Specifically, they emphasize lifestyle changes such as physical activity, healthy eating and tobacco cessation as essential in delaying or preventing many chronic diseases in later life.

6. Prevention actions

The World Health Organisation has developed many sophisticated approaches to health promotion based on education, disease prevention and enhancing fitness in the workplace, based on recognition of the determinants of health and interventions based on a model of how they work together known as the health field concept. Health promotion activities take many forms but generally target exercise and activity, diet, cancer screening tests, smoking cessation, and vaccination. Disease prevention and health promotion share many goals, and there is considerable overlap between functions. On a conceptual level, it is useful to characterize disease prevention services as those concentrated within the health care sector, and health promotion services as those that depend on intersectoral actions and/or are concerned with the social determinants of health (*WHO EMRO | Assessment of essential public health functions, 2017*).

6.1 Behavioral

Prevention of illness is acknowledged as a critical means of limiting the impact of disease and illness as people get older. Three of the most prominent non-communicable diseases (cardiovascular disease, cancer and chronic obstructive pulmonary disease) are linked by common risk factors related to lifestyle. These

include poor diet and nutrition, tobacco use and physical inactivity. The incidence of these diseases can be reduced through health promotion.

Health promotion includes policies and interventions to address tobacco, physical activity and diet. Dietary and nutritional intervention should also appropriately tackle malnutrition, defined as a condition that arises from eating a diet in which certain nutrients are lacking, in excess or in the wrong proportions (*Physical activity, WHO Fact sheet Reviewed June 2016*).

Better lifestyles are likely to be key to further improvements in the longer-term health of the elderly. But because they require changes to individual behaviour, improvements in this policy dimension may be difficult to engineer. While it is “never too early and never too late” to change lifestyles, it is clear that, the earlier risky behaviour changes, the higher the chances of enjoying longer healthy lives. In this context, three policy concerns stand out:

- ✓ *Physical Activity*: This is widely recognised as benefiting both the length and the quality of life of the elderly and promotes independence. Nonetheless, the elderly tend to become less active as they age. There is some evidence that policies to encourage activity can bring about a reversal in this physical decline.
- ✓ *Nutrition*: Older people’s energy requirements decline with age but they have the same need for nutrients. Thus, special attention needs to be given to promoting healthy diets.
- ✓ *Substance use/misuse*: While smoking often starts in adolescence, the longer-term negative effects are mainly felt by the elderly. Promote smoking cessation and lowering excessive alcohol consumption are therefore key policy objectives. Inappropriate use of pharmaceutical drugs also remains an important policy issue and continues to contribute to visits to accident and emergency units and unplanned hospital stays (*Oxley, H., 2009*).

Achieving better lifestyles has probably the largest potential for improving the health of the elderly. This can cover a number of dimensions: physical ability, substance misuse or abuse and healthy eating and diet (*Peel NM et al, 2005*), in a systematic review of evidence on the behavioural determinants of healthy aging, confirmed *inter alia* that healthy aging is associated with non-smoking, being physically active, maintaining weight within moderate ranges and consuming alcohol in moderation.

6.1.1 Physical exercise

It is very important for maintaining health and physical functioning as people age; it increases strength and, more importantly, it is a strong predictor of healthy aging. It is associated with lower incidence of cardiovascular disease, osteoporosis and bone loss, and certain forms of cancer. It can reduce the risk of falls, lower blood pressure among those suffering from hypertension, and reduce the risk of stroke and of insulin sensitivity. Exercise may also reduce the risk of depression and may decrease the chances of developing dementia, although it is difficult to isolate exercise from other factors that are often associated with other healthy aging policies such as social networks (*Callaghan P., et al, 2004*). Better physical condition reduces the risk of dependency. In sum, exercise is the “best preventive medicine for old age” and reduces significantly the risk of dependency in old age (*The Swedish National Institute of Public Health (SNIPH), 2006*). For older people, physical activity includes recreational or leisure-time physical activity, transportation (e.g. walking and cycling), occupational physical activity (if still engaged in work), household chores, play, games, sports or exercise planned in the context of daily, family, and community activities. The motivations and needs of men and women differ, and actions should therefore take gender norms, values and access to resources into consideration.

Some prevention actions proposed to be taken are the following:

- foster cooperation and sharing of experience and good practice on effective measures to increase physical activity levels among elderly, in order to support their implementation and evaluation
- develop and implement targeted community programmes for physical activity among elderly, including a combination of individual and group-based behaviour change approaches with support and follow-up
- provide advice about physical activity in all health and social care settings for elderly, specifically targeting sedentary people, with a focus on promoting moderate intensity physical activity (particularly walking) and providing ongoing support and
- support local authorities in creating motivating environments and infrastructure for physical activity (in particular active transport) for all ages (*Strategy and action plan for healthy ageing in Europe, 2012-2020*).

The WHO recommends at least 150 minutes of moderate-intensity aerobic physical activity throughout the week for adults aged 18-64 years old, or an equivalent combination of moderate- and vigorous-intensity activity (*Physical activity, WHO Fact sheet Reviewed June 2016*). A 2013 Council Recommendation on Health-Enhancing

Physical Activity also promotes sport and physical activity. WHO and the European network for the promotion of health-enhancing physical activity collaborate closely, strengthening and supporting efforts to increase participation in physical activity. Studies have shown that common barriers to physical activity include perception of lack of time, feeling too tired and preferring to rest, and concerns about personal safety (*Physical activity, WHO Fact sheet Reviewed June 2016*).

Promotion of physical activity is being used in public health campaigns in many countries. An increasing number of private large companies have also invested in wellness programmes to encourage physical activity and improve health-related behaviours of their employees with the view of keeping workers in good health and working longer (*Health at a Glance, 2016*).

6.1.2 Healthy eating

It belongs to a wider set of policy issues concerning diet, particularly in the context of increasing levels of obesity (*OECD, 2008*). Finding and maintaining the appropriate weight for the elderly needs to take account of a number of factors:

- ✓ Problems of obesity are also frequent for the elderly and require programmes to reduce the associated health risks. As for younger age groups, it remains difficult to know how to achieve extensive weight loss and to sustain it over time.
- ✓ While obesity remains a major public health problem, some bodyweight increase may help promote healthy aging. While the elderly do need slightly less calorie intake than younger age groups, care must be taken to ensure that bodyweight is maintained as the elderly find it difficult to put weight back on once they have lost it.
- ✓ At the other extreme, low weight is associated with increasing risk of osteoporosis and malnutrition.

The elderly need to ensure that they receive adequate nutrients. As with other age groups, they need high consumption of vegetables and fruits and lower intake of saturated and animal fats and salt. There are significant effects on diet of fruits and particularly vegetables on the risks of cancer and diabetes; reducing intake of salt and animal and dairy fats can significantly reduce blood pressure, cholesterol and associate the mortality and morbidity from cardiovascular disease (*Riboli and Norat, 2003*). In this context, a report of the Swedish Council on Technology Assessment in

Health Care found that eating habits were related to bone density and osteoporosis. They also found that Vitamin D was very important in the northern countries where lack of sunlight in winter reduces its natural formation. There are wide variations in diet across OECD countries. Within Europe, for example, people in the north tend to have less balanced diets than in the Mediterranean area where there is greater consumption of vegetables, fruits and fibre and less of dairy fats, contributing to some of the differences in morbidity patterns. But whatever the country, dietary patterns appear to be changing and elderly people –like their younger counterparts – are relying more on pre-packaged and processed foods, often with high salt content. While there is relatively little in the way of experimental results as to how best to induce the elderly to change their eating habits or the best way to adjust diets to maximise the effect on health and disability, several meta-studies provide some hints as to how healthy eating can be improved (*The Swedish National Institute of Public Health (SNIPH), 2006*).

The promotion of fruit and vegetable consumption, is a policy objective of the European Union. The 2007 EU Strategy on Nutrition, Overweight and Obesity-related Health Issues promotes a balanced diet and active lifestyle among all the population. The WHO recommends adults consume five portions (400g) of fruit and vegetables daily, excluding starches. It features in the EU platform for action on diet, physical activity and health, a forum for European-level organisations including the food industry, consumer protection NGOs and other stakeholders committed to improving trends in diet and physical activity (*European Commission 2016*). The European Commission is also monitoring progress in the consumption of fruit and vegetables as one of a number of ways to offset a worsening trend of poor diets and low physical activity. The WHO European Food and Nutrition Action Plan 2015-20, adopted in 2014 by 53 countries of the WHO European Region, is intended to significantly reduce the burden of preventable diet-related non-communicable diseases, obesity and all other forms of malnutrition still prevalent in the WHO European region (*Health at a Glance, 2016*).

6.1.3 Obesity

Governments need to focus more aggressively on preventive obesity. In Europe, for example, some predict that by 2020 all the health gains of successful anti-smoking policies will be wiped out by the effects of obesity.

The aims of Obesity Action Campaign that organised by the Royal College of Physicians in London, are:

- To support scientific research into prevention of obesity-induced diseases, with an emphasis on the currently neglected liver and pancreas diseases caused by obesity, plus support research into cancers linked with obesity
- To educate families about obesity and its adverse consequences in the hope of reducing its rising prevalences.

Changes in CVD risk factors can be brought about by intervening at the population and individual level. Government has addressed the risk factors at both levels. Interventions focused on changing an individual's behaviour are important and are supported by a range of existing NICE guidance. Changes at the population level could lead to further substantial benefits and this guidance breaks new ground for NICE. These changes may be:

-Decrease of salt consumption: high levels of salt in the diet are linked with high blood pressure and can lead to stroke and coronary heart disease. High levels of salt in processed food have a major impact on the total amount consumed by the population.

-Promotion of the benefits of a reduction in the population's salt intake in the European Union. Introduce national legislation if necessary.

-Saturated fats: reducing general consumption of fats is crucial to preventing CVD. They should encourage manufacturers and producers to reduce the amount of saturated fat in all food products. If necessary, consider supportive legislation. Create favourable conditions for industry and agriculture to produce dairy products for human consumption that are low in saturated fat (*European Food and Nutrition Action Plan 2015–2020*).

At EU level, the 2007 Strategy for Europe on Nutrition, Overweight and Obesity-related Health Issues promotes a balanced diet and active lifestyles. It also encourages action by member states and civil society through marketing and advertising, consumer information and labelling, and advocacy and information exchange, among other commitments (*European Food and Nutrition Action Plan 2015–2020*). The 2016 European Council conclusions on food products improvement recognise the potential of reformulation and food improvement reducing salt, sugars and saturated fats, and they call for national plans to make the healthy food choice easier for consumers by 2020 (*Health at a Glance, 2016*).

A growing number of countries have adopted policies to prevent obesity from spreading further. The policy mix includes, for instance, public awareness campaigns, health professionals training, advertising limits or bans on unhealthy food, taxations and restrictions on sales of certain types of food and beverages and nutrition labelling (*Health at a Glance, 2014*). Better informed consumers, making healthy food options available, encouraging physical activity and focusing on vulnerable groups are some of the areas in which progress has been made.

6.1.4 Tobacco

It is one of the few consumer products that eventually kills half of its regular users if manufacturers' recommendations are followed. Although tobacco consumption often starts at a young age, the lag between smoking and negative health effects is long. The impact of continued smoking tends to be larger at older ages and the risks of illness and death increase as people age and continue smoking. Smokers lose on average 13 years of healthy life expectancy and smoking is associated with increased risks (sometimes as much as 10 to 20 times) of contracting 40 or more different diseases. As studies suggested ex-smokers and never-smokers with a high level of physical activity were 2½ times more likely to age successfully. Even though stopping smoking when aged 65-70 halves the excess risk of premature death, some studies show that older smokers are less likely to try to stop than younger smokers (but are more successful when they do) (*WHO, 2012*). In summary, smoking cessation has very high payoffs in terms of healthy aging and remains one of the key policy levers in improving health in old age. Also preventing smoking has long been an important public health issue for governments and many continue to tighten their anti-smoking policies. China, for example, which has the world's highest prevalence of male smokers, is introducing a range of prevention measures, including raising taxes on cigarettes and placing a ban on smoking in public places.

In most countries, much of the decline in tobacco use can be attributed to policies aimed at reducing tobacco consumption through public awareness campaigns, advertising bans, increased taxation, and restriction of smoking in public spaces and diseases. More stringent policies and higher level of taxes have led to bigger reductions in smoking rates between 1996 and 2011 in many EU countries (*Health at a Glance, 2015*). A new Tobacco Products Directive (2014/40/EU), adopted in February 2014, lays down rules governing the manufacture, presentation and sale of tobacco and related products. The Directive notably requires that health warnings

appear on packages of tobacco and related products, bans all promotional and misleading elements on tobacco products, and sets out safety and quality requirements for electronic cigarettes. As governments continue to reinforce their anti-tobacco policies, new strategies such as plain packaging for tobacco products aimed to restrict branding are being adopted by an increasing number of countries (e.g. in France and the United Kingdom) (*Health at a Glance, 2016*).

6.2 Vaccination

Vaccines for Adults: Important Preventive Health Measure

By contrast to the behavioral proposals for non-communicable diseases, communicable diseases and some other serious conditions can be reduced or prevented by using immunisation programmes that are practical and easy to implement. Vaccination is an effective preventive public health strategy that will become a keystone in life-course healthcare. A life-course approach to vaccination will provide a major contribution to healthy aging through a reduction in the burden and potential suffering caused by vaccine-preventable diseases, benefiting individuals and society. The 20th century saw a dramatic increase in life expectancy, which was largely the result of improved living and working conditions, healthcare advances and the control of infectious diseases. Vaccinations have been a particular success story, with children being a key beneficiary of this technology. Immunisation has become a standard element in preventive healthcare regimes worldwide. The promotion of vaccination among older persons should be part of a comprehensive strategy to promote healthy aging, a priority for the European Commission and policy-makers throughout Europe. With the exception of the flu vaccine, many people believe that vaccination is relevant only for children, but vaccines can help to protect adults against a host of infectious and sometimes deadly diseases. Indeed, more adults die from vaccine-preventable diseases each year than children. Although vaccination is particularly important for persons aged 60 years and older as well as persons with chronic diseases and other high-risk conditions, such as compromised immune system, we argue below that vaccine programs to promote healthy aging should start at the age 50, before age-related immunological decline has begun (*Michael K., 2009*). **Figure 35** shows rates of vaccination coverage in 2004 and 2014. Overall vaccination coverage has decreased across the European Union from 57.4 in 2004 to 53.5 in 2014. Notable drops in coverage were seen in Slovenia, with rates of 30% in 2004 dropping to 11% in 2014. The Slovak Republic, Luxembourg, France, Croatia and Italy also showed declines of over 20% during this time period. These

decreases may be related to changing vaccination behaviour following the 2009 flu pandemic.

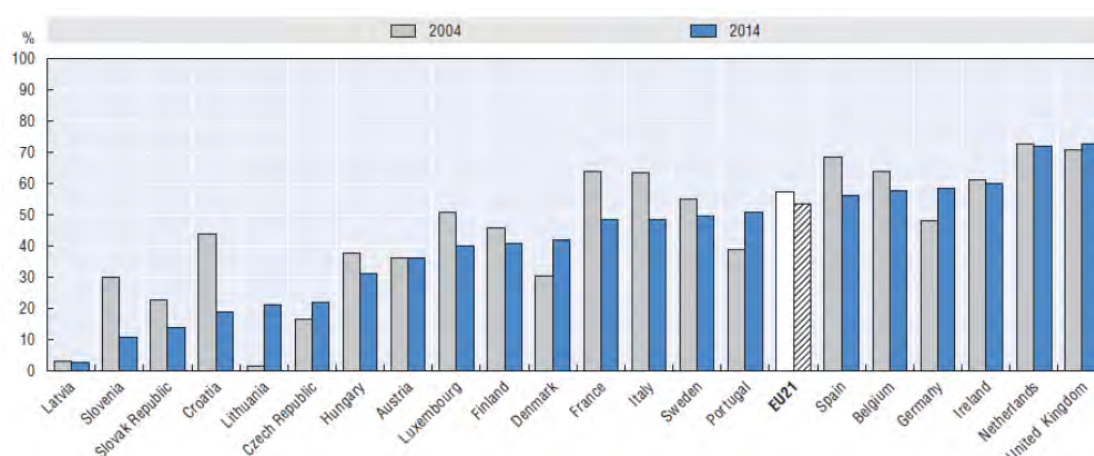


Figure 35. Influenza vaccination coverage, population aged 65 and over, 2004-14 (or nearest year)
Source: OECD Health Statistics 2016; Eurostat Database

One study measured the value of preventive services by two criteria – health impact and cost effectiveness – and found that influenza immunisation and pneumococcal immunisation rank among the best preventive health services, as highly as smoking cessation and cancer screening (*Garau et al, 2011*). Influenza viruses circulate globally and affect all age groups. Vaccines are the best tools available for preventing influenza illness and are recommended annually by the WHO for groups at high risk of mortality or significant morbidity, including pregnant women, children six months to five years of age, elderly individuals (65 years of age and older), individuals with chronic medical conditions, and health care workers. The CDC have broadened the WHO recommendation for influenza vaccination to all persons older than six months of age, with two doses for children between six months and eight years old who are receiving influenza vaccine for the first time. In general, influenza vaccines have an excellent safety record, but their efficacy varies significantly in various age groups and against different strains. Rare exceptions to the safety profile have emerged in association to the use of specific adjuvants, as discussed later. Strain mismatch and pandemics are frequent causes for vaccine failure and, over the last few years, several mismatches and one pandemic have occurred. The development and deployment of an H1N1 pdm2009 vaccine was relatively rapid, but the vaccine still became available too late to provide timely protection to vulnerable populations during the pandemic. Vaccine mismatch with seasonal influenza strains also has occurred multiple times, for example during the 2003/2004 season when an

A/Fujian/411/2002 virus emerged as a new and unanticipated antigenic variant of influenza A/H3N2 (*Scorza, et al, 2016*).

Vaccination reduces costly hospitalizations and admissions to long-term care facilities. Until now, only a few studies have examined the economic value of vaccines. Recent studies of influenza and pneumococcal vaccines have concluded that they are highly cost-effective. Analysis of this sort should be expanded and applied to other vaccines, but the findings to date support calls for increasing vaccine uptake in the 50+ population. Although vaccination plays a key role in maintaining the health of adults, the use of vaccination in Europe is far below guidelines established by the WHO, the European Union Geriatric Medicine Society (EUGMS) and other medical and public health organisations. Although all countries in Europe have vaccination schedules that recommend annual influenza vaccination among persons over 65, most do not have recommendations for persons 50-64 years of age. This is a missed opportunity to promote healthy aging because the 50-64-year age group is characterized by a significant prevalence of high-risk factors. Identifying and developing strategies for overcoming barriers to vaccination is therefore an important health policy goal for Europe (*Michael, et al, 2009*).

Greece is one of the few EU Member States that can refer to a detailed guidance document setting out what constitutes an adult immunisation schedule, the Adult Vaccination Programme published in 2011 (some details of it are presented in the **Figure 35**). The National Immunisation Committee provides clinical recommendations to the Greek Ministry of Health. The Committee consists of 11 voting members and does not operate under formal written terms of reference [WHO 2008]. In addition, several organisations, such as the National Infectious Disease Society, the National Pulmonary Society and GP associations, issue guidance for infectious diseases. The Greek authorities have not set national coverage targets for infectious diseases.

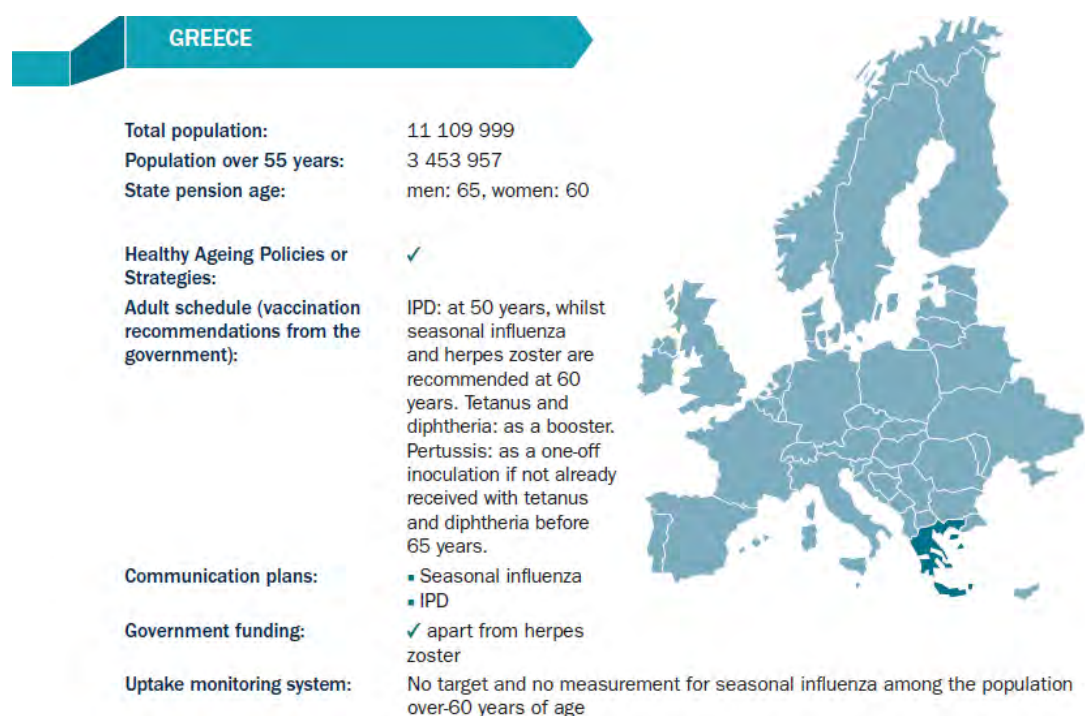


Figure 35. Country snapshot for vaccination. Source: (SAATI report, 2013).

The WHO states that this century promises to be the century of vaccines, with the potential to eradicate, eliminate or control a number of serious, life-threatening or debilitating infectious diseases with immunisation at the core of preventative strategies. Risk factors vary based on type of disease, but include chronic conditions such as diabetes, asthma, heart disease, history of smoking and frequent travel. According to the WHO, vaccination prevents an estimated 2.5 million deaths globally each year. Vaccines stimulate the body's immune system to help prevent subsequent infectious disease. A 2007 report revealed adult immunisations for influenza and pneumococcal disease ranked among the top 15 best preventative health services. Adult immunisations ranked highly among other preventative services such as cancer screenings and smoking cessation because of immunisations' health benefits and cost effectiveness.

How can vaccines help in a healthy aging strategy?

To date, one of the best publications concerning vaccination of older adults involves an analysis of 713,872 individuals (415,249 vaccinated and 298,623 nonvaccinated) who entered a study to assess the effectiveness of influenza vaccination in community-dwelling persons aged 65 years or over. Over ten flu seasons, vaccination was associated with a 27% reduction in the risk of hospitalization for pneumonia or influenza, and a 48% reduction in the risk of death. These findings clearly highlight the benefits of influenza vaccination in terms of increasing longevity

and decreasing morbidity. In a separate analysis from three large managed-care plans, in which 58% of the members were at least 65 years of age and received influenza vaccination, vaccinated individuals had significantly lower hospitalization for cardiac disease, cerebrovascular disease, influenza and pneumonia compared with nonvaccinated subjects over two flu seasons. In addition, vaccination was associated with a lower risk of death from any cause. These results were achieved despite the fact that the vaccinated group had more comorbidities at baseline (Maggi, 2010).

Vaccination of the adult population needs to be a key component of a healthy aging strategy, since there is already convincing evidence that this approach can have an important impact on morbidity, mortality and quality of life. The large increase in vaccine-preventable diseases in older adults (≥ 60 years) represents a significant barrier to healthy aging initiatives. Indeed, without a vaccination program specifically targeting adults aged 60 years or over, infectious diseases in this population will remain a major problem for health authorities. This will be further exacerbated by the predicted increase in the numbers of people passing the age of 65 years, particularly in developing countries (Figure 36). Human aging comes at a price, and in the case of the immune system there is an age-related decline (immunosenescence), which results in greater susceptibility to infection and a reduced response to vaccination. Immunosenescence affects both the innate and adaptive immune systems and is manifested as alterations in both numbers and functions of the various immune cell types.

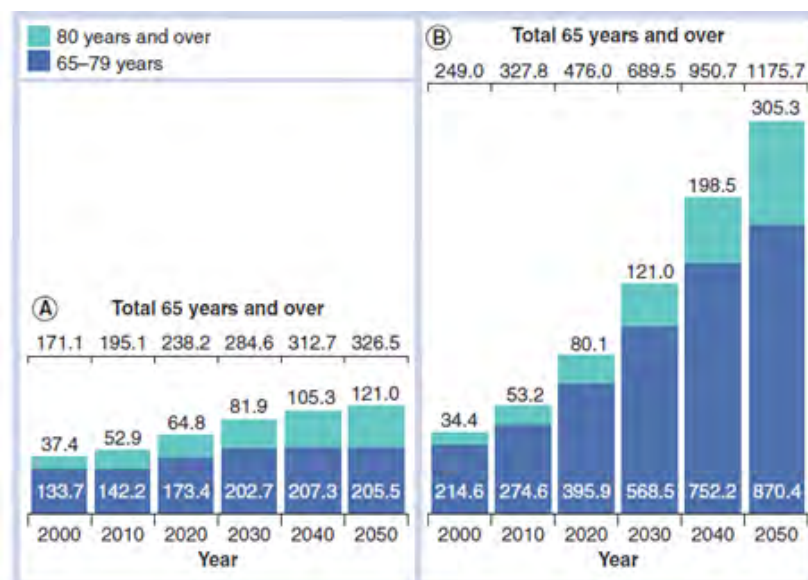


Figure 36. Vaccination percentage for people 65 and older. Population aged 65 years and over for developed and developing countries by age: 2000-2050 (in millions). (A) Developed countries. (B) Developing countries. Source: (Maggi, 2010).

The most important reasons relate to the fact that infectious diseases in this population tend to be more severe and have a greater impact on health outcomes, such as morbidity, disability, quality of life and mortality. For example, pneumonia and influenza are the fourth most common cause of death in adults aged over 65 years and the prevalence increases from approximately ten cases per 100,000 in adults aged 55–64 years to approximately 500 cases per 100,000 in those aged 85 years or over. Death from pneumonia occurs more than twice as often in older adults compared with younger adults. The increased severity of infectious diseases in the older adult combined with a markedly increased number of comorbidities in this group, leads to much higher level of hospitalizations.

6.2.1 Vaccines for Therapeutic Uses

In the pharmaceutical companies it is exploring whether vaccines can do *more than prevent disease* and have a number of therapeutic vaccines in clinical development that may be used as potential treatments for chronic conditions or diseases. It is believed that therapeutic vaccines may have longer-lasting benefits compared to traditional medicines and are currently conducting clinical trials with vaccines targeted towards:

- **Prevenar.** The most prominent vaccine that is promoted from WHO against pneumococcal disease. The PREVNAR 13[®] (Pneumococcal 13-valent Conjugate Vaccine [Diphtheria CRM₁₉₇ Protein]) vaccine is a single injection approved for adults 18 and older to help prevent pneumococcal pneumonia and invasive disease caused by 13 strains of *Streptococcus pneumoniae*. PREVNAR 13[®] is not 100% effective and will only help protect against the 13 strains included in the vaccine (www.prevenar13.com).

The adult immunisation enterprise is more complex, encompassing a wide variety of vaccines and a very diverse target population. Some vaccines are universally recommended for adults, while others are recommended for certain age groups, targeted to individuals with specific risk factors or targeted to particular combinations of age and risk factors (Pfizer, 2016).

6.2.2 Recommendations for vaccines promotion

CAPiTA: CAPiTA is the largest vaccine efficacy trial ever conducted for vaccines against pneumococcal diseases. It is a double-blind, randomized, placebo-controlled efficacy study to assess vaccine-mediated prevention of community-acquired

pneumonia (CAP). It involves approximately 85,000 subjects aged 65 years and older and is the first ever conducted with a conjugated vaccine to evaluate CAP at this scale. CAPIITA was designed to evaluate whether Prevenar 13 (a conjugated pneumococcal polysaccharide vaccine) is effective in preventing CAP caused by the 13 pneumococcal serotypes included in the vaccine. However, even in many high-income countries, only influenza vaccine is offered free of charge to the elderly. As with recent childhood vaccines, many new and emerging vaccines for adult populations are relatively expensive. For example, the 13-valent pneumococcal conjugate vaccine and live-attenuated zoster vaccine are priced upwards of 90\$ per dose (US price, 2015). Since the majority of vaccines have been developed for children, economic evaluations of vaccination programmes have tended to focus on this age group. While programmes targeted at older adults may induce some herd effects, there are other important challenges that have received less attention. For example, the economic evaluation of programmes targeted at the elderly are often subject to important age and time effects in relation to vaccine efficacy as well as the distribution of the disease risk and comorbidities between individuals. The interaction and impact of childhood vaccination programmes on adult programmes targeted at the same pathogen is also important to consider (*Dirmesropian et al., 2016*).

Global Vaccine Action Plan (GVAP): it was coordinated by the Decade of Vaccines Collaboration, a group of leading international vaccine experts, and represents the collective vision of hundreds of global health stakeholders to extend the full benefits of immunisation to all people, regardless of where they are born, who they are, or where they live. It focuses on the health needs of people at all stages of life and promotes greater coordination and synergies between immunisation and other child, adolescent and reproductive health interventions leading to healthier communities everywhere. The Decade of Vaccines Collaboration is an effort that has brought together diverse organisations, experts, scientists and governments to develop a Global Vaccine Action Plan that will stimulate the discovery, development, and delivery of lifesaving vaccines, to achieve the vision of a world in which all individuals and communities enjoy lives free from vaccine-preventable diseases. Its mission is to extend, by 2020 and beyond, the full benefits of immunisation to all people, regardless of where they are born, who they are, or where they live (*Global Vaccine Action Plan 2011–2020*).

According to the WHO, countries can likely afford the aging of its populations if governments, international organisations and civil society enact active aging policies

and programs that enhance the health, participation and security of older citizens. Preventive services consist of screening tests, counseling, immunisations or medications used to prevent disease, detect health problems early, or provide people with the information they need to make good decisions about their health. If undertaken together, efforts to extend the coverage of existing vaccines and introduce new vaccines have the potential to prevent millions of future deaths, as well as hundreds of millions of cases of disease over the next decade.

SAATI recommendations: at EU and national level, the SAATI partnership recommends that the following steps be taken:

- incorporate life-course immunisation into EU and national level healthy and active aging policies or public health and prevention strategies to prevent infectious diseases
- expand opportunities for the whole EU population to receive vaccination across the life-course as a part of national immunisation policies
- work with healthcare professionals to improve their leadership in recommending immunisation across the life-course, as well as improving their own vaccination rates

Enhance the European surveillance and monitoring system to better measure the burden of infectious diseases. In order to give impetus to effective adult vaccination programmes and to stimulate discussions about the value of life-course immunisation in promoting healthy aging, the SAATI Partnership calls for the establishment of recommendations and develop strategies for their implementation (*SAATI report 2013*).

A 50+ vaccination programme: Guidelines are increasingly recommending preventive services starting at 50 years of age and policymakers are considering such a recommendation for pneumococcal vaccination (*Mogasal et al, 2011*). Such a programme has several potential health benefits:

- 1) the prevalence of cardiovascular death at 1 year was significantly lower in patients receiving vaccination compared with those who were not vaccinated
- 2) antibacterial vaccines fight against antibiotic resistance by reducing the prescription of antibiotics, thereby contributing to a reduction of healthcare costs

As to promote vaccination the following actions should be taken:

- implement national immunisation schedules, including for higher age groups;
- continue to provide data on vaccine-preventable diseases and vaccination coverage among older people in order to obtain a better understanding of disease epidemiology; and
- ensure implementation of infectious disease control programmes in institutions, extending beyond hospitals to take in other facilities, including those for older people (*Strategy and action plan for healthy ageing in Europe, 2012-2020*).

6.2.3 Costs of vaccination

Immunisation is one of the most cost-effective preventive measures for older people. Influenza and pneumococcal vaccines are cost saving in the short-term and cost-effective over the longer term after accounting for improved life expectancy and suggesting that for every 1 euro invested in adult vaccination commencing at the age of 50 years would yield 4.02 euros over the remaining lifetime of the cohort (*SAATI report 2013*). Moreover, not only does vaccination prevent morbidity and mortality due to pneumococcal disease and influenza-related complications but economic studies have shown it also reduces costly hospitalizations and admissions to long-term care facilities. The costs related to influenza alone ranged from between 0,5-1% of the GDP in 2006 for high-fatality scenarios and larger still for an extreme pandemic scenario and it was estimated that about 275.000 quality-adjusted life years (QALYs) would be saved if influenza vaccination were offered annually to all people after 50 (*Maciosek, 2006*).

Guidelines

Vaccine guidelines that advocate immunisation in adults aged up to 60 years and an international policy brief that explores the importance of life-course vaccination have been proposed. Vaccination can provide cost-effective protection against a host of diseases throughout life, but remains an underused public-health strategy in adults for the promotion of healthy aging. Without specific vaccination programmes for the adult population aged over 50 years, infectious diseases will continue to be a cause of substantial morbidity and mortality in late adulthood. The reasons for low vaccination rates among adults were identified and the four common determinants for the successful implementation of 50+ vaccination programmes were examined: vaccination programme objectives, the role of healthcare professionals, access to

vaccines, and public awareness. To achieve the goal of healthy aging, nationally customised measures should be instigated to address these determinants in the 50+ age group and to ensure access to vaccination for those who are expected to benefit. The high burden of infectious diseases in late adulthood is surprising considering that many of the diseases can be prevented by vaccination. Unfortunately, with the exception of the seasonal influenza vaccine, many adults believe that vaccination is relevant only for children, and awareness of adult vaccines is low (*Michel, 2010*). In 2003, the WHO called for influenza vaccination rates to reach 50% by 2005 and 75% by 2010. Later, the European Parliament, the U.S. Centers for Disease Control and Prevention (CDC) and the Advisory Committee on Immunisation Practices (ACIP) approved many closed targets. However, the 2006-7 vaccine coverage rates in many European countries were below in the 50-60 age group. Adult vaccination rates for other immunisable conditions like pertussis or tetanus-which are less well advertised by public health officials and the media-are even lower. While the WHO and the European Parliament have set common influenza vaccination rate goals for Europe, individual countries have authority to set their own schedules for influenza and other immunisable conditions. There are common licensing standards for new vaccines across the European Union, but each country determines which vaccines to use, sets its own schedule and organizes its own vaccination programme.

6.3 Diagnostics

Screening tests are laboratory tests that are used to identify individuals with or at increased risk for a particular condition or disease before they may even be experiencing symptoms or realise they may be at risk. The information derived from these tests can be used to counsel patients about their risks or likelihood of developing the condition or disease. Screening tests also help to detect disease in its earliest and most treatable stages. Therefore, screening tests are most valuable when they are used to screen for diseases that are serious and treatable, so that there is a benefit to detecting the disease before symptoms begin. They should be sensitive - that is, able to correctly identify those individuals who have a given disease. A positive screening test often requires further testing with a more specific test, which can correctly exclude those individuals who do not have the given disease, in order to confirm a diagnosis. Many routine tests performed at regular health examinations fall into the screening category, such as cholesterol testing and cervical smears for women. A diagnostic test may be used for screening purposes, although a diagnostic test is generally used to confirm a diagnosis in an individual

who usually has signs, symptoms, or other evidence of a particular disease. As you get older, the number and frequency of screening tests that are recommended change (<http://www.labtestsonline.org.au/learning/list-of-screeningrecommendations>).

6.3.1 Screening tests for heart diseases

Regular cardiovascular screening is important because it helps detect risk factors in their earliest stages and by this way, the risk factor can be treated with lifestyle changes and pharmacotherapies, if appropriate, before it ultimately leads to the development of cardiovascular disease. However, if someone do have test results that are less than ideal, it doesn't mean that is destined to develop a serious cardiovascular disease. On the contrary, it is a good chance to begin changing health in a positive way. For many patients, screening results can serve as a wake-up call. Higher than optimal cholesterol or body mass index, for example, may drive home the message that it's time to modify diet and get more physical activity.

Advanced obstructive coronary heart disease (CHD) can exist with minimal or no symptoms, with manifestations that can progress suddenly and/or rapidly. The first clinical manifestation of CHD, acute myocardial infarction (MI), unstable angina, or sudden cardiac death, is often associated with significant morbidity and mortality. The rationale for early detection of CHD is that detection during the subclinical stages of disease might permit the reliable identification of subjects at increased risk of an adverse cardiac event and that appropriate therapy (eg, lipid lowering) might improve the prognosis of those at high risk. Other rationales for screening include certain high-risk occupations (eg, pilots, bus drivers, etc) where an acute cardiac event could endanger large numbers of people, or individuals with higher perceived risk of CHD who are beginning an exercise program. Although screening can identify patients with CHD at increased risk, there is a paucity of evidence that such screening actually improves outcomes. The primary purpose of screening for CHD is to identify patients whose prognosis could be improved with an intervention (in this case, medical therapy for risk factors or coronary revascularization) (*Bax et al, 2016*). Most regular cardiovascular screening tests should begin at the age of 20.

The main screening tests recommended for optimal cardiovascular health are the following below:

- 1) Blood pressure is one of the most important screenings because high blood pressure usually has no symptoms so it can't be detected without being measured.

High blood pressure greatly increases risk of heart disease and stroke.

2)Fasting Lipoprotein Profile (cholesterol and triglycerides). A fasting lipoprotein profile taken every four to six years, starting at age 20. This is a blood test that measures total cholesterol, LDL (bad) cholesterol, HDL (good) cholesterol and triglyceride. Older women tend to have higher triglyceride levels than men. Like high blood pressure, often cholesterol and triglycerides can be controlled through lifestyle changes or medication. Periodic cholesterol screening for early detection and treatment can decrease hospital and ambulatory services, prevent premature mortality from coronary heart disease, and avoid considerable disability, distress and pain.

3)Blood glucose. It starts at age 45, the blood glucose level must be checked at least every three years. High blood glucose levels increases the risk of developing insulin resistance, prediabetes and type 2 diabetes. Untreated diabetes can lead to many serious medical problems including heart disease and stroke. For persons who are overweight and they have at least one additional cardiovascular risk factor, doctors may recommend a blood glucose test even if the person is not yet 45, or more frequently than every 3 years. In the figure below the most important screening tests are presented:

Recommended schedule for screening tests

Recommended Screenings	How Often?	Starting when?
Blood pressure	Each regular healthcare visit or at least once every 2 years if blood pressure is less than 120/80 mm Hg	
Cholesterol ("fasting lipoprotein profile" to measure total, HDL and LDL cholesterol, and triglycerides)	Every 4-6 years for normal-risk people; more often if any you have elevated risk for heart disease and stroke	Age 20
Weight / Body Mass Index (BMI)	During your regular healthcare visit	Age 20
Waist circumference	As needed to help evaluate cardiovascular risk. This is a supplemental measurement if your BMI is greater than or equal to 25 kg/m ² .	Age 20
Blood glucose test	At least every 3 years	Age 45
Discuss smoking, physical activity, diet	Each regular healthcare visit	Age 20

Besides **blood tests** and a **chest X-ray**, tests to diagnose heart disease can include:

- **Electrocardiogram (ECG).** An ECG records these electrical signals and can help doctor detect irregularities in heart's rhythm and structure. Initial screening for coronary heart disease commonly involves stressing the heart under controlled conditions. These stress tests are able to detect the presence of flow-limiting blockages in the coronary arteries, generally in the range of at least a 50% reduction in the diameter of at least one of the three major coronary arteries. There are two basic types of stress tests; those that involve exercising the patient to stress the heart (exercise cardiac stress tests), and those that involve chemically stimulating the heart directly to mimic the stress of exercise (physiologic stress testing). Physiologic stress testing can be used for patients who are unable to exercise.
- **Holter monitoring.** A Holter monitor is a portable device you wear to record a continuous ECG, usually for 24 to 72 hours. Holter monitoring is used to detect heart rhythm irregularities that aren't found during a regular ECG exam.
- **Echocardiogram.** This noninvasive exam, which includes an ultrasound of your chest, shows detailed images of your heart's structure and function.
- **Cardiac computerized tomography (CT) scan.** This test is often used to check for heart problems. In a cardiac CT scan, you lie on a table inside a doughnut-shaped machine. An X-ray tube inside the machine rotates around your body and collects images of your heart and chest.
- **Cardiac magnetic resonance imaging (MRI).** For this test, you lie on a table inside a long tube-like machine that produces a magnetic field. The magnetic field produces pictures to help your doctor evaluate your heart (Tests and diagnosis, By Mayo Clinic Staff)

Besides these, the most accurate method of defining coronary heart disease remains the coronary angiogram, which reveals the existence of coronary arterial blockages (*American Health Association, 2014*).

6.3.2 Screening tests for cancer

Each year, approximately 350,000 persons are diagnosed with breast, cervical, or colorectal cancer in the United States, and nearly 100,000 die from these diseases. The U.S. Preventive Services Task Force (USPSTF) recommends screening tests for each of these cancers to reduce morbidity and mortality. *Healthy People 2020* sets national objectives for use of the recommended cancer screening tests and identifies the National Health Interview Survey (NHIS) as the means to measure progress. Data from the 2010 NHIS were analyzed to assess use of the recommended tests by age, race, ethnicity, education, length of U.S. residence, and source and financing of health care to identify groups not receiving the full benefits of screening and to target specific interventions to increase screening rates. Overall, the breast cancer screening rate was 72.4%, cervical cancer screening was 83.0%, and colorectal cancer screening was 58.6%. Continued monitoring of screening rates helps to assess progress toward meeting *Healthy People 2020* targets and to develop strategies to reach those targets. Any report of testing for cancer was categorized as a screening test. Reports of screening were used to determine the portion of the population up-to-date for screenings recommended by USPSTF (*Cancer Screening-United States, 2010*).

The Early Lung Cancer Action Project (ELCAP) is designed to evaluate baseline and annual repeat screening by low-radiation-dose computed tomography (low dose CT) in people at high risk of lung cancer. The diagnostic investigation of screen-detected non-calcified pulmonary nodules was guided by ELCAP recommendations, which included short-term high-resolution CT follow-up for the smallest non-calcified nodules. Low-dose CT can greatly improve the likelihood of detection of small non-calcified nodules, and thus of lung cancer at an earlier and potentially more curable stage. Although false-positive CT results are common, they can be managed with little use of invasive diagnostic procedures. It was confirmed that low-dose CT greatly increases the likelihood of detection of small non-calcified nodules and, thus, of lung cancer at an earlier and more curable stage (*Henschke et al, 1999*).

A definitive trial to evaluate a new technique for the detection of early lung cancer would be so expensive that no funding agency will underwrite such a trial without strong prospects for success. This difficulty is one that has beset the assessment, in large cohorts, of several new developments in lung-cancer diagnostics—for example, “diagnostic platforms”, an assembly of instruments capable of automated analysis of

sputum specimens for biomarkers. Fortunately, reports of the use of spiral computed tomography (CT) to screen for lung cancer have generated sufficient interest in validation of the technique. Thus the likelihood of assessing new biomarkers and biomarker based approaches on the back of the trials of spiral CT, with little increase in the cost of the trial, has become realistic. With the rapid increase in knowledge about the molecular events leading to lung cancer, it may become possible to use biomarkers (panel) to identify the early clonal phase of progression of lung cancer in high-risk populations, thus enabling cancers to be detected earlier than is possible with spiral CT. The use of biomarkers might also be a valuable as a complementary test to spiral CT, since the latter is not as sensitive for small central cancers as it is for small peripheral cancers. A hybrid CT-biomarker approach to lung-cancer screening may improve the robustness with which lung cancer of any cell type can be detected early. Likewise, advances in computed analysis have improved in-vitro methods of detection of early lung cancer because, however important the biomarker may be, having an instrument that can efficiently, precisely, and reproducibly analyse the exfoliated bronchial epithelial cells has been the greater challenge. One high-throughput diagnostic platform for the analysis of biomarker expression in bronchial epithelial cells recovered from sputum samples uses the same automated, computer-driven image-processing system that has been successfully applied to keep costs down in cervical-cancer screening. Spiral CT is being used routinely in the investigation of patients with emphysema or osteoporosis. Research at the Mayo Clinic has indicated that CT can be used for screening for lung cancer and emphysema simultaneously and the investigators are extending their analysis to include osteoporosis and cardiovascular disease. If validated, the simultaneous screening for coexisting disorders would be of enormous public-health value, so a rational approach to the rapid evaluation of the use of spiral CT in an integrated screening programme that includes analysis of biomarkers is needed (*Mulshine et al, 2000*).

6.3.3 Screening tests for COPD

In adults without a diagnosis of asthma the cause of about 90% of airflow limitation is chronic obstructive pulmonary disease (COPD) due to cigarette smoking. COPD is easily detected in its preclinical phase, using office spirometry. Successful smoking cessation (a cost-effective intervention) prevents further disease progression in most patients. Though almost all hospitals have a pulmonary function testing (PFT) laboratory, and almost all allergy and pulmonary specialists have spirometers, less

than half of primary care practitioners use spirometry in their practices. The American Association for Respiratory Care supports the National Lung Health Education Program (NLHEP) to promote the appropriate use of spirometry by primary care practitioners for the detection of COPD in adult smokers. However, screening for COPD remains controversial, since it has not yet been proven that the staff in primary care offices can attain the same low misclassification rate as can experienced and certified pulmonary function technologists who perform spirometry in PFT laboratories. A recent COPD workshop summary stated that “there are no data to indicate that screening spirometry is effective in directing management decisions or in improving COPD outcomes. Chronic obstructive pulmonary disease (COPD) is a substantially underdiagnosed disorder, with the diagnosis typically missed or delayed until the condition is advanced. Spirometry is the most frequently used pulmonary function test and enables health professionals to make an objective measurement of air flow obstruction and assess the degree to which it is reversible.

As a diagnostic test for COPD, spirometry is a reliable, simple, non-invasive, safe, and non-expensive procedure. Early diagnosis of COPD should provide support for smoking cessation initiatives and lead to reduction of the societal burden of the disease, but definitive confirmation of both proves elusive. Despite substantial effort and investment, implementation of quality spirometry is deficient because of several hurdles and limitations, described in this Review. All in all, spirometry is recognized as the essential test for diagnosis and monitoring of COPD. Early intervention following early identification of lung function abnormalities can lead to improved smoking cessation, work-place or home environmental changes, and increased awareness of and attention to cancer, cardiac health, and non pulmonary health issues associated with abnormal lung function. Early identification of lung function abnormalities in relatively asymptomatic patients may provide “teachable moments” (ie, moments when the patient has increased awareness of medical risks and a more positive response to medical education and intervention). Even when test quality is good, diagnostic spirometry is highly recommended to confirm the initial abnormal spirometry findings prior to initiating an expensive work-up or interventions with negative economic consequences, such as a recommendation to change jobs. When airway obstruction is identified in a smoker, the primary intervention is smoking cessation, since it is currently the only intervention that has been demonstrated to improve the decline in lung function and thereby reduce the risk of disabling COPD. In asymptomatic smokers with airway obstruction, smoking cessation is the only intervention with proven value. Referral to a subspecialist for further diagnostic

testing should be considered in some cases. In the event that a patient with airway obstruction continues to smoke, renewed/increased effort to assist with smoking cessation is essential (*Soriano JB, 2009*).

Knowledge of the approximate prevalence of disease is a prerequisite to interpreting screening test results. Screening can improve health; strong indirect evidence links cervical cytology programmes to declines in cervical cancer mortality. However, inappropriate application or interpretation of screening tests can rob people of their perceived health, initiate harmful diagnostic testing, and squander health-care resources. Screening is a double-edged sword, sometimes wielded clumsily by the well-intended. Although ubiquitous in contemporary medical practice, screening remains widely misunderstood and misused. Screening is defined as tests done among apparently well people to identify those at an increased risk of a disease or disorder. Those identified are sometimes then offered a subsequent diagnostic test or procedure, or, in some instances, a treatment or preventive medication. Looking for additional illnesses in those with medical problems is termed case finding; screening is limited to those apparently well. Screening can improve health. For example, strong indirect evidence lends support to cytology screening for cervical cancer. Insufficient use of this screening method accounts for a large proportion of invasive cervical cancers in industrialised nations. Other beneficial examples include screening for hypertension in adults; screening for hepatitis B virus antigen, HIV-1, and syphilis in pregnant women.

Does a screening programme really improve health?

Even worthless screening tests seem to have benefit. This cruel irony underlies many inappropriate screening programmes used today. Two common pitfalls lead to the conclusion that screening improves health; one is an artifact and the other a reflection of biology. Moreover, assume that mammography screening leads to cancer detection 2 years earlier than would have ordinarily occurred, yet the screening does not prolong life. On average, women with breast cancer detected through screening live 2 years longer than those with cancers diagnosed through traditional means. This gain in longevity is apparent and not real: this hypothetical screening allows women to live 2 years longer with the knowledge that they have cancer, but does not prolong survival, an example of zero-time shift.

Screening can promote or impair health, depending on its application. Unlike a diagnostic test, a screening test is done in apparently healthy people, which raises

unique ethical concerns. Sensitivity and specificity tend to be inversely related, and choice of the cut-off point for abnormal should indicate the implications of incorrect results. Even very good tests have poor predictive value positive when applied to low-prevalence populations. Lead-time and length bias exaggerate the apparent benefit of screening programmes, underscoring the need for rigorous assessment in randomised controlled trials before use of screening programmes (*Grimes DA et al, 2002*).

7. European projects support promotion of healthy aging

During the last 15-20 years there has been a great effort on promoting strategies aiming at healthy aging. As shown in figure 37, these strategies try to compress morbidity by slowing the processes of aging, either by targeting the fundamental biological processes of aging or by preventing or treating individual age-associated clinical disorders.

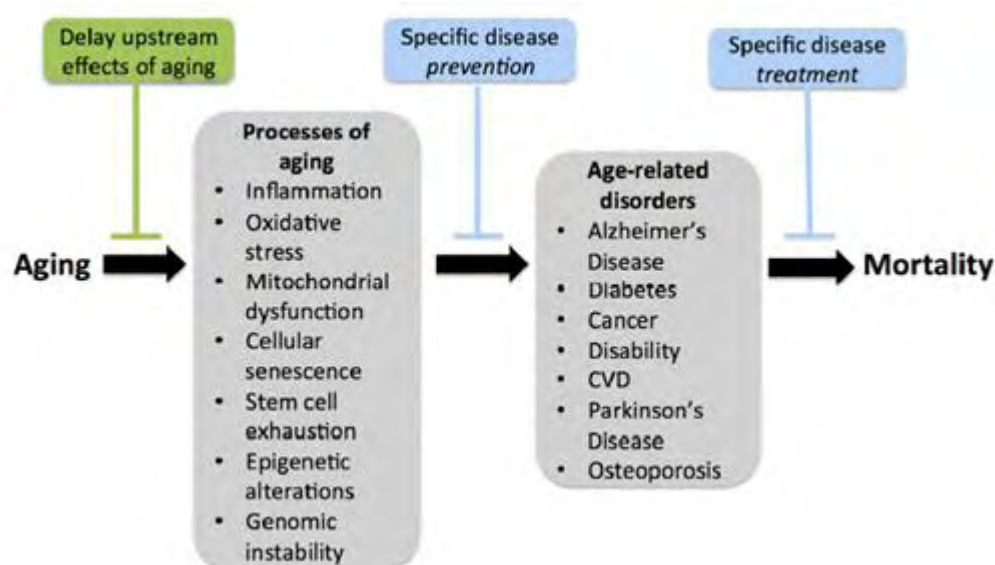


Figure 37. Compressing morbidity by slowing the process of aging (Douglas R. Seals et al, 2014).

Aging EU population represents a substantial sociological and economical threat to social and healthcare system sustainability affecting many sectors of the economy. So Europe must play a leading global role. Action to improve healthy aging and reduce health inequities, therefore include (a) action within the health sector or health system, including social care and (b) action on the broader social determinants of health-for the later, these are actions that often lay outside of the health sector or health system, such as the built environment or economic policies (*Sadana, 2016*).

There has been a series of actions held by European Organisations to promote healthy aging and ensure a high quality of life in people of later life stages (people aged 50 plus). According to the WHO, most countries have been slow to generate and use evidence to develop an effective health response to new disease patterns and aging populations. In light of this, WHO mounted a multicountry longitudinal study designed to simultaneously generate data, raise awareness of the health issues of older people and inform public policies.

The programs and actions that exist in Europe and promote healthy aging are the following below:

The Silver Economy: a project supported by the EU Commission to tackle the challenge of an aging society and develop strategies. The European Commission has been pursuing policy initiatives relevant to the Silver Economy on:

- the need for ensuring accessible, high-quality and sustainable long-term care systems and for promoting a life course and social investment approach to social protection systems and services
- stakeholder-driven innovation for active and healthy aging through large scale innovation actions such as the European Innovation Partnership on Active and Healthy Aging and the Active and Assisted Living Joint Programme
- new skills and entrepreneurship in relation to the need of an aging population, supported by a new Knowledge and Innovation Community on Healthy Living and Active Aging under the European Institute of Technology
- smart specialization and eligibility for regional funding has led 110 European regions to identify Active and Healthy Aging as a smart specialization priority
- the accessibility, quality and financial sustainability of health and social care systems
- research and innovation in response to demographic change through Horizon 2020.

The Silver Economy can be defined as the economic opportunities arising from the public and consumer expenditure related to population aging and the specific needs of the population over 50. The Silver Economy comprises a large part of the general consumer economy, but with considerable differences in spending priorities and patterns and is driven both by the emergence of new consumer markets and by the need to improve the sustainability of public expenditure linked to aging. The already existing national and sectional initiatives provide examples for public policy actions in

the area of Silver Economy. The French government's Silver Economy strategy includes the development of French voluntary norms and quality labels for Silver Economy goods and service providers. In response to the emergence of different national initiatives the European Standardisation Organisations announced in June 2014 their readiness to work with business and other stakeholders, including groups representing older citizens and consumers to develop standards for age-friendliness that will meet the needs of an aging population and support the growth of the Silver Economy at European scale (*Silver Economy. European Commission, Innovation Union*).

IROHLA: Intervention Research on Health literacy among aging population, which aims at developing evidence based guidelines to improve healthy equity in the aging population and promote policies for healthy aging. It is supported by EuroHealthNet (*IROHLA*).

CIRI: European Centre for Innovation, Research and Implementation. It aims at promoting evidence-based approaches to health and wellbeing across all groups in society. Members include leading centres of research and public health that are committed to improving the uptake of evidence in policy making processes. It is supported by EuroHealthNet (*Centre for Innovation, Research & Implementation in Health & Wellbeing*).

SHARE: Survey of health, aging and retirement in Europe is a multidisciplinary and cross-national panel database of micro data on health, socio-economic status and social and family networks of approximately 123,000 individuals aged 50 and older. SHARE responds to a Communication by the European Commission calling to 'examine the possibility of establishing, in co-operation with Member States, European Longitudinal Aging Survey'. It has become a major pillar of the European Research Area, selected as one of the projects to be implemented in the European Strategy Forum on Research Infrastructures in 2006 and given a new legal status as the first ever European Research Infrastructure Consortium in March 2011. SHARE covers 27 European countries and Israel. It is funding from the European Commission (Horizon 2020), the US National Institute on Aging and national sources, especially the German Federal Ministry of Education and Research (*Survey of Health, Ageing and Retirement in Europe*).

Center of Healthy Aging at the National Council on the aging. It supports the expansion and sustainability of evidence-based health promotion and disease prevention programs in the community and online through collaboration with national,

state, and community partners. Its goal is to help older adults live longer and healthier lives via healthy aging programmes for influenza, falls and chronic diseases management. It is supported by WHO (*National Council on Aging*).

European Innovation Partnership on Active and Healthy Aging: a pilot initiative launched by the European Commission to foster innovation in the field of active and healthy aging. This programme will pursue a triple win for Europe:

1. enabling EU citizens to lead healthy, active and independent lives while ageing;
2. improving the sustainability and efficiency of social and health care systems;
3. boosting and improving the competitiveness of the markets for innovative products and services, responding to the ageing challenge at both EU and global level, thus creating new opportunities for businesses

and it will be realised in the three areas of prevention and health promotion, care and cure, and active and independent living of elderly people. The overarching target of this partnership will be to increase the average healthy lifespan by two years by 2020 (*EuroHealthNet Healthy Ageing*).

Strategy and action plan for healthy aging in Europe, 2012-2020: the WHO has organised a strategy and action plan for healthy aging in Europe, 2012–2020. It proposes strategic action areas and a set of interventions that will be in synergy with Health 2020, the new European policy framework supporting action across government and society for health and well-being, to which its strategic areas correspond. It is the first European strategy to bring together, in a coherent manner, the aging-related elements of the WHO Regional Office for Europe's work programme and to present them in the form of four strategic action areas and five priority interventions, together with three supporting interventions. The action plan is intended as a guide for Member States at different income levels or stages of aging policy development or demographic transition. The action plan has 4 main sections: (i) healthy aging over the life-course (ii) supportive environments (iii) health and long-term care systems fit for aging populations and (iv) strengthening the evidence base & research. The third section suggests five priority interventions: (i) promoting physical activity (ii) falls prevention (iii) vaccination of older people and infectious disease prevention in health care settings (iv) public support to informal care-giving,

with a focus on home care (v) geriatric and gerontological capacity-building among the health and social care workforce (*WHO, 2012, Strategy and action plan for healthy ageing in Europe, 2012-2020*).

The first European Summit on Innovation for Active and Healthy Aging took place in Brussels on 9 and 10 March 2015. Over 1400 leaders from government, civil society, investment and finance, industry and academia discussed how Europe can transform demographic change into opportunities for economic growth and social development. The event was organised by the European Commission in collaboration with the Active and Assisted Living Programme, AGE Platform Europe, the European Connected Health Alliance and Knowledge for Innovation (*European Commission, Innovation Union, 2015*).

The Summit built on the achievements of ongoing EU initiatives:

- 1) The European Innovation Partnership on Active and Healthy Aging launched in 2012
- 2) 'More years, better lives', the Joint Programming Initiative which enhances coordination and collaboration between European and national research programmes related to demographic change
- 3) Horizon 2020, the EU Research and Innovation Framework programme, in particular funding under Societal Challenge 1 for Innovative ICT solutions for active and healthy aging. It will be supported by a series of partnership between the public and private sectors. About 1,000 public and private sectors will be get together to this partnership in an Educational Incentive Program on active and healthy aging. This partnership aims to translate innovation into concrete solutions that assist elderly people in living healthy and independent lives. It is the biggest EU Research and Innovation programme ever with nearly 80 billion euros of funding available over 7 years (2014 to 2020) – in addition to the private investment that this money will attract. It promises more breakthroughs, discoveries and world-firsts by taking great ideas from the lab to the market. One domain of this program is the European Innovation Partnership (EIP) on Active and Healthy Aging, which will help to provide solutions to long-term aging. The EIP was launched in 2011 and aims to increase the healthy lifespan of EU citizens by two years by 2020. It is based on research to improve the understanding of health, disease, development and aging and to translate this knowledge into innovative and effective products, strategies,

interventions and services for the benefit of patients and all citizens (*European Commission, Innovation Union, 2015*).

4) The Active and Assisted Living Programme, where Member States in cooperation with the European Commission fund projects on applied research for innovative ICT-based products, services and systems for aging well (*Active and Assisted Living Programme, 2016*).

8. World Health Organisation actions

Complementary to these actions, the WHO has published specific prevention actions to fight the most frequent illnesses that spread fast all over the world. The most important of these actions is smoking cessation. In particular, WHO's actions for the five most common diseases are present below:

1) WHO response for CVDs: Although many CVDs can be treated or prevented, an estimated 17.1 million people die of CVDs each year. A substantial number of these deaths can be attributed to tobacco smoking, which increases the risk of dying from coronary heart disease and cerebrovascular disease 2-3 fold. The risk increases with age and is greater for women than for men. In contrast, cardiac events fall 50% in people who stop smoking and the risk of CVDs, including acute myocardial infarction, stroke and peripheral vascular disease, also decreases significantly over the first 2 years after stopping smoking. Under the leadership of WHO, all Member States (194 countries) agreed in 2013 on global mechanisms to reduce the avoidable NCD burden including a 'Global action plan for the prevention and control of NCDs 2013-2020'. This plan aims to reduce the number of premature deaths from NCDs by 25% by 2025 through 9 voluntary global targets (*WHO, 2013*). The sixth target in the Global NCD action plan calls for 25% reduction in the global prevalence of raised blood pressure. Raised blood pressure is one of the leading risk factors of CVDs. Reducing the incidence of hypertension by implementing population-wide policies to reduce behavioral risk factors, including harmful use of alcohol, physical inactivity, overweight, obesity and high salt intake, is essential to attaining the target. A total risk approach needs to be adopted for early detection and cost-effective management of hypertension in order to prevent heart attacks, strokes and other complications. The eighth target in the Global NCD action plan states at least 50% of eligible people should receive drug therapy and counselling to prevent heart attacks and strokes. Prevention of heart attacks and strokes through a total CVD risk

approach is more cost-effective than treatment decisions based on individual risk factors thresholds only and should be part of the basic benefits package for pursuing universal health coverage. Achieving this target will require strengthening key health system components, including health-care financing to ensure access to basic health technologies and essential NCD medicines (*Global action plan, 2013-2020. WHO, 2013*).

2) Cancer prevention strategies: the key mission of WHO Cancer Control Programme is to promote national cancer control policies plans and programmes, integrated to non-communicable diseases and other related problems. Its core functions are to set norms and standards, promote surveillance, encourage evidence based prevention, early detection, treatment and palliative tailored to the different socioeconomic settings. In 2013, WHO launched the Global Action Plan for the Prevention and Control of Noncommunicable Diseases 2013-2020 that aims to reduce by 25% premature mortality from cancer, CVD, diabetes and chronic respiratory diseases by 2025 (*WHO, 2013*). Some of the voluntary targets are most relevant for cancer prevention aimed at reducing the prevalence of tobacco use by 30%. WHO and the International Agency for Research on Cancer (IARC), collaborate with other United Nations organisations within the UN Noncommunicable Diseases Interagency taskforce (2014) and partners to:

- increase political commitment for cancer prevention and control
- coordinate and conduct research on the causes of human cancer and the mechanisms of carcinogenesis
- monitor the cancer burden
- develop scientific strategies for cancer prevention and control
- generate new knowledge and disseminate existing knowledge to facilitate the delivery of evidence-based approaches to cancer control
- develop standards and tools to guide the planning and implementation of interventions for prevention, early detection treatment and care
- facilitate broad networks of cancer control partners and experts at global, regional and national levels
- strengthen health systems at national and local levels to deliver cure and care for cancer patients

- provide technical assistance for rapid, effective transfer of best practice interventions to developing countries

- 8.2 million people die each year from cancer, an estimated 13% of all deaths worldwide

- 70% the increase in new cases of cancer expected over the next 2 decades

- >100 cancer types exist, each requiring unique diagnosis and treatment (*International Agency for Research on Cancer, WHO*).

3) COPD prevention strategies: WHO recognizes that COPD is of major public health importance. The Organisation plays a role in coordinating international efforts against the disease. The aim of its strategy is to support Member States in their efforts to reduce the toll of disease, disability and premature death related to COPD. International action is needed to:

- increase public awareness of the disease to make sure patients and health professionals recognize the disease and are aware of the severity of associated problems

- organize and co-ordinate global epidemiological surveillance to monitor global and regional trends in COPD

- develop and implement an optimal strategy for its management and prevention.

Moreover, WHO leads the Global Alliance against Chronic Respiratory Disease (GARD), the Framework Convention on Tobacco Control and the Programme on Indoor Air Pollution. Firstly, GARD is a voluntary alliance of national and international organisations, institutions and agencies from a range of countries working towards a common goal of improving global lung health. Its vision is a world where all people breathe freely. GARD promotes an integrated approach that capitalizes upon synergies of chronic respiratory diseases with other chronic diseases and focuses specifically on the needs of low and middle income countries and vulnerable populations. Secondly, the Framework Convention on Tobacco Control was developed in response to the globalization of the tobacco epidemic, with the aim to protect billions of people from devastating impact of tobacco consumption and exposure to tobacco smoke. It is the first global health treaty negotiated from the WHO and has been ratified by more than 140 countries (*Global Alliance against Chronic Respiratory Diseases, WHO*). Finally, the Programme on Indoor Air Pollution collects and evaluates the evidence for the impact of household energy on health

and for the effectiveness of interventions in reducing the health burden on children, women and other vulnerable groups. Cooking and heating with solid fuels on open fires or traditional stoves results in high levels of indoor air pollution. Indoor smoke contains a range of health-damaging pollutants, such as small particles and carbon monoxide and particulate pollution levels may be 20 times higher than accepted guideline values (WHO).

4)Pneumococcal & influenza Prevention: the most effective way to prevent the disease is vaccination. Safe and effective vaccines are available and have been used for more than 60 years. Among healthy adults, influenza vaccine provides protection, even when circulating viruses may not exactly match the vaccine viruses. However, among the elderly, influenza vaccination may be less effective in preventing illness but reduces severity of disease and incidence of complications and deaths. Vaccination is especially important for people at higher risk of serious influenza complications, and for people who live with, or care for, high risk individuals.

WHO recommends annual vaccination for:

- pregnant women at any stage of pregnancy
- children aged between 6 months to 5 years
- elderly individuals (aged more than 65 years)
- individuals with chronic medical conditions
- health-care workers.

Due to the constant evolving nature of influenza viruses, the WHO Global Influenza Surveillance and Response System (GISRS) – a network of National Influenza Centres and WHO Collaborating Centres around the world – continuously monitors the influenza viruses circulating in humans and updates the composition of influenza vaccines twice a year. For many years, WHO has updated its recommendation on the composition of the vaccine that targets the 3 (trivalent) most representative virus types in circulation (two subtypes of influenza A viruses and one influenza B virus). Starting with the 2013–2014 northern hemisphere influenza season, a 4th component is recommended to support quadrivalent vaccine development. Quadrivalent vaccines include a 2nd influenza B virus in addition to the viruses in trivalent vaccines, and are expected to provide wider protection against influenza B virus infections. A number of inactivated influenza vaccines and recombinant influenza

vaccines are available in injectable form. Live attenuated influenza vaccine is available as a nasal spray.

WHO, through the GISRS network, in collaboration with other partners, monitors influenza activity globally, recommends seasonal influenza vaccine compositions twice a year for the Northern and Southern hemisphere influenza seasons, and supports Member States' efforts to develop prevention and control strategies. It works to strengthen national, regional and global influenza response capacities including diagnostics, antiviral susceptibility monitoring, disease surveillance and outbreak responses, and to increase vaccine coverage among high-risk groups and prepare for the next influenza pandemic (*Influenza seasonal, Fact sheet November 2016*).

Many deaths from respiratory diseases could be prevented by tackling some of the main risk factors, notably smoking, and also by increasing vaccination coverage for influenza and pneumonia, particularly among more vulnerable groups. Better management of both asthma and COPD in primary care could also help reduce exacerbations (*Pneumonia WHO, Fact sheet, September 2016*).

9. Discussion

In so – called developed societies [OECD countries] the main causes of morbidity and fatality are chronic non-infectious diseases. These kinds of diseases have been resulted due to long – time exposure of human organism to several unhealthful factors which, regarding the role they play in a disease's development, are called risk factors. Every chronic diseases caused not just by one risk factor but also the whole collaboration of several risk factors' causal nexus, risks that create cumulative damages. Smoking, lack of physical activity and exercise, unhealthy diet and obesity are included in these unhealthful factors. These factors could be handled effectively if, public policy approaches are endorsed. These policies should also involve a lot of entities (mass media, educational programs) (*Milio N., 1989*). Prevention actions have to focus on people over 50, because from this age and on aging begins and people must be convinced and supported to follow a healthier lifestyle, get subjected to diagnostic tests and vaccination. In this way, people over 50 can, protect themselves against diseases' risk factors and continue to have a good quality of life.

Elderly are a vital part of urban, rural and tribal communities, so it is important to support their living and aging well. The need for extending working lives as life-expectancy increases has been and continues to be extensively discussed in OECD member countries. Delayed retirement raises the level of GDP, and therefore, the capacity to finance social programmes, in general. The economic impact of aging populations on public sector's spending on pensions and health over coming decades can substantially be mitigated if lengthening lifetimes are accompanied by parallel increases in the age of retirement (*Health at a Glance, 2016*). Once in retirement, healthier individuals can also take care of their partners or elderly relatives who are still alive, younger generations can act as a labour reserve for community support activities. Thus, they can become an important resource for the economy and for society in a broad sense.

Greece, having followed the example of other developed countries, has achieved significant progress regarding both the control and the limitation of plenty of infectious diseases via massive vaccination and constant improvements on nutrition and hygiene living conditions. To cite an example, smallpox and diphtheria have been fully eliminated. However, past infectious diseases have made a comeback, such as poliomyelitis and tuberculosis, because of unvaccinated economic immigrants and refugees, not to mention the fact that newly – appeared diseases, like AIDS, have caused great concern.

Due to the particularity of the situation mentioned above, nothing has to be taken for granted when it comes to applying prevention schedules as well as assertive formulation where appropriate. Nevertheless, despite its positive attitude, Greece has not managed to establish a uniform prevention schedule since prevention seems to hold low position as regards not only the operators but citizens, too. Daily life and consumption habits, especially eating habits, constitute negative social standards which are frequently incident to social success combined with unhealthy beverages and foods' consumption and lack of physical activity and exercising. The state ought to be well – organised and successfully cooperative with a lot of social entities in order to accomplish effective implementation of preventive measures. Finding efficient amounts of financial resources for the specific implementation seems quite troublesome, though. Internationally much financial resources are disposed in order to cure or prevent diseases while in Greece prevention is in a low priority.

However, while there is considerable evidence about the linkages between specific policy instruments and improved health, it still remains unclear as to which are most effective and cost-effective. Within this policy context, government will want to focus on areas where the costs of intervention are low and the payoffs are high. Changing lifestyle factors appear particularly important: cessation of smoking, reduced alcohol intake and particularly more exercise, seem to be the most promising measures to improve the health of the elderly. But much of the success of many existing programmes appears to depend on the willingness of the elderly themselves and studies reviewed here suggest that it may be very difficult to engineer sustained changes in their behaviour. With this in mind, issues of prevention may need to start early: encouraging 'good' behaviour at an early age may help ensure that these healthy lifestyles persist into older age. As emphasized by SNIPH (2007): 'It is never too early and never too late to promote health' (Oxley, 2009).

Population aging, combined with tight budgetary constraints will require profound adaptations to the health systems of EU countries, in order to promote more healthy aging and respond in a more integrated and patient-centred way to growing and changing health care needs. On average across EU countries, the share of the population aged over 65 has increased from less than 10% in 1960 to nearly 20% in 2015 and is projected to increase further to nearly 30% by 2060 (*Health at a Glance*, 2016).

As EU countries take up these challenges, there will be a need to further improve the planning and organisation of services to improve the resilience of health systems to be able to respond to new needs in the most efficient way. Health systems will also have to remain fiscally sustainable. Achieving further efficiency gains in hospital, pharmaceutical spending, administration and other health spending items will be crucial to meet the growing demands with limited resources. Many of the required improvements in health systems will involve at least some upfront investment and some initiative actions from the government, such as the establishment of an organisation of Health Promotion, in Greece, whose main role will be the application of new, complete and effective Health Prevention and Promotion programmes. Because prevention saves human lives and relieves the pain (Jossey-Bass; 2007). As it is highlighted by the program of Health Treatment: 'it's main role is to ensure that people adopt and provide healthy ways of living, use social health services rationally and make decisions at an individual and social level that ameliorate the public health status and the environment'.

Conclusion

As a result of this thesis, it is found that life expectancy has increased in OECD countries and people, while they are living longer suffer from many chronic diseases that corrupt their quality of life. We identified evident and simple prevention ways that people have to follow in order to enjoy a 'Healthy Aging' at later stages of life.

In Europe and many developed countries worldwide, there is a large number of organisations and research foundations that try to find and promote the best and less costly prevention ways. While these efforts are very important and well organised, they are fragmentary too. That means that the project of prevention ways for Healthy Aging must take a global and more organised dimension and be promoted as a Uniform Prevention Program and Promotion of Health and Healthy Aging.

In Greece while there have been some efforts to promote prevention, as the Vaccination Program that has been promoted in 2011, the result was not satisfactory. Health spending is much increased in comparison to prevention ways and quality of life that both remain bad. So, as we all know the reasons that cause diseases and the ways to prevent them and ameliorate quality of life, we conclude that there is a need for a well organised program from the European Commission and each country to focus on prevention, and ensure productive and healthy aging.

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