CHAPTER

3

Aging Population: Challenges and Opportunities in a Life Course Perspective

Angelo Scuteri[a] *and Peter M. Nilsson*[b]

[a]Hospital San Raffaele Pisana, Istituti di Ricovero e Cura a Carattere Scientifico (IRCCS), Rome, Italy; [b]Department of Clinical Sciences, Lund University, Skåne University Hospital, Malmö, Sweden

The European Commission has identified demographic change and population aging as one of the six "Grand Challenges" facing Europe of today. Indeed, the number of Europeans aged 65+ years will almost double over the next 50 years, from 85 million in 2008 to 151 million in 2060. At the population level, over the last 100 years we have gained 30 years in average life expectancy [1]. Figure 3.1.

This gain in life expectancy has not followed the adagio "more years, better life" as it often means a higher number of years with disability, at least until now. Indeed, two out of three people have experienced at least two chronic medical conditions at the time of retirement. The prevalence of disabilities increases dramatically with age, from 30% in those aged 65–74 years to 50% in the 75–84 age group and 80% in those over 85 years. This is also the case for the prevalence of cardiovascular diseases, dementia, and mobility loss, suggesting a relationship between both these observations. The annual incidence of functional decline in community-dwelling people over 75 years old is nearly 12%. Notably, more than 700 billion Euros in the European Union is spent on the treatment of chronic disease, representing 70% of total healthcare costs.

AGING POPULATIONS—BETWEEN DECREASING MORTALITY AND IMPROVED HEALTH

The dramatic and unexpected gain of about 30 years in life expectancy in the so-called "developed countries" is thus one of the most important human achievements of the last century. Notably, the yearly increases in life expectancy since 1950 was similar in most developed countries [2]. Understanding the potential relative role of decreasing morbidity and mortality and of improved health conditions is also critical to try to foresee future trends in morbidity and disability, which clearly impact on the societal resources required to face the challenges of population aging.

The primary factor contributing to the dramatic increase in life expectancy observed in the last 150 years is the improvement in infant survival due to combating infectious diseases early in life [3]. On the other hand, especially after the Second World War, gains in life expectancy are attributable to decreased mortality in adults. Of note, in the last 50 years, a significant and constant decrease in mortality at ages 80 years and older has also been recorded [4–5]. Indeed, in developed countries the average probability of survival from age 80 years to 90 years was 15% for women and 12% for men in 1950, but 37% and 25% in 2002, respectively [5].

Consistently, the over-80-year-old subjects, usually identified as the old-old subjects, represent the fastest growing segment of the population. At the beginning of the second millennium, subjects aged 90 or older were 2 million in the United States, representing the oldest 0.5% of the population. United Nation projections suggest that they will represent 2.5% of the US population, 5.5% of Japanese population, and >3% in European countries like Italy, France,

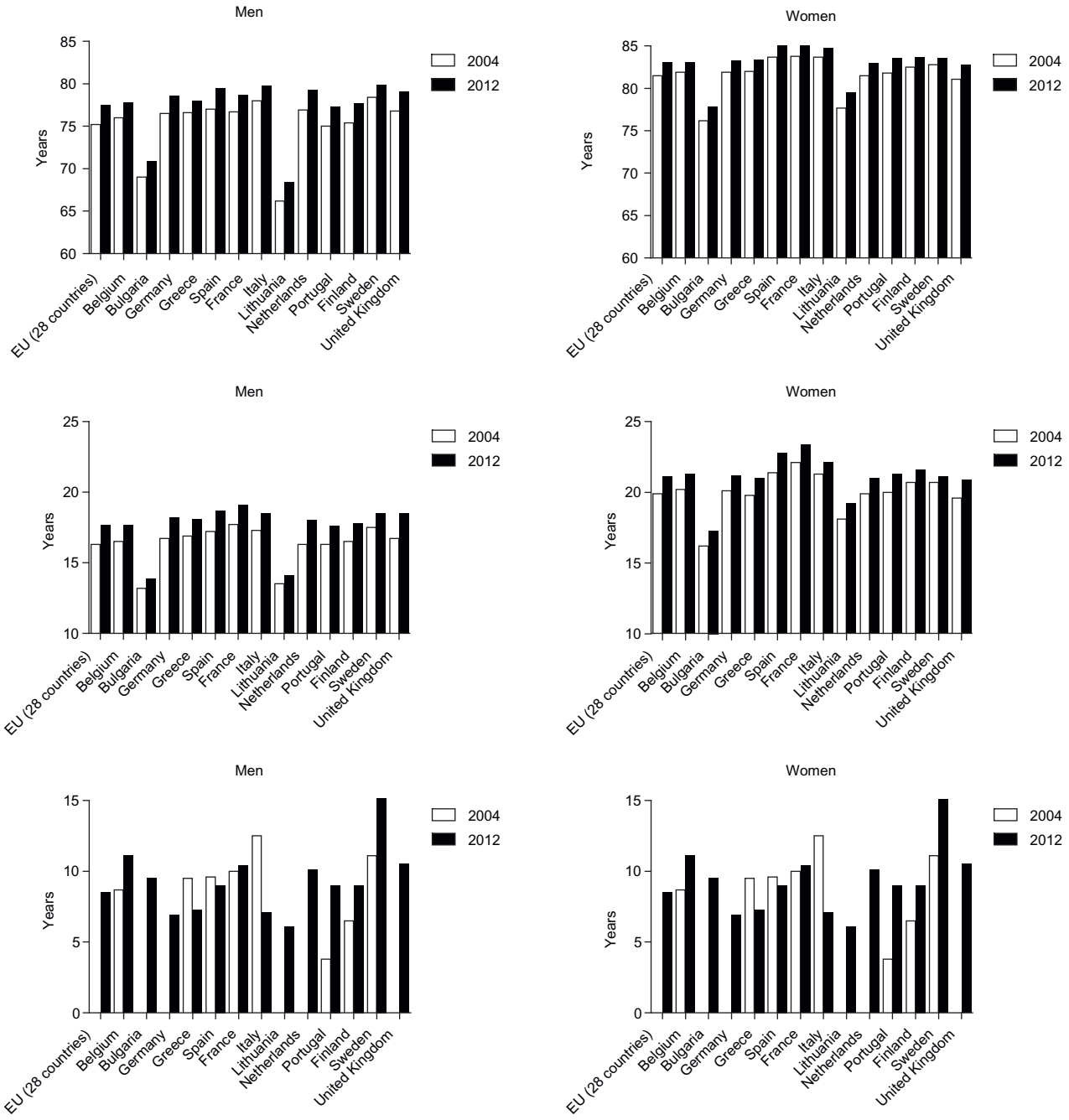

FIGURE 3.1 Life expectancy at birth (top), at age 65 years (middle), and healthy life expectancy at age 65 (bottom) in men and women across EU countries.

Note: For healthy life expectancy at age 65, some countries did not report data in 2004 and some other ones had changed definition of healthy life years from 2004 to 2012 (thus explaining the apparent reduction in healthy life years from 2004 to 2012).

The figure illustrates:

- life expectancy is reaching a plateau in EU;
- gain in life expectancy is still increasing (higher in 2012 than in 2004);
- there are inequalities in life expectancy at birth and at age 65 across EU countries, reflecting also accessibility to health care and education;
- there is still a considerable gap between life expectancy and healthy life expectancy at age 65. This means that not all the years gained are in good health conditions.

Source: EUROSTAT.

and Germany [6]. Of note, subjects 90+ years also represent an increasingly larger percentage of the elderly population (those aged 65 and older): by 2050 they will constitute 12% of the elderly population [6].

LIVING LONGER, BUT WITH MORE CHRONIC DISEASES

A greater likelihood of reaching older ages has been accompanied by a greater occurrence of chronic diseases. The increased prevalence of chronic disease in aging population may reflect a longer time lived with the disease, whether it is due to improved healthcare or to earlier diagnosis, or to both factors [7–8]. This is the case of cardiovascular disease, type 2 diabetes, and cancer.

However, a longer life expectancy does not necessarily mean better health conditions. For example, a longer survival time after cardiovascular events or cancer diagnosis means also a longer period of morbidity, with a progressively worsening functional status until the development of disability.

The increased life expectancy has made some prevalent conditions more common, such as congestive heart failure, osteoarthritis, type 2 diabetes, and cognitive decline [9–10], with an emerging role of functional and cognitive disability in older subjects.

Additionally, multiple diseases simultaneously occur in subjects of older ages—a phenomenon defined as comorbidity or multimorbidity. For instance, in the United States, of Medicare beneficiaries older than 65 years 32% have no or one chronic medical condition, 32% have two to three chronic conditions, 23% have four to five, and 14% have six or more [11].

The combination of increased life expectancy and prevalence of multiple chronic diseases will result in different individual and population health expectancies. This health expectancy is often indicated as the (expected) disability-free life expectancy and can be calculated as quality-adjusted years of life. For instance, both men and women from Italy and Belgium had a greater increase in the proportion of life spent without disability as compared to Denmark or the Netherlands, whereas the rate of increase in life expectancy was similar amongst these countries [12].

Though comparison across countries are hampered by lack of tight harmonization in the relatively few long-term surveys, it has been estimated that the greater number of years lived with disability—associated with longer and longer life expectancy—are accompanied by a relative decrease in severe disability and an increase in the least years' severe degrees of disability.

FROM HEALTHCARE OF OLDER SUBJECTS TO LIFE COURSE APPROACH

For a considerable time researchers have tried to understand the biology of aging, which underlies these shifting trends in demography on the population level. The first important concept is that aging is a continuous phenomenon starting at younger age. For instance, arterial stiffness indexed as increased pulse wave velocity is a marker of arterial aging that already increases over time beginning at the age of 20 years [13–14]. Additionally, the role of heritability/genetic factors for arterial stiffness seems greater at older ages than in younger subjects in a population-based study in Sardinia [15], an observation that is counterintuitive.

Therefore, the so-called *life course perspective* [16] has become the novel framework to understand the aging process. Consistently, factors in early life are also taken into account in order to better understand the aging process. Numerous studies have now documented that impaired fetal growth, or intrauterine growth retardation (IUGR), is a detrimental factor for both childhood and adult health, especially if a pattern of IUGR leading to a phenotype of small-for gestational-age at birth is later followed by a rapid catch-up growth pattern in early childhood, the so-called "mismatch" condition [17]. This is associated with increased risk for development of obesity, type 2 diabetes and cardiovascular disease in adult life, whereas large-for-gestational age babies seem to be at increased risk for some hormone-sensitive cancer forms [18].

STRATEGIES FOR HEALTHY AGING

Based on insights from demography and the increasing longevity of Europeans some conclusions can be made. Reducing premature mortality is relevant for low- and middle-income countries because it will represent a closing gap of inequality in life expectancy worldwide. A consequence might be increased risk of disabilities and

frailty in old age. Mortality as the main outcome in epidemiological and clinical studies is therefore not sufficient and no longer fully adequate. The comorbidities influencing disability in old age should be given priority in preventive work, for example, major cardiovascular events (myocardial infarction (MI) and stroke), dementia, reduced function in the lower limbs (arthrosis, diabetic neuropathy, etc.). These conditions, and markers of the disease process, should be taken into account and regarded as "novel" primary outcomes of surveys and clinical trials. One such marker is arterial stiffness, as the core of early vascular aging [19], as it links with a number of conditions of aging and frailty [20]. Thus innovation should not regard technological developments only, but also new biomedical models of aging in a social and life course context. Aging should preferably be regarded as a continuum beginning at younger ages, even in prenatal life. The identification of early/accelerated aging becomes crucial for prevention of clinical events such as MI, stroke, dementia, and functional disability, and for an efficient allocation of healthcare resources. This approach will allow prevention of the development of chronic diseases, slowing disease progression, mitigating complications to optimize quality of life, and a decrease in the demand of the healthcare system.

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