Anne B. Newman
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Editors

The Epidemiology of Aging

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ISBN 978-94-007-5060-9 ISBN 978-94-007-5061-6 (eBook)
DOI 10.1007/978-94-007-5061-6
Springer Dordrecht Heidelberg New York London

Library of Congress Control Number: 2012954272

Printed on acid-free paper

Springer is part of Springer Science+Business Media (www.springer.com)

For Frank,
Who understands me and takes care of me, With all my love.

ABN

For Kathryn and Nora,
Who bring me great joy; Their unconditional love keeps me whole.

JAC

Foreword

In recent decades, the field of the epidemiology of aging has grown substantially in breadth and depth. The many cumulative successes in public health over the past century have led to a larger proportion of the population surviving to achieve longevity, but this has come with an increase in the number of individuals who eventually experience disability. The field of the epidemiology of aging evaluates these public health successes and addresses the new challenges that have come with them. The focus is not only on the length of life, but on the quality of life.

As a core discipline of public health, epidemiology serves to identify key problems and the rates at which they occur, determine risk factors for these problems in populations, and then formulate interventions to reduce the rates and risk factors. Ultimately, the purpose of epidemiology is to inform and improve the health of populations. The epidemiology of aging ranges from the study of the process of aging itself to the study of health outcomes in older adults. In spite of the achievement of longevity, the epidemic of aging includes an overall increase in disability and the need for care and prevention, including primary, secondary and tertiary prevention. As the scope of the problems of aging has become better defined, projections for the future now depend on whether the prevention of age-related chronic disease will compress or expand the period of morbidity at the end of life. Thus, the field of the epidemiology of aging has been uniquely focused on improving the quality of life in old age.

The definition of old age itself has evolved over time. The age of 65 has been most commonly used as the threshold for old age. Historically, this threshold comes from the age for pension eligibility, initially established in Europe and later adopted in the US for the Social Security Program. Early epidemiologic studies and clinical trials on aging included adults ≥60 years of age (e.g., the Systolic Hypertension in the Elderly Program [SHEP]) or ≥65 years of age (e.g., the Cardiovascular Health Study [CHS], the Study of Osteoporotic Fractures [SOF]). However, until after age 70, the majority of older adults experience few health problems and mortality risk is fairly low. More recent studies such as the Health Aging and Body Composition Study (Health ABC) and the Lifestyles and Independence Interventions in the Elderly (LIFE) now start at age 70. Life expectancy at age 65 is now close to 20 years and the most rapidly growing age group of older adults is the "oldest old", generally defined as the group over age 80 or 85. Many ongoing studies on aging (e.g., CHS, SOF) continue to follow their participants well into the tenth decade of life. Studies of healthy aging and longevity focus on exceptional

survival and health, generally enrolling adults ≥90 years of age or ≥100 years of age, as in the studies of centenarians.. The longevity phenomenon is unique in human history and it is leading to a new and urgent need to understand the oldest old. Thus, many epidemiologic studies and prevention trials now focus on individuals who are ≥70 years of age.

The early-life origins of age-related disease and disability are also of increasing interest. Long-term follow-up of younger cohorts and retrospective designs offer the opportunity to study aging from a life course perspective. Early life experiences, including exposures *in utero*, are thought to impact the risk of chronic disease and thus impact aging. In effect, all epidemiologic studies, if carried on for many years, can inform the study of aging. The conversion of the Honolulu Heart Study to the Honolulu Asian Aging Study is an example of the rich progress that can be made in understanding the mid-life origins of aging. The continued follow up of women who are enrolled into the Study of Women's Health Across the Nation (SWAN), a study of premenopausal women who were 42–52 years of age at baseline, will provide important information on the transition from "middle" age to "old" age. It is critical that we continue to capitalize on future opportunities to maintain the long-term follow-up of such rich long-term data sets.

The epidemiology of aging draws from important contributions to the field of gerontology that have been made in multiple disciplines. Demography has defined the growth of the aging population, while social gerontologists have identified important interactions between health and social factors in older adults. Psychologists have identified the importance of mental and cognitive health to the quality of life in old age. Physiologists and basic scientists have identified aspects of aging processes that can be measured in population studies. Geriatric physicians and allied health professionals have defined important clinical syndromes—such as falling and immobility, weight loss and frailty—which are best managed by addressing their multiple contributing factors. Advances in our imaging techniques have facilitated the identification of subclinical disease. Together, these diverse disciplines have contributed to the methodology that is used for the multidisciplinary assessment of older adults in population studies and the assessment of solutions to extend the active lifespan.

Aging has proven to be an area of inquiry that is particularly well suited to epidemiologic methods. Age-related health conditions are by nature multifactorial, with contributions from many domains including physical, social and emotional factors. The disabling consequences of disease and of aging are relevant to the entire population, but they are highly heterogeneous. Large population studies are needed to understand this variability and complexity. Older adults have high rates of the common chronic diseases and many risk factors for these diseases have been identified in disease-specific epidemiologic cohort studies. Disability has come to be recognized as a highly variable dynamic process and various aspects of disability have been targeted as key endpoints for identifying risk factors and designing prevention trials. Such trials are currently being designed to encompass these critical issues of variability and the need for generalizability.

Though the demographic imperative is clear, there is a need to attract more investigators to the field of the Epidemiology of Aging. The chapters that follow form a foundation of knowledge that hopefully will serve to propel careers and research in the field forward. We hope that the quality of aging throughout the world can improve as a result.

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Preface

This book was developed to support training and research in the epidemiology of aging. It evolved from the Epidemiology of Aging course that we have been co-teaching at the University of Pittsburgh Graduate School of Public Health since 1989. What began as a single course has since transformed into three courses, a training program that has been funded for 20 years by the National Institutes of Health, National Institute on Aging, multiple United States (US) cohort and randomized clinical trials, a Center for Aging and Population Health and now a focus on aging and global health. It's been a fun train ride—especially in our positions as co-conductors at Pitt. Now we find a need to summarize the seminal findings that have emerged with regard to aging over the past 20 years.

Why create a separate book on the Epidemiology of Aging? There are many reasons why research into older adults requires different considerations than research into younger adults. There is tremendous heterogeneity in the way that individuals age and study designs must take this heterogeneity into consideration. Researchers must distinguish normal age-related physiologic changes from changes that are related to disease. Comorbidity is very high in older adults and it increases with advancing age. Students of aging need to understand this, measure it and adjust for it either as a confounder or as a mediator. The risk factors for disease in middle age differ from the risk factors at older ages. In the epidemiology of aging, we focus on disease outcomes, but also on staying healthy and living well. There is a greater need for social services in older populations, so the consequences of disease are greater. The study of health and disease at older ages must be a study of interrelated changes. The domains of health status and function are key concepts. Also, the goals of therapies will likely differ in older populations compared to younger populations.

The field of epidemiology of aging continues to expand to encompass the many factors that contribute to health and function. Specific methods that address the tremendous heterogeneity in the aging experience have been established. These methods and important key findings have grown to form a substantial body of knowledge. This book is designed to take stock of the progress in the field and to form a foundation for future progress in improving the quality of life of older adults. We hope that it is only the beginning.

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Acknowledgments

The idea of the book came from a need to support our training program in the epidemiology of aging. We want to acknowledge the funding of our program in the Epidemiology of Aging at the University of Pittsburgh by the National Institutes on Aging.

Our program of study began with a single course on the epidemiology of aging when the training program was first funded in 1990. The establishment of this course corresponds to our respective first pregnancies and births of our oldest children. Thus we view the development of the field and this book with our own life course perspective. We would like to acknowledge the support of our families in this venture.

We have always attempted to teach from the perspective of current and active researchers in the field, including invited and visiting faculty. This book would not have been possible without the support of the many contributing authors who are our colleagues in the quest to improve the aging experience for all older adults.

Finally, we would like to acknowledge the expert assistance of Ms. Mary Parker, Sharon Happe, Amy Flaugh. A special thanks to Ms. Michelle Utz-Kiley for her expertise in handling all correspondence and editing of each chapter and successfully carrying the project through to completion.

Contents

Part I

Methods

The Demography of Aging

1

Jane A. Cauley

Abstract

Demography is the study of changes in the size, diversity, distribution and composition of human populations over time. The world's age composition has changed dramatically and these changes continue. The percentage of individuals ≥65 years of age will double from 7 to 14 %, rising from 506 million in 2008 to 1.4 billion by 2040, with the largest increases in developing countries. It is important to note that the older population is getting older, with the largest increases in those ≥80 years of age. Life expectancy at age 65 has increased. In 2003, the average 65-year old woman in the United States was expected to live an additional 19.6 years, and a man, an additional 16.8 years. The older population is mostly female, especially in developed nations. Cardiovascular disease is the major cause of death worldwide. Disability in older adults is declining, though these trends may not continue given the exponential growth of the oldest old population. These demographic changes will profoundly impact public health. Cross-national research must address this unprecedented growth, specifically longitudinal studies to identify links between health, disability, economic status, work and family structure; to establish mechanisms to harmonize and standardize data collection internationally; and to develop multidisciplinary research designs to address issues impacted by population aging.

Keywords

Aging • Epidemiology • Geriatrics • Older Adults • Longevity • Demography • Mortality • Disability • Oldest Old • Trends • Minorities • Epidemiologic studies • Demographic studies • Socioeconomic status • Global health • Race/ethnicity • Population • Future Projections

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A.B. Newman and J.A. Cauley (eds.), *The Epidemiology of Aging*,
DOI 10.1007/978-94-007-5061-6_1,

Abbreviations

ADL	Activity of Daily Living
CVD	Cardiovascular Disease
NRC	National Research Council
ODR	Older Dependency Ratio
SHARE	Survey of Health Aging and Retirement in Europe
US	United States

1.1 Introduction

The age composition of the world's population has changed dramatically during the twentieth century. These changes continue into the twenty-first century. Specifically, the size and proportion of the older population (defined as age 65 and above), especially the oldest old (defined as age 80 and above), have increased substantially and will continue to increase. The purpose of this chapter is to present a broad and general overview of current demographic trends across the world. The main source of information for the United States (US) was the Federal Interagency Forum on Aging-Related Statistics (Older Americans 2010) [1]. For outside of the US, the major sources of information were the International Population Report, An Aging World: 2008 [2]. These data should be considered in light of two caveats. First, the data are based on summary statistics and it is important to keep in mind the heterogeneity in the way that people age. The population age 65 and over is large and very diverse. Second, the population that survives to ≥65 years of age represents only a fraction of their original birth cohort. There may be survivor bias in those who survive to older ages, especially the oldest old.

Demography is the study of the change in the size, diversity, distribution and composition of human populations over time. Demographers have identified a general progression of changes in fertility, mortality, population composition and the demographic transition. The demographic transition is a gradual process where a society moves from relatively high rates of fertility and mortality to low rates of both fertility and mortality. The demographic transition has three stages [3]. In the first stage, birth and death rates are high and the population grows slowly. The age pyramid for this stage has a very narrow top with few older people and the largest number of children 0–4 years of age. In the second stage modernization begins, especially industrialization and urbanization. Medical care and public health improves, leading to a sharp decline in death rates and longevity. Infant mortality declines, but birth rates remain high. In the final stage, death rates continue to decline but birth rates decline, population growth surges and the age pyramid becomes more rectangular. From 1900 to 1950, a steady decline in infant mortality raised the life expectancy in industrialized nations from 45–50 in 1900 to 65–70 in 1950. By 1950, most industrialized nations had experienced their demographic transition. For the purposes of this chapter, per the United Nations, "developed" countries include all countries in Europe and North America plus Japan, Australia and New Zealand. All other countries are considered "developing" nations.

1.2 Global Aging

Virtually all nations in the world are now experiencing growth in the number of residents ≥65 years of age, though there is considerable variability. Most developed countries have relatively high proportions of individuals ≥65 years of age, but the most rapid increases in the older population are in the developing world. Birth rates are also rapidly declining in many countries, including developing countries like India and China, further accelerating the shift toward an aging society. In 1950, about 5% of the world's population was ≥65 years of age while about 13% was <5 years of age. By 2020, individuals who are 65 years of age or older will outnumber children who are <5 years of age. The global population ≥65 years of age was estimated to be 506 million in 2008, which was about 7% of the world's population. By 2040, the world is projected to have 1.3 billion older adults, accounting for 14% of the total population. Eastern and

Table 1.1 Percentage of the population that is older, 2008–2040 [4]

	Age (years)		
Region	≥65	≥75	≥80
Northern Africa			
2008	4.9	1.6	0.7
2020	6.7	2.2	1.1
2040	12.8	5.0	2.5
Sub-Saharan Africa			
2008	3.0	0.9	0.3
2020	3.3	1.0	0.4
2040	4.2	1.4	0.6
Asia (excluding Near East)			
2008	6.8	2.4	1.1
2020	9.3	3.3	1.7
2040	16.2	6.8	3.7
Near East			
2008	4.6	1.7	0.8
2020	5.7	2.0	1.1
2040	9.9	3.8	2.0
Eastern Europe			
2008	14.5	6.0	3.0
2020	17.3	6.9	4.3
2040	24.4	12.6	7.8
Western Europe			
2008	17.8	8.5	4.9
2020	20.9	10.1	6.2
2040	28.1	15.0	9.3
Latin America/Caribbean			
2008	6.5	2.5	1.2
2020	8.8	3.3	1.8
2040	15.3	6.6	3.7
Northern America			
2008	12.8	6.2	3.8
2020	16.5	6.9	4.0
2040	20.8	11.6	7.3
Oceania			
2008	10.8	4.9	2.9
2020	13.7	5.7	3.3
2040	18.5	9.1	5.5

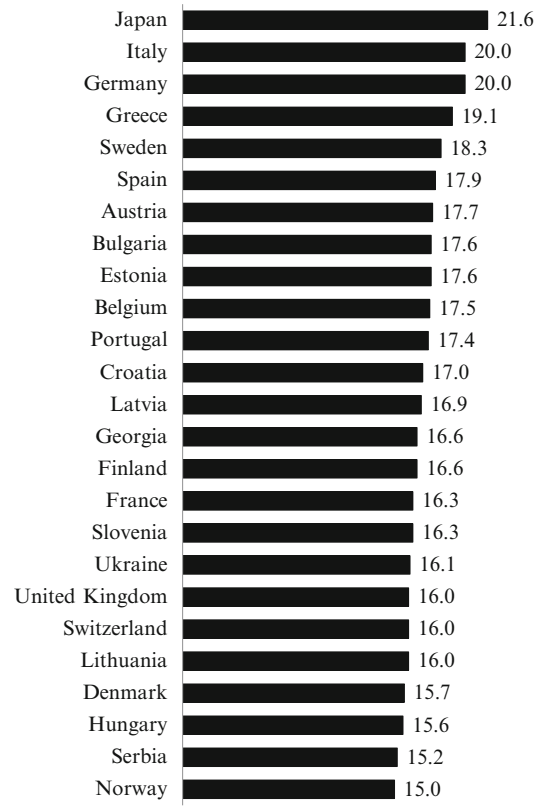

Fig. 1.1 The world's 25 oldest countries: 2008 (percent of population age 65 years and over) [2]

Western Europe will have the highest populations of people ≥65 years of age, including about 8–9% who are ≥80 years of age (Table 1.1). In Europe, by the year 2040, one in four individuals will be ≥65 years of age. In Asia, Northern Africa, the Near East and Latin America, the proportion of residents who are ≥65 years of age will more than double. However, it is important to point out heterogeneity within a region. For example, the population in China and India that were ≥65 years of age numbered 166 million in 2008, nearly one-third of the world's total in that age group. The absolute number will increase to 551 million in 2040 (329 million in China and 222 million in India).

Japan is the country with the world's oldest population (Fig. 1.1), with 21.6% of its population ≥65 years of age. Almost 20% of the populations of Italy, Germany and Greece are ≥65 years of age. With the exception of Japan and Georgia, all of the other countries with the oldest populations are in Europe.

During the period of 2008–2040, the projected increase in the older population in 52 studied countries ranged from a low of 18% in Bulgaria to 316% in Singapore (Fig. 1.2). As shown in Fig. 1.2, the percent increase will be greatest in developing nations compared to developed

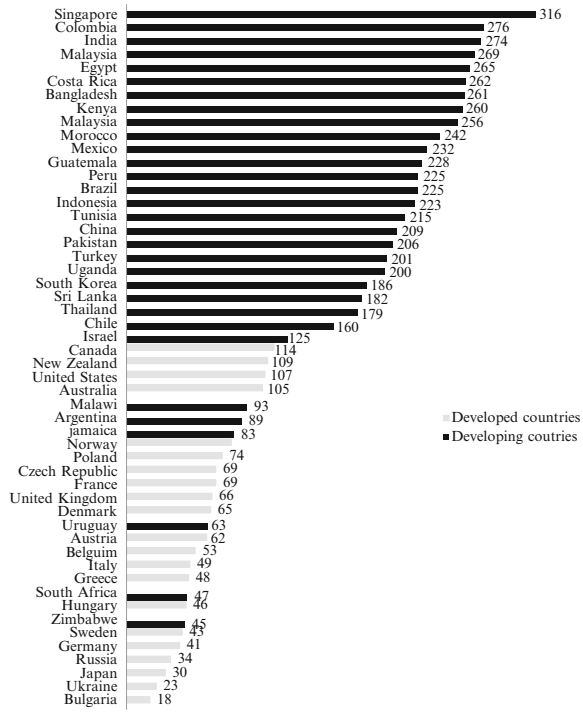

Fig. 1.2 Percent increase in population age 65 and over: 2008–2050 [2]

nations such as the US. The pace at which the world's population is aging is also increasing. From 2007 to 2008, there was a per-month increase of 870,000 individuals ≥65 years of age. In 10 years, the pace will increase to 1.9 million per month.

The median age will rise in all countries of the world. In Germany, the median age was 43 in 2008 and is projected to be 49 in 2040. In China, the increase will be much larger, with the median age of 33 in 2008 increasing to age 44 by 2040. In 2008, many developing countries had median ages younger than 27, but by 2040 the median age in these countries will be in the 30s or early 40s. Japan will have the highest median age at 54, indicating that half of its population will be ≥65 years of age by 2040.

An important feature of population aging is that the older population is getting older. The oldest old (≥80 of age) constituted 19% of the world's older population in 2008, 26% in developed countries and 15% in developing countries. More than half (52%) of the world's oldest old live in six countries: China, the US, India, Japan, Germany and Russia. China has the largest percentage of the

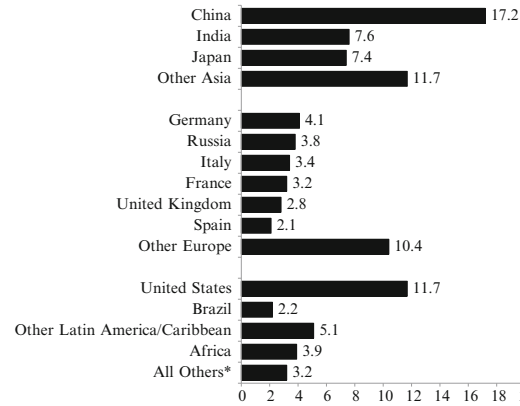

Fig. 1.3 Global distribution of people aged 80 and over: 2008 (percent of world total in each country/region) [2] * "All others" includes Oceania and Northern America except the United States. *Notes*: Individual countries with more than 2% of the world's total are shown separately. Figures may not sum to 100% due to rounding

oldest old, with 17.2% in 2008 compared with about 7% in Japan and India and 2–3% in Europe (Fig. 1.3). In 2008, 11.7% of the world's population ≥80 years of age lived in the US. The number of centenarians is also increasing, especially in

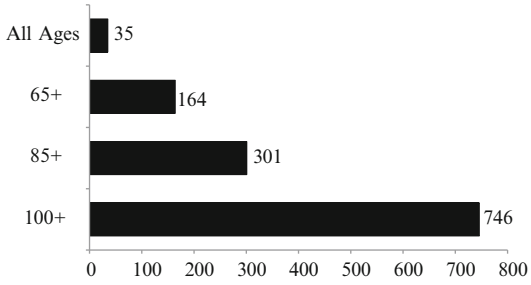

Fig. 1.4 Percent change in the world's population: 2005–2040 [2]

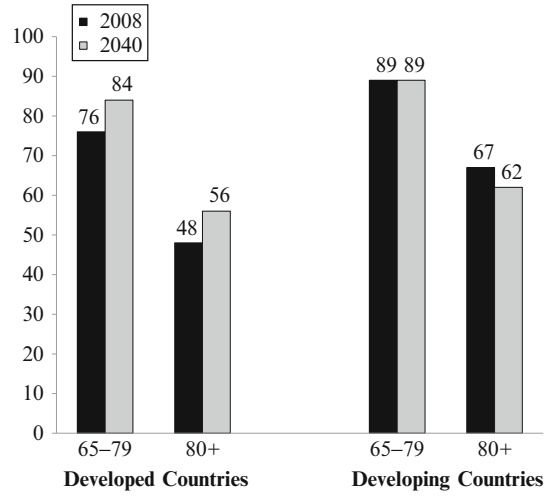

Fig. 1.5 Aggregate sex ratios for older age groups: 2008 and 2040: number of men per 100 women [2]

developed countries (Fig. 1.4). While the overall world population will increase 35% from 2005 to 2040, the percentage that is ≥85 years of age will increase by 300%, and the percentage that is ≥100 years of age will increase by 750%. Researchers estimate that the odds of living to 100 have risen from 1 in 20 million to 1 in 50 for women in low-mortality countries like Japan or Sweden. The United Nations estimated that the population of centenarians was about 270,000 in 2005. By 2040, this number is projected to reach 2.3 million.

The sex ratio, defined as the number of men per 100 women, is a common measure of the gender composition. In 2008, the older population was primarily female. In developed nations, for every 100 women 65–79 years of age there were 76 men of that age, and for every 100 women ≥80 years of age there were 48 men of that age (Fig. 1.5). However, by 2040, with projected gains in the life expectancy in men, the number of men per 100 women in these age groups will increase. In developing countries, the gender differences are less evident and are expected to change little from 2008 to 2040.

1.3 Life Expectancy

Life expectancy at birth is greatest in Japan and Singapore at 82 years of age, with most others developed countries—including the US—in the 78–80 year range (Fig. 1.6). On average, an individual born in a developed country can expect to outlive his or her counterpart in the developing

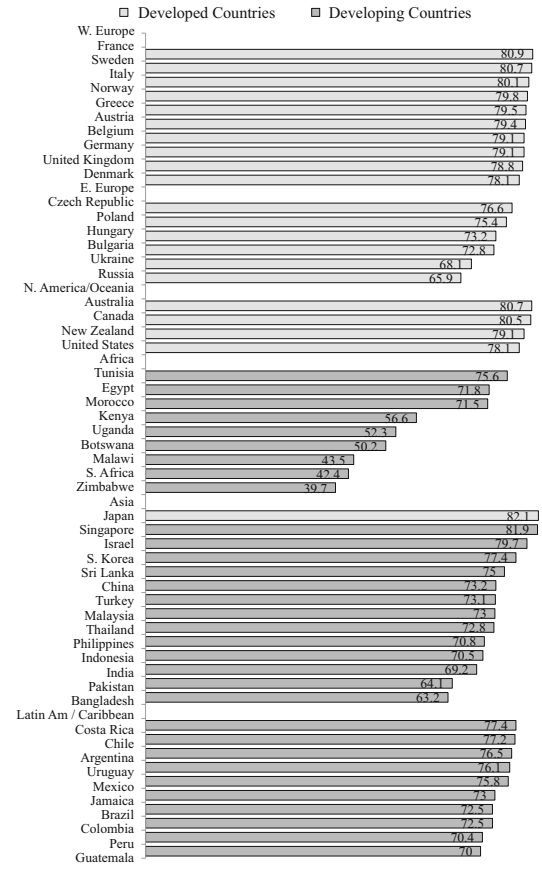

Fig. 1.6 Life expectancy at birth for selected countries by region: 2008 [2]

world by 14 years. Life expectancy has increased dramatically in most parts of the world since 1900. In some countries, life expectancy has more than doubled (e.g., Austria, Greece and Spain). In many developing countries, information on life expectancy prior to 1950 is unavailable. Since World War II, improvements in life expectancy have been fairly common and uniform. One exception is the impact of HIV/AIDS on life expectancy, especially in Sub-Saharan Africa. Almost universally, life expectancy is greater in women than in men, with the average gap in life expectancy at about 7 years. The gender difference is smaller (3–6 years) in developing countries, likely due to higher rates of maternal deaths. The life expectancy at birth exceeds 80 years in more than 45 countries.

Life expectancy at age 65 has also been increasing. Japanese women who had reached age 65 in 2004 could expect to live an additional 23.3 years, and a man who had reached age 65 could expect to live an additional 18 years. In the US in 2003, the average woman at age 65 was expected to live an additional 19.6 years, and a man at age 65 was expected to live an additional 16.8 years.

1.4 The Aging of the United States Population

In 2008, 39 million people ≥65 years of age lived in the US, accounting for 13% of the total population. The older population grew from 3 million in 1990 to 39 million in 2008. The population ≥85 years of age grew from 100,000 in 1900 to 5.7 million in 2008. The baby boomers (born between 1946 and 1964) started turning 65 years of age in 2011. This will result in a dramatic increase in those ≥65 years of age in the US. By 2030, the older population in the US is projected to be twice as large, growing from 35 million in 2000 to 72 million in 2030, with older adults representing 20% of the population. After 2030, the proportion of the population ≥65 years of age will be relatively stable. The percentage of oldest old, however, will grow rapidly because the baby boomers will be entering this age group. There is state-by-state variability in the proportion of adults who are ≥65 years of age. In 2008, Florida had the highest percentage (17%) followed by Maine, Pennsylvania and West Virginia, each at 15%.

As the US population ages, the population ≥65 years of age will become more diverse (Fig. 1.7). In 2008, 80% of the US adults ≥65 years of age were White. By 2050, this is projected to decrease to 59% with increasing proportions of Blacks, Asians and Hispanics. This increase reflects, in part, gains in life expectancy in the minority populations.

1.5 Health Concerns in Older Populations

1.5.1 Mortality

Worldwide, cardiovascular disease (CVD) is the major cause of death, despite declines in overall CVD deaths. A study of the major causes of death in the 25 countries in the European Union (2001) estimated that at age 65–69, CVD and cancer each account for about 35% of all deaths. By age 85, the proportion of deaths due to CVD increases to about 55% and the proportion due to cancer declines to about 15% (estimates taken from graphs) [5].

The major causes of death among individuals in the US are summarized in Table 1.2. Diseases of the heart, cancer and stroke are the top three causes of death, despite an overall decline in death rates of 21% from 1981 to 2006. Death rates for heart disease and stroke declined by about 50%. On the other hand, death rates due to diabetes increased by 20%.

1.5.2 Chronic Health Conditions

The estimated rank order of disease burden differs in high- versus middle/low-income countries (Table 1.3). In high-income countries, most of the disease burden was from chronic conditions, such as CVD and neuropsychiatric conditions. In middle/low-income countries, most of the

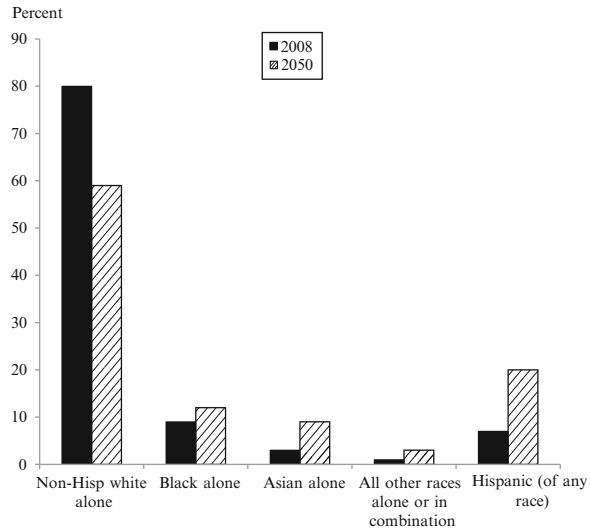

Fig. 1.7 US Population age 65 and over, by Race and Hispanic Origin, 2008 and Projected 2050 [2]. *Note*: The term "non-Hispanic white alone" is used to refer to people who reported being white and no other race and who are not Hispanic. The term "black alone" is used to refer to people who reported being black or African American and no other race, and the term "Asian alone" is used to refer to people who reported only Asian as their race. The race group "All other races alone or in combination" includes American Indian and Alaska Native alone; Native Hawaiian and Other Pacific Islander alone; and all people who reported two or more races

Table 1.2 Leading causes of death: US population ≥65 years of age, 2006

Rank	Cause	Rate per 100,000
1	Diseases of heart	1,297
2	Malignant neoplasms	1,025
3	Cerebrovascular disease (stroke)	297
4	Chronic lower respiratory diseases	279
5	Alzheimer's disease	177
6	Diabetes mellitus	137
7	Influenza/pneumonia	124

Table 1.3 Rank order of disease burden in high-income vs. low and middle-income countries, 2001

Rank	High-income countries	Low and middle-income countries
1	Ischemic heart disease	Perinatal conditions
2	Cerebrovascular disease	Lower respiratory infections
3	Unipolar depressive disorders	Ischemic heart disease
4	Alzheimer and other dementias	HIV/AIDS
5	Lung, trachea, and bronchus cancers	Cerebrovascular disease
6	Hearing loss	Diarrhoeal diseases
7	Chronic obstructive pulmonary disease	Unipolar depressive disorders
8	Diabetes mellitus	Malaria
9	Alcohol use disorders	Tuberculosis
10	Osteoarthritis	Chronic obstructive pulmonary disease

Disease burden measured in disability-adjusted life years [6]

disease burden was due to problems related to maternity and infections. However, these patterns are likely to change. Non-communicable diseases accounted for 85% of the burden of disease in high-income countries compared to 44% in middle/low-income countries. It is estimated that by 2030, non-communicable diseases will account for 87% of the disease burden in low-, middle- and high-income countries.

Figure 1.8 shows the most common chronic health conditions among US populations ≥65 years of age. The most common chronic conditions were hypertension, arthritis and heart disease. The prevalence of certain conditions differs in men

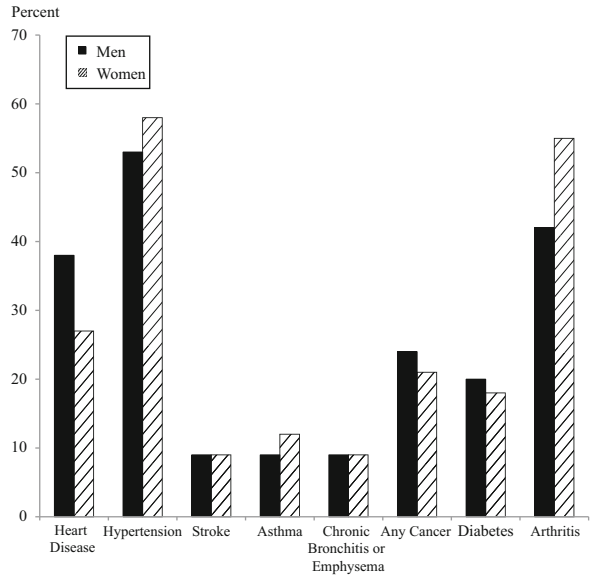

Fig. 1.8 Chronic health conditions among the population age 65 and over, by sex, 2007–2008 [2]. *Note*: Data are based on a 2-year average from 2007 to 2008. *Reference population*: These data refer to the civilian non-institutionalized population

and women, with higher rates of heart disease in men but higher rates of hypertension and arthritis in women. There are also ethnic differences in the prevalence of conditions, with higher rates of hypertension and diabetes in Blacks and higher rates of diabetes in Hispanics compared to Whites.

The rise in the number of individuals who are overweight or obese is a global pandemic and raises the possibility that gains in life expectancy will not be realized. In the Survey of Health Aging and Retirement in Europe (SHARE), 59–71% of men and 41–67% of women were overweight or obese (Fig. 1.9). In the US, the percentage of individuals ≥65 years of age who are obese increased from 22% in 1988–1994 to 32% in 2007–2008 (Fig. 1.10). The prevalence of obesity is higher in individuals 65–74 years of age compared to those ≥75 years of age.

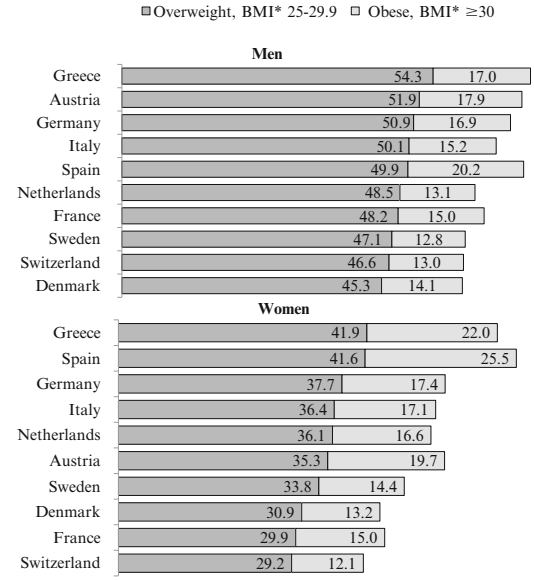

Fig. 1.9 Percent overweight and obese among men and women aged 50 and over in ten European countries: 2004 [2, 7]; * BMI is body mass index (kg/m^2)

1.5.3 Disability

As people are living longer, the quality of that longer life becomes a central issue. This issue will impact national health systems, retirement and the demand for long-term care. Global estimates of disability prevalence rates are difficult to make due to different definitions of disability. One study that examined trends in 2005 in 12 countries defined disability as having one or more limitations in basic activities of daily living (ADLs). A decline in disability was observed in 5 of the 12 countries (Denmark, Finland, Italy, the Netherlands and the US). Disability rates were stable in Australia and Canada, while Belgium and Japan reported increases [9].

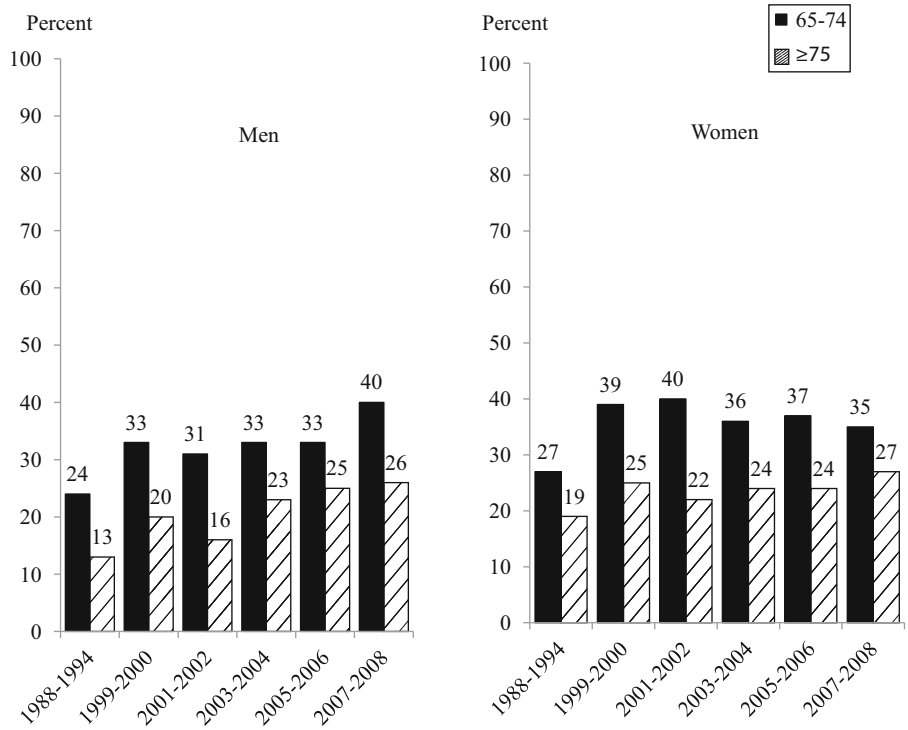

Fig. 1.10 Percentage of US population age 65 and over who are obese, by sex and age group, selected years 1988–2008 [2, 8]. *Note*: Data are based on measured height and weight. Height was measured without shoes. Obese is defined as a Body Mass Index (BMI) of 30 kg/m^2 or greater. *Reference population*: these data refer to the civilian non-institutionalized population

Additional evidence from the US suggests that disability rates have declined in the population that is ≥65 years of age. Data from the US National Long-term Care Survey showed declines in disability from 1982 to 2004–2005 (Fig. 1.11). In 2004–2005, 81% of the US older adult population was not disabled—a decline of about 4% from 1982—and only 4% were institutionalized [10].

1.6 Social Factors in Older Populations

1.6.1 Marital Status/Living Arrangement

Older men are more likely to be married than are older women: 60–85% of men ≥65 years of age are married. Even at ages 75 and older, 70% of men are married. This pattern is true for both developed and developing countries [2], in part because men tend to marry younger women.

Multigenerational living arrangements have been declining in many countries, especially in Europe. Even in Japan, the proportion of older Japanese individuals who are living with children dropped from 87% in 1960 to 56% in 1995. It is expected to further decline to 42% by 2010. Thus, the proportion of individuals—especially women—who live alone has been increasing. In the US in 2008, older women were more than twice as likely as older men to live alone: 40% vs. 19%, respectively. Older Black (41%) and White (42%) women were more likely to live alone compared to Asian (22%) and Hispanic women (27%) [1].

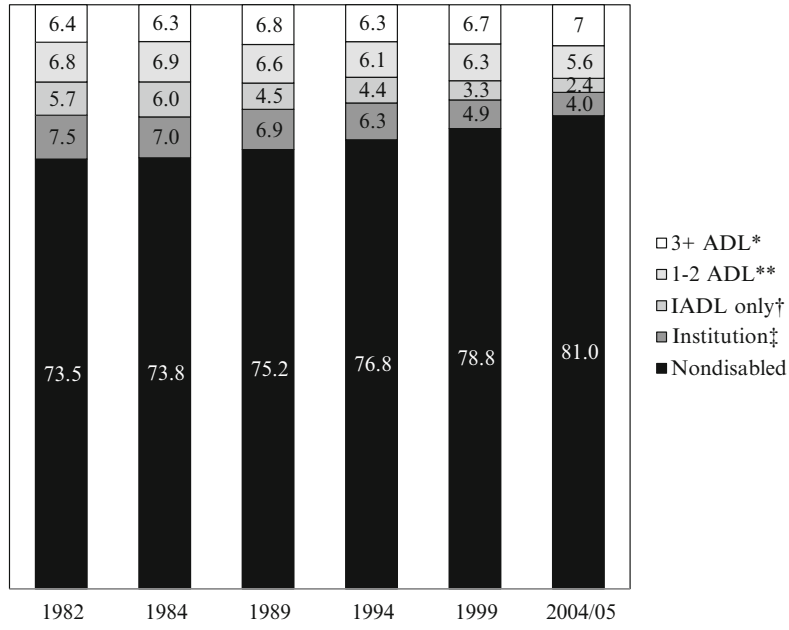

Fig. 1.11 Chronic disability decline in the United States: 1982–2005 (percent of older people in each category) [2]; *"3+ADL" refers to difficulty with three or more basic activities of daily living (ADLs), such as eating, toileting, dressing, bathing and ambulation; **"1–2 ADL" refers to difficulties with one or two of these items; †"IADL only" refers to difficulty with one or more instrumental activities of daily living (IADLs), such as preparing meals, managing money, shopping, performing housework, and using a telephone; ‡"Institution" refers primarily to nursing homes. *Note*: Data refer to the Medicare-enrolled population aged 65 and over

1.6.2 Societal Support

A commonly-used indicator of societal support is the dependency ratio, the ratio between older individuals and working-age individuals. The older dependency ratio (ODR) is defined as the number of individuals ≥65 years of age per 100 individuals 20–64 years of age. The ODR is rising in most regions of the world, except for Sub-Saharan Africa (Fig. 1.12). From 2000 to 2040, the ODR is likely to increase at least two-fold. By 2004 in Western Europe, for every 100 individuals who are 20–64 years of age, there will be 53 individuals who are ≥65 years of age. Thus, the ratio of workers to older adults will only be 2–1.

1.6.3 Education

Individuals with higher education tend to have lower mortality rates and better overall health than do their less educated peers. This may reflect higher income and better access to health care. Educational attainment differs markedly between developed and developing countries. In developed countries, half or more of the populations 55–64 years of age have completed secondary and tertiary education. This compares to about 5% in Chinese men and 10% in Indian men [2, 3], with educational attainment even lower for women in these countries. In contrast, in 2008 in the US, 77% of the total population ≥65 years of age were high school graduates and 21% held a