Chapter 4
The 'New Era' in Health

Health status is one of the most important indicators of well-being, and it predicts a large proportion of societal expenditures on health and social services for the elderly.

(National Research Council 2001: 201)

4.1 New Longevity

In the last quarter of the twentieth century the population of Japan's subtropical island prefecture of Okinawa achieved prominence as having the highest life expectancy in the world, the lowest risk of major age-related chronic diseases in Japan, and the highest proportions surviving to 100. A long-standing and reliable family register system verified this (Willcox et al. 2008). More recently the prefecture's lead may have waned as younger Okinawans have adopted Western diets and forsaken traditional practices. Nevertheless the reasons underlying the longevity of the oldest generations remain of great interest and practical importance because of lessons potentially transferable to other populations. Lifestyles, rather than genetics or scientific interventions, have accounted for Okinawa's exceptional longevity. Beneficial practices include low calorie intake ("only eating until 80% full"), a diet high in vegetables, fruit and fibre, regular exercise, moderate alcohol use, and avoiding smoking. Other important influences are thought to be stress coping mechanisms associated with strong social support and deep spirituality – especially among older women – together with optimistic attitudes, adaptability and an easy-going approach to life (Cockerham and Yamori 2001: 157; Suzuki et al. 1995). The Okinawans' cardiovascular and cancer mortality rates have been up to 40% lower than the national average for Japan (Willcox et al. 2004: 789 and 793).

Among all nation states, life expectancy is also highest in Japan as a whole where, in mid-2010, the figures were 86 years for women and 79 for men (Population Reference Bureau 2010). Despite this there is a substantial gap between the average

D.T. Rowland, *Population Aging: The Transformation of Societies*,
International Perspectives on Aging 3, DOI 10.1007/978-94-007-4050-1_4,

length of life and average length of life in good health. Typically, Japanese men aged 60 spend about 4 years in ill health over their remaining lifetimes, while the figure for Japanese women is 5 years. This amounts to nearly 20% of their later years – counting all periods of ill health, not just a final illness. Japan's achievement in life expectancy is evidence of the current potential for similar progress in other aging societies, and of an enduring disparity between total years lived and years in good health. This chapter reviews current theoretical perspectives on changes in survival and health in developed countries. It focuses on ideas about the characteristics of a new fourth stage of the epidemiologic transition and the nature and causes of contemporary changes in survival and health in developed countries.

4.2 The Fourth Stage

Since the 1980s, a revolution has taken place in understanding how the goals of improving health and 'adding life to years' might be accomplished. Together, these insights have led to a reformulation of the epidemiologic transition, which is concerned with trends through time in mortality rates, causes of death and the prevalence of diseases and ill health (see Chap. 1). Until the 1980s, the notion of a three-stage epidemiologic transition provided a foundation for expectations about the limits of change in survival and health. It then became apparent that developed country populations were progressing beyond Omran's assumed limits. Clear evidence was the continuing rise in life expectancy at birth. Whereas 75 years was once thought to be a limit in the epidemiologic transition, female life expectancies of between 80 and 85 years are now widespread. They occur in most countries of Western and Northern Europe, together with the United States, Canada, Australia and New Zealand. Equally striking are the associated gains in life expectancy at age 65 where, for females, a gain of 8 years accompanies the shift from 70 to 85 years in life expectancy at birth.

Recognition of continuing changes in 'post-transition' societies prompted the suggestion that 'a new era in epidemiologic history' had begun, dating from the mid-1960s in the United States: Olshansky and Ault (1986) called it "the age of delayed degenerative diseases". They distinguished this 'new era' or fourth stage of the epidemiologic transition from the third stage by the rapidly declining death rates at older ages and a shift to even older ages in the distribution of mortality from degenerative diseases. Latitude for progress in preventing or delaying diseases long existed, for example, where early onset was related to lifestyles or to environmental influences such as air pollution.

Emergence of the current stage of the epidemiologic transition in developed countries comprises part of the new demography that is reshaping prospects for aging societies. Ideas about the nature of the fourth stage, however, have changed and broadened over time. A new assessment is now needed of the characteristics that distinguish the current stage of the epidemiologic transition in developed countries. Ensuing sections discuss the characteristics that are most important in relation to the study of aging, including the extension of life into the eighth and ninth decades, which is a key feature of the fourth stage.

4.3 Longevity

Long life is now an achieved goal for many countries and gains are still occurring. Recent reductions in later life mortality are unprecedented and unexpected (Christensen et al. 2009: 1196). The phenomenon known as 'the rectangularization of the survival curve' summarizes the revolution in survival in middle and later ages that that has been characteristic of the epidemiologic transition (Fig. 4.1). It provides broad evidence of a long-term trend towards a narrower range in the ages at which most deaths occur, particularly because of the decline in death rates of infants, children and young adults.

Figure 4.1 shows the changing shape of a population's survival curve, which represents the proportions surviving to successive ages from an original 100,000 live births. The curve becomes more rectangular as infant and child mortality decline and higher proportions survive to maturity and later ages. In the fourth stage of the epidemiologic transition, rectangularization becomes especially pronounced because the longest life expectancies at birth entail close to 100% survival of females to their 50th birthday (i.e. 'exact age' 50). At the same time there occur great increases in the proportions reaching older ages. Thus female life expectancies at birth of 70, 80 and 90 are associated respectively with survival to age 75 of 52%, 76% and 94%. Some countries already have around a third of their female population reaching their mid-eighties. A rise in this figure to 80%, assuming life expectancy at birth reaches 90, would mean that a protracted period of dependency had become a typical part of the life course.

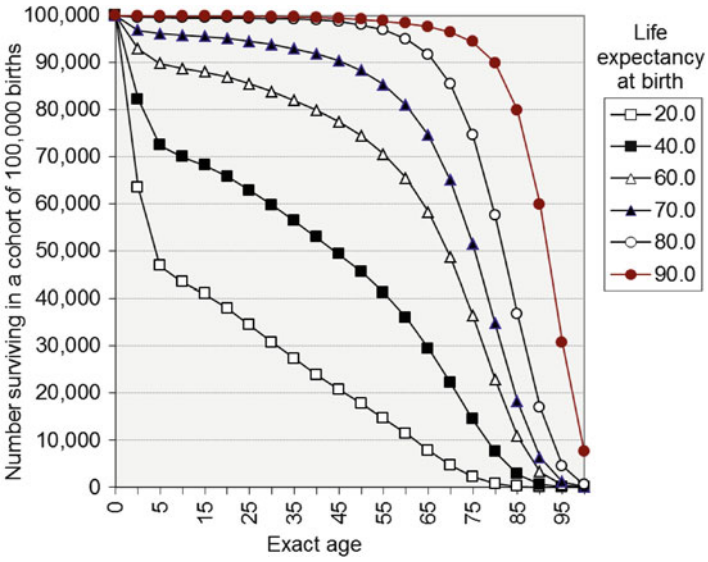

Fig. 4.1 Rectangularization of the survival curve for females (Source: Coale and Demeny (1983) and author's calculations for a life expectancy of 90)

Prolonged survival, and longer survival through ages at greatest risk of frailty, are characteristic of the current stage of the epidemiologic transition. Progress from a life expectancy of 80 to 85 and from 85 to 90 entail major increases in the number of years individuals live in later life – because there is little remaining scope for further improvements in survival among the young. Late in the epidemiologic transition, increases in life expectancy at birth are due especially to longer life at older ages, to an extent greater than any earlier changes at these ages.

Oeppen and Vaupel (2002: 1029) argue that life expectancy is not yet approaching its maximum, particularly because of improvements in adult survival. The authors assert that all previous estimates of the limits to human life expectancy have been shown to be false within 5 years of publication. They note that, in the best circumstances, life expectancy has increased by 2.5 years per decade for a century and a half; a continuation of this, they envisage, would raise the record life expectancy from the current 86 years for females in Japan to 100 years by about 2060. In other words "centenarians may become commonplace within the lifetimes of people alive today" (ibid.: 1031). No limit is in sight in the longest lived populations. This is raising the possibility that a majority of babies born in the first decade of the twenty-first century will celebrate their 100th birthdays (Christensen et al. 2009: 1196). Such a development would greatly augment the role of mortality decline as a force in population aging.

The current revolution in survival is due to a range of factors including the important role of moderate interventions, such as raising awareness of distinctions between healthy and unhealthy lifestyle practices, screening for early detection of common diseases, and prescription of medications to control diseases and their and precipitating factors. The decline in death rates from diseases of the circulatory system, such as coronary heart disease and stroke, has been particularly important (Andrews 2001: 6). Disease prevention, delayed onset, death prevention from particular causes and delayed mortality all contribute to longer survival overall. The *National Strategy for an Ageing Australia* identified smoking, poor nutrition, alcohol and inadequate physical activity as significant contributors to the burden of disease, and concluded that "perhaps as much as half of the functional decline associated with aging is the result of disuse and can be reversed by exercise" (ibid.: 40 and 43).

A negative consequence of more prevalent survival to advanced ages has been expansion in the numbers with severely disabling neurodegenerative diseases, especially Alzheimer's disease, vascular dementia and Parkinson's disease (Broe and Creasey 1995). Without research breakthroughs in preventing or treating neurodegenerative diseases, their high prevalence will remain a leading characteristic of the fourth stage of the epidemiologic transition, simply because higher proportions are reaching the ages at greatest risk. Appropriate care of dementia patients, especially those with advanced symptoms, is particularly costly because it calls for dementia-specific facilities rather than placement in mainstream nursing homes (Senate Community Affairs Committee 2005: page 5.25).

4.4 Hubris

Another suggested feature of the fourth stage of the epidemiologic transition consists of engaging in hubristic behaviour, ignoring risks and endangering one's own health or life. Rogers and Hackenberg saw this as a key characteristic, dating from the 1970s in the United States. They argued that: "death is becoming increasingly influenced by individual behaviours and new life-styles" (Rogers and Hackenberg 1987: 239). Risk-taking has many forms including smoking, alcohol abuse, avoiding exercise, eating too much and consuming foods high in saturated fat, salt and sugar. For example, four out of five older Australians have chronic diseases influenced by diet (Volker and Caterson 2001, cited by Temple 2006: 28). Other risks are driving at high speeds, using addictive drugs, sharing injecting needles and engaging in unsafe sex. All are behaviours entailing health risks of which many are aware, but may choose to ignore. Rogers and Hackenberg (1987: 240) also included accidents, suicides, homicides, avoidance of vaccinations for preventable diseases, and the rise in lifestyle-related cases of HIV/AIDs as instances of hubristic behaviour. Although the consequences of some forms of hubristic behaviour occur early or immediately, the inability to modify unhealthy behaviours in the long term can be fatal in later years.

Smoking is one of the most devastating forms of hubristic behaviour in developed countries. A 50 year study of British doctors, which commenced in 1951, found that doctors who smoked throughout their lives died, on average, 10 years younger than lifelong non-smokers; their habit killed more than half the lifelong smokers. Stopping smoking at age 50 halved the mortality, while stopping at age 30 avoided most of the risk (Doll et al. 2004: 1519). The authors concluded that it is reasonable to assume that, in the future, half the smokers world-wide will die of smoking related diseases, although cessation, even in mid-life, offers hope for a substantial catch-up in survival (ibid.: 1528). Stampfer (2004: 1507), observed that smoking commences at much younger ages today, implying that the current generation of persistent smokers will face even higher excess mortality, most conspicuously where the prevalence of smoking has increased – in developing countries, among women and lower socio-economic groups.

A focus on hubristic behaviour emphasizes individual agency – people's responsibility for their own health. It implies an approach to health policies in which promotion of lifestyle changes is a key aspect. Another viewpoint argues that people's position in society needs to be considered as well: "Blaming the victim fails to address underlying questions of why disadvantaged people are drawn into these behaviours and the nature of the social and individual influences that maintain them" (Jarvis and Wardle 1999: 241). Hubristic behaviour can scarcely be ascribed to people who have limited choices.

Accordingly, individuals are not solely responsible for their own lifestyles and health. What some may perceive as outcomes of reckless or thoughtless behaviour, others regard as outcomes of the social context in which people live. An influence on health that arises from the nature of the society is whether the health system

provides timely, affordable and adequate care. Deficiencies in health care provision can lead, not to general disadvantages throughout the society, but to social inequalities such that the most deprived experience the most adverse consequences. For example, under-funding and under-supply of health care can have greater impacts on the poor because they are least able to afford health insurance, dentistry, medications, consultations with specialists and early treatment in a hospital. Social class further influences people's health if they cannot afford good housing or good nutrition, or if there is peer-group or advertising pressure for smoking, excessive alcohol consumption and other risky behaviours. Some argue, therefore, that health inequalities need to be addressed particularly through policies that address education, income and other aspects of socio-economic inequality (Kawachi et al. 1999).

4.5 The Status Syndrome

The influence of social class is more pervasive than evident from broad distinctions between rich and poor. Since the 1980s an important realization has been that people's location at seemingly advantaged levels in the social hierarchy can be a health hazard. This is because of the stresses associated, not with economic deprivation itself, but with individuals' lack of control over their own circumstances and lack of opportunities for full social participation: "control over one's life and opportunities for meaningful social engagement are necessary for health" (Marmot 2004b: 241). This creates 'the social gradient of health' or 'the status syndrome' (Marmot 2004b; Marmot and Wilkinson 2006: 2). The social gradient concept, focusing on social inequality and health, originated from the 'Whitehall studies' of British civil servants. The research revealed that even though the subjects were neither very wealthy nor very poor, the lower their position in the civil service hierarchy, the greater the death rate (Marmot 1999: 10–12). Lifestyle factors explained less than a third of the social gradient, which prompted the conclusion that other social and psychosocial factors – linked to social class – were major influences.

Higher stress was found to be associated with lower social status for reasons arising in the social environment in childhood, as well as in the work environment and the community. Long term adverse effects on health, with high risk of premature illness and death, were thought to arise from childhood deprivation, such as being raised in stressful circumstances due to poverty and poor diet, possible consequences of which are impaired physical and mental development. In employment, ill health was linked with lack of control over work, lack of variety and small chance of reward, leading to chronic anxiety and low self-esteem – which undermine mental and physical health. In contrast, 'executive stress' in the uppermost social rank, where high effort was linked to high reward, was thought to be "satisfying and generally health promoting". Other potential causes of the social gradient of health were insecurity of employment, unemployment, shame, inferiority, subordination, social isolation, difficulty paying bills, distressing life events and exposure to hostility within communities (Brunner and Marmot 1999: 26 and 32; Wadsworth 1999: 51; Wilkinson 1999: 260).

Studies of animal groups with hierarchical social arrangements have provided some corroborative evidence as well as indicating a biological mechanism. Among baboons, subordinate social status can induce chronic anxiety leading to increased arteriosclerosis, high cholesterol, abdominal obesity, depression and poorer immune function. A biological mechanism here is the 'stress hormone' cortisol which, if maintained at high levels, is harmful to health. Baboons well illustrated the health effects of social status independently of lifestyle risk factors (see Wilkinson 1999: 260; Brunner and Marmot 2006: 26).

Research on the social gradient has implications for older people because the risk of relatively early death in later life is associated with the number of years lived in disadvantaged social positions. People take into later life the accumulated damage to their health incurred earlier. The social gradient of health envisages that adverse health consequences flow from relative deprivation in the social hierarchy, leading to stress-induced damage implicated in cardiovascular disease, cancer, infection, cognitive decline and accelerated aging. In developed countries, relative rather than absolute deprivation is paramount, with health related less to people's absolute material living standards than to their position in society (Blane 2006; Brunner and Marmot 2006).

Box 4.1 Social Inequality and Smoking

Although lifestyle risk factors are easier to address than the social gradient, a focus on risk factors alone can preserve or widen health inequalities, because lifestyle advice and controls may be least helpful to the most deprived groups. The risk factor of smoking illustrates this point. Jarvis and Wardle's (1999, 2006) research in Britain in 1996 found that there was a social gradient in smoking, with 80% of the poorest fifth of the adult population smoking compared with less than 20% of the most affluent fifth. Also, although the prevalence of cigarette smoking had declined steeply over the previous 20 years, smoking rates fell particularly among the affluent, with little change for the most deprived. The gulf in smoking prevalence between social groups has continued to widen.

There was a similar social gradient in death rates from smoking-related diseases, including heart disease, lung cancer, emphysema and chronic airways obstruction. The British evidence pointed to similar desires to quit smoking across all social groups, but with nicotine dependence increasing with deprivation arising from smoking more cigarettes more intensively. The hypothesis that deprived people smoke to relieve stress was not supported. Rather, deprived people smoked more because of a need to relieve their higher levels of nicotine dependence and stronger withdrawal symptoms when not smoking. The authors argued that successful quitting leads to lower rather than higher levels of perceived stress. For deprived people with already more

(continued)

Box 4.1 (continued)

stressful lives, contending with an extended period of nicotine withdrawal appears to make quitting smoking all the more difficult. Increasing the price of cigarettes, health education campaigns, and banning smoking in public places do not address the problem of nicotine dependence. While such interventions have reduced the overall prevalence of smoking, they have increased health inequalities as well as economic inequalities because those most dependent on cigarettes and least able to afford them have continued to smoke. Some suggested strategies to address the social gradient are nicotine replacement therapy, reimbursement of the cost of smoking cessation treatments, and product development to make smoking less harmful (Jarvis and Wardle 1999, 2006).

Accordingly, while some have argued that the most effective way to reduce excess mortality from diseases such as coronary heart disease is through population-wide control of risk factors – including high cholesterol, high blood pressure, smoking and inactivity – others point out that this approach ignores the additional influence of social inequality (Box 4.1). In relation to coronary heart disease in Britain, population-wide strategies have brought the greatest improvement among people of higher socioeconomic position, thereby widening social inequality (Marmot 2004a: 297–298). This has led to recognition that population-wide control of major risk factors needs to give particular attention to the most vulnerable groups (Emberson et al. 2004: 1153). In risk factor modification there is a major role for the primary health care sector – general practitioners, community nurses, pharmacists, physiotherapists and other allied health professionals– who have opportunities to make early interventions and promote preventative strategies and behaviours (Andrews 2001: 50).

4.6 The Paradox of Health

A further potential impediment to health improvements in the fourth stage of the epidemiologic transition is fear of illness. This first came to prominence in a paper on 'the paradox of health' in the *New England Journal of Medicine* (Barsky 1988). Barsky observed that respondents in American health surveys were reporting a higher incidence of illnesses, a trend associated with (a) an increased prevalence of chronic and degenerative disorders; (b) society's heightened consciousness of health leading to greater self-scrutiny and amplified awareness of bodily symptoms and feelings of illness; (c) a climate of apprehension, insecurity and alarm about disease created by commercialization of health and media attention to health issues; (d) the

progressive medicalization of everyday life, bringing unrealistic expectations of cure that make untreatable infirmities and unavoidable ailments seem worse. Barsky (1988: 415) considered there was occurring:

> … a progressive decline in our threshold and tolerance for mild disorders and isolated symptoms, along with a greater inclination to view uncomfortable symptoms as pathologic – as signs of disease. Coupled with this has been a readiness to adopt the "sick" role, to seek medical care for isolated symptoms, and to acknowledge to others that we feel ill. The standard we use for judging our health appears to have been raised, so that we are more aware of – and more disturbed by – symptoms and impairments that previously we deemed less important.

Barsky's paradox raises the possibility of adverse consequences from health promotion and publicity about diseases. The paradox of health implies a widening gap between objective health status and subjective well-being (Barsky 1988: 414). Rowe and Kahn (1998: 25–26), for example, observed that: "Older people have become so sensitized to the threat of Alzheimer's disease that every forgotten name or misplaced key ring strikes fear." People in ill health, however, are not equally affected by medical concerns. Some may be "body transcendent" while others are "body preoccupied", leading to differences in activity levels and well-being among people with the same objective health status (Shanas et al. 1968: 67). The broad implication is that health promotion programmes should seek not only to encourage risk avoidance and early recognition of diseases, but also to foster well-being and acceptance of the inevitability of biological aging.

4.7 Health Risk Factors

Bombardment with information about the symptoms of dread diseases needs to be counterbalanced with positive information about health-protective behaviours that can foster long-term benefits. Although early recognition of symptoms saves lives, health practices that enable avoidance of disease symptoms can save many more. This is essential because a relatively small number of preventable or controllable health risks are responsible for a substantial proportion of deaths and lost years of healthy life. Three types of factors comprise the main health risks in high income countries (e.g. in North America, Northern, Western and Southern Europe, and Australasia), namely addictive substances (tobacco and alcohol) and factors related to diet and physical inactivity.

In high income countries the six leading causes of lost years of healthy life are, in descending order: use of tobacco and alcohol, overweight and obesity, high blood pressure, high blood glucose and physical inactivity (Table 4.1). These also account for a substantial proportion of deaths. All are risk factors for chronic diseases, such as heart disease and cancers. Tobacco use takes the greatest toll both in terms of its involvement in lost years of healthy life (11%) and total deaths (18%). The figures in Table 4.1 cannot be added, however, because many deaths are the result of more than one risk factor. The World Health Organisation (WHO) estimated that, in high

Table 4.1 Ten leading risk factors in causes of lost years of healthy life (DALYs) and death, high and middle income countries, 2004

High income countries[a]			Middle income countries[b]		
Risk factor	Percentage of total DALYs[c]	Percentage of total deaths	Risk factor	Percentage of total DALYs[c]	Percentage of total deaths
Tobacco use	10.7	17.9	Alcohol use	7.6	6.4
Alcohol use	6.7	1.6	High blood pressure	5.4	17.2
Overweight and obesity	6.5	8.4	Tobacco use	5.4	10.8
High blood pressure	6.1	16.8	Overweight and obesity	3.6	6.7
High blood glucose	4.9	7.0	High blood glucose	3.4	6.3
Physical inactivity	4.1	7.7	Unsafe sex	3.0	
High cholesterol	3.4	5.8	Physical inactivity	2.7	6.6
Illicit drugs	2.1		High cholesterol	2.5	5.2
Occupational risks	1.5	1.1	Occupational risks	2.3	
Low fruit and vegetable intake	1.3	2.5	Unsafe water, sanitation, hygiene	2.0	
Urban outdoor air pollution		2.5	Low fruit and vegetable intake		3.9
			Indoor smoke from solid fuels		2.8
			Urban outdoor air pollution		2.8

Source: WHO (2009a: 11–12)

[a] High income: gross national income per capita US$10,066 or more (World Bank definition)

[b] Middle income: gross national income per capita US$ > 825 < 10,066 (World Bank definition)

[c] DALYs: disability-adjusted life years, or lost years of healthy life (for details see Chap. 5)

income countries in 2004, 21% of lost years of healthy life and 28% of deaths were attributable to the ten risks shown in each column of the table (WHO 2009a: 5 and 30).

The potentially dire consequences of each risk factor highlight the universal benefits of health protective behaviours. Physical inactivity increases the risk of cardiovascular disease, breast and colon cancers and type 2 diabetes. It also excludes possible benefits of exercise such as improved musculoskeletal health, control of body weight and reduced symptoms of depression. Similarly, increasing levels of overweight and obesity are associated with greater risk of stroke, cardiovascular

disease, type 2 diabetes, and cancers of the breast, colon, prostate and other organs. High blood pressure brings heightened risks of stroke, heart disease, kidney failure and other diseases. It is commonly caused by the effects of too much salt, as well as alcohol, obesity and lack of exercise. High cholesterol increases the risks of heart disease, stroke and other vascular diseases. High blood glucose is related to diet and physical inactivity which increase resistance to insulin, but genetics also have an important role. Globally raised blood glucose causes all deaths from diabetes, as well as 22% of deaths from ischemic heart disease and 16% from strokes. Consuming fruit and vegetables may prevent some cancers but the main benefit is from reducing cardiovascular disease. Whereas regular exercise is one the most beneficial interventions individuals can make for their own health, smoking is one of the worst. It greatly increases the risk of dying from a range of diseases, including lung and other cancers, heart disease, stroke and chronic respiratory disease. Alcohol contributes to more than 60 types of disease, such as oesophageal cancer and liver cancer, as well as to motor vehicle accidents, other injuries and homicide. In relation to cardiovascular disease in older people, its net effect may be protective provided consumption is moderate. The WHO estimated that ischemic stroke deaths would be 11% higher in high-income countries if no one drank alcohol. Despite this the overall impact of alcohol is harmful (ibid.: 16–21).

The above summary by no means captures all of the ramifications of the leading risk factors and it omits other risk factors with health implications in later life. The WHO estimated that 33% of deaths world-wide in 2004 were attributable to ten leading risks, while 44% were attributable to 24 leading risks. If the 24 risks were eliminated, global life expectancy would have been 9 years longer, compared with 7 years without the ten leading risks (ibid.: 29–30). The relative importance of health risks changes through time and currently varies according to national income levels. The WHO uses the income classification of the World Bank. The ‘middle income’ group is very broad and includes countries with a range of different levels of development. For this reason it is sometimes split into ‘upper middle’ and ‘lower middle’ groups (see Table 5.1). In middle income countries, which tend to have younger populations, the percentages experiencing the consequences of the leading risk factors are generally lower but the numbers of people affected are much larger (ibid.: 11). Prominent also in middle income countries are some risk factors associated with lower levels of socio-economic development, such as unsafe water and indoor smoke (Table 4.1). In aging societies the health risks associated with environmental hazards, poor infrastructure and poverty are usually greatly reduced, but reduction of further risks is an ongoing priority.

In all aging societies hubris and social inequality persist as key obstacles to the dissemination of knowledge of health risk factors and empowerment to act upon such knowledge. In addition, the most disadvantaged socio-economic groups are more likely to have low levels of health literacy, which the WHO (1998: 10) defined as: “the cognitive and social skills which determine the motivation and ability of individuals to gain access to, understand and use information in ways which promote and maintain good health.” Health literacy has applications in addressing health risks through its recognition of a range of relevant strategies. These include

enhancing access to and comprehension of information about protective behaviours, improving decision making in the event of illness, enabling effective use of available health services, facilitating understanding of medical advice, and obtaining culturally appropriate care (see Morrow et al. 2006; Sadowski 2010). Implementation involves responsiveness of health professionals and the health system to particular needs and circumstances as well as motivation and willingness to learn on the part of individuals. Australian survey data show that the percentages aged 15–74 with at least an adequate level of health literacy ranged from 26 in the lowest socio-economic status areas to 55 in the highest (AIHW 2010: 81). More striking than the socio-economic differences, however, was the low percentage of Australia's total population with adequate health literacy: only 41%. This was despite Australia's high living standards and a GDP per capita ranking eighth in the OECD (OECD 2010a). Continuing low levels of health literacy is a likely further characteristic of the fourth stage of the epidemiologic transition, one which may partly account for hubristic behaviour.

The prevalence of health risks and premature mortality are concerns in most countries, although some with the lowest birth rates – Italy, Japan and Singapore – are relatively well-positioned in relation to health risks (Table 4.2). Among Western countries, only the United States has premature mortality in excess of 10% of a birth cohort dying between the ages of 15 and 60. High death rates of American males are responsible for this anomaly: 14% of males die between these ages, compared with 8% of females. Meanwhile the Eastern European countries have losses at the same ages ranging from 10% to 30%, placing some well above the level for China and even India.

The most important factors in Eastern Europe's level of premature mortality are death rates from cardiovascular diseases for which the highest levels occur in the Russian Federation and Ukraine. Cancer mortality rates are also relatively high in Eastern Europe (Table 4.2). In the developing countries the prevalence of tobacco use, especially by males, is indicative of a future major burden of smoking-related disease. Most of the lowest rates of tobacco use by males occur in North America and Australasia but even there the proportions smoking remain a significant health concern for governments. Similarly, although smoking is not as prevalent among females in all the countries in Table 4.2 the proportion of the population involved is substantial. Obesity is a relatively new 'epidemic' in which the United States leads with over 30% of men and women having BMI's of 30 or more. Australia, New Zealand, the United Kingdom and Greece are the only other Western countries in the table with more than 20% obese. Finally, while the WHO's data show that alcohol consumption of 5–10 L of pure alcohol per capita is typical in many countries the figures do not reveal peak figures, for instance where men, or a proportion of them, consume much of the alcohol.

Table 4.2 Mortality and health risks in selected countries, 2000–2007

	Proportion dying at ages 15–60 per 1,000	Age-standardized mortality rate for cardiovascular diseases per 100,000	Age-standardized mortality rate for cancer per 100,000	Percentage using tobacco at ages 15 and over	Percentage using tobacco at ages 15 and over	Percentage obese at ages 15 and over	Percentage obese at ages 15 and over	Per capita alcohol consumption (litres of pure alcohol) ages 15 and over
Sex:	Both	Both	Both	Males	Females	Males	Females	Both
Year:	2006	2002	2002	2005	2005	2001–2007	2001–2007	2003
North America and Australasia								
United States	109	188	134	26.3	21.5	31.1	33.2	8.6
Canada	72	141	138	24.3	18.9	15.9	13.9	7.8
Australia	65	140	127	27.7	21.8	22.3	20.4	9.0
New Zealand	75	175	139	29.7	27.5	21.9	23.2	9.7
Northern and Western Europe								
United Kingdom	80	182	143	36.7	34.7	22.3	23.0	11.8
France	91	118	142	36.6	26.7	10.5	10.4	11.4
Switzerland	63	142	116	30.7	22.2	7.9	7.5	10.8
Belgium	86	162	148	30.1	24.1	11.9	13.4	10.6
Netherlands	70	171	155	38.3	30.3	10.2	12.2	9.7
Denmark	88	182	167	36.1	30.6	9.8	9.1	11.7
Norway	70	181	137	33.6	30.4	6.4	5.9	5.5
Sweden	64	176	116	19.6	24.5	10.4	9.5	6.0
Finland	96	201	115	31.8	24.4	14.9	13.5	9.3
Germany	81	211	141	37.4	25.8	13.6	12.3	12.0
Austria	79	204	127	46.4	40.1	12.0	12.7	11.1
Southern Europe								
Italy	64	174	134	32.8	19.2	7.4	8.9	8.0
Greece	76	258	132	63.6	39.8	26.0	18.2	9.0
Slovenia	104	228	160	31.8	21.1	16.5	13.8	6.7

(continued)

Table 4.2 (continued)

	Proportion dying at ages 15–60 per 1,000	Age-standardized mortality rate for cardiovascular diseases per 100,000	Age-standardized mortality rate for cancer per 100,000	Percentage using tobacco at ages 15 and over	Percentage using tobacco at ages 15 and over	Percentage obese at ages 15 and over	Percentage obese at ages 15 and over	Per capita alcohol consumption (litres of pure alcohol) ages 15 and over
Sex:	Both	Both	Both	Males	Females	Males	Females	Both
Year:	2006	2002	2002	2005	2005	2001–2007	2001–2007	2003
Spain	75	137	131	36.4	30.9	13.0	13.5	11.7
Portugal	93	208	140	40.6	31.0	14.6	16.1	11.5
Eastern Europe								
Poland	145	324	180	43.9	27.2	15.7	19.9	8.1
Czech Republic	108	315	177	36.6	25.4	13.7	16.3	13.0
Croatia	113	356	167	38.9	29.1	21.6	22.7	12.3
Bulgaria	157	554	125	47.5	27.8	–	–	5.9
Russian Fed.	300	688	152	70.1	26.5	–	–	10.3
Ukraine	264	637	139	–	–	–	11.3	6.1
Hungary	177	364	201	45.7	33.9	17.1	18.2	13.6
Latvia	223	482	156	54.4	24.1	11.9	19.5	9.6
Asia and Latin America								
Japan	67	106	119	44.3	14.3	2.9	3.3	7.6
Singapore	67	171	128	–	–	6.4	7.3	2.2
China	116	291	148	59.5	3.7	2.4	3.4	5.2
Indonesia	212	361	132	65.9	4.5	1.1	3.6	0.1
India	241	428	109	33.1	3.8	1.3	2.8	0.3
Bangladesh	254	428	111	47.0	3.8	–	–	0.0
Pakistan	206	425	107	35.4	6.6	–	–	0.0
Mexico	122	163	88	36.9	12.4	18.6	28.1	4.6
Brazil	176	341	142			8.9	13.1	5.8

Sources: WHO (2009b) and OECD (2010a, b)

4.8 Compression of Mortality and Morbidity

The most positive evidence of change in the fourth stage is the continuing rise in life expectancy. Counterbalancing this are a range of influences such as: Barsky's paradox, the status syndrome, hubris, the rising prevalence of neurodegenerative diseases, the high prevalence of health risks and low levels of health literacy. Mixed outcomes for societies are therefore apparent. Nonetheless, there is considerable interest in seeking evidence of whether an overall improvement in the health of aging populations is accompanying the broad rectangularization of the survival curve, and whether rectangularization is actually resulting in a greater concentration of deaths in the oldest ages. Potential indicators of such developments are measures of 'the compression of mortality' and 'the compression of morbidity'. The majority of people do not die at or near the average life expectancy, which is merely a summary statistic for a range of outcomes above and below it. In long-lived populations, more than half live beyond the average life expectancy at birth. Also, although most deaths now occur after age 50, an important feature of present and projected future mortality is the considerable spread in the ages at which deaths occur, as illustrated in Fig. 4.2. A key question is whether this spread is narrowing over time, in other words is a 'compression of mortality' occurring?

The concept of compression of mortality is best known from the work of James Fries (1980) who considered that the upper limit of human life expectancy is about 85 years and, since many deaths occur in old age, there would be a tendency for mortality to become 'compressed' around age 85 (Wilmoth and Horiuchi 1999: 476).

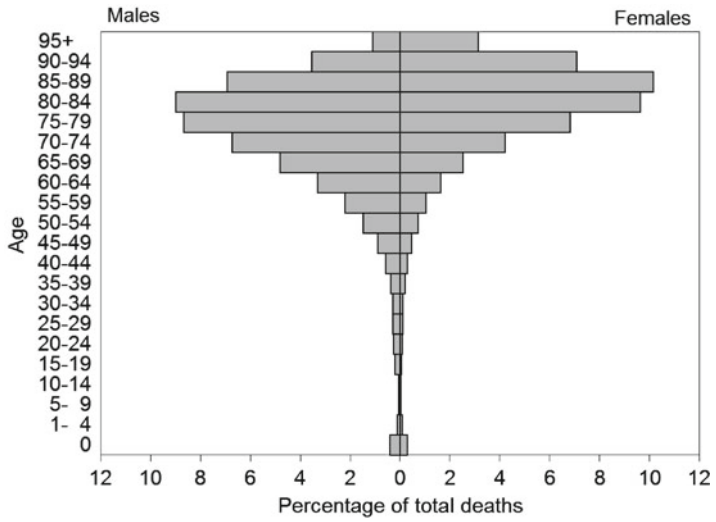

Fig. 4.2 Distribution of deaths in a long-lived population (*Note*: The first two age groups are <1 and 1–4 years) (Source: 'West' model life table with life expectancies of 80.0 for females and 76.6 for males)

The ultimate outcome would be near universal survival until people reach their eighties, followed by a concentration of deaths around the supposed biological limit. Fries (1980) also introduced the term 'natural death' referring to death at the biological limit to life, that is, in the absence of exogenous or socially avoidable influences.

A substantial decline in the variability of ages at death occurred between the 1870s and 1950s, as death rates at young ages fell (Wilmoth and Horiuchi 1999: 475). Thus there is evidence of compression in the general shift towards older ages at death. However, there is less agreement about compression of mortality within age groups 65 and over. An opposing view, predating Fries hypothesis, is that of Gruenberg (1977) who concluded that life-preserving technology is merely keeping sick people alive longer – the opposite of Fries' belief in a universal extension of life in good health. Gruenberg's hypothesis about 'the failures of success' however, gives too little recognition to the contribution of medical advances to preventing diseases and disabilities and successfully treating formerly untreatable conditions (Howse 2006: 5). An early assessment of Fries' hypothesis found that there was greater variability in the ages at death of older people, rather than decreasing variability due to a compression of mortality around some age representing a natural life span (Myers and Manton 1984). Supporting this finding was an accompanying analysis of the age distribution of deaths from five major causes, thus disproving the notion that mortality compression might be pronounced for particular causes of death. Nor could the authors find, from authoritative actuarial sources, evidence that the United States population was currently near a biological limit to life span that was constraining increases in life expectancy (ibid.: 348). Later research similarly found that neither mortality nor morbidity was becoming compressed at older ages (Wilmoth and Horiuchi 1999: 475). For example, groups with higher socio-economic status appear to have longer life in ill health.

Nevertheless more recent research employing historical data, for nine countries with the longest life expectancies, produced qualified evidence supporting Fries' hypothesis (Robine et al. 2008a). The study found that the distribution of ages at death became more compressed around the modal age at death, but there was some evidence of the trend ceasing as countries reached higher life expectancies. The authors observed that, in the nine countries, "a significant compression of old-age mortality occurred during the last 50 years." The general pattern was that "the higher the modal length of life, the more concentrated the distribution of the individual life spans" (ibid.: 11). Contrary to Fries' theory, however, they noted a continuing shift to longer lives, rather than compression around 85 years, as well as the persistence of a greater dispersion in the ages at death than Fries envisaged (ibid.: 5–10). They also found that, among Japanese women, compression of mortality ceased in the late 1980s, despite continuing increases in the modal age at death.

Fries (1980: 28–29) estimate of 85 as the biological limit of life raises other complexities, including the problem of differentiating between endogenous (biological) and exogenous (external) causes of death and calculating their respective contributions to overall mortality. Exogenous causes are supposedly preventable

causes including social and environmental factors. Yet distinctions between the two types of causes are often arbitrary: the factors responsible for 'natural death' are impossibly intertwined with exogenous causes (Olshansky and Ault 1986: 381).

The 'compression of morbidity' hypothesis, associated with the notion of compression of mortality, envisages that later life morbidity will ultimately become compressed into the period immediately before death. Its realization would require not only the elimination of all exogenous factors in mortality but also elimination of the chronic disabling diseases and conditions that are most prevalent in later life. Genetic differences in susceptibility to disease militate against morbidity compression, and Gruenburg's 'failures of success' suggests a lengthening of the average duration of ill health among the aged. Although extension of life into very old ages, together with earlier and more comprehensive detection and treatment of diseases, supports Gruenburg's hypothesis, interventions that reduce the severity of diseases and prolong survival imply success rather than failure. Fries' defence of his hypothesis argues that compression of morbidity is possible if primary prevention substantially delays the onset of disabling diseases (Howse 2006: 7). This would require sufficient delay to counterbalance the effects of still longer life expectancies and more person-years lived at ages 85 and over. Currently, there is no consensus about a shift towards a compression of morbidity. There are thought to be different trends for different diseases and conditions, as well as variations between countries (Robine et al. 2008b; Cox and Hope 2006: 232). Also "the kind of evidence that is needed to support solid conclusions about the expansion or contraction of morbidity is simply not available for most countries in the developed world" (Howse 2006: 19).

4.9 Conclusion

For older age groups, as well as society generally, key characteristics of the 'new era' in health, or the current stage of the epidemiologic transition, are features associated with demographic changes, and features arising from the social context of people's lives, namely: (i) continuing improvements in life expectancy, now due especially to better survival in middle and later life, which inevitably raises the proportions reaching the ages where chronic illnesses and disabling diseases have their highest prevalence; (ii) a decline in mortality from certain degenerative diseases, because of prevention, delayed onset or earlier diagnosis and treatment; (iii) a great increase in the prevalence of degenerative diseases of the brain as higher proportions survive to advanced ages; (iv) a more conspicuous role for hubristic behaviour accompanied by the persistence of health risks and inadequate health literacy, despite better knowledge and higher levels of education; (v) the pervasive influence of social inequality on health; (vi) negative, as well as positive, effects of the medicalization of everyday life.

References

AIHW (Australian Institute of Health and Welfare). (2010). *Australia's health 2010: The twelfth biennial health report of the Australian institute of health and welfare* (Cat. No. AUS 122). Canberra: Australian Institute of Health and Welfare.

Andrews, K. (2001). *National strategy for an ageing Australia: an older Australia, challenges and opportunities for all*. The Hon Kevin Andrews MP, Minister for Ageing. Canberra: Commonwealth of Australia.

Barsky, A. J. (1988, February). The paradox of health. *The New England Journal of Medicine, 18*, 414–418.

Blane, D. (2006). The life course, the social gradient, and health. In M. Marmot & R. G. Wilkinson (Eds.), *Social determinants of health* (pp. 54–77). Oxford: Oxford University Press.

Broe, G. A., & Creasey, H. (1995). Brain ageing and neurodegenerative diseases: A major public health issue for the twenty-first century. *Perspectives in Human Biology, 1*, 53–58.

Brunner, E., & Marmot, M. (2006). Social organization, stress, and health. In M. Marmot & R. G. Wilkinson (Eds.), *Social determinants of health* (2nd ed., pp. 6–30). Oxford: Oxford University Press.

Christensen, K., Doblhammer, G., Rau, R., & Vaupel, J. W. (2009). Ageing populations: The challenges ahead. *Lancet, 374*, 1196–1208.

Coale, A. J., & Demeny, P. (1983). *Regional model life tables and stable populations*. New York: Academic Press.

Cockerham, W. C., & Yamori, Y. (2001). Okinawa: An exception to the social gradient of life expectancy in Japan. *Asia Pacific Journal of Clinical Nutrition, 10*(2), 154–158.

Cox, M., & Hope, S. (2006). Health service needs and labour force projections. In J. Boston & J. A. Davey (Eds.), *Implications of population ageing: Opportunities and risks* (pp. 221–251). Wellington: Institute of Policy Studies, Victoria University of Wellington.

Doll, R., et al. (2004). Mortality in relation to smoking: 50 years' observations on male British doctors. *British Medical Journal, 328*(26 June), 1519–1528.

Emberson, J. R., Whincup, P. H., Morris, R. W., & Walker, M. (2004). Reducing social inequalities and the prevention of coronary heart disease. *International Journal of Epidemiology, 33*(5), 1152–1153.

Fries, J. (1980). Aging, natural death, and the compression of morbidity. *The New England Journal of Medicine, 303*(3), 130–135.

Gruenberg, E. M. (1977). The failures of success. *The Milbank Memorial Fund Quarterly/Health and Society, 55*, 3–24.

Howse, K. (2006). *Increasing life expectancy and the compression of morbidity: A critical review of the debate* (Working Paper No 206). Oxford: Oxford Institute of Ageing.

Jarvis, M., & Wardle, J. (1999). Social patterning of individual health behaviours: The case of cigarette smoking. In M. Marmot & R. G. Wilkinson (Eds.), *Social determinants of health* (pp. 240–255). Oxford: Oxford University Press.

Jarvis, M. J., & Wardle, J. (2006). Social patterning of individual health behaviours: The case of cigarette smoking. In M. Marmot & R. G. Wilkinson (Eds.), *Social determinants of health* (2nd ed., pp. 224–237). Oxford: Oxford University Press.

Kawachi, I., Kennedy, B. P., & Wilkinson, R. G. (Eds.). (1999). *The society and population health reader: Income inequality and health*. New York: New Press.

Marmot, M. (1999). Introduction. In M. Marmot & R. G. Wilkinson (Eds.), *Social determinants of health* (pp. 1–16). Oxford: Oxford University Press.

Marmot, M. (2004a). Commentary: Risk factors or social causes? *International Journal of Epidemiology, 33*(2), 297–298.

Marmot, M. (2004b). *The status syndrome: How social standing affects our health and longevity*. New York: Henry Holt.

Marmot, M., & Wilkinson, R. G. (Eds.). (2006). *Social determinants of health* (2nd ed.). Oxford: Oxford University Press.

Morrow, D., Clark, D., Tu, W., & Wu, J. (2006). Correlates of health literacy in patients with chronic heart failure. *The Gerontologist, 46*(5), 669–676.
Myers, G. C., & Manton, K. G. (1984). Compression of mortality: Myth or reality. *The Gerontologist, 24*(4), 346–353.
National Research Council. (2001). *Preparing for an aging world: The case for cross-national research*. Washington, DC: National Academy Press.
OECD. (2010a). *Factbook 2010: Economic, environmental and social statistics*. Paris: Organisation for Economic Co-operation and Development.
OECD. (2010b). *Health data 2010, selected data, risk factors*. http://www.oecd.org/document/16/0,3343,en_2649_34631_2085200_1_1_1_1,00.html. Accessed Sept 2010.
Oeppen, J., & Vaupel, J. W. (2002). Broken limits to life expectancy. *Science, 296*(5570), 1029–1031.
Olshansky, S. J., & Ault, A. B. (1986). The fourth stage of the epidemiologic transition: The age of delayed degenerative disease. *The Milbank Memorial Fund Quarterly, 64*(3), 355–391.
Population Reference Bureau. (2010). *2010 World population data sheet*. Washington, DC: Population Reference Bureau.
Robine, J., Cheung, S. L. K., Horiuchi, S., & Thatcher, A. R. (2008a). Is there a limit to the compression of mortality? In *Living to 100 and beyond*. Orlando, USA: Society of Actuaries. http://www.soa.org/library/monographs/retirement-systems/living-to-100-and-beyond/2008/january/mono-li08-03-cheung.pdf. Accessed Feb 2011.
Robine, J., Cheung, S. L. K., Horiuchi, S., & Thatcher, A. R. (2008b). Is the compression of morbidity a universal phenomenon? In *Living to 100 and beyond.* Orlando, USA: Society of Actuaries. http://www.soa.org/library/monographs/retirement-systems/living-to-100-and-beyond/2008/january/mono-li08-04-cheung.pdf. Accessed Feb 2011.
Rogers, R. G., & Hackenberg, R. (1987). Extending epidemiologic transition theory: A new stage. *Social Biology, 34*, 234–243.
Rowe, J. W., & Kahn, R. L. (1998). *Successful aging* (large print ed.). New York: Random House.
Sadowski, C. A. (2010). Providing health information to older adults. *Reviews in Clinical Gerontology, 21*(1), 55–66.
Senate Community Affairs Committee. (2005). *Quality and equity in aged care*. Canberra: Commonwealth of Australia. http://www.aph.gov.au/senate/committee/clac_ctte/completed_inquiries/2004-07/aged_care04/report/index.htm. Accessed June 2011.
Shanas, E., Townsend, P., Wedderburn, D., Friis, H., Mihoj, P., & Stehouwer, J. (Eds.). (1968). *Old people in three industrial societies*. London: Routledge and Kegan Paul.
Stampfer, M. (2004). New insights from the British doctors study. *British Medical Journal, 328*, 1507.
Suzuki, M., Willcox, B., & Willcox, C. (1995). *Centenarians in Japan*. Tokyo: Nakayamashoten. See: Okinawa centenarian study. http://www.okicent.org/study.html. Accessed June 2011.
Temple, J. B. (2006). Household factors associated with older Australian's purchasing a varied diet: Results from household expenditure data. *Nutrition and Dietetics, 63*(1), 28–35.
Volker, D., & Caterson, I. (2001). Nutrition and senescence: Healthy ageing. *Australasian Journal on Ageing, 20*, 114–123.
Wadsworth, M. (1999). Early life. In M. Marmot & R.G. Wilkinson (Eds.), *Social determinants of health* (pp. 44–63). Oxford: Oxford University Press.
WHO (World Health Organisation). (1998). *Health promotion glossary*. WHO/HPR/HEP/98.1 Geneva: WHO. http://www.who.int/hpr/NPH/docs/hp_glossary_en.pdf. Accessed Jan 2011.
WHO (World Health Organisation). (2009a). *Global health risks: Mortality and burden of disease attributable to selected major risks*. Geneva: World Health Organisation Press.
WHO (World Health Organisation). (2009b). *WHO Statistical information system*, http://www.who.int/whosis/data/Search.jsp; and WHO *Core health indicators*, http://apps.who.int/whosis/database/core/core_select.cfm. Accessed Apr 2009.
Wilkinson, R. G. (1999). Putting the picture together: Prosperity, redistribution, health and welfare. In M. Marmot & R. G. Wilkinson (Eds.), *Social determinants of health* (pp. 256–274). Oxford: Oxford University Press.

Willcox, B. J., Yano, K., Chen, R., et al. (2004). How much should we eat? The association between energy intake and mortality in a 36-year follow-up study of Japanese-American men. *The Journals of Gerontology: Biological Sciences, 59A*(8), 789–795.

Willcox, D. C., Willcox, B. J., He, Q., Wang, N., & Suzuki, M. (2008). They really are that old: A validation study of centenarian prevalence in Okinawa. *The Journals of Gerontology: Biological Sciences, 63A*(4), 338–349.

Wilmoth, J. R., & Horiuchi, S. (1999). Rectangularization revisited: Variability of age at death within human populations. *Demography, 36*(4), 475–495.