One of the major public health achievements this century has been the sharp decline in premature mortality from many communicable and non-communicable diseases. This is largely due to improvements in sanitation, housing, and nutrition as well as to medical innovations, including vaccinations and the discovery of antibiotics. Consequently life expectancy has risen, and is expected to continue to rise, in virtually all populations throughout the world (Fig. 1), leading to a steep increase in the number of people reaching older age. The sharp increases in life expectancy have been followed by substantial falls in fertility world-wide in developed and developing countries (Fig. 2), mainly due to availability of modern contraceptive methods. In India, for example, total fertility rates (TFR) – that is, the total number of children a woman is expected to have at the end of her reproductive years – have decreased from 5.9 in 1970 to 3.1 in 1998.

A Life Time of Ageing

Ageing can be defined as the life-long process of progressive change in biological, psychological and social structures of a person. For statistical purposes, ‘ageing’ is commonly referred to specific age groups, for example, those aged 60 years and above. However, the ageing process begins even before we are born, and continues throughout life.

Although some associate ‘ageing’ with mental decline and physical impairment, this is a misconception, as the majority of older people enjoy good health and lead active lives. While the functional capacity of biological systems (e.g., muscular strength, cardiovascular performance, etc.) declines after peaking in early adulthood, health and activity in older age are largely determined by the exposures and actions of an individual during the whole life span. Thus, individuals are able to influence how they age by adapting to ageing-associated changes and by adopting healthier life styles.

An Ageing World

One of the major public health achievements this century has been the sharp decline in premature mortality from many communicable and non-communicable diseases. This is largely due to improvements in sanitation, housing, and nutrition as well as to medical innovations, including vaccinations and the discovery of antibiotics. Consequently life expectancy has risen, and is expected to continue to rise, in virtually all populations throughout the world (Fig. 1), leading to a steep increase in the number of people reaching older age. The sharp increases in life expectancy have been followed by substantial falls in fertility world-wide in developed and developing countries (Fig. 2), mainly due to availability of modern contraceptive methods. In India, for example, total fertility rates (TFR) – that is, the total number of children a woman is expected to have at the end of her reproductive years – have decreased from 5.9 in 1970 to 3.1 in 1998.
This decline is even more pronounced in China, where the ‘one-child-per-family’ policy was officially introduced in 1979. Total fertility rates fell from 5.5 in 1970 to the current 1.8, which is below the 2.1 replacement level.1 By 2020 differences in TFR between countries will have virtually disappeared – a powerful determinant of population ageing, as the number of children and young people ‘joining’ the population gradually decreases.

This demographic transition from a pattern of high mortality/high fertility to that of low mortality/low fertility, is commonly referred to as ‘population ageing’, and will be compressed to an unprecedentedly short period of time in developing countries. While it has taken France 115 years for the proportion of older people to more than double from 7 to 14%, it will take China only 27 years to achieve the same between 2000 and 2027.1 Figures 3a and 3b illustrate this shift in age structure for the world population from 1995 to 2025.

**Implications of Rapid Ageing**

There are currently about 580 million older people (60 years and above) in the world, with 355 million in developing countries.
By 2020 the figures will reach 1,000 million, and over 700 million, respectively.1

With this rapid growth in the proportion of older people, more people will enter the age of higher risk of developing non-communicable diseases (NCDs). This in turn may result in disability. In fact, NCDs including cardiovascular diseases, diabetes and cancer are predicted to be the main contributors to the burden of disease in developing countries by 2020,2 and will be responsible for over three quarters of all deaths. At the same time, communicable diseases – although declining – will not have disappeared in those regions,3 thus leading to the so-called ‘double burden’.

It is projected that in countries with fertility rates below replacement level, the proportion of older people will exceed the proportion of the very young (aged up to 19 years) by 2050. This implies that in future one child may have to care for several elderly relatives, and the ‘younger old’ may be looking after the ‘older old’.

Given this population ageing, it is becoming increasingly critical to ensure that populations will grow older enjoying the highest possible health status. In this respect it is encouraging to see increasing evidence from developed countries that people are maintaining better health in later life than ever before. It is now known that the health status of older people in the USA has been improving since the early 1980s.4 It is estimated that because of this, there are now 1.4 million fewer disabled people in that country than there would have been otherwise.

### Ageing and Vision Worldwide

The number of blind people in the world today is about 45 million, and a further 135 million have severely impaired vision.1 Most of them are older people, as visual impairment and blindness increases with age. This is mainly due to age-related disorders such as cataract, macular degeneration, and glaucoma, which together are responsible for about 60% of the world’s blindness.4

In most countries of Asia and Africa cataract alone accounts for over 40% of all blindness.1 Diabetes and smoking, among others, are thought to be risk factors for the development of cataract. With the predicted increase in the rates of diabetes and tobacco use in developing countries, the burden of blindness from cataract may soon reach even higher proportions.

### The Response to Population Ageing

Rapid population ageing poses immense challenges to health and social services. Such challenges will be daunting to developing countries, which are still faced with infrastructural development problems and scarce resources. We have seen how advances in medical technology have offered solutions to specific ageing related problems – a situation which is likely to continue. However, these measures are often unaffordable to developing countries. For this reason, and considering the pace of global ageing, radical answers urgently need to be worked out by those societies.

In acknowledgement of this, WHO established in 1995 its ‘Ageing and Health’ Programme. This is a cross-sectional programme, which promotes health and a high level of functional capacity throughout the life span. It is in the process of establishing substantial collaborative work with acade-
The Epidemiology of Ageing and the Eye

Robert Weale DSc
Emeritus Professor of Visual Science
Age Concern Institute of Gerontology
King’s College London, London SE1 8WA, UK
Eye Department, University College Hospital, London WIN 8AN, UK

The probability of an adult dying doubles every six or seven years. At the moment the progression is somewhat slower for women than for men. The ‘law’ describing the ‘nature of the function’ relating to human mortality was first reported by Gompertz in 1825. More recent studies have shown that the Gompertz ‘law’ is valid only within limits, breaking down in the upper age range. This implies the following. On the basis of the ‘law’ one would predict tentatively that there is a fixed human lifespan (a maximum length of life) of about 120 years. More recent analyses see this number only as a most probable one, with a longer mortality, the chance of cataract appearing increases in incidence with age, but, in some instances, one can be more specific. In the case of cataract, a law similar to that of Gompertz has been observed, and, as with mortality, the chance of cataract appearing in a cohort doubles every six or so years. Although apparently not true of glaucoma, and be lacking amongst the Bantu, namely a thin lens. It may be mentioned in passing that, in a British study, patients with angle-closure glaucoma were found to have lenses thicker than those of normal controls: however, an additional anatomical detail and relevant biological variables, which have been established with some reliability mainly for Caucasian eyes. This matter is most important for the understanding of the variation of some wide-spread conditions, and for their potential prevention or cure.

As regards lenses in Southern countries, there is much that is unknown. A great deal about age-related changes in (Caucasian) lenses is known. The World Health Report 1998

References

Presbyopia occurs earlier in warm climates

Photo: Manya McGowan