Living to 100 years and beyond: Drivers and implications

George W. Leeson

Abstract
The world is ageing, both at an individual and a population level, and population ageing is truly a global phenomenon. The emergence of large numbers of centenarians has accompanied this development and the twenty-first century promises to be the century of centenarians. The number of centenarians in Europe increased from around 57,000 in 2006 to almost 90,000 in 2011. By 2100 the number is expected to reach around 1.4 million in England and Wales alone. This century of centenarians will be challenging in both the developed and the emerging economies. The trend has fundamental consequences for the way in which individuals view and live these ever-extending lives, but also for the way in which societal infrastructures (education, workplaces, housing, transport, and health and social care) will need to be adapted to the needs of extreme-aged populations. More importantly, perhaps, our perception of old age needs a dramatic reappraisal.

Keywords
Ageing populations, Radical life extension, Centenarians

The success of ageing
In the 1970s and 1980s, when population ageing was beginning to make itself felt across Europe and North America, this demographic development was widely regarded as a problem. As it continued, the problem became a challenge and, more recently, has been seen as an opportunity. Inherently, the extent of this ageing—certainly at the individual level—is a success.

Corresponding author:
G. W. Leeson, Oxford Institute of Population Ageing, University of Oxford, 66 Banbury Rd, Oxford OX2 6PR, UK.
Email: george.leeson@ageing.ox.ac.uk
The proportion of the world’s population aged 60 years and over has increased from 8% and 200 million in the mid-twentieth century to 12% and almost 1 billion now; by 2050, it is expected to reach 21%, corresponding to 2.1 billion people aged 60 years and over (UN 2017). The ageing of Europe’s populations has been slower over this same period. The population aged 60 years and over in Europe increased from 65 million and 12% in 1950 to 131 million and 18% in 1990—doubling over 40 years (UN 2017). By 2015 this had increased further to 177 million and 24%, and it is expected to peak around 2050 at 247 million and 35%, well short of a repeat 40-year doubling (UN 2017).

Life expectancies also increased during the twentieth century and are expected to continue to do so in the twenty-first century (UN 2017). For the foreseeable future, each new generation can expect to live longer than previous generations, and the rate of increase is expected to be surprisingly strong and constant (Leeson 2014). Life expectancies at birth for both sexes combined have increased at the global level from around 47 years in the mid-twentieth century to around 71 years today, and are expected to rise to around 77 years by the mid-twenty-first century and to around 83 years by the end of the twenty-first century. In Europe life expectancies have increased from 64 years in 1950 to around 77 years today, and are expected to reach around 83 years by the middle and 89 years by the end of the twenty-first century.

Historically, there has been scepticism about the limit of longevity, moving from a belief in limits to lifespan to a belief in a limit to life expectancy. There is strong historical evidence to suggest that this success story will continue, as pointed out by Oeppen and Vaupel (2002). Female life expectancy at birth in the country with the longest life expectancy at any given time has increased year on year since 1840 at a rate of approximately 2.5 years per decade. And the same is true, but at a slower rate, for males (Westendorp 2004).

While the question is, of course, whether or not we are prepared for this success, both individually and at a societal level, it is also pertinent to ask what this success will bring with it.

The emergence of extremely long lives

Claims of people living extremely long lives are nothing new, but verifiable ages at death are difficult to identify pre-nineteenth century, as records were unreliable even where they existed. The Greek philosopher Democritus of Abdera is referenced by Diogenes Laertius in AD 250 as assuredly having lived 109 years. The longest-lived person in the Bible was Methuselah, who lived to 969 years old (Genesis 5:27), just 7 years longer than Jared who lived for 962 years (Genesis 5:20). Indeed the Bible includes many people who lived for at least 100 years and a few who lived for several hundred years. This extended and fanciful longevity is probably symbolic of their influence rather than the actual physical length of their lives.
Not everyone is convinced of the existence of these long lives in centuries past. According to Jeune (1995), centenarians did not exist before 1800 in any population or in any period of world history; this is an interesting claim as his main thesis seems to be that there are no reliable records. In Norway, however, there does seem to be evidence of a centenarian before 1800 (Kjaergaard 1995). The verified oldest person ever to have lived is Jeanne Calment, who died in France in 1997 aged 122 years and 164 days. Since the death of 117-year-old Violet Brown of Jamaica on 15 September 2017, 117-year-old Nabi Tajima of Japan, born 4 August 1900, is the oldest living person in the world whose age can be reliably documented. The verified oldest person to have lived in the UK was Charlotte Hughes, who died in 1993 aged 115 years and 228 days. As of 30 October 2017, the oldest living person in the UK is Bessie Camm, aged 113 years, 132 days. The last surviving Briton born in the nineteenth century was Grace Jones, who died on 14 November 2014. Living in three centuries is nothing new. Margaret Neve from Guernsey lived in the eighteenth, nineteenth and twentieth centuries (1792–1903) and is one of the earliest such cases to have been verified. Large proportions of those born towards the end of the twentieth century will live into the twenty-second century (Evans 2011).

The highest reported reliable age at death globally is thus well over 100 years, even over 110 years, and has been increasing. The highest verified age at death has increased from 109 to 115 years in England and Wales (Thatcher 1999; 2001).

As a result of declines in mortality then, we have experienced significant increases in the numbers of centenarians, and not just in the more developed economies of the world (Leeson 2016). The declines in mortality that began in the middle of the nineteenth century drove up life expectancies at birth in particular, but also affected expectancies later in life, although these increased more slowly and later on. These developments led to the rise in the number of centenarians; for example, the number has doubled in more or less every decade in France and in England and Wales since the early 1950s. In 2011, the number of centenarians in Europe was almost 90,000, corresponding to around 17 centenarians per 100,000 inhabitants. France had the highest ratio, of around 28 centenarians per 100,000 inhabitants, while the Czech Republic, Slovakia, Croatia, Romania and Bulgaria had the lowest ratios, of between 5 and 3 centenarians per 100,000 inhabitants. The total number of male centenarians in Europe in 2011 was almost 15,000 (Teixeira et al. 2017).

Thus, not only have lives been extended, but more and more individuals are enjoying these extended lives. While only one person has verifiably reached 122 years of age, the future will be one with hundreds and even thousands of individuals in the population reaching this age . . . and beyond.

**The never-ending story of longer lives**

By the turn of the next century, life expectancies at birth for Europe as a whole are predicted to be 87 years for males and 91 years for females. Survival curves, in other words, are expected to continue to rectangularise (Fries 1980), which will lead to increasing numbers of people of extreme age, including centenarians.
In England and Wales, for example, the number of centenarians is projected to increase steadily across the twenty-first century, from just over 12,000 in 2012 to an incredible 1.4 million by 2100. But consider a scenario in which the projected mortality rate for those aged 55 years and over falls by an additional 5% every 5 years in relation to the official projected mortality rate, fuelled by potential additional decreases brought about by medical advances—such as stem-cell therapies that might enable 80-year-olds to live to 200 years of age (Lavasani et al. 2012).

In this scenario the number of centenarians in England and Wales by 2100 would reach around 1.8 million. This additional 5% decline scenario is not science fiction but is based primarily on the observed decreases in mortality for those aged 55 years and over in the previous 90 years from 1910–19 to 2000–9, during which the mortality rate for females aged 55–79 years declined on average by between around 3% and 5.5% every 5 years. For males, declines amounted to between 2.5% and 4%.

**Do we need to redefine old age?**

European populations were surprised by the fundamental changes brought about by the ageing of their populations in the latter part of the twentieth century. This was a combination of demographic resistance to the idea that human longevity could exceed expectations and the decline in mid- and late-life mortality rates as the prevention and treatment of lifestyle diseases, such as cardiovascular diseases, improved.

The future will also present surprises and challenges if we ignore the evidence that the number of extremely long-lived individuals in our societies is significantly increasing. The twenty-first century as the century of centenarians will be challenging in both the developed and the emerging economies of the world. Regardless of location, the trend has fundamental consequences for the way in which individuals view and live these extending lives, but also for the way in which societal infrastructures (education, workplaces, housing, transport, and health and social care) will need to be adapted to the needs of these extreme-aged populations. This must also challenge our concept of *old age*.

How could, or should, people begin to prepare themselves for such long lives? At the individual level the trend presents a challenge to life course planning. Family dynamics will be challenged by the survival of these extremely long-lived generations, which will delay intergenerational succession and inheritance and depend on smaller families for support in their frail and dependent old age.

This demographic development is clearly a challenge to current concepts of old age and therefore, most importantly, perhaps, we need to redefine old age.

Harper (2017) discusses the reformation of ageing and old age and argues, amongst other things, that we are attempting to tackle the twenty-first century phenomenon of extremely long lives with twentieth-century institutions. In this context, it is pertinent to
consider how old age is defined and how ageing became a subject of interest (Leeson 2017) in order to redefine old age in light of our potentially and likely very long lives.

Towards the end of the sixteenth century, Shakespeare provided us with the seven ages of man in his play *As You Like It*. It is the last scene of all that defined old age for the centuries to follow, as a return to childhood and a time of total dependency:

Last scene of all,
That ends this strange eventful history,
Is second childishness and mere oblivion,
Sans teeth, sans eyes, sans taste, sans everything.
(Shakespeare in Parker 2005, 52–3)

However, in modern times, Shakespeare’s fifth and sixth, still active, ages of man have been packaged into old age along with the seventh age.

But more determinate than even Shakespeare is the fact that there are three institutional structures which have historically defined older people as a separate group from everyone else in a population. These three structures are almshouses,¹ the pensions systems increasingly introduced in Western Europe from around the end of the nineteenth century and the development of geriatrics as a medical speciality.

From the eighteenth century, almshouses developed from institutions for poor disadvantaged people of all ages into institutions populated by older people, which led to (all) older people becoming homogenised in this group. Almshouses institutionalised a marginalised *social space* for older people.

Pensions systems introduced a marginalised *social time* defining old age. They define an exact age beyond which individuals become dependent, separated from the younger, productive section of the population. In this way, a well-defined phase of life called ‘old age’ becomes anchored in society’s judicial and administrative structures. A collective perception of old age as a well-defined, chronologically determined phase of life appears from the middle of the nineteenth century. This opened the floodgates for a standardised definition of old age based on statistical probabilities, and along with this came the opportunity to treat and understand older people collectively as a group in a chronologically well-defined phase of life. This *statisticalisation* of old age provided a scientific platform for the introduction of social support mechanisms in old age.

The medicalisation of the ageing body or person arrived with the birth of geriatrics as a discipline around 1840 (Kirk 1995). The medicalisation of ageing—helped by the marginalisation of old age and older people—led to the dominant image of ageing and old people as one characterised by the tired, failing, ageing body. The seventh age of man, described by Shakespeare as second childishness, fitted this image perfectly.
The early retirement schemes of the 1970s and 1980s in Europe and North America, introduced to create jobs for the unemployed youth, redefined the collective perception of and attitude to old age dramatically. They also redefined the space and time of old age.

The issue now is that someone aged 60 is expected to join the collective ranks of old age, slotting neatly into the stereotypical image of old age built up over the previous 150 years or so.

Given increasing life expectancy and longevity, individuals potentially have the opportunity to contribute to their families, communities and workplaces for much longer—breaking through the legislative and administrative age barriers that constrain them and redefining old age in the life course. This is the potential benefit of living extended lives. It is about extending our active contributory life, in whatever way we want to define this as individuals, into our seventies, eighties and even nineties before real old age begins to reduce our potential for this.

Conclusion

This paper has considered the emergence of centenarians historically and the development in the number of centenarians in the twenty-first century, and asks whether we need to redefine old age. One of the greatest achievements of humankind has to be that so many people are living for so long. Around the world, new generations can expect to live longer than previous generations. The evidence for our increasingly long lives, however, is accompanied by less positive evidence of increasing inequalities. If we look at life expectancies at any age, we find inequalities in death everywhere, between countries, between regions within countries and between different socio-economic groups within a region.

While we continue to live longer and longer, the infrastructures around us, designed to support us as we age, seem to be struggling to keep pace with our increasing years. The struggle is not simply about the funding of pensions. Nor is it about the provision of health and care services for our ageing populations. Fundamentally, we need to ask ourselves: what do we want from our longer lives? Do we simply want to live as long as possible (quantity)? Or do we want to remain healthy, active and independent, before dying without reaching the limits of age that science can achieve for us (quality)? And our governments need to address the important questions about how ageing will transform our societies, from our homes to our workplaces, and from our families to our communities. What are these important questions? A key question relates to the development of national policies which will maintain well-being for all citizens across our increasingly long lives, as well as address the inequalities between and within generations. Another key question relates to the way in which technological development will change our lives. The digital revolution of the twenty-first century threatens low- and perhaps even middle-skilled jobs on the one hand, but offers opportunities to develop new methods of providing health and social care for an ageing population on the other. But the demography itself demands political attention. In
a world of declining numbers of young people and increasing numbers of older (but not burdensome) people, both the individual and the societal mindset needs to change: this is probably the greatest challenge of all as we move deeper into the twenty-first century—the century of centenarians.

**Note**

1. An almshouse provided shelter in the community for people who could no longer work to earn enough money to pay rent; they were therefore primarily for the poor. As such, stigma was attached to them.

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Author biography

George W. Leeson is Director of the Oxford Institute of Population Ageing at the University of Oxford. His main research interests are in the socio-demographic aspects of ageing populations, covering both demographic modelling of population development and the analysis of national and international data sets.