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What I will talk about is longevity, effectively ageing, and I would like to put forward the thesis that nothing will change the experience of individual lives on this planet more in the 21st century than what is happening to the changes in age structure and life expectancy. The challenges for global governance are sweeping, and the state of play at the moment is that governments are simply in a tailspin in terms of what they should do in relation to increasing longevity. Those are strong statements, and I hope I will be able to justify them to you.

An important point to make clear at the beginning is that population ageing is truly a global phenomenon, not just a concern for high-income countries. Back in 1990, I was very surprised to see in a very small immigration post on the border between Burkina Faso and Ghana, a poster printed by the Ghanaian Ministry of Health which declared 'Young today, old tomorrow; take care of the aged'. Not only was this one of the poorest parts of Ghana, where child mortality was still more than 25% in the first five years of life, but this was a part of sub-Saharan Africa where traditional respect for the aged is part of the fabric of society, so it was a clear indication of what was changing.

I want to cover some of the common myths and misconceptions about ageing, and I begin by making another strong statement: most of what most of us think we know about ageing is wrong. Ageing is a phenomenon that is deeply familiar to us but there is an old saying that "familiarity breeds contempt" and this contempt might be a factor in the widespread failure to look sufficiently openly at the real truths about ageing.

Most people believe that we are programmed to age and die. They believe there is a genetic programme for ageing and death because this is necessary both to prevent the planet from overcrowding, and also to secure the succession of generations. But this is wrong.

Most people believe that old age is inevitably a period of poor-quality existence, and I will present evidence that challenges this.

Most people believe that population ageing is the main cause of increased health costs around the world. This again is incorrect.

Many people believe that population ageing is the primary cause of growth in the size of the global population; again, this is simply wrong.

Most people believe that older people are an unsupportable economic burden for today's societies. Unfortunately this could well prove to be correct, if we play it badly, but there is absolutely no reason, if global governance recognises what needs to be done, why this should be true.

The rapidity of recent changes is very striking. If we look at how the pattern of survival across the life course has changed in just one century, from 1900 to 2000, using as an example data from the Registrar General of England and Wales, we can see how dramatically things have changed. Whereas survival past 65 for those born in 1900 was statistically unlikely, it now occurs with very high probability. Very few changes have occurred in human society as fast as this, and the implications are enormous.

These demographic data help us to understand what has also become clear from scientific research on ageing: that human ageing is not and cannot be genetically programmed. Nature cannot evolve a programme for a phase of life that is not normally seen; this applies to humans and wild animals. Mice in the wild only rarely survive past their first birthday; the top survival is probably no more than 18 months, though if you keep a mouse as a pet, you can keep it alive for three years. That means that what happens during the ageing phase of the life history is something that nature never planned for, and it is really important to understand that. Ageing happens because random molecular damage is occurring all the time we are living our lives. If we could hear it, the damage impacting on our bodies right now would be truly terrifying. Every second that passes, the DNA in the cells of your body is struck ten million million times by



what are called free radicals. Think about it; every second, ten million million hits are occurring in your body. If those hits passed unrepaired, you would not last long at all! The reason you will survive for many further years is that you have armies of repair systems that are working extremely hard to try and repair the damage as it happens, but even so they are not perfect. A fraction of the damage that is occurring in your body now will persist. This is a tremendously dynamic process that is occurring. This is the ageing process; this is what those of us who work on the science of ageing have to understand.

The other thing we have to look at is the demography. A graph published in *Science* in 2002 by two leading historical demographers shows a very striking story. Each data point showed, for the year in question, the life expectancy in the longest-living country in the world. The identity of the leader has changed; it started in Scandinavia, went down to Australia and New Zealand, and has bounced around the world, and for the last 20 years it has been Japan. I should add that Monaco is technically the longest-living country in the world today, but it is so small that it does not figure in these league tables.

When we look at a graph like this, what is striking is the linearity of the increase over the last two centuries in life expectancy around the world. This is a background progressive change; because it is a graph of the leaders of the pack it does not show the blips that are caused by the world wars or by major pandemics like the 1919 flu epidemic. For individual countries, their trajectories would show dips that corresponded with periods of warfare or major disease, but the underlying, global trend is upwards.

You can also see, very importantly, the United Nations forecast that was made back in 1980. Despite the fact that we had had 200 years of steadily increasing life expectancy, the UN (along with all of the other forecasting agencies) predicted that this increase would soon stop. The reason was that, until that point, just one thing had been driving the increase in life expectancy, which was that we were preventing deaths in the early and middle years of life. Everybody assumed that the ageing process was something fixed, which would not change. By 1980 in high-income countries we had reduced the death rates in the early and middle years of life to such an extent that, if you could eradicate all death before the age of 50, you would see only a very small further increase in life expectancy.

The statistics show, however, that humanity disregarded the UN predictions! This was because, contrary to expectation, a new driver of increasing longevity appeared. This new driver is that death rates of very old people are falling. In high-income countries, death rates of people aged 80 and above are less than half today what they were just 50 years ago, and we see no immediate end to this trend in sight.

This unexpected violation of previous predictions is why governments around the world have found themselves unprepared. Indeed, there is plenty of evidence that even the basic facts are less widely appreciated than they need to be. And the attitudes towards the increase are curiously negative. A few years ago a headline in an English newspaper said, 'The bad news is, we're living even longer.' It is bizarre that what is arguably humanity's greatest success - the doubling of the average length of a human life over the course of the last 200 years - is so often portrayed as a disaster in the making, the "grey tsunami" or "ticking time bomb" of demographic change.

The picture we have of the nature of the ageing process is incomplete. It is much more malleable than we used to think. Ageing is shaped not just by intrinsic factors and there are many things about the way our lives are lived which impact on the processes of accumulating molecular damage. Thus, we know that stress, adverse environments and unhealthy nutrition actually accelerate the build-up of the molecular damage that drives the ageing process. On the other hand, that a healthy lifestyle and healthy nutrition empower the body's protective mechanisms.

In all countries there is a marked difference in life expectancy between people at the rich end of the spectrum and people at the poor end of the spectrum, and there is a strong social gradient also in healthy life expectancy - how long it takes to develop life-limiting illness. This presents an enormous challenge to governments, to try to reduce the inequality in healthy life expectancy. This is important especially when we look at the necessary changes in the retiring ages that are to date another area of failed governance. We have seen an increase in life expectancy of two to 2.5 years per decade over a century, during which governments have not even thought to address the difficult issue of changing retirement age. Now we have to do it in a hurry, and it is very difficult.



For us in this room, who have good standards of health and living, greater longevity is an opportunity to enjoy more good years of healthy existence. However, for people at the lower end of the social spectrum, the increases in retiring age are taking them well beyond the expected age of the development of the first major limiting illness. This leads to serious risk of perpetrating a profound social injustice.

Another major challenge is simply the absence of information. Back in 2001, the BBC asked me to deliver the annual Reith Lectures, which are intended to address issues of major concern for society. I spoke about ageing (www.bbc.co.uk/radio4/reith2001). 2001 happened to be a census year in the UK. Several of my audience wrote to point out that the first page of the census form asked whether the respondent was over 75. If the answer was yes, the form instructed you to turn to the back page, sign the form and return it uncompleted. What this shows is that the then UK Government, and I am sure it is not alone in this, regarded it as inappropriate or too difficult to gather information from people 75 and older. Similarly a health expectancy survey in Scotland similarly excluded people over the age of 75. But how can you make informed policy about health expectancy in the 21st century if you exclude older people from the data gathering?

In 2006, together with colleagues at Newcastle University, I started the Newcastle 85+ study to try to gain detailed information about very old people. This is still the largest study in the world to look in detail at what life is actually like for people aged 85 and above. Very comprehensive health assessments were made, visiting each participant in their normal place of residence, with visits on three occasions lasting 90 minutes, taking blood samples, doing medical health checks, reviewing the GP records and so on. Among other data, for each individual in this study we could find out whether they had (or did not have) each of 18 different age-related diseases. So everybody got a number, a disease count, which could be zero up to 18, and these are the statistics.

We found that not a single person in our sample of about 1,000 people had nothing wrong with them at age 85. In fact, three-quarters of them had four or more age-related illnesses. What this says is that multi-morbidity is the norm, and yet the health services in every single country in the world are configured to deal with diseases one at a time. I go to a wonderful general practice, the best I have ever been to, but I always tease the doctors, because they have a card on the door which says, 'Remember when you come to see your doctor, bring only one problem at a time'. Many health services are organised in this way, to treat one problem at a time. But we should perhaps consider that this is intrinsically ageist, because you cannot deliver effective medicine to older people if you do not adjust the configuration of the health services to take proper account of multi-morbidity.

However, what was also very interesting was that when we asked these people to self-rate their health, 78% rated their health as good, very good or excellent. This contradicts the notion that 85-year-olds or people of great age are necessarily bundles of sickness and misery. Many of them are very dynamic; some of them had started companies within the last five years; many of them were entirely independent. 20% could perform all of the activities of daily living.

It is sadly not an exaggeration to say that medical research is seriously failing sufficiently to address the challenges associated with ageing. Age is the single biggest risk factor for perhaps 90% of the medical conditions that command attention in today's richer parts of the world. Around the world there are many institutes for research on cancer. Age is the biggest risk factor for the great majority of cancers and there many important connections between ageing and cancer. But how many of these institutes have staff researching into how age contributes to cancer? The answer is extremely few, and it is the same for heart disease and other age-related conditions.

Therefore, we have to reconfigure our medical research to be able to provide us with the answers, and the interesting thing is that, as we discover the answers relating to one disease, we will also discover common pathways contributing to other age-related diseases, so the prize will be enormous. I would forecast that in 20-30 years' time the world will have changed profoundly how it does research on these diseases, and people writing the histories of the first half of the 20th century will ask how it could have taken so long.

The last area I want to touch on briefly, which again is tremendously important in terms of governance, concerns some work I was involved in for the UK Government Office for Science five years ago. This looked at the issue of 'mental capital' through life. Mental capital was defined for this project as the totality of an individual's cognitive and emotional

resources. What we looked at was the trajectory individuals follow through life in terms of their mental capital and wellbeing, and the analysis was based on intensive scientific reviews.

The one thing that came out of this most strongly was that there is an enormous resource of mental capital in older people that, in the way the world is configured today, simply goes to waste. It goes to waste because policies do not recognise how important it is to keep this mental capital engaged in society. This can be extraordinarily productive. Recognition of the value of mental capital in older people is good for them individually and it is good for economies. Evidence shows that older people can use their mental capital to start successful businesses; companies started by people in later life grow faster on average and fail less frequently than companies started by people in their twenties and thirties. Therefore, this mental capital is a great economic resource which is currently not being used.

There are big barriers to developing positive policies for ageing populations. There is distaste; people do not like to think about getting old. There is ignorance; they just have not paid the attention, and are fatalistic. Ageism is pervasive. There is a youth bias. People say that we have to invest in the young and in the future; of course we have to invest in young people, and even older people say not to do anything for them but for their children and grandchildren. My answer to them is to say that their children, grandchildren and great-grandchildren are almost certain to become very old, and if they can bring their experience to resolve the problems that exist for people who are very old in today's society, it is one of the best things to provide for their grandchildren's futures, because they are creating a better path into old age than they have enjoyed themselves.

One of the important issues and challenges in the world today is the fact that we have become very disconnected from issues around death and dying. Going back 100 years, most people died early, and most people died a simple death with a single dominant cause. Today, most people approach death through multiple illnesses, open complicated by frailty and confusion. Transitions are a common feature in the later stages of life, and they are too often badly handled through lack of preparation.

Therefore, the overarching message here, and this applies to governments and to individuals, is that we have to be prepared and to be flexible. Regarding the demographic forecasts, the forecasters got it spectacularly wrong in the 1980s and the 1990s. The forecasters, having got it so badly wrong in one direction, now may be getting it wrong in the other direction. The truth is that, as far as the future is concerned, we do not know. What we have to do, to develop the structures to govern populations as we go into a 21st century of uncertain longevity, is to build flexibility into the way we prepare with this.

Population ageing is commonly blamed as the main cause of increased health costs. This is a fallacy, because the main expenditure on health costs occurs through dying. Most people who are dying today are old people, so all the costs are showing up in old people. The main driver of increasing health costs is simply that medicine becomes more technologically sophisticated all the time, and thereby more expensive.

Population ageing is also commonly blamed for global over-population. This too is not strictly true; those countries which are the longest lived have generally reduced their birth rates so that they are lower than replacement. Actually it is our successes in child survival that are the major driver of population growth. In countries undergoing transition to older demographic profiles, it is therefore important to speed up the adjustments in family planning that have occurred in most populations, once parents become accustomed to the idea that their children can be expected to survive.

Finally, the idea that population ageing is necessarily creating an unsupportable economic burden does not stand up well to objective scrutiny of the facts. But innovations in governance will surely be needed to avoid potential problems.

Therefore, there is tremendous material here that challenges our current perception of providing inclusive governance around the world for populations which will exhibit far greater age diversity than we have been used to.