

Living too long

The current focus of medical research on increasing the quantity, rather than the quality, of life is damaging our health and harming the economy

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Should medical research be focused on increasing the quantity or quality of life? For a variety of reasons, past research has focused more on quantity of life, but the resultant life extension, without reducing ageing, has increased the extent of ageing and age-related disease, plus pension, and social and medical costs, in an unsustainable way. I argue here that medical research urgently needs to be refocused away from cancer and cardiovascular research, and onto reducing ageing and age-related morbidity, thereby increasing both our health and our wealth.

“...years are being added to our lives, life is not being added to our years: the extra years are being added at the very end of our lives and are of poor quality”

Human life expectancy has been increasing at a rapid rate [1]. Better health care and hygiene, healthier life styles, sufficient food and improved medical care and reduced child mortality mean that we can now expect to live much longer than our ancestors just a few generations ago. Life expectancy at birth in the EU was about 69 years in 1960 and about 80 years in 2010, which corresponds to a rate of increase in life expectancy of 2.2 years per decade [1,2]. If this rate of increase remains unchanged, as it has for the last century, then someone born in the EU today would be expected to live about 100 years.

However, this dramatic increase in life expectancy did not come with a proportionate

increase in quality of life for the elderly. Generally, increased life expectancy has increased the risk of disease, disability, dementia and advanced ageing prior to death [3,4]. For example, 30% of the population over 60 in the UK become demented before they die, and this proportion is likely to grow as a result of the ageing population and the exponential dependence on age of the prevalence of dementia [4]. In the past, people died young and relatively quickly, but increasingly people die old and slowly from degenerative diseases preceded by years of multiple morbidity and advanced ageing [5]. This puts increasing pressure on the economy and social systems in most countries. Current public expenditure on the retired population—mainly pensions, health and social care—is about 25% of GDP in the EU, but it is expected to rise substantially in the future, challenging economic sustainability [2].

Medical progress, and the underlying biomedical research that has enabled this progress, is not just a major cause of increased life expectancy, but could also contribute to reducing the morbidity of our ageing populations that threatens our social and economic systems. This raises the important question of what type of medical research we should invest in the coming years and decades, either to further reduce mortality and thereby increasing life expectancy or to reduce ageing and morbidity in order to address the increasing prevalence of chronic diseases, disability, detrimental ageing and economic dependency among the elderly.

Public and private investment in medical research is primarily focused on reducing death rates, rather than reducing ageing and

age-related disease (Table 1). However, as I argue here, there are medical, economic, ethical and political reasons for favouring medical research that aims to increase quality of life rather than quantity of life.

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The major problem with merely increasing life expectancy is that it also increases morbidity simply because people live long enough to get more age-related disease, disability, dementia and dysfunction. Many serious diseases have increased prevalence with age, including cancer, heart disease, stroke, respiratory disease, kidney disease, dementia, arthritis and osteoporosis. For example, in Europe, the prevalence of dementia is 0.6% in those aged 60–64 years, 3.5% in those aged 70–74 years, 16% in those aged 80–84 years and 41% in those aged 90–94 years (www.alzheimer-europe.org). Consequently, disability increases dramatically with age: such that more than 80% of the UK population over the age of 85 years reports having a disability (Fig 1). Moreover, disabilities in late life are more likely to be multiple and severe, so that 50% of people over the age of 85 years require care and/or help with daily activities. Decreasing death rates without reducing age-specific morbidity

Table 1. UK spending, cost to the economy, % of deaths and % of disability attributed to different diseases [8] and ageing (<http://scienceogram.org/in-depth/health>).

	UK spending on disease per person per year	Cost to the economy per person per year	% of all deaths	% of all disability
Cancer	£9.50	£250	28	2
Heart disease	£2.70	£125	19	5
Dementia	£0.82	£360	4	11
Stroke	£0.37	£80	9	9
Ageing	£0.40	>£5,000	85	80

rates will inevitably increase morbidity, including severe disability and dementia.

There has been some debate in the past as to whether morbidity would expand in the future or would be compressed as average lifespan increased [1]. Current evidence indicates that morbidity is expanding in Europe: for example, while life expectancy at the age of 65 years increased by 1.3 years between 2005 and 2011 (when comparable statistics were available for the EU), healthy life expectancy (years lived free of disability) was unchanged over the same period, that is, years lived with disability increased by 1.3 years (Fig 2). Thus, while years are being added to our lives, life is not being added to our years: the extra years are being added at the very end of our lives and are of poor quality.

Even in the absence of disease and disability, human abilities—including memory, cognition, mobility, sight, hearing, taste and communication—decline with age (Fig 3), so that the quality of life for someone older than 90 years is on average very poor [3]. Given the increasing prevalence of multiple diseases, disabilities, dementias and dysfunctions at high age, it is not obvious that just extending lifespan beyond 90 years of age is a worthwhile undertaking. Consequently, it is unclear why we are currently investing so much money in cancer and cardiovascular research aimed at reducing death rates in the elderly, if the consequence is more years lived with disease, dementia, disability and advanced ageing. Note, that I am not discussing whether it is currently worth extending the life of individuals—which should be up to the individuals concerned—but whether it is currently worth funding medical research to further extend the life expectancy of future populations if this results in greater morbidity.

The European Commission’s 2012 Ageing Report predicted that the EU population aged 65 and above will rise from 87 million in 2010 to 152 million in 2060 while the population of people aged between 15 and 64 years is expected to decline over this period, thus shifting the demographic old-age dependency ratio—the number of people at the age of 65 and older relative to those aged 15–64—from 26% to 52%. If this happens, the EU would have only two working-age people for every retired person instead of the current four working-age persons. The economic old-age dependency ratio is the ratio between the economically inactive elderly (65+) and total employment (15–64) and is projected to rise from around 39% in 2010 to 71% in 2060 in the EU27 [2]. If the dependent population

under the age of 15 is also included, the effective economic dependency ratio will be close to 100%, that is, there will be as many dependents as workers in 2060.

Age-related spending by EU governments was €3.1 trillion in 2010, equivalent to 25% of GDP (including 11% on pensions, 7% on health care and 2% on long-term care of the old), and is projected to rise to 30% in 2060 [2]. The 2010 healthcare costs of the EU population older than 65 years were €900 billion. The direct and indirect costs of dementia alone were €130 billion in 2009 in the EU [2]. Because of the exponential increase of dementia risk with age, increasing longevity will increase the proportion of the population surviving long enough to become demented, and thus public and private expenditure on health and social care caused by this and other age-related diseases.

The economic costs of an aged population are already high and rapidly increasing, in part because public policy during the last century was focused on reducing causes of death rather than reducing ageing or the detrimental effects of ageing. Average lifespan in the world almost doubled during the 20th century, whereas the rate of ageing did not change at all, causing more age-related disease, disability and dementia. In addition, the number of years people live after retirement

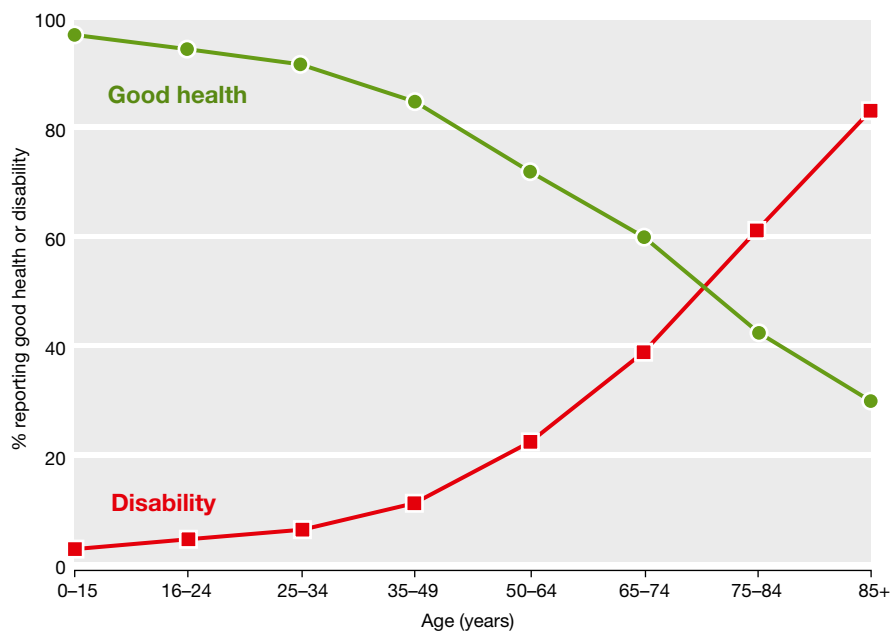


Figure 1. Percentage of people in England & Wales 2011 reporting 'Good health', or 'Disability' in different age ranges (www.ons.gov.uk/ons/dcp171776_353238.pdf).

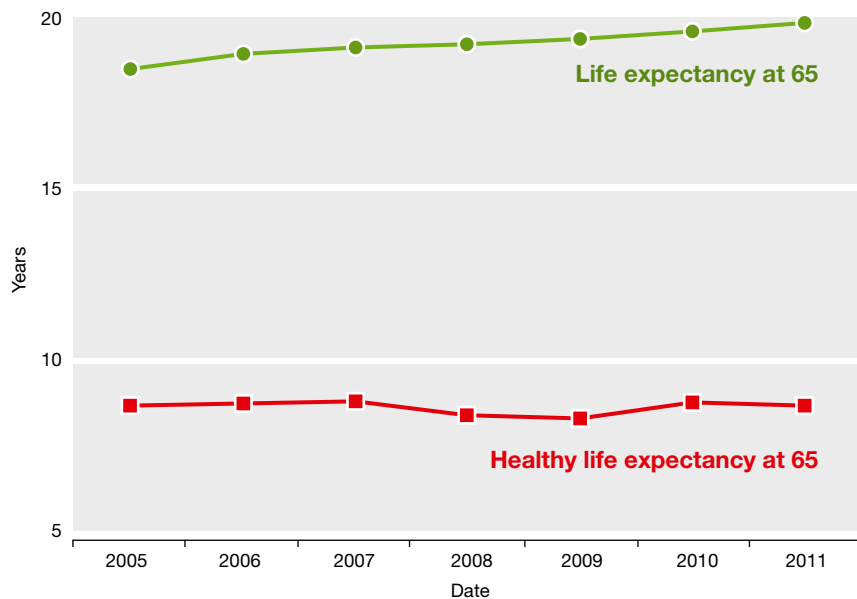


Figure 2. Average life expectancy and healthy (disability-free) life expectancy at the age of 65 in the EU25 countries (www.ehemu.eu). The gap between them is the expected years of disability.

is extended, thereby increasing pension costs and the dependency ratio.

Part of the cause of the pension crisis was the belief that humans have a maximum lifespan, so the increase in average lifespan would eventually slow down and stop [1], and consequently, the dependency ratio and pension costs would stop increasing. However, the increase in average lifespan shows no signs of slowing down since, as we know now, there is no biological reason for an absolute maximum lifespan. Ageing is not programmed or selected for during evolution, but it is rather a result of accumulating wear and tear, which was not selected against in our evolutionary past because we died prior to significant ageing. Thus, if we continue to eliminate causes of death without reducing the rate of ageing, then pension, health and care costs will become unsustainable [2]. If we eliminated or at least alleviated ageing instead, there would be no necessity for people to retire into economic unproductivity. And if we had decreased the rate of ageing in proportion to the extension of lifespan during the past century, there would be no pensions or healthcare crisis.

However, we also need to consider the relative costs and efficacy of investing in medical research to reduce morbidity

versus mortality. It could be that it is more difficult and thus more costly to reduce morbidity and ageing than to reduce mortality. It is difficult to generalize over different diseases, but the record of the past century indicates that wherever significant efforts and resources have been invested, there has been success to reducing morbidity, including pain relief, arthritis, infections, sight, hearing, mobility, schizophrenia and depression. This suggests that the greater progress in reducing mortality may simply be due to the greater funding and attention that has been paid to it.

Ageing may appear to be intractable if we think of it in digital (all-or-none) terms, that is, as caused by a single, monolithic process that we either can block or not. However, ageing is in fact—like disease generally—caused by many different processes, such that if we block one, we will reduce the rate or extent of ageing or some feature of ageing. Age-related disease is one such feature of ageing, and there is no biological reason to believe that reducing ageing is any more difficult than reducing mortality.

Are there moral or ethical reasons for favouring an increase in the quantity rather than quality of life? Ethical arguments are generally based on

either moral theory or utilitarianism. Moral theory in turn can be based on theology, human rights, tradition, emotion, duty or virtue, but it is unclear how this applies to life extension or the relative merits of extending the quantity versus quality of life. Certainly, there is no consensus in the literature of theology, human rights or tradition, which would favour quantity over quality of life.

One might be tempted to argue that ageing is ‘natural’ and therefore humans should not tamper with it. However, ageing does not occur significantly in animals when in the wild and did not occur significantly in humans before the onset of civilization, because they died from extrinsic causes before appreciable aging, and therefore, there was never a significant selection pressure against ageing [5]. Thus, ageing is not natural, but rather a side effect of our culture—a culture that seeks to extend lifespan without tackling the ageing that this extension exposes.

Alternatively, one could argue that eliminating ageing might cause all kinds of problems for society and individuals. However, ageing is not a digital (all-or-none) process, so that arguments about whether eliminating ageing is good have little bearing on whether reducing ageing is good—just as arguments about whether eliminating death is good have little bearing on whether reducing mortality rates is good.

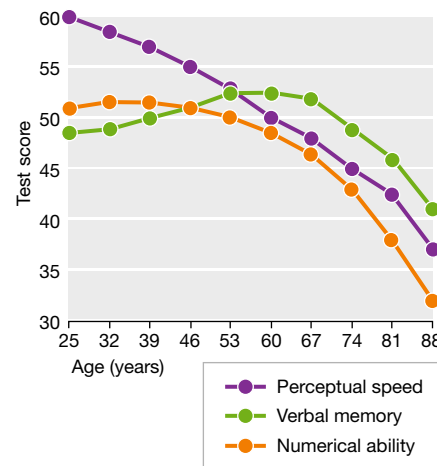


Figure 3. Longitudinal estimates of cognitive abilities from the Seattle Longitudinal Study [7] indicating decline after 70 years.

Utilitarianism is based on the principle of achieving the greatest benefit for the greatest number of people. Does increasing the quantity or quality of life maximize benefit? That depends on how benefit is measured. For example, medical funding is sometimes based on the perceived burden of different diseases, measured, for example, by disability-adjusted life years (DALY). DALY is the number of years lost owing to early death and the number of years lived with ill health or disability. If this is used to compare the burden of different diseases, then cancer and cardiovascular disease have the highest disease burden in most rich countries and therefore appear to justify investing into medical research. However, importantly, this does not take into account the impact of reduction of other diseases and ageing resulting from increased longevity. For example, if cancer rates were halved, then the rates of all other age-related diseases, disabilities, dementias and dysfunctions would increase, simply because, on average, people would live longer.

“10 times as much is spent on cancer as on dementia research in the UK, although dementia contributes 5 times as much morbidity as cancer”

The quality-adjusted life year (QALY) is a similar measure of disease burden to assess the value for money of a given medical intervention, which is based on the number of years of life that would be added by the intervention. Each year in perfect health is assigned the value of 1.0 down to a value of 0.0 for being dead. If the extra years would not be lived in full health—for example, if the patient were to lose a limb or be blind—then the extra life years are given a value between 0 and 1. There are two problems with this approach. First, the quality-adjusted life year does not normally take into account the indirect effect of extending life expectancy on quality of life via increased prevalence of ageing and age-related disease. Second, the quality-adjusted life year does not normally use negative quality-of-life values, so that, for example, an extra year lived with dementia is quantified as positive and therefore beneficial.

In conclusion, moral theory has nothing obviously relevant to say about whether the quantity or quality of life should be increased. Utilitarianism in principle provides a calculus for addressing this type of question, but measures of quality of life need to take into account: i) the indirect effect of extending quantity of life on quality of life via extended ageing and ii) negative values of quality of life.

Current government and charity funding of medical research are influenced by a variety of factors, but the relative funding on different diseases appears to be more heavily influenced by the contribution to mortality than their contribution to morbidity (Table 1). For example, 10 times as much is spent on cancer as on dementia research in the UK, although dementia contributes 5 times as much morbidity as cancer. Generally, funding for ageing research is tiny compared to its huge impact on mortality, morbidity and the economy (Table 1).

So why do governments and charities provide more funds for medical research that focuses on increasing quantity rather than quality of life? One possible answer is that politicians believe, or believe that other people believe, that death trumps disease, that death is more terrifying than disease and ageing or that preventing death is more

essential to health than increasing quality of life. However, such beliefs—if they exist—are misguided because everybody dies eventually; we can not eliminate death itself, only try to affect when and how one dies. Furthermore, such beliefs may be based on an out-dated image of death, as the average death today is no longer an event at the end of life, but rather a long drawn-out process merged with ageing [5].

But do people care more about the quantity than the quality of life? A recent survey of more than 9,000 people across seven European countries, which explored people's priorities when confronted with a serious disease and had less than one year to live, found that 71% thought it more important to improve the quality rather than the quantity of life for the time they had left; 4% thought it more important to extend life irrespective of quality, and 25% said both quality and extending life were equally important [6]. A similar survey of Americans found that they believe it is more important to enhance the quality of life for seriously ill patients, even if it means a shorter life (71%) than to extend their lives through every medical intervention possible (23%) [<http://syndication.nationaljournal.com/communications/NationalJournalRegenecetoplins.pdf>]. Thus, at least in the context of serious illness at the end of life, it

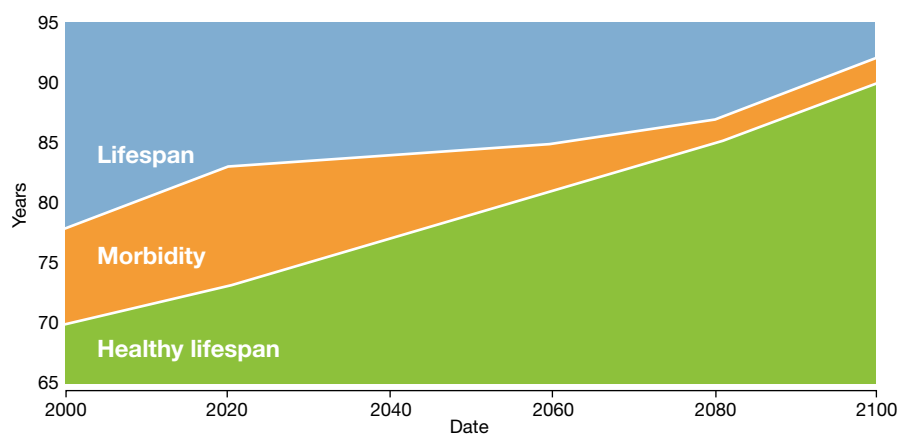


Figure 4. A managed compression of morbidity.

Life expectancy is currently increasing more rapidly than healthy life expectancy (average number of years lived in good health), so that morbidity (average number of years lived in poor health) is slowly expanding in the EU. We need to actively compress morbidity by switching medical research funding from causes of death to causes of ageing and age-related morbidity. If successful, this would slow the rate at which life expectancy increased and speed the rate at which healthy life expectancy increased, resulting in a compression of morbidity, which would benefit our health and the economy. When morbidity was sufficiently compressed, resources could be switched back to expand life expectancy.

appears that people generally favour quality over quantity of life. Therefore, governments and charities should not assume that people favour medical research that extends quantity rather than quality of life.

Should public policy favour increasing the quantity or quality of life? I would advocate a managed compression of morbidity (Fig 4). This would entail switching most medical research funding from tackling the causes of death to the causes of ageing and age-related morbidity until the quality of life at the end of life is sufficiently high to make it worth extending lifespan further. Medical research funding therefore needs to be shifted from the main causes of death of the elderly, such as cancer and heart disease, towards the main causes of morbidity of the elderly, such as dementia, depression, arthritis and ageing itself. Doing so is likely to be cost neutral in the short term and cost beneficial in the

long term by reducing healthcare and pension costs. More importantly, it will reduce the chances of degenerative disease, disability, dementia and extreme ageing for ourselves and our children, hopefully enabling a better quality of life and end of life for us all.

Conflict of interest

The author declares that he has no conflict of interest.

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