

# The ultimate aims of medicine and the future of old age

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**ABSTRACT** There has been an extraordinary increase in life expectancies in developed countries. This trend, instead of being hailed as a great achievement, is often seen as ‘a problem’. The reason for this is that it is expected that the increasing number of old and very old people will bring with it an increased burden of illness, particularly chronic disabling diseases. There is, after all, an exponential relationship between the prevalence of disabling conditions such as stroke, dementia and osteoarthritis, and age. In fact, recent trends are rather encouraging: despite recent dramatic increases in the life expectancy of people who reach old age, there have not been significant increases in the prevalence of disability among the old. This is because the biology of ageing suggests that the longer chronic illness is postponed, the shorter its duration before death. As Grimley Evans has put it, we “spend a longer time living and a shorter time dying”. The challenge therefore is to prevent the onset of disabling conditions or mitigate their impact. We have made good progress in the case of stroke but there is much more to be done by way of health promotion, disease prevention, improving the way we use medication in older people, and in developing new methods of reversing disability. In the case of neurodisability, recent advances in neuroscience offer great promise of new approaches, exploiting the plasticity of the brain. A future in which people enjoy a long life, with a largely healthy old age—so that the health span approximates ever more closely the life span—lies within our grasp.

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## INTRODUCTION

Every now and then it is useful for those of us involved in delivering medical care to step back and think about our ultimate aims.

Medicine, it seems to me, has two broad aims: to postpone dying due to disease and to mitigate the suffering (pain, disability, anguish) disease may bring. Despite the continuing remarkable triumphs of science-based medicine, some recent developments have prompted questions about whether these two aims may be coming into conflict. More specifically, questions are being asked about whether this conflict is especially evident in the medicine of old age and whether, in particular, increased life expectancy

is inevitably associated with an increased burden of suffering due to illness. In this paper, I want to address this last question, focusing on data mainly derived from the UK, though I believe that the (largely optimistic) conclusions that I draw have a more general application.

## THE DEMOGRAPHIC REVOLUTION

The century just past has witnessed a remarkable extension of life worldwide. The most striking changes have occurred in developed countries. In the UK, for example, life expectancy at birth increased by nearly a decade in both men and women between the late 1940s and the mid-1990s. Life expectancy in males increased from 66 to 74.4 and in females

from 70.5 to 79.6.<sup>1</sup> Life expectancy increases over the entire century were even more dramatic: a male born in 1900 had an average life expectancy of 45 years and a female 49; by 2000, these figures had increased to 76 and 81 respectively.<sup>2</sup> In the earlier half of the 20th century, decline in infant mortality was the most important determinant of increased life expectancy at birth. At the end of the 20th century, decreases in mortality at late ages had become most important.

These trends continue. According to a Report by the House of Lords Science and Technology Committee,<sup>3</sup> at current rates, life expectancy in the UK is increasing at a rate of about 2 years for each decade that passes. Looking more broadly, Oeppen and Vaupel<sup>4</sup> have estimated that, in those countries which are most advanced in the ageing transition, life expectancy is increasing at about 3 months each year. If these increases continue, life expectancy in women will reach 100 in at least one country by 2060.

If we look at life expectancy in people who have already reached later life, as opposed to overall life expectancy, the figures are almost as dramatic. Life expectancy in men and women aged 60 increased between 1980 and 2000 from 16.3 to 19.5 and from 20.8 to 23.0 years respectively.<sup>5</sup> A recent study of men with private pensions showed that their life expectancy at 65 had increased from 83 years and 2 months in 1997 to 86 years and 7 months in 2005 with an anticipated figure of just under 90 years by 2015.<sup>6</sup> The so-called Gompertz curve seems to be flattening: mortality rates are slowing down in extreme old age and tending toward a ceiling.<sup>7</sup>

## CONCERNS ABOUT THE AGEING OF THE POPULATION

All of this must surely be very good news. However, many have expressed concerns about the impact of an ageing population in which a greater portion of people achieve old age and live on longer when they are old. These concerns may be summarised by Roy Porter's observation that, at a time when death from acute illness has been replaced by death from chronic illness, 'longer life means more time to be ill'.<sup>8</sup> Is this true?

One might expect it would be. There is, after all, an exponential relationship between age and the

prevalence of chronic ill health and this is in part due to the exponential relationship between age and chronic disabling diseases. This is dramatically true of chronic neurological diseases such as Parkinson's disease, Alzheimer's disease, and stroke. The chances of being disabled by a stroke increase nearly a hundred fold between the ages of 45 and 85.<sup>9</sup> And rates of non-neurological disabling diseases, such as osteoarthritis, have a similar exponential relationship to age.

These concerns seemed to be born out by a study carried out in the UK in the 1980s, which showed that the prevalence of disability in the population rose exponentially with age.<sup>10</sup> This applied to every level of disability from minor problems to being totally dependent on others. Repeated studies have shown that there is a very steep rise in dependency on others for activities of daily living as one moves from 'young old age' to 'old old age'.

## ARE THINGS WORKING OUT AS BADLY AS PEOPLE FEAR?

Roy Porter's observation,<sup>8</sup> that living longer means more time to be ill, is certainly true. The question we have to ask ourselves, however, is whether in practice people are living with illness for a longer time. We may imagine four possible scenarios associated with increased life expectancy:

- One year of increased illness for every year of life gained
- Less than one year of increased illness for each year of life gained
- No additional period of illness for each year of life gained
- Less overall illness despite life gained—so-called 'compression of morbidity'

Which scenario is coming to pass? The truth is, despite some very good data from the USA and certain European countries, we are not entirely sure what is happening. One thing that seems to be clear is that the gloomiest scenario is not transpiring. While it is probable that total life expectancy is increasing at a slightly faster rate than healthy life expectancy, both appear to be increasing.

The figures for the UK showing the trends from 1981 to 2001 (**TABLE 1**) indicate that the ratio of healthy life expectancy to overall life expectancy has

**TABLE 1**  
Trends in life expectancy (LE) and healthy life expectancy (HLE), 1981-2001

Year	Women		Men	
	1981	2001	1981	2001
LE	76.8	80.4	70.9	75.7
HLE	66.7	68.8	64.4	67.0
% HLE/LE	86.9%	85.6%	90.0%	88.5%

**TABLE 2**  
Life expectancy (LE) and healthy life expectancy (HLE\*) at 65

	Women, UK 1981-2001			
	LE		HLE	
	1981	2001	1981	2001
Men	-	-	-	-
Women	16.9	19.2 (17%)	8.5	10.2 (20%)

\* Free from limiting long-standing illness, ONS 2002

not decreased, despite substantial increases in life expectancy.<sup>11</sup> The extra years of life are not simply extra years of ill health. If you look over the same 20-year period at the life expectancy and healthy life expectancy of women over 65 (**TABLE 2**) it will be seen that the latter has increased proportionately slightly more (20%) compared with overall life expectancy (17%).<sup>12</sup>

The very large databases examined by Manton and Gu<sup>14</sup> in the USA have shown a similar, not discouraging, picture. Whereas between 1962 and 1976 life expectancy increased by 1.8 years, only 0.3 of which were without activity restriction,<sup>13</sup> the more recent data are much less worrying. According to the National Long Term Care survey, between 1982 and 1999 disability rates in people over 65 have decreased from 26.2% to 19.7%.<sup>14</sup> This is a 2% decrease per year, double the decrease in the mortality rate, and it is accelerating. In Denmark, a study conducted over the last decade has shown a compression of morbidity, with the period of chronic illness before death showing a slight reduction.<sup>15</sup>

Why are the trends less worrying than might have been expected? In part this is due to improvements in the prevention and treatment of illnesses that cause chronic disability. A good example here is stroke, the commonest cause of severe disability in later life. Two studies in Oxford, UK—the Oxford Community Stroke Project<sup>9</sup> and the OXVASC study<sup>16</sup>—separated

by 20 years, examined the same population. In both cases, they found an exponential relationship between the incidence of stroke and age. In the later study, however, the age-related incidence had fallen dramatically. The result was that, instead of the anticipated increase of about 30% in total strokes (due to the ageing of the populations studied), there was an approximately 30% fall.

## WILL AGEING COME TO THE RESCUE?

We cannot, of course, postpone chronic illness forever. Surely, therefore, we should expect an elderly population with an increasing burden of illness because their postponed illnesses eventually arrive? In order to understand the surprising and rather cheerful answer to this question, we need to remember something else that is going on as people get older: biological ageing.

Ageing has been described by Kirkwood as “an harmonious decline of all organ systems leading to increased probability of death”.<sup>17</sup> There are two points to take away from this definition. The first is that the decline is harmonious: it is generalised and not associated with events localised to particular organs. It will not therefore be accompanied by symptoms such as pain, nausea, dyspnoea and so on. Secondly, it is nonetheless associated with an increase in mortality. The reasons for this are best captured by thinking of the biologically ageing body as having

globally impaired homeostatic mechanisms—we may call this ‘homeostenosis’. As a result, it is less able to deal with challenges to ‘the constancy of the internal environment’, which, as Claude Bernard pointed out, is the condition of viability.

This presents a possible scenario that has been beautifully captured by Professor John Grimley Evans<sup>18</sup>:

“By delaying the onset of disabling diseases to later ages when intrinsic ageing has raised fatality by reducing adaptability, the average duration of disability before death will be shortened. *In brief, we will spend a longer time living and a shorter time dying.*” (The italics are mine.)

That this scenario is a genuine possibility is shown by data analysed by Grimley Evans. He found that the period of dependent life before death in a particular population decreased slightly in males dying in their late 80s compared with those dying in their 60s. In females, the findings were even more encouraging: dependent life before death fell from just under 9 years for women dying in their 60s to just under 5 years for women dying in their late 80s.<sup>18</sup>

We might conclude from this that the older the age attained before becoming disabled, the shorter period of dependency before death. This is illustrated by a recent study of survival in stroke.<sup>19</sup> There was a dramatically lower survival rate in patients who had their strokes when over 85, compared with those who had them when under 85. The bottom line is that postponement of disabling diseases leads not merely to postponement but to reduction and prevention of lifetime disability.

## REALISING THE POTENTIAL FOR A HEALTHY OLD AGE

The key to a healthy old age and to an increased life span that is not associated with an increased, and protracted, burden of illness, must lie in the postponement of disability. There are many possible strategies and I have space to mention only a few here.

First we should pay more attention to the promotion of a healthy lifestyle (exercise, weight control, healthy diet, avoiding smoking and excess alcohol, and so on). Education in childhood, and

throughout adult life, is essential here. Secondly, there should be more focus on preventing the preventable, as in, for example, preventing strokes. For a long time, epidemiologists have talked about the so-called ‘Rules of Halves’: half of the people with a treatable risk factor are not detected; half of those detected are not treated; and half of those treated do not reach the target value to maximise protection. This rule has certainly applied in the UK until recently, as a study of the use of cholesterol-lowering drugs for secondary prevention in patients with known coronary heart disease has shown. The new contract for family doctors places a great emphasis on prevention and there is much well-founded optimism that this will deliver a reduction in cardiovascular disease. There is, however, a long way to go.

Another area where there are huge opportunities for prevention of chronic illness in old age is in the better use of the technologies we have available already, most notably drug treatments. In the 80s and 90s a series of studies showed that many elderly people were on suboptimal drug treatment— inadequate or untailored doses—or on inappropriate treatment. One study showed that 10% of elderly people admitted acutely to hospital were on contra-indicated drugs.<sup>20</sup> Another study found that about 6% of acute admissions of elderly people were due to adverse drug reactions arising out of inappropriate medication.<sup>21</sup> This was confirmed in a more recent survey<sup>22</sup> which found that 6.5 % of 18 000 acute admissions were due to adverse drug reactions, of which about two thirds were avoidable. The median age of patients admitted due to adverse drug reactions was 76 years.

Finally, in the case of those patients who do become disabled, we should be able to mitigate its impact better than we do now by more universal application of best care. In the case of neurological disability, there are very exciting prospects for reversing or limiting the underlying neurological damage by applying what we already know about plasticity in the nervous system and the drivers to recovery.<sup>23</sup>

In short, there is no reason why we should not expect that, with better medical care, the period of disability before death will be further greatly reduced.

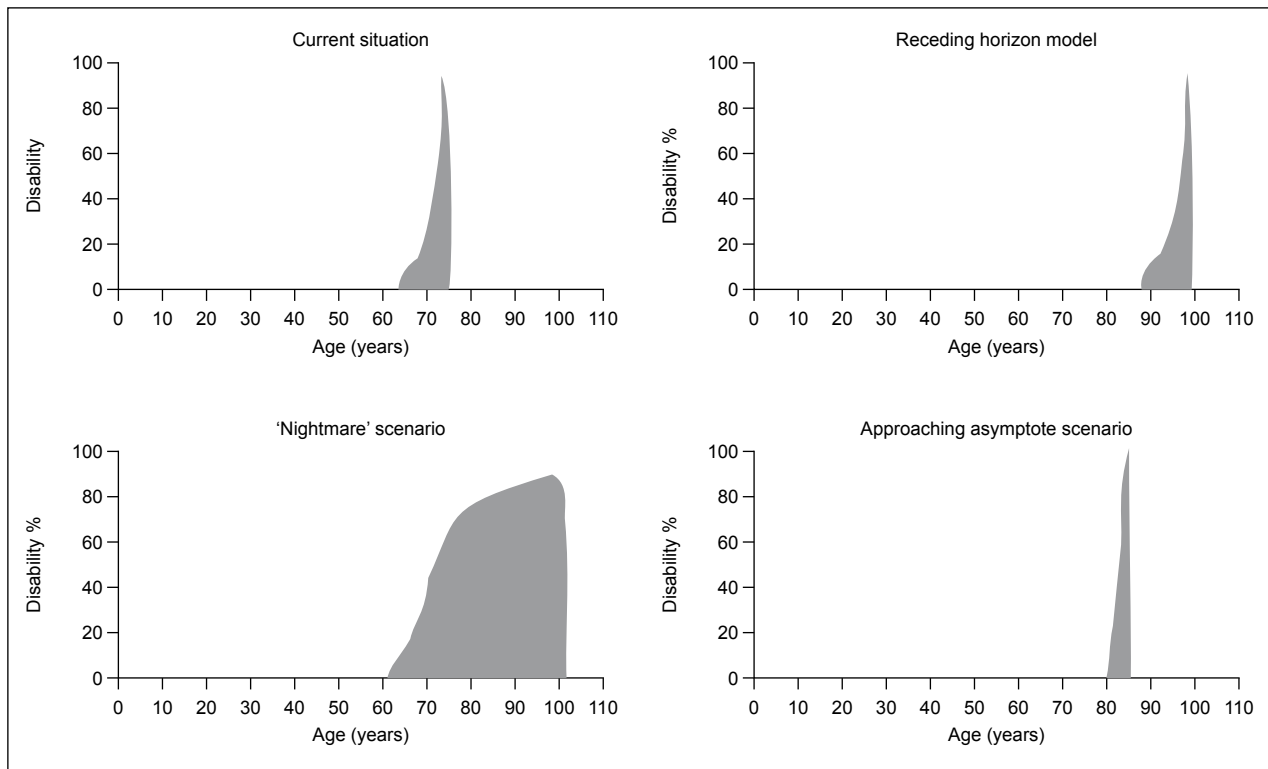


FIGURE. The possible futures of old age

## MODELS OF THE FUTURE

Let us therefore examine some possible models of the future of old age and see how consistent they are with the ends and aims of medicine (FIGURE). We begin with the present—the year 2006. In the UK, the situation is that Mr and Mrs Average continue until their late 60s when they start running into medical problems. As time goes on, they accumulate further medical problems and their levels of ill health and disability rise until they reach 100%—in other words death. The picture shows a period, of illness and disability before death, which may be seen as an area under the curve of poor health at the end of life. The question is which way will things go? Will this area get bigger or smaller?

One scenario, which I have described as ‘the Nightmare scenario’, is one in which chronic ill health strikes at the same age but people live on much longer due to medical care. In this scenario, the area under the curve of ill health before death is greatly increased. This is what people have feared is happening or will happen. The data do not, however, support this. Another, more cheerful scenario is that the onset and progression of ill health are postponed

and death is postponed by the same amount. This ‘receding horizon’ scenario is an attractive one, even though completely fulfilling the ultimate aims of medicine eludes us. The final scenario is one in which the onset of chronic ill health is postponed by a much greater amount than is death. In this scenario people have a long life but a greatly reduced period of ill health before death. We approach, as an asymptote, the goal of a long life in which the health span gets closer and closer to being as long as the life span. This was the picture James Fries suggested as a possibility nearly a quarter of a century ago.<sup>24</sup> I think it is both attractive and feasible.

## CONCLUSION

In this paper, I have addressed fundamental questions about medical care in developed countries: whether its two aims of postponing death and reducing suffering are in conflict; whether its success in ensuring that the vast majority of people have a long life is offset by increased ill health; whether living longer not only means having a longer time in which one might be ill but also a longer time in which one actually is ill. The data I have presented demonstrate that things are not as gloomy as some people feel. Both life expectancy

and healthy life expectancy are increasing, though the added years of life are not entirely free of illness. We have seen that ageing, which is in itself symptom free and which nonetheless increases the probability of death due to loss of adaptability, may be the key to reconciling the twin ambitions of increasing life expectancy without increasing the burden of illness. Postponement of chronic and disabling diseases will result in a shorter period in which they are present in an individual's life.

There is everything to play for and geriatricians, as health educators, leading figures in disease prevention, experts in the treatment of disease in old age, and advocates for medical care for older people, will continue to play a central role. This is an appropriate thought on which to end a paper published to coincide with the 20th Anniversary of the Hong Kong Association of Gerontology. The prospects for a long life and a healthy old age for most people by the time we reach the 50th Anniversary look very good indeed.

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