



Trends in health in the UK: implications for the NHS.
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Variations over time and space tell us a lot about what is likely, and what is possible in health in the future. In a previous lecture in the series, I covered geographical variation in health in the UK and the fact that even over short distances there can be very substantial differences in health outcomes. In this lecture I will consider variation in health over time. Trends in health can be remarkably stable; areas of medical science that are steadily progressing often continue to steadily progress over decades whilst others can get stuck for long periods with very little progress. Trends over the last 20 years are therefore reasonable indicators of what will happen over the next 20. These notes highlight themes covered in this talk rather than being a transcript.

The last 170 years have been the most transformational for health in human history and this is continuing. Between 1597, the year Gresham College was founded and around 1850 life expectancy in the UK was relatively stable at around forty years. Since 1850 there has been a steady improvement in life expectancy which has doubled over this period and the majority of people now live over 80 years. Over this period age of death has become increasingly concentrated. Prior to this last century it was common for people to die at any point along the life course, but this is now very rare for us to do so from the first week of life right through to late 70s. This increasing concentration of mortality in the 80s and 90s is continuing; life expectancy for those aged 80 or above is improving much more slowly than for those aged under 80.

Along with changes in mortality there have been significant changes in the number of children per mother so the demographic pyramid in the UK has transformed over the last hundred years, with major implications for care provision in the NHS. A century ago, a very high proportion of the population were children, and a relatively small proportion of the population was in what we would now consider old age. The situation is now reversed, and ill health is becoming increasingly concentrated at the top end of the age range.

The shift in mortality and age structure of the country has been exacerbated because those in older age are increasingly located in rural and coastal areas where it is less easy to provide health services. Alongside this there has been a very substantial change in the structure of the NHS over the last 70 years with the number of hospital beds available shrinking substantially whilst the number of medical and nursing staff have steadily increased. When the NHS started a lot of medicine was about nursing people who were convalescing; periods of time spent in hospital are much shorter now than they were and a lot of what would have been done as an inpatient is now being done as an outpatient. This trend is likely to continue.

Over the same period the balance of which diseases have dominated in terms of mortality and disability has shifted quite radically. When the NHS was formed infectious diseases such as tuberculosis provided a very large proportion of the workload, and the causes of mortality, in all ages. Medical science has been remarkably successful in tackling infectious diseases by multiple routes and these have decreased over time. Cardiovascular diseases, in particular heart disease and stroke, increased steadily until the 1950s when they were by far the dominant cause of mortality. Since then, there has been a steady decline in both coronary heart disease and stroke which

continues. Cancer mortality has stayed stable for the proportion of deaths overall, but which cancers are important has also shifted over time. The lecture takes each of those in turn.

Infectious diseases retain their ability to kill especially in older age. This is before we get to major epidemics and pandemics such as COVID-19. Science has however been repeatedly effective against infections and whilst hospital admissions for infections are common both in younger and older age, mortality from infections pre-Covid were heavily weighted towards people in their 90s and 80s. Infections which have been tackled over this period include viruses, bacteria, fungi and parasites. Multiple public health and medical interventions combine to control these including sanitation, better diet and housing, anti-sepsis, vaccination, antibiotics, antivirals and social interventions. This is not an entirely one-way street. New infections do emerge, and we are permanently at risk of losing some of the most powerful tools such as antibiotics and wider antimicrobials due to resistance increasing over time. Infections are covered quite lightly in this lecture because I will be doing a full series on this in the next academic year.

One of the most impressive improvements over the last few decades has been in *coronary heart disease* mortality. There has been around a 73% reduction since the mid-1970s in overall mortality and in those aged under 75 rates have fallen from 206 to 36 per 100,000. Alongside this there has been a shift from a very invasive heart surgery to much less invasive angioplasty which can be done as a day case or a very short stay case. *Stroke*, the other most common cardiovascular cause of mortality has also had a substantial and sustained drop in mortality over time although both heart disease and stroke remain major causes of death and disability. The steady improvement is likely to continue although possibly on a slightly less steep downward trajectory over the next years. The remarkable improvements in cardiovascular disease are made up of multiple, usually modest advances, stacked on top of one another. These include smoking reduction (arguably the most important), reduced air pollution, aspirin and antiplatelet agents, statins for cholesterol, hypertension reduction through reducing salt intake, drugs for heart failure such as ACE inhibitors and β -blockers, thrombolysis to break up clots after some heart attacks and strokes, and angioplasty and surgery. Although the popular image is of dramatic breakthroughs, most of medicine progresses by steady accumulation of advances which makes progress a lot more predictable.

Progress in improving the survival of people who have *cancer* has been substantial over the last decades and is set to continue. We've now reached a stage where the majority of those diagnosed with cancer will live 10 years or more from diagnosis although this varies very considerably by cancer type. Of the most common cancers for breast, prostate and bowel for all three of them there has been a decade-by-decade improvement in 10-year survival. For prostate cancer over 80% now survive more than 10 years whilst for breast cancer it is approaching 80%. Bowel cancer is steadily improving but has reached around 57%. Some cancers such as melanoma or testicular cancer survival is now 90% or more. As with cardiovascular disease improvements in cancer is made of many small steps with a small number of really notable breakthroughs. Early diagnosis is key for most solid tumours. Surgery, chemotherapy and radiotherapy are also improving steadily. New targeted treatments and immunotherapy are transforming some cancers, and this is going to lead to a very different outlook for many cancers over the next few years with a number of them being managed chronic diseases rather like diabetes. For cancer prevention still remains better than cure and many, although not all, cancers can be prevented to some degree.

The most depressing of the cancers is *lung cancer*. This is the U.K.'s number one killer from cancer, accounting for over one in five cancer deaths. There is around 5% 10-year survival, and this has hardly moved over several decades. This is an example of a disease where medical science has progressed relatively slowly. What makes this doubly tragic is that this is a cancer almost entirely to profit for a small number of companies that make up the cigarette industry. The great majority of lung cancer deaths are from *smoking* where the model is for companies to addict people very early in their lives and keep them addicted to a product the company knows will kill many of their

customers. Over time cigarette smoking rates are drifting down, but too slowly. Smoking not only causes lung cancer but also many other cancers, cardiovascular diseases and respiratory diseases. Where action such as bans on smoking in public places have been introduced the impact on health can be seen over time and is often substantial. Accelerating the decline of smoking over the next few years remains one of the greatest priorities for public health in the UK and internationally.

Two areas where public policy has led to significant improvements is *air pollution* and *occupational diseases*. Many major air pollutants are decreasing over time but particulate matter (PM2.5 and PM10) still remain high and contribute significantly to cardiovascular disease such as stroke and heart disease as well as lung disease and other health conditions. We now have the technical capacity to change this through for example the switch away from diesel and petrol transport towards electric in urban areas and it is in our interest to do this if we wish to continue to see declines of pollution driven disease. Of the major occupational causes of ill-health accidents, which used to take a very high toll, occupational cancers have decreased over time with the last major one being mesothelioma caused by asbestos which is now gradually decreasing and will continue to do so over the next two decades.

This lecture has so far considered diseases which can often lead to fatal outcomes and noted that for a very large proportion of them outcomes have steadily improved over many decades and are likely to continue to do so. The same is also true for many common diseases that cause *debilitating nonfatal outcomes*. An example is the diseases which were driven by immune dysfunction such as rheumatoid arthritis, inflammatory bowel disease and some Multiple Sclerosis. New, effective immune modulating drugs have been developed which can lead to significantly better outcomes for many patients although there are still significant room for improvement.

The outlook for many rare genetic diseases has also improved. There are a large number of rare diseases and although individually their impact on society is small, collectively the impact is very significant and of course for individuals and their families' genetic conditions can be devastating. There is particularly good progress on several conditions caused by single genetic mutation where early diagnosis is improving and now treatments are available. Genetic diagnosis is now improving steadily and will increasingly be useful for conditions where more than one gene is involved. An example of the steady improvement to many genetic diseases is one of the most common serious ones in the UK, cystic fibrosis. The majority of people with cystic fibrosis used to die in early childhood; a series of scientific steps means that most now survive much the way through adulthood and the rate of improvement is being maintained with several new drugs.

So far, the lecture has concentrated on areas which are going very well including the historically great killers of infectious diseases, cardiovascular disease and cancer. It is important also to consider those areas which will lead to greater problems in the future. The first is *obesity*. In the UK this has steadily risen from around 15% to around 26% over the last two decades and although there is some slowing, in areas of deprivation this is a really major problem for the future. Obesity is associated with multiple subsequent health conditions including diabetes, cardiovascular disease, some cancers, infections and mechanical problems. The difference in childhood obesity between the most and least deprived is growing and if we do not tackle this it will undermine many of the advances we are making in other areas.

Obesity is a situation where things are actually getting worse. In most areas where there is likely to be a greater proportion of disease in the future it is because medical science is *relatively* less successful and therefore, they will increase as a proportion of healthcare needs. There are examples in every field and some whole fields that are moving very slowly relative to need. Examples in preretirement adults include mental health and musculoskeletal disease. A particularly striking one in later life is trends in dementia. The prevalence of dementia is steadily increasing as people are living longer but there is some evidence that incidence of dementia (new cases per year) is

decreasing particularly in men. Because however people do not die of other conditions as much as they did, so people are living to old age, which is the main risk factor for dementia in most people, the prevalence of dementia is steadily increasing and is set to continue to increase in the UK.

A trend which is going to require a significant shift of thinking for the medical profession is *multiple chronic conditions, also known as multimorbidity*. This is a major problem because by the time people reach older age, they will tend to have multiple conditions which interact in the same person, but medical care and medical science are optimised for single diseases. This includes specialist clinics, medical training, national guidelines, laboratory research and clinical research. Since the trend is for a steady increase in multimorbidity relative to single diseases healthcare training needs to respond, including with doctors and other healthcare workers maintaining generalist skills throughout their career.

The steadily increasing *cost of healthcare* in the UK and elsewhere is a significant challenge for the future. Some component of this is due to an older population but not as much as is often assumed. Costs of drugs goes up in areas which are rapidly advancing with on patent drugs including newer cancer drugs but actually can decrease in areas where drugs are off patent such as cardiovascular disease. There is however an increase in healthcare activity which is not explained either entirely by age or by new advances. We need to examine this carefully if we wish to maintain a sustainable healthcare system into the future.

This lecture has concentrated on trends in healthcare in the UK, although these are relatively typical for high income countries. The remarkable and welcome shifts we are seeing in healthcare internationally, particularly in low- and middle-income countries, is a fundamental good in its own right. It will however also have an impact on healthcare in the UK and on the direction of medical science. Much of this will be positive including the fact that healthcare problems are increasingly similar everywhere in the world leading to a greater concentration of effort, and the burgeoning scientific capacity of many newly wealthy countries. Medical science is an international activity where advances anywhere advantage everybody. They will however alongside this be competition particularly for healthcare workers as the global populations age as well as becoming wealthier and we need to plan for this in advance.

The march of medical science continues. Some of the advances we are going to see over the next few decades are predictable, although many are not. Some predictable areas include non-chemotherapy drugs for cancer, better immunotherapy for inflammatory diseases, a steady move to less invasive procedures rather than major surgery, and early diagnosis. Early diagnosis really matters as survival is often determined by disease being caught early. Treatment is often much less invasive or unpleasant if picked up early. Better imaging, visualising inside the body, artificial intelligence, liquid biopsies to identify blood markers for cancer, screening by genotype and other risk factors are all examples where diagnosis is likely to improve.

Medical science has advanced and will continue to advance but the human aspects of medicine, nursing and allied professions would be recognisable to our predecessors centuries back. It will always remain important.

Overall, this has been a highly optimistic lecture. In many areas of medicine, the remarkable march of progress continues but we do need to address the areas that are lagging. The areas getting better include cardiovascular diseases, much cancer treatment, many inflammatory diseases, infectious diseases, many rarer diseases of childhood and less invasive treatment. Challenges we must address include disease associated with obesity, some aspects of mental health, dementia, multi-morbidity, costs of healthcare, the continuing huge burden of disease caused by smoking and social care. Widening disparities in health cause for real concern.

The overall medium-term future for the NHS and for the health of the population is however on balance one of progress in multiple fields and that is something we should celebrate.

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