IMPACT OF LIFE EXPECTANCY ON HEALTHCARE

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Ageing is an inevitable circumstance of life. With the average global life expectancy (LE) determined by WHO (2020) rising from 67 in 2000 to 73 in 2023, it is empirically proven that people across the globe are living longer. The global ageing population will no doubt present a profound impact on healthcare services worldwide. This article aims to explore measures such as healthcare expenditure growth and the effects of polypharmacy with reference to life expectancy and healthy life expectancy at birth (determined by WHO) to provide a global outlook on the consequences of life expectancy on healthcare.

Physiology of Ageing

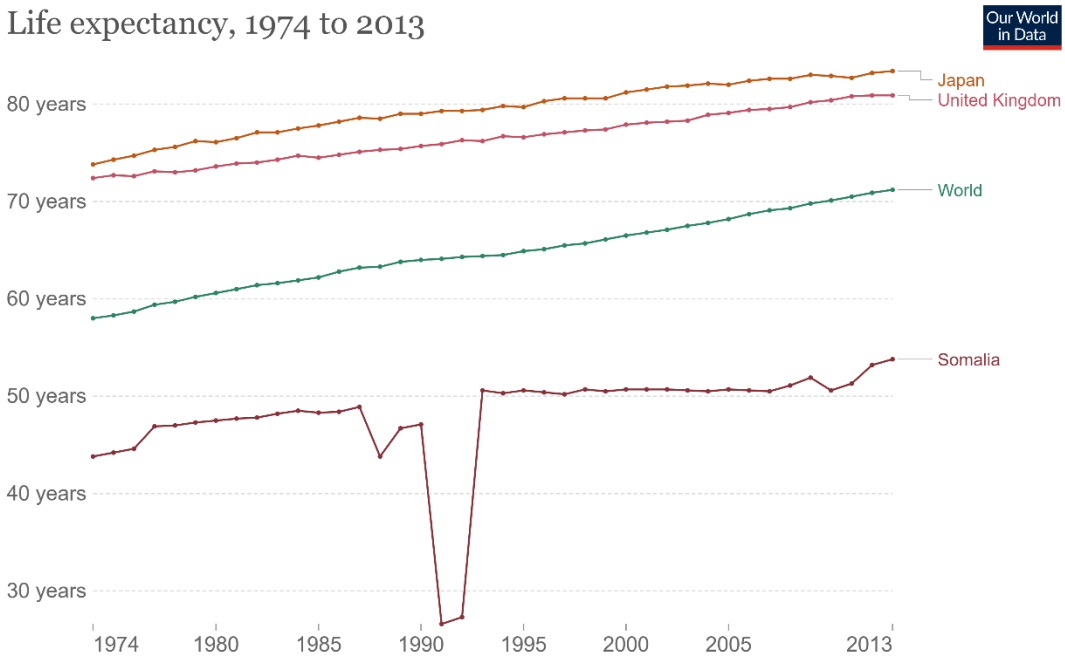
In the physiological sense, ageing is a process in which degenerative changes accumulate over time, regardless of an organism's level of disease (Boss and Seegmiller, 1981; Flint and Tadi, 2021; The Royal Australian College of General Practitioners, 2019). On a cellular and molecular level, damages occur predominantly due to the eventual production of reactive oxygen species; this is determined predominantly by genetics alongside nutritional and environmental influences (The Royal Australian College of General Practitioners, 2019; Knight and Nigam, 2017a). For example, in the cardiovascular system, age-related changes reduce the efficiency of the heart, with the cardiac output of a normal 80 year old falling to only 50% of the level of a normal 20 year old (Knight and Nigam, 2017a; Boss and Seegmiller, 1981). By the time a human adult reaches their 40s, there is permanent decline across most organ systems (Boss and Seegmiller, 1981). Moreover, elderly people enter into a state of immunosenecensce whereby their capacity to respond to and recover from injury and infection is greatly decreased and there is a larger susceptibility to infection, malignancy and autoimmunity (Knight and Nigam, 2017b; Lian et al., 2020). UK healthcare systems currently generate a £5.8 billion annual cost from 50% of patients over 85 living with frailty (British Geriatrics Society, 2023). Hence, it is clear that adding disease atop of the physiological and immunological decline already accumulated with age poses a significant challenge for healthcare systems when caring for the elderly.

What is Life Expectancy and how it has Changed

In order to fully determine the impact of LE on healthcare, we must first establish whether it is a useful predictor of population health. Roser et al. (2013) declare LE to be "the key metric" in expressing the health of a population, particularly for its ability to convey "mortality along the entire life course" compared to the parameters of infant and child mortality (which focus on mortality in individuals under the ages of one and five respectively). For any given calendar year and geographical region, WHO (2020) details *life expectancy* at birth (LEAB) as the average lifespan of a newborn in account of the "sex- and age-specific death rates" at the time of their birth. *Healthy life expectancy* at birth (HLEAB) is defined by the average number of expected years lived at "full health," accounting for the years of poor health resulting from disease or injury (WHO, 2023).

Currently set at 73 years, the world has seen a substantial increase in global LE since the 18th century, with no present-day country having a life expectancy beneath 40, the highest in the world in the year 1800 (Roser et al., 2013). Dubbed the "Epidemiologic Transition" by Abdel Omran in 1971 (Vallin and Meslé, 2004), this stark increase emerged at different rates for different nations, with more developed countries seemingly racing ahead and a particular strict global divide in LE in 1950. This may perhaps be due to the lasting effects of conflict and exploitation faced by many developing nations in the events preceding and succeeding the gain of independence from their colonial powers (US Office of the Historian, 2019).

Being determined predominantly by death rates, LE appears to be a highly impressionable parameter; peaks and troughs in LE can be seen for many reasons. For example: decreasing child mortality rates and a shift in the predominant causes of death from infectious disease to non-communicable diseases such as cancers, dementia and diabetes (Roser et al., 2013; University of Bolton, 2022) have led to increases in LE. As seen in figure 1 from Roser et al. (2013) a rapid decline in LE can be seen in Somalia in 1992-2 (perhaps in the wake of its civil war and ensuing famine). Furthermore, distinct troughs can be seen as a result of the Spanish Influenza outbreak in 1918 and similarly (albeit on a smaller scale) after the COVID-19 pandemic (Roser et al., 2013).



Source: UN WPP (2022); Zijdeman et al. (2015); Riley (2005) OurWorldInData.org/life-expectancy • CC BY
Note: Shown is the 'period life expectancy'. This is the average number of years a newborn would live if age-specific mortality rates in the current year were to stay the same throughout its life.

Hence, LE appears to be a crude estimate of population health, drastically influenced by several factors which are not easy to explicitly account for. It can serve as a useful average, however it may be more beneficial to look to other parameters such as morbidity, mortality, HLE and diseased years when assessing implications for healthcare services globally.

Morbidity, Mortality and the Expenses of an Ageing Population

Diseased Years

Though HLE has risen, a rise in the number of diseased years (determined by LE – HLE) is also emerging. As of 2019, the UK LEAB stands at 81.4 years, compared to a 70.1-year HLEAB (WHO, 2020; WHO, 2023). A current newborn UK can therefore expect to live for up to 11.3 years at "less than full health," an increase from the 10.25 diseased years projected for those born in 2000. In itself, being at "less than full health" is a vague notion with no reference to explicit levels of frailty or disease. However, with patients 65 and over comprising more than 40% of UK hospital admissions and 2/3rds of inpatients (British Geriatrics Society, 2023), it is reasonable to assume that these final 11.3 years of living may be spent requiring a healthcare intervention of some sort.

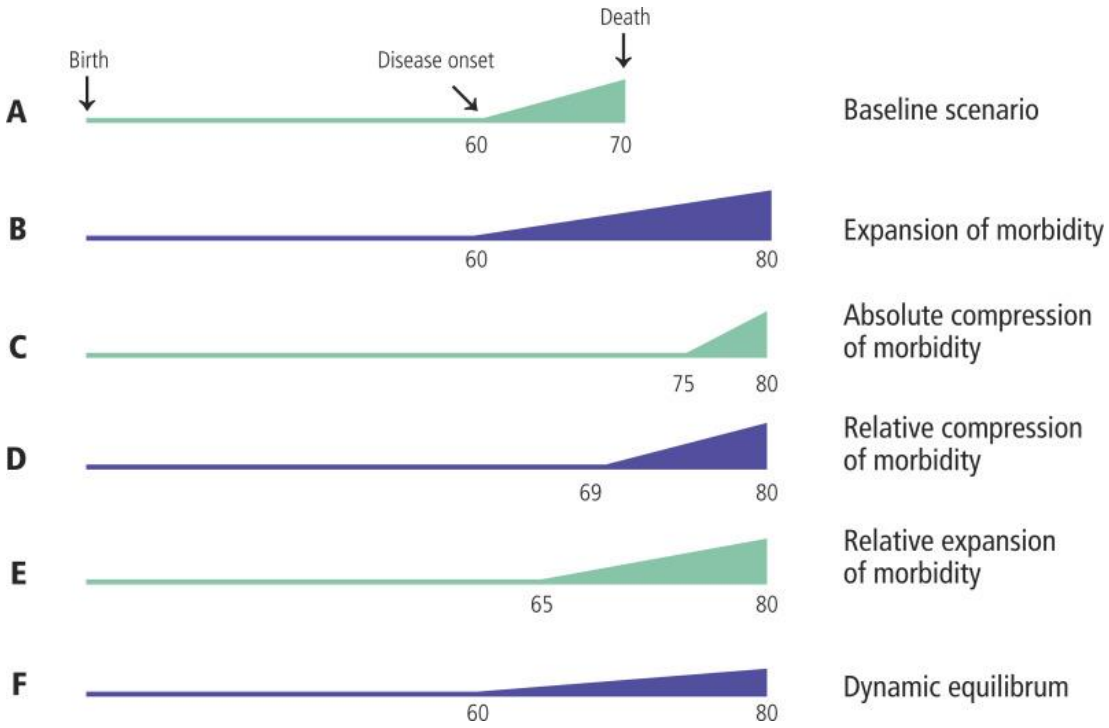
This is not limited to the UK. The proportion of older people in every nation is increasing alongside rising population numbers, leading to a "population ageing" effect wherein the distribution of age is skewed towards older people (WHO, 2022). In fact, in 2020 there were more adults over 60 than children under 5 (WHO, 2022). This shift is most prominent in LMICs who are set to house 80% of older people by 2050, and with fewer fiscal resources they may face greater obstacles in healthcare provision (WHO, 2022). Howdon and Rice (2018) attribute this rise to the post WWII "baby boom" as well as increases in longevity and refer to OECPD data suggesting that social expenses in associated with age in Europe will increase from 19% of GDP in 2000 to 26% in 2050. This global acceleration in LE has seen profound financial implications:

Compression vs Expansion of Morbidity

At large, there are two theories suggested in the literature for the proposed effects of advances in technological and preventative medicine: the 'compression' and 'expansion' of morbidity hypotheses. The former predicts a postponing of the onset of chronic conditions, resulting in a 'compression' of diseased years before death. The latter outlines a mortality rate decreasing alongside a continued rise in morbidity so that elderly individuals live with their chronic conditions for longer, leading to a rise in healthcare expenditure on older individuals (Ferguson and Belloni, 2019).

Neither are perfect. The compression theory appears to rely on the rate of medical advances exceeding that of rises in LE. However, with multimorbidity negatively affecting quality of life (Nelis et al., 2018) and being associated with an increased risk of mortality (as seen for example by studies seen in China led by He et al. (2021) and Denmark led by Willadsen et al.(2018)) this may not be the case. Though more widely accepted, the expansion theory does not account for factors that may decrease individuals accessing preventative measures in the first place. In Jamaica for example, a study led by Bourne et al. (2022) discovered low levels of health literacy and health seeking behaviours amongst the country's elderly male population, leading to delayed healthcare interventions.

A third, 'dynamic equilibrium' theory proposes a general increase in the prevalence of low severity chronic diseases (as outlined in figure 2) which will apparently lead to fewer costs and use of healthcare services (Rechel et el. 2020).



Comorbidity, Multimorbidity and Polypharmacy

Co and multimorbidity are indeed of concern. The prevalence of comorbidity rises with age (Mason et al., 2021) and this comes at a significant cost. In the UK, 68% of individuals aged 65 and over currently suffer with two or more chronic conditions (Healthy Aging Team, 2021) and this is not cheap. A 2020 report by Blawat et al. for PHE found there to be a £19, 413 annual social care cost per individual living with dementia. With a projected rise from the current total of 944,000 to 1,651,000 UK individuals living with dementia by 2050, the financial demands in caring for these individuals are bound to increase, particularly as **age is the biggest risk factor for Dementia** (Alzheimer's Research UK, 2022. On this account, an ageing population proves to have a compelling effect on healthcare expenditure.

There is also the issue of polypharmacy, where one patient is prescribed multiple drugs for long term use. The prevalence of polypharmacy is increasing globally (Duerden et al., 2013), and this also accrues costs for healthcare systems. A 2019 report on polypharmacy by Petchey and Gentry for Age UK discovered the common prescription of medications resulting in unfavourable and unsafe side effects. They state that 75% of patients over 70 will experience an adverse drug reaction over a period of six months, leading to increased hospitalisation and a greater need for medical care. In 2004 adverse drug reactions comprised 6% of unplanned hospital admissions (Pirmohamed et al., 2004). Moreover, the risk of falls – a considerable risk factor for hospital admissions - increases alongside the number of medicines taken by an individual (Kojima et al., 2011; Petchy and Gentry, 2019). This appears to be a vicious cycle, with 1/3 of older people suffering a post admission medication related harm within 30 days, amounting to a £400million annual cost in the UK (Parekh et al., 2018; Petchy and Gentry, 2019). Additionally, many patients report not taking certain medications at all due to negative side effects (Petchy and Gentry, 2019), and this has a

knock-on effect: If pharmacological interventions are not followed, a patient's multimorbidity is improperly managed. Patients remain unwell, may then have to be admitted to hospital and alongside this, medications are wasted (Petchy and Gentry, 2019). In fact, in 2010/11 there was a reported wastage of £300million worth of medications (DH Medicines Pharmacy and Industry Group, 2011; as cited by Petchy and Gentry, 2019). It therefore follows that polypharmacy, often uniquely faced by older individuals poses a significant age-related challenge for healthcare systems, with a demonstrable impact on patient safety.

Trajectory for the Future

Worldwide challenges such as national conflict, global warming, cost of living crises and disease epidemics raise the question of whether life expectancy will truly continue to rise as projected. The UN however predicts a net rise in life expectancy across the globe, with Japan holding a projected life expectancy of 94 years in 2099 (Roser et al., 2013). Regardless, with the proportion of diseased years increasing and the consequent financial implications, it is evident that healthcare reform to accommodate for the needs of elderly individuals is due. While clear that ageing populations impose a significant impact on healthcare systems, elderly people still deserve access to the healthcare systems which are of course intended for *all*. Health inequalities arise due to several environmental factors, including socioeconomic status, sex, ethnicity and childhood environment (WHO, 2022) which exacerbate the predisposing genetic factors and base physiological age-related decline. Many therefore spend their final years in poor health through little fault of their own.

Dr Stella George et al. of Aetna International predict age-related ill-health to be the next epidemic. Their 2017 White Paper outlines the need to augment healthcare prevention and intervention programmes and increase access to community-based care. Nations could consider implementing supportive infrastructure such as accessible buildings or walkable districts (WHO, 2022). One such example of this is Västra Götaland in Sweden, who introduced 'Close Care Units' to provide urgent care for patients over 65 (Haseltine, 2018a-c). They are comprised of three units: a mobile operational unit which acts as the main port of call, discharging those not in need of urgent care to a mobile doctor unit, and those for end-of-life care to a palliative care unit (Haseltine, 2018c). As a result, Västra Götaland has seen a "drastic" decline in ED and unscheduled on-takes with savings of $8000 (USD) per patient (Haseltine, 2018c; Anell, 2016). It is clear from this example that provisions can be made for healthcare systems to adapt ageing populations.

Conclusions

Life expectancy is increasing across the globe and projected to increase much further. The global shift (though albeit at different rates for different nations) from communicable to non-communicable diseases such as cancers, diabetes and dementia has led to people living much longer. There have been stark increases in healthcare expenditure, with polypharmacy in particular posing a unique issue for both patient safety and healthcare costs. However, diseases suffered by the elderly are not a strictly direct result of modifiable risk factors such as diet. In fact, multimorbidity seen in old age is predetermined by a host of reasons. Namely, predisposing genetics, base physiological decline and a number of environmental factors such as sex, ethnicity, socioeconomic status or childhood environment; all of which all lie beyond individual control. Burdens placed on healthcare systems as a result of ageing do not take away from the fact that the world's elderly population deserves to live in environments that support and accommodate for them. Service reform across society such as the introduction of close care units in Västra Götaland, Sweden can ease pressures via lowered expenses per patient and reduced hospital admissions. Nations should follow their example to bring about an accommodating society for all individuals.

ABBREVIATIONS

- LE: life expectancy
- LEAB: life ecpectacy at birth
- HLE
- HLEAB
- OECDP: Organisation for Economic Co-operation and Development
- PHE Public health England
- LMICs – low and middle income countries
- ED – emergency department

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