

Extended abstract for the 2021 International Population Conference

Best-practice healthy life expectancy vs life expectancy: catching up or lagging behind?

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Abstract

Best-practice life expectancy has been shown to steadily increase since 1840. A topic of increasing interest is whether or not the raising years of life that are gained in low-mortality settings are spent in good or bad health. We aim to contribute to the compression versus expansion of morbidity debate by examining time trends in best-practice in healthy life expectancy (HALE) over the last 3 decades and compare them with best-practice life expectancy (LE) using data from the Global Burden of Disease Study 2019. Best-practice female LE is increasing 0.19 years per year in 1990-2019, which is slower than what previously estimated using longer time trends (1840-2017, slope=0.24). Best-practice female HALE is increasing at slower speed (slope=0.15) as compared with LE. Best-practice male LE and HALE were lower compared with women, but HALE was also increasing at slower pace. Years spent with disability are increasing, and the proportion of years lived with disability seems to be increasing as well. This work will be extended by including estimates at different age groups and by exploring the robustness of the results using other estimates or data sources for estimating HALE. The implications of these findings on morbidity dynamics will be discussed.

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Introduction

Two decades ago, Oeppen and Vaupel (2002) demonstrated that best-practice life expectancy has followed a linearly increasing trend since 1840. As they argued, different estimated upper bounds to life expectancy have repeatedly been surpassed. This bold and provocative result has generated widespread interest for its implications on future mid- and long-term longevity dynamics. A recent update of the best-practice life expectancy up to 2017 has shown that the strong correlation and best-practice life expectancy increase of about 2.5 years every decade has persisted. However, beyond these long-term trends it is worth noting the visible slow down over the last decade (Vaupel et al. 2021) in which the best-practice life expectancy – corresponding to Japanese women – has increased barely one year (HMD).

One of the key concerns with increasing longevity is whether the additional years of life that modern societies have gained are spent in “good” or “less-than-good” health. If mortality declines but morbidity remains constant, the socio-economic burden will increase and put under severe strain pension systems, welfare states, care supply and public health policies. Back in the late 1970s and early 1980s several authors postulated competing theories on the dynamics of morbidity and mortality that have been used as reference in the empirical studies carried out up to date. Fries (1980) argued that a compression of morbidity over time occurs, therefore suggesting that “the age at first appearance of aging manifestations and chronic disease symptoms can increase more rapidly than life expect” (Fries 1983). In contrast, other authors have posited that increases in life expectancy are accompanied by increases in the time lived with morbidity, even predicting a pandemic of chronic diseases – or expansion of morbidity – through the progress in medical care extending the life of those already with disease and disability (Gruenberg, 1977; Kramer 1980). A third intermediate scenario, known as the “dynamic-equilibrium” was proposed by Manton (1982), in which the life expectancy increases are accompanied by proportional increases in the years of live lived in good health (e.g., free of morbidity/disability). In addition, severe disability decreases, while mild and moderate disability increases because the rate of disease progression slows down.

So far, the evidence supporting the different hypotheses is mixed, and no clear pattern has been observed between life expectancy (LE) and disease- or disability-free life expectancy (DFLE) (Crimmins et al., 2016; Fries, 1980; Gispert et al., 2007; Jagger & Robine, 2011; Manton, 1982; Nielsen et al., 2021; Olshansky et al., 1991; Robine et al., 2009; Sagardui-Villamor et al., 2005; Zunzunegui et al., 2006). Partly, this is because results depend on several factors, including the morbidity measures that is used to calculate DFLE (e.g., disability, chronic conditions), country and period of time.

In this paper, we revisit Oeppen and Vaupel’s approach to investigate the trends in best-practice *healthy* life expectancy (or ‘health-adjusted life expectancy’ – HALE for short) in relation to the best-practice life expectancy. HALE measures the average number of

years individuals are expected to live in “good” health (i.e., free from disease and disability) under the mortality and morbidity conditions prevailing in a given year. Such results can throw new light to the future prospects of the compression vs expansion of morbidity debate in the more advanced/lowest-low mortality countries.

Data and methods

To attain our research objectives, we take advantage of the HALE estimates that the Institute for Health Metrics and Evaluation (IHME) have published for all years between 1990 and 2019 (i.e., a 30-year observation window). Data used in this research was retrieved from the GBD 2019 estimates (Wang et al 2020). In this dataset, HALE was estimated using disability as a health variable, which was defined as being “in less-than-ideal health. This includes conditions such as influenza, which may last for only a few days, or epilepsy, which can last a lifetime. It is measured by taking the prevalence of the condition multiplied by the disability weight for that condition. Disability weights reflect the severity of different conditions and are developed through surveys of the general public” (Wang et al 2020).

To report best-practice trends in LE and HALE we use standard linear regression models and document the slope of the corresponding regression line. In addition, we report the fractions of life expectancy that are spent in less-than-good health $((LE - HALE)/LE)$.

Results

In Figure 1 we plot the trajectories of best-practice HALE and LE from 1990 until 2019 across all countries included in the IHME database (excluding very low populated ones, like Andorra or San Marino²). For females, best-practice HALE increases at a slower pace than best-practice LE (see left panel). The slopes of the best-practice regression lines are 0.15 and 0.19, respectively, and the fit is very high ($R^2 \approx 0.97$). In the right panel of Figure 1 we show the results for males. Again, the slope of the best-practice LE is higher than the slope of the best-practice HALE (0.24 vs 0.21), and the fit of the regression lines is even higher ($R^2 \approx 0.98$). Thus, best-practice LE and best-practice HALE increase at a faster pace for men, though starting at considerably lower levels than those of women. These trends lend support to the expansion of morbidity side of the debate, that is: mortality seems to decline at a faster pace than morbidity does when we focus our attention on best-practice settings.

² Andorra and San Marino approximately had 77.000 and 33.000 inhabitants in 2019. Indicators of longevity for these very low populated and small territories are very sensitive to annual fluctuations and migration patterns.

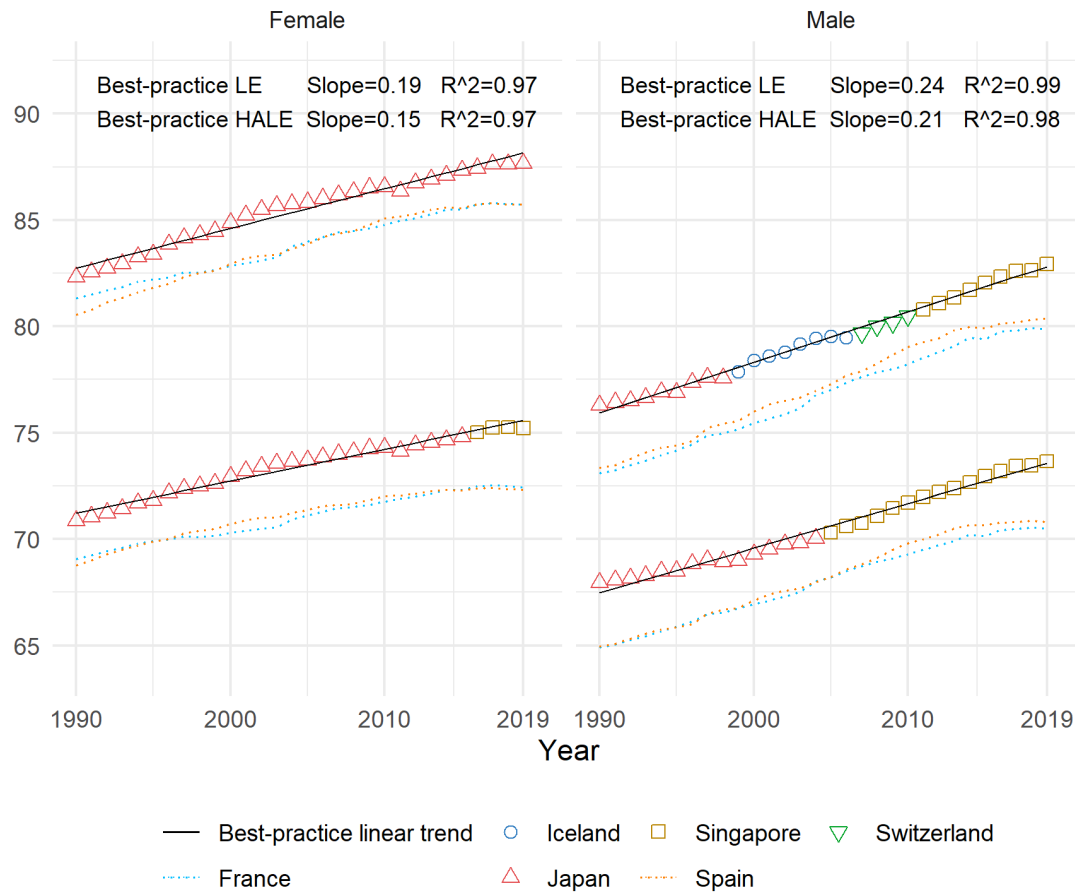


Figure 1. Best-practice LE (top) and HALE (bottom) for females and males between 1990 and 2019 (excluding Kuwait, San Marino and Andorra) and LE and HALE values for Spain and France. Source: Authors’ elaboration based on IHME data.

To investigate in further detail what happens in these fore-running countries, in Figure 2 we plot the corresponding fractions of life expectancy spent in “less-than-good” health. That is, for each country we plot the values of the ratio $(LE - HALE)/LE$ between 1990 and 2019. For both women and men (see left and right panels), we observe flat or slightly increasing trends, suggesting that among the vanguard countries, a decreasing share of life expectancy is spent in “good” health – once again lending support to the expansion of morbidity side of the debate. Despite their higher longevity, women tend to spend longer fractions of their lives in bad health – a phenomenon referred to as ‘health-survival paradox’, which has been previously investigated in several other studies (e.g., van Oyen et al 2013)

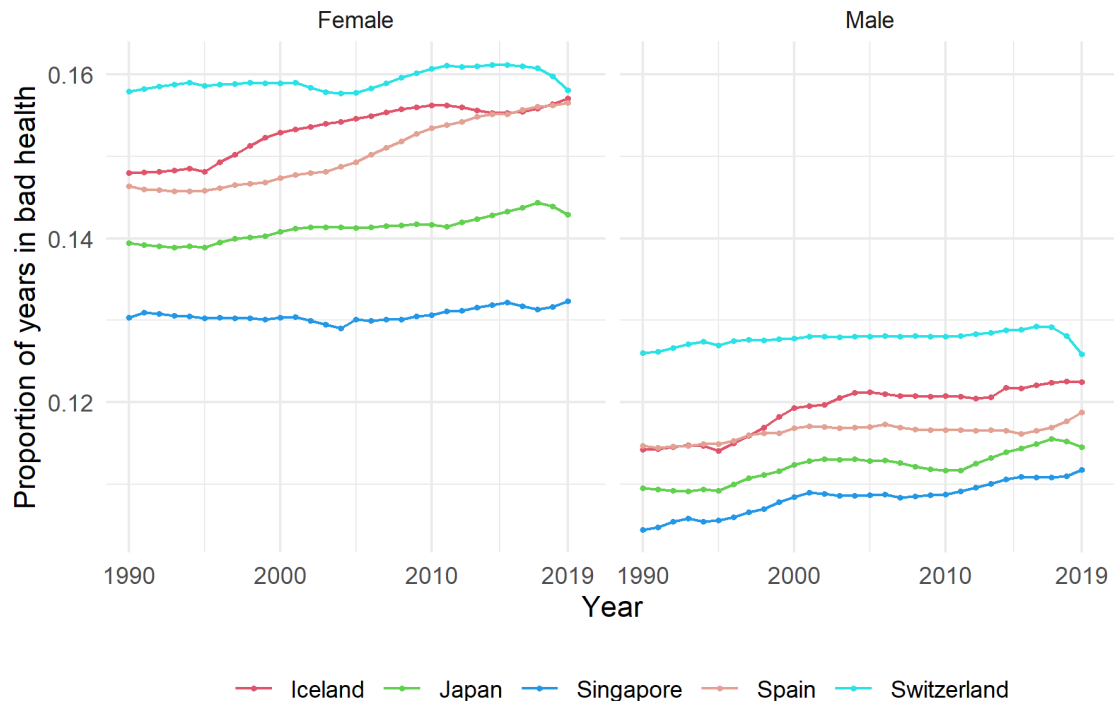


Figure 2. Fraction of life expectancy spent in less-than-good health for Iceland, Japan, Singapore, Spain and Switzerland between 1990 and 2019. Source: Authors' elaboration based on IHME data.

Key messages and concluding remarks

- Best-practice female LE is increasing 0.19 years per year in 1990-2019, which is slower than what previously estimated using longer time trends (1840-2017, slope=0.24) (Vaupel et al. 2021). Best-practice male LE is increasing faster (slope around 0.24).
- Best-practice HALE is increasing at slower speed as compared with LE, both for women and for men.
- Years spent with disability are increasing, and the proportion of years lived with disability seems to be increasing as well.
- Results are consistent across a selection of lowest-low mortality countries.
- Whether these trends will continue over time is highly uncertain. The outbreak of the covid-19 pandemic introduces much uncertainty to forecast the future prospects for mortality and morbidity dynamics.
- This work will be extended by including estimates at different age groups and by exploring the robustness of the results using other estimates or data sources for estimating HALE.

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