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Changes in inter-country differences in length of life and lifetime losses (1970-2010)

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Short abstract:

Mortality declines in best-practice countries have continued unabated, while laggard countries have experienced mixtures of mortality decline, stagnation and in some instances even mortality increases in recent decades. In this study we focus specifically on the age patterns of mortality change driving trends in life expectancy and lifetime losses, in high and medium countries included in the HMD. Specifically we aim to unravel the relative importance of different initial age-specific mortality patterns in 1970 (initial conditions), different age-specific patterns of improvement in mortality (shape differences), and different rates of mortality improvement (level differences) in driving overall mortality convergence and divergence, using a variety of existing and newly developed decomposition techniques. Uncovering these age-specific dynamics will be useful to more precisely determine the prime conditions for optimal mortality declines, and the obstacles faced by groups of countries in converging toward current low mortality regimes.

Long abstract:

The past two centuries have witnessed extraordinary declines in mortality, which appear to be continuing unabated in best-practice countries (Oeppen & Vaupel 2002; Rau et al. 2008; Vallin & Meslé 2009). As we celebrate this achievement, it becomes important to question and monitor whether all countries are participating in the longevity revolution.

While initial mortality reduction was owing in large part to reductions in infant mortality, the past four decades have seen unprecedented declines in adult mortality, in large part owing to reductions in cardiovascular mortality (Glei et al. 2010; Jemel et al. 2005; Meslé & Vallin 2002). Yet at the same time, certain countries, especially in Eastern Europe, experienced relatively little reduction or even increases in adult mortality during much of this time frame (McMichael et al. 2004; Meslé & Vallin 2002). Thus rather than all countries experiencing a uniform epidemiologic revolution guided by declines first in infectious then chronic diseases (Omran 1971), cross-country experiences might be better described by a series of convergences and divergences in mortality regimes (Vallin and Meslé 2009).

To date most global studies in mortality convergence have looked at convergence with respect to a summary figure such as the life expectancy (McMichael et al. 2004; Moser et al. 2005; Wilson 2001). Yet doing so may hide different dynamics over different age ranges, for instance convergence in mortality over infancy, and divergences in adult mortality.

Indeed differences in mortality convergence by age can be seen by looking at between-country differences in age-specific death probabilities (Figure 1). The top panels depict box plot of the probability of death among infants, children and men in their early 20s across all countries of the HMD over successive decades from the 1970s to the 2000s. Mortality over these ages declined and converged across countries, apart from a few outliers in the figure depicting age 20-24 mortality. In the second row, early middle adult mortality is depicted. Although most counties experienced mortality reductions over these ages, the spread between countries in death probabilities over these ages has increased, especially at the higher mortality end. The bottom row depicts late adult and old age mortality, all of which showed strong reductions in the level, but less change in the between-country spread in age-specific death probabilities.

The relative importance of the initial age-specific mortality patterns in driving convergence has yet to be investigated. Yet the change in life expectancy is the product of the average rate of decline in death rates and the average years of life lost due to death ($e^\dagger$), which itself is a measure of the variation in ages at death (Vaupel and Canudas Romo 2003). Thus, with larger variability, smaller average rates of progress in mortality decline are needed to achieve the same increase in life expectancy. Despite this, in most years the country with the highest life expectancy also experienced the lowest total lost life years (Vaupel et al. 2011).

In this paper, we hope to extend the discussion on mortality convergence by conducting a detailed examination of the age patterns of mortality change. We focus on high and medium income countries, specifically the countries included in the Human Mortality Database (2013) with time series dating back to the 1970s. This time interval is chosen to cover the period most crucial for changes in adult mortality.

Specifically, we are guided by the question of whether differences in trends in life expectancy and age-at-death variation are caused by different initial age-specific mortality patterns in 1970, different patterns of age-specific improvement in mortality (shape), or different rates of mortality improvement (level). To answer these questions we will use a combination of existing and newly developed decomposition techniques.

We are both interested in the general pattern that more developed countries have followed, as well as pathways followed by the outliers: frontier populations such as Japan, stagnating countries such as Russia, and countries with unusual age patterns of mortality such as the USA (i.e. high early age mortality, low old age mortality). Uncovering these age-specific dynamics will be useful to more precisely determine the prime conditions for optimal mortality declines, and the obstacles that groups of countries are facing in converging to current low mortality regimes.

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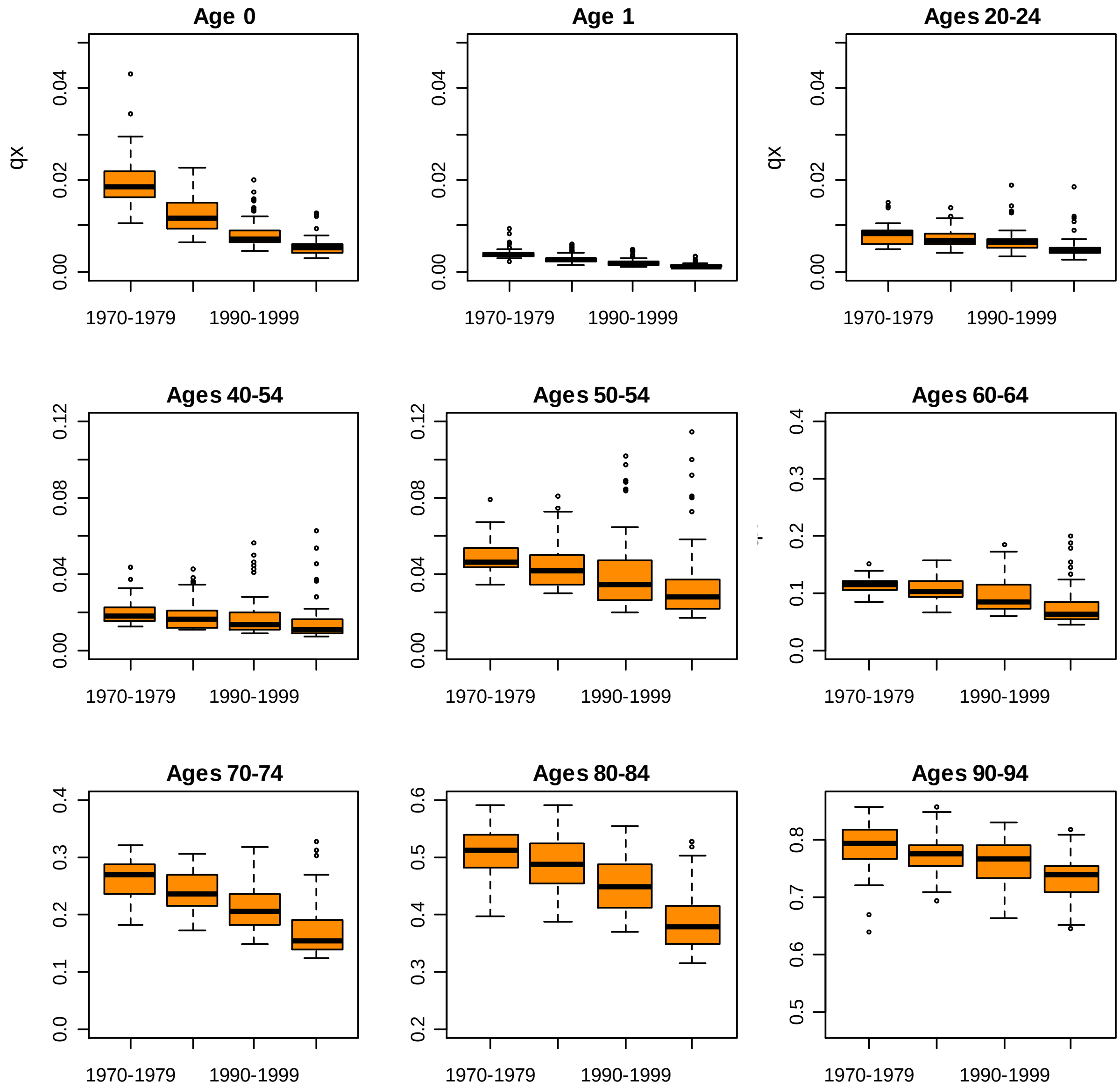

Figure 1: Box plots of male death probabilities in all countries currently in the Human Mortality Database, over different age ranges and time intervals. Note: the scale on the y-axis differs for different age intervals.