Supplemental Information

Data and methods

Data sources

We use data on all-cause mortality from the Human Mortality Database (HMD) (1) and on causes of death from the World Health Organization Mortality Database (WHO) (2). We focus on data from roughly 1950 to 2017 as these are the years that are present in both databases.

Cause of death classification

Between 1950 and 2017, there were four separate revisions of the International Classification of Diseases (ICD 7-10). As such, analyses of detailed causes of death are likely problematic due to the changing understanding of diseases and classification of causes of death over this period. Following prior research, we group causes of death into broad cause categories that are less likely to suffer from changing disease classifications over time (3). Specifically, we group mortality into: infant mortality (all mortality under age 1 regardless of cause), child mortality (all mortality between ages 1-5 regardless of cause), and among those ages 5+, infectious and respiratory, external (accidents and injuries), cardiovascular, cancers, and a residual other category.

Cause-specific mortality rate estimation

For each country-year (separately by sex), we estimate the age-cause-specific mortality rates from these 7 broad causes by first estimating the age-specific share of deaths due to each cause from the WHO database and then multiplying these shares by the all-cause age-specific mortality rates from the HMD. We use the mortality shares rather than directly estimating cause-specific mortality rates from the WHO since the WHO data are not corrected for coverage and thus may undercount mortality. By using the shares from the WHO with the rates from the HMD we assume that the age-specific cause distribution of deaths among covered deaths in the WHO database is the same as among deaths that were not counted.

Quality checks and final country selections

To assess the stability of the cause groupings across revisions, we plotted time trends of age-cause-standardized mortality rates for each country and examined whether
rates discontinuously changed at the ICD revision change points. After removing countries with irregular cause-specific mortality rates, large discontinuities at the ICD change points, or countries with only a few years of data (such as Chile), our final selection included 20 countries spanning 5 geographic regions (Table S1)

| Table S1 Countries included in the main analyses |
|-----------------------------------------------|
| Northern Europe                               | Denmark, Finland, Norway, Sweden            |
| Western Europe                                | Austria, France, Great Britain, Ireland, the Netherlands, and Switzerland |
| Southern Europe                               | Greece, Italy, Portugal, and Spain          |
| North America and Oceania                     | Australia, Canada, New Zealand, and the United States |
| Asia                                          | Japan and South Korea                      |

Estimating the “importance” of each cause group

Our analysis requires estimates of the importance of each cause-of-death group for each country-year of data. There are several possible metrics of the importance of a cause of death, including the share of deaths due to each cause group, age-standardized cause-specific mortality rates, or years of life lost from each cause. For our analysis, we apply cause-deleted life table methods and estimate the importance of each cause group as the years of life expectancy gained if mortality from that cause were eliminated. While cause-deleted life tables are unrealistic in that it is unlikely that mortality from a given cause could just be eliminated, they provide a useful accounting framework for understanding the burden of mortality due to any cause in a way that adjusts for the age distribution of countries and has a clear interpretation (years of life expectancy of birth gained) (4).

References
1. University of California, Berkeley (USA), Max Planck Institute for Demographic Research (Germany). Human Mortality Database [Internet]. [cited 2019 Jun 24]. Available from: www.mortality.org
2. World Health Organization. WHO Mortality Database [Internet]. Available from: https://www.who.int/healthinfo/mortality_data/en/
3. Vallin J, Meslé F. Convergences and divergences in mortality: a new approach of health transition. Demogr Res. 2004;2:11–44.
4. Beltrán-Sánchez H, Preston SH, Canudas-Romo V. An integrated approach to cause-of-death analysis: cause-deleted life tables and decompositions of life expectancy. Demogr Res. 2008;19:1323.