DEMOGRAPHY

Remeasuring Aging

Adjusting aging forecasts to incorporate increases in longevity and health can provide better tools for policy-makers.

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Population aging is an international concern, in part because of consequences of coming age-structure changes, e.g., growth in the number of elderly, decline in the number of youth, and accompanying economic and social costs (*1*–*4*). These expectations are based on conventional measures of aging that link expected phenotypes to fixed chronological ages. But as life expectancies increase and people remain healthy longer, measures based solely on fixed chronological ages can be misleading. Recently, we published aging forecasts for all countries based on new measures that account for changes in longevity (*5*–*8*). Here, we add new forecasts based on disability status. Both types of forecasts exhibit a slower pace of aging compared with the conventional ones.

Limits to Chronological Age

One advantage of aging forecasts based on fixed chronological ages (*1*, *9*, *10*) is that the United Nations (UN) computes them consistently for all countries of the world. These include the proportion of the population 65 and older, and the old-age dependency ratio (OADR), which considers people dependent upon others when they reach the age of 65 (often calculated as the number of people aged 65 or older, divided by the number of people of working age, 15 or 20 to 64). When using indicators that assume fixed chronological ages, it is implicitly assumed that there will be no progress in important factors such as remaining life expectancies and in disability rates. But many age-specific characteristics have not remained fixed and are not expected to remain constant in the future (*11*). In 1950, for example, 65-year-old women in Canada, Sweden, and the United States could expect to live an average of around 15 more years. By 2000, that had risen to about 20 (*12*), and the UN foresees further increases. Other forecasts also assume continuation of trends in life expectancy growth seen in the last decades (*8*, *13*), although the UN forecasts assume that the speed of life expectancy increases will slow.

Disability-free life expectancies, which describe how many years of life are spent in good health, have also been increasing, often as fast as unconditional life expectancies, because of decreases in age-specific disability rates (*14*). For example, in the United States, the proportion disabled in the age group 65 to 74 declined from 14.2% in 1982 to 8.9% in 2004–05 (*15*). Thus, fixed chronological ages do not work well in evaluating the effect of age structure changes on health care costs, because most of those costs occur in the last few years of life, which happen at ever later ages as life expectancies increase (*16*, *17*).

Life-Expectancy Adjustments

Defining old age by using life expectancy instead of chronological age was first suggested in (*18*), and expanded upon in (*19*). The more general point that ages could be adjusted for life-expectancy change much as financial variables are adjusted for inflation appeared first in (*20*). Forecasts of aging that take life expectancy into account are relatively easy to compute, but several issues contributed to their remaining underexplored. For example, concern about aging was less a priority until relatively recent years. And before publication of (*21*), life-expectancy adjustments were not available in a consistent format for all countries, and people were not trained in their use.

Alternative measures that account for life-expectancy changes show slower rates of aging than their conventional counterparts (*5*, *8*, *21*). For example, an alternative to the OADR is the prospective old age dependency ratio (POADR, defined as the number of people in age groups with life expectancies of 15 or fewer years, divided by the number of people at least 20 years old in age groups with life expectancies greater than 15 years). Effects of aging are evident in both measures, but when forecasted increases in life expectancy are taken into account, the POADR increases less rapidly than the OADR (see the table). Similar patterns are seen for many countries of the world (table S1).

Disability Adjustments

Disability-adjusted aging measures are another alternative [e.g., (*22*, *23*)]. But consistent disability-adjusted aging measures from many countries have not previously appeared in the literature. To investigate the effects of disability, we define a measure analogous to OADR, the adult disability dependency ratio (ADDR, defined as the number of adults at least 20 years old with disabilities, divided by the number of adults at least 20 years without them) (see the table and table S1).

Forecasting Dependency of the Elderly Population

	Old-age dependency ratios (OADR)			Prospective OADR (POADR)			Adult disability dependency ratios (ADDR)		
	2005–10	2025–30	2045–50	2005–10	2025–30	2045–50	2005–10	2025–30	2045–50
Switzerland*	0.27	0.41	0.48	0.15	0.18	0.24	0.09	0.10	0.11
Czech Republic	0.23	0.36	0.52	0.20	0.26	0.29	0.08	0.09	0.10
Germany	0.33	0.48	0.63	0.21	0.25	0.34	0.12	0.13	0.15
France	0.28	0.44	0.51	0.18	0.21	0.24	0.09	0.10	0.11
United Kingdom	0.27	0.36	0.41	0.19	0.20	0.22	0.10	0.10	0.10
Hungary	0.26	0.34	0.48	0.25	0.28	0.31	0.21	0.22	0.23
Italy	0.33	0.45	0.68	0.20	0.23	0.31	0.10	0.11	0.12
Japan*	0.35	0.55	0.78	0.18	0.27	0.29	0.10	0.12	0.13
Sweden	0.30	0.40	0.44	0.19	0.23	0.23	0.08	0.09	0.09
United States*	0.21	0.34	0.38	0.13	0.17	0.20	0.09	0.10	0.10
Average	0.28	0.41	0.53	0.19	0.23	0.27	0.11	0.12	0.12

*A country not in the EU-SILC survey.

Dependency ratios. Authors' calculations. OADR and POADR are based on (*11*). ADDR based on (*11*) and (*28*). The lower age boundary in all denominators is 20. See SOM §1 and tables S1 and S2 for more detailed methods and additional countries.

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The OADRs increase much faster than the ADDRs. In the United Kingdom, for example, the OADR increases from 0.27 in 2005–10 to 0.36 in 2025–30 to 0.41 in 2045–50. In contrast, the ADDR stays constant at 0.10. Although the British population is getting older, it is also likely to be getting healthier, and these two effects offset one another. Not only does the ADDR increase less rapidly than the OADR, it also increases less rapidly than the POADR, so that adjusting for the likely future path of disability rates does not simply replicate the results of adjusting aging measures for changes in longevity.

In our forecasts for the United States, in 2023 the number of expected years of disability above age 65 is 4.1. This finding differs slightly from (*22*), which forecast that figure to be 3.7 years in 2022. If the number of years of disability were forecast to change as in (*22*), the increase in ADDRs would be even less.

Previous forecasts were made for years 2003 to 2030 of the number of people 65 and older with severe disabilities for 12 countries of the Organization for Economic Cooperation and Development (OECD) from data that were not harmonized across countries (*23*). Constant age- and sex-specific disability rates were applied to future populations, and the trend in age- and sex-specific disability rates between two recent surveys was extrapolated. However, age- and sex-specific disability rates are changing, and trends between two surveys taken only a few years apart can be misleading, especially in the case of age- and sex-specific disability rates, because of the noisiness of those data.

Making consistent multicountry forecasts of the disability rates underlying the ADDR was difficult in the past. Data with a consistent measure of disability, harmonized across countries, were lacking. Data available for only one country, with disability-adjusted forecasts based on self-evaluated definitions of health, could reflect cultural specificity. The European Union Statistics on Income and Living Conditions survey (EU-SILC) survey now provides harmonized data on a specific definition of disability based on activity limitations [supporting online material (SOM) §2] for a large enough set of countries. A forecasting methodology was also needed that accounted for long-term relations between disability rates and mortality rates, and relations of disability rates across ages and sexes (SOM §1).

Even with the EU-SILC data, there are still problems. The EU-SILC could be biased if it systematically omits older people with disabilities. The survey does not include people in nursing homes (SOM §3.2 shows that this has little effect). In addition, we can currently only make disability-adjusted aging forecasts for high-income OECD countries, although we feel that this is sufficient to illustrate the potential advantages of the approach.

Better Tools for Policy-Making

Policy analysts long had little choice but to use aging forecast measures (e.g., published by the UN) based on chronological age. More recently, however, measures have been developed that do not assume that improvements in health and longevity will cease. These measures are not just different metrics for measuring the same thing. They measure different aspects of aging, ones in which biological and behavioral factors play a larger role. Other perspectives on aging are also possible, for example, in terms of prevalence of chronic diseases or of frailty, but these would also require new measures that are not based on chronological age.

The figures presented here are based on UN forecasts of survival rates. But populations are heterogeneous, and how this heterogeneity is treated influences how survival rates are forecast (*24*). Uncertainty in our forecasts comes primarily from two sources, (i) life-expectancy forecasts and (ii) disability rates that are conditional on those forecasts. But ADDRs are rather robust to differences in the speed of forecast life-expectancy changes and thus fairly insensitive to how heterogeneity is treated in making those forecasts (SOM §3.1). Use of ADDR could thus limit the scope for political speculation and controversy.

Such new measures of aging can help educate the public about likely consequences of improvements in health and longevity. Slow and predictable changes in pension age, for example, justified by an increased number of years of healthy life at older ages, may be more politically acceptable than large, abrupt changes justified on the basis of budgetary stringency. In 2000, the normal retirement age in the United States was 65. Today, it is 66; current legislation has it increasing to 67 in 2027 (*25*); and it is likely to increase further to help avoid reductions in future pension payouts. In the United Kingdom, the normal pension age is scheduled to rise from 65 to 68 by 2044 (*26*) and in Germany from 65 to 67 by 2031 (*27*). A change in U.S. legislation, for example, that would increase the normal pension age by one-half year for each year of additional life expectancy at age 65 would go a long way to ensuring the sustainability of Social Security payouts, even without further reforms. People who enjoy longer lives would finance part of their additional years of retirement themselves.

Population aging will certainly be the source of many challenges in coming decades. But there is no reason to exaggerate those challenges through mismeasurement. We will be able to address those problems better with a larger array of measures of aging, using those that are appropriate to the task at hand.

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29. The authors thank J. Vaupel and J. Goldstein for comments.

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www.sciencemag.org/cgi/content/full/329/5997/1287/DC1

10.1126/science.1193647