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Special Article

Cross-Country Comparisons of Disability and Morbidity: Evidence from the Gateway to Global Aging Data

Jinkook Lee, PhD,[1,2,3] Drystan Phillips, MS,[1] Jenny Wilkens, MPH,[1] Sandy Chien, MS,[1] Yu-Chen Lin, MPH,[1] Marco Angrisani, PhD,[1] and Eileen Crimmins, PhD[4]

[1]Center for Economic and Social Research, University of Southern California. [2]Department of Economics, University of Southern California, Los Angeles. [3]RAND Corporation, Santa Monica, California. [4]Leonard Davis School of Gerontology, University of Southern California, Los Angeles.

Address correspondence to: Jinkook Lee, PhD, 635 Downey Way, VPD 312, Los Angeles, CA 90089-3332. E-mail: jinkookl@usc.edu

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Abstract

Background: International comparisons of disease prevalence have been useful in understanding what proportion of disease might be preventable and in informing potential policy interventions in different cultural and economic contexts. Using newly available, harmonized data from 20 countries, we compare disability and morbidity of older adults between the ages of 55 and 74.

Methods: The Gateway to Global Aging Data, a data and information portal, provides access to easy-to-use individual-level longitudinal data from 10 surveys covering over 30 countries. Exploiting harmonized measures available from the Gateway, we descriptively examine how disability and morbidity differ across countries.

Results: Significant cross-country differences are observed for several health indicators. Comparing countries with the highest and lowest prevalence rates, we observe that hypertension rates vary twofold and stroke rates vary threefold, while disability and arthritis rates vary more than fivefold. Among women, higher gross domestic product and life expectancy are related to lower diabetes, heart disease, and better functioning. Among men, national indicators of economic conditions are not significantly associated with reported disease prevalence.

Conclusions: We document substantial heterogeneity in disability and morbidity across countries, separately for men and women and after controlling for population age composition and education. Rich data from various surveys across the world offers remarkable opportunities for cross-country analyses, calling for further investigation of what drives observed differences. The Gateway to Global Aging Data provides easy-to-use harmonized data files and tools to facilitate this type of research.

Keywords: Epidemiology, Functional performance, Health disparities, Public health, Cross-national comparisons

International comparisons and the subsequent ranking of countries is a popular endeavor in public health research. These comparisons can be useful in understanding the success and failure of public health policies and be used to inform potential policy interventions. Well-harmonized data with common standards of definitions and thorough documentation are prerequisites for such comparisons. In their absence, cross-country analyses may give rise to inconsistent results and to diverging conclusions (1).

The Gateway to Global Aging Data (g2aging.org) is a data and information platform developed to facilitate cross-country analyses using the Health and Retirement Study (HRS)-family of surveys. The Gateway has compiled and indexed metadata (ie, the content and flow of the questionnaires, information about samples, etc.) from all available waves of the HRS and its sister surveys, enabling users to quickly attain concordant information across surveys for over 30 countries, and across waves of individual surveys. The Gateway also provides *Harmonized data files* that can be readily used for analyses across countries and over time. The complexity of survey design and the challenges of longitudinal linkages result in significant costs to construct suitable datasets for international investigations. The harmonized data files have been built to significantly reduce such costs and to minimize errors, therefore increasing replicability of scientific findings.

Using the harmonized measures available from the Gateway, we describe health outcomes, particularly disability and morbidity, across countries, focusing on older adults between the ages of 55 and

74. We also relate individual-level health outcomes to a country's macro-level characteristics, such as the levels of economic development and inequality.

Methods

Data Sources

For our analysis, we use the Harmonized data files built from individual-level data from seven HRS-family surveys. The HRS is a biennial panel study that surveys a representative sample of Americans over the age of 50 and their spouses. It has been conducted since 1992 and includes a refresher cohort of persons 50–56 every 6 years. The Mexican Health and Aging Study (MHAS) is a longitudinal, nationally representative survey of Mexicans aged 50 years and older and their spouses. The first two waves of MHAS were collected in 2001 and 2003. The third wave was collected in 2012–2013 and includes a refresher cohort. The English Longitudinal Study of Ageing (ELSA) is a biennial, nationally representative panel survey of individuals aged 50 years and older in England, conducted since 2002. The Survey of Health, Ageing and Retirement in Europe (SHARE) is a longitudinal, multi-country survey of persons aged 50 years and older and their spouses, conducted biennially since 2004, with the number of countries included increasing in later waves. The countries represented in the 2004 SHARE Wave 1 include: Austria, Belgium, Denmark, France, Germany, Italy, Spain, Sweden, Switzerland, Netherlands, Israel, and Greece. Three additional countries were added in 2006 for Wave 2: Czech Republic, Poland, and Ireland. The SHARE did not conduct longitudinal interviews for Wave 3, and instead collected life-history information. The 2010 SHARE Wave 4 added three additional countries, Estonia, Slovenia, and Portugal, and dropped the following three countries: Israel, Greece, and Ireland. The 2012 SHARE Wave 5 brought back Israel and added Luxembourg, while no data were collected in Greece, Poland, Ireland, and Hungary. We included all SHARE countries participating in the 2012 Wave. The Korean Longitudinal Study on Aging (KLoSA) is a biennial, nationally representative panel survey of community-residing adults aged 45 and older, conducted since 2006. The age threshold of 45 was selected for KLoSA due to the early transition into retirement in the country. The Japanese Study of Aging and Retirement (JSTAR) is a biennial panel survey of Japanese aged 50 years and older, conducted since 2007. The JSTAR baseline sample was randomly drawn from five municipalities, which was expanded to include five additional municipalities by the 2011 wave. The China Health and Retirement Study (CHARLS) is a biennial, nationally representative panel survey of community-residing Chinese aged 45 years and older and their spouses, conducted since 2011. The age threshold of 45 was adopted because of the relatively low life expectancy in China. For more information about each study, their sample sizes, and design features, see Supplementary Appendix Table 1.

The analysis in this study relies on data from the RAND HRS Version P, Harmonized MHAS Version A, Harmonized ELSA Version D, Harmonized SHARE Version D.2, Harmonized KLoSA Version B, Harmonized JSTAR Version B, and Harmonized CHARLS Version B.4 (2–8).

In addition to the individual-level data, we use countries' macro-economic characteristics, such as the level of economic development and economic inequality, as well as life expectancy. Specifically, we include Gross Domestic Product (GDP) per capita, as provided by the World Bank, the Gini coefficient, as provided by the OECD and World Bank, and life expectancy at age 50 from the World Health Organization (9–12). The Gini coefficient is a measure of income inequality which captures the degree to which an economy deviates from a perfectly equal distribution of income on a scale from zero to one, where zero represents perfect equality (everyone has the same income) and a one represents perfect inequality (one person has all the income, all others have none).

Harmonized Measures

We use several measures drawn from the study specific harmonized datasets which assess demographic, socioeconomic, and health status. Attainment of tertiary education is harmonized across surveys based on the UNESCO 1997 International Standard Classification of Education (13). Disability is indicated by having difficulty with at least one of five activities of daily living (ADL) tasks: bathing, dressing, eating, getting in and out of bed, and using the toilet. Five diseases, reported by respondents as having been diagnosed by a doctor, are included as health indicators, namely diabetes, heart conditions, stroke, hypertension, and arthritis. Further details of variable definitions are available from the codebooks of the harmonized data files.

Statistical Analysis

Tables 1 and 2 show descriptive statistics on selected health indicators for men and women, respectively. In order to report national-level or country-specific population estimates, we use the sample weights provided by each study and account for complex survey design by using stratum and cluster variables.

At the country level, we examine the association between national macro characteristics and the prevalence of diseases using Pearson correlation coefficients (Table 3). At the individual level, we estimate a probit model for each health indicator with a set of country dummy variables, controlling for age, gender, and education, to gauge cross-country differences. We omit the United States dummy; hence, we estimate country-specific differences relative to the United States. We discuss the results of the probit analysis in the text and present the full set of estimated coefficients in Supplementary Appendix Table 2. All analyses were performed using Stata 14.

In Figure 1, we document patterns of ADL disability, defined as difficulty performing at least one of five specific ADL tasks, by sex and age across countries. For this purpose, we group SHARE countries into four geographic regions of Europe.

Results

We observe significant cross-country variations in disability and morbidity, as shown in Tables 1 and 2. The prevalence of ADL disability among individuals aged 55–74 ranges from 3%–4% in Korea, Japan, and Switzerland to 13%–14% in China, Estonia, and England for men, and from 2%–4% in Korea and Switzerland to over 15% in China, Mexico, and England for women. Cross-country variation in morbidity is also substantial. The prevalence rate for diabetes varies threefold for men and fivefold for women, the prevalence rate for heart disease varies fivefold for both men and women, the prevalence rate for stroke varies fourfold for men and threefold for women, and the prevalence rate for hypertension varies about twofold for both men and women. The prevalence rate for arthritis exhibits more pronounced variation across countries. For men, it increases almost 14 times from the lowest value of 3.4% in Japan to the highest value of 46.8% in the United States, while for women, it varies sixfold.

Table 1. National Economic Characteristics, Life Expectancy, Education, Disability, and Morbidity by Country for Men in 2012

	Men Aged 55–74										
	2012 GDP per Capita PPP ($)[a]	Gini Coeffi-cient[b]	Life Expect-ancy at Age 50[c]	*N*	Tertiary Education (%)	Any ADL Difficulty (%)	Diabetes (%)	Heart Disease (%)	Stroke (%)	High Blood Pressure (%)	Arthritis (%)
China	11,351	0.42	26.9	5,060	2.8	13.6	8.9	12.5	4.3	32.2	34.3
Mexico	16,457	0.46	28.8	3,949	14.0	8.5	19.5	4.6	2.1	35.9	14.2
Estonia	26,023	0.34	25.2	1,535	19.3	13.1	12.0	23.8	7.6	48.8	27.4
Slovenia	28,842	0.25	29.1	859	20.4	6.9	17.6	17.1	4.7	51.5	9.1
Czech Republic	29,047	0.26	27.3	1,701	15.6	9.2	23.7	18.5	7.9	58.5	27.0
Israel	31,751	0.37	31.7	724	34.3	6.4	29.9	19.6	6.2	47.5	9.6
Spain	31,987	0.34	30.9	1,848	12.0	7.6	23.1	17.1	4.8	45.8	24.8
Korea	32,097	0.31	29.8	2,061	17.2	2.7	16.7	7.4	5.4	33.3	8.1
Italy	36,237	0.33	31.4	1,410	8.8	6.4	14.4	15.0	4.4	49.9	27.4
Japan	37,191	0.33	31.8	1,775	28.9	3.4	18.0	12.7	5.5	40.8	3.5
England	37,478	0.35	30.9	2,778	20.8	14.1	13.1	19.0	3.7	43.7	30.4
France	37,645	0.26	30.8	1,286	26.0	7.5	16.0	17.1	4.2	36.9	30.4
Belgium	42,355	0.27	29.9	1,565	38.8	10.2	13.7	15.9	4.7	40.0	26.4
Germany	43,564	0.29	30.0	1,713	39.1	8.7	16.2	15.0	5.8	46.4	23.1
Sweden	44,725	0.27	31.6	1,433	28.4	5.7	13.3	12.5	5.7	39.3	17.1
Denmark	44,804	0.25	29.7	1,259	39.5	7.1	10.0	14.2	6.2	40.8	28.8
Austria	46,233	0.28	30.2	1,284	30.4	6.6	16.9	15.4	7.2	50.2	13.7
Netherlands	46,707	0.28	30.7	1,276	33.6	5.3	13.5	17.8	5.0	32.6	14.7
USA	51,450	0.40	29.8	5,110	32.5	11.1	22.8	22.8	6.2	57.2	46.8
Switzerland	57,591	0.29	32.1	939	21.2	4.0	10.6	10.0	2.9	38.3	19.4
Luxembourg	91,622	0.30	30.2	541	23.0	8.2	17.1	12.4	2.7	38.2	35.5

Note: All statistics are 2012 except Japan 2011. ADL = Activities of daily living; GDP = Gross domestic product; PPP = Purchasing power parity.
All statistics are from harmonized datasets (2–8), except where noted.
[a]Per capita GDP in 2012 is provided by World Bank (9). [b]Gini coefficient in 2012 is taken from OECD (10) and World Bank (11) and is a measure of inequality, ranging from 0 (complete equality) to 1 (complete inequality). [c]Life expectancy in 2012 is taken from WHO (12).

The countries considered in this study, which represent both newly developing economies, such as China and Mexico, and long-developed ones, like England, Sweden, and the United States, have a range of GDP per capita from just over $11,000 in China, to more than $91,000 in Luxembourg. Income inequality is quite variable across these countries; it is relatively large in Mexico, China, and the United States, and more modest in Slovenia, France, and Denmark. Life expectancy is highest in Switzerland for men and in Japan for women. The educational level of the older population computed from the harmonized data also shows tremendous differences across countries, with China and Denmark having the lowest and highest number of older adults with a tertiary education, respectively.

Among men, country-specific disease prevalence is not associated with either the level of GDP or the level of income inequality as represented by the Gini coefficient. Nor is educational attainment or life expectancy related to the prevalence of heart disease, diabetes, stroke, hypertension, or arthritis (lack of association is indicated by no coefficient in Table 3 being statistically significant). ADL disability for men is less prevalent in countries with higher life expectancy. For women, hypertension is less prevalent in countries with higher GDP, diabetes is less prevalent in countries with more inequality, heart disease is less prevalent in countries with higher life expectancy, and stroke is more prevalent where women have higher education. Among women, ADL disability is more likely in nations with more income inequality and lower life expectancy.

We also examine the prevalence of ADL disability in each country/region separately for men and women (Figure 1). The steepness of age gradients in disability prevalence varies greatly across countries and by gender. For instance, relatively stable levels of disability are observed among women in the United States, Northern Europe, and Korea, while sharp increases with age are detected for men in England, China, and Mexico, and in Israel for both men and women. In most countries/regions, gender-specific age gradients are similar, with the exception of Northern Europe and Mexico, where men exhibit much steeper increases in disability than women. The prevalence of disability is the lowest among Korean women; even for those aged 70–75 years, the rate of disability is substantially lower than that of women in their 50s in other countries.

Discussion

Our study is observational in design. With the exception of Table 3, our units of analysis are individuals living in a given country at a particular point in time. We use study-specific sample weights to obtain national-level statistics. These weights were constructed by the originating studies to make the weighted sample of each study representative of all individuals in the country's population within the age-eligible range used for sampling. To the extent that the age-eligible range varies (although slightly) across studies, observed differences across countries may also reflect differences in the composition of the reference populations.

In Table 3, we document associations between national macroeconomic characteristics and the prevalence of diseases. In this case, our units of analysis are countries and, to avoid the ecological inference fallacy, one should refrain from interpreting the observed aggregate associations as individual-level associations.

Table 2. National Economic Characteristics, Life Expectancy, Education, Disability, and Morbidity by Country for Women in 2012

	Women Aged 55–74										
	2012 GDP per capita PPP ($)[a]	Gini Coeffi-cient[b]	Life Expect-ancy at Age 50[c]	*N*	Tertiary Education (%)	Any ADL Difficulty (%)	Diabetes (%)	Heart Disease (%)	Stroke (%)	High Blood Pressure (%)	Arthritis (%)
China	11,351	0.42	29.5	5,081	1.7	19.3	11.7	20.4	3.1	36.3	45.4
Mexico	16,457	0.46	31.9	4,479	6.1	16.9	27.3	4.0	2.8	55.4	26.2
Estonia	26,023	0.34	32.7	2,152	24.5	12.8	15.9	21.8	5.9	55.9	41.1
Slovenia	28,842	0.25	34.3	1,033	18.7	5.8	10.9	13.5	3.1	47.6	21.4
Czech Republic	29,047	0.26	32.3	2,288	10.6	8.0	18.7	13.0	4.9	54.8	38.5
Israel	31,751	0.37	34.8	912	30.0	5.7	25.0	12.3	3.4	44.1	25.1
Spain	31,987	0.34	36.0	1,950	9.1	10.0	17.0	10.8	3.7	48.5	51.9
Korea	32,097	0.31	35.7	2,549	4.5	1.7	15.6	7.3	3.9	39.0	31.2
Italy	36,237	0.33	35.4	1,633	8.6	9.1	12.0	9.4	2.6	47.6	47.1
Japan	37,191	0.33	37.7	1,711	15.5	4.8	9.1	10.2	3.8	36.2	9.4
England	37,478	0.35	33.8	3,348	13.4	15.6	9.2	14.9	2.6	37.5	43.2
France	37,645	0.26	36.0	1,560	23.6	8.4	11.9	11.1	4.9	37.1	51.8
Belgium	42,355	0.27	34.2	1,799	31.7	13.0	11.3	11.4	5.0	44.1	43.8
Germany	43,564	0.29	34.2	1,793	22.9	8.6	12.1	9.2	5.2	45.6	33.5
Sweden	44,725	0.27	34.6	1,669	37.7	6.4	7.4	7.5	3.6	37.7	30.0
Denmark	44,804	0.25	33.1	1,375	47.8	6.8	7.8	10.6	4.6	39.0	39.7
Austria	46,233	0.28	34.5	1,655	24.2	6.4	13.0	10.9	6.0	45.0	25.4
Netherlands	46,707	0.28	34.2	1,530	25.0	6.4	10.6	9.8	5.0	36.4	30.2
United States	51,450	0.40	33.4	6,749	27.5	12.4	20.5	17.1	5.5	52.5	60.0
Switzerland	57,591	0.29	35.8	1,073	12.7	4.1	5.7	5.7	2.3	28.5	33.1
Luxembourg	91,622	0.30	34.4	536	15.3	12.4	9.9	8.6	2.3	32.9	50.5

Note: All statistics are 2012 except Japan 2011. ADL = Activities of daily living; GDP = Gross domestic product. PPP = Purchasing power parity.
All statistics are from harmonized datasets (2–8), except where noted.
[a]Per capita GDP in 2012 is provided by World Bank (9). [b]Gini coefficient in 2012 is taken from OECD (10) and World Bank (11) and is a measure of inequality, ranging from 0 (complete equality) to 1 (complete inequality). [c]Life expectancy in 2012 is taken from WHO (12).

Table 3. Pearson Correlations Between National GDP, Gini Index, Life Expectancy at Age 50 and Prevalence of Disease and Disability

	Men Aged 55–74			
Percent with:	2012 GDP Per Capita[a]	Gini Index[b]	Life Expectancy at Age 50[c]	Tertiary Education
Heart Disease	0.01	−0.14	−0.22	0.25
Diabetes	−0.06	0.20	0.16	0.07
Stroke	−0.20	−0.31	−0.33	0.30
Hypertension	−0.03	−0.10	−0.17	0.06
Arthritis	0.25	0.16	−0.29	−0.09
ADL	−0.24	0.38	−0.62*	−0.19
	Women Aged 55–74			
Percent with:	2012 GDP Per Capita[a]	Gini Index[b]	Life Expectancy at Age 50[c]	Tertiary Education
Heart Disease	−0.32	0.21	−0.48*	0.04
Diabetes	−0.42	0.60*	−0.28	−0.21
Stroke	−0.08	−0.30	−0.08	0.47*
Hypertension	−0.47*	0.26	−0.33	−0.05
Arthritis	0.22	0.11	−0.25	−0.02
ADL	−0.22	0.62*	−0.70*	−0.25

Note: All statistics are 2012 except Japan 2011. ADL = Activities of daily living; GDP = Gross domestic product.
All statistics are from harmonized datasets (2–8), except where noted.
[a]Per capita GDP in 2012 is provided by World Bank (9). [b]Gini coefficient in 2012 is taken from OECD (10) and World Bank (11) and is a measure of inequality, ranging from 0 (complete equality) to 1 (complete inequality). [c]Life expectancy in 2012 is taken from WHO (12).
*Indicates significance at the 0.05 level.

For instance, a positive correlation at the country level between tertiary education and prevalence of stroke for women should not be considered informative of the relative likelihood of highly educated women having a stroke, but may indicate that people living in more educated countries are more likely to report strokes because they have more medical care. It could also reflect that people in these countries are more likely to survive strokes and be alive to report them.

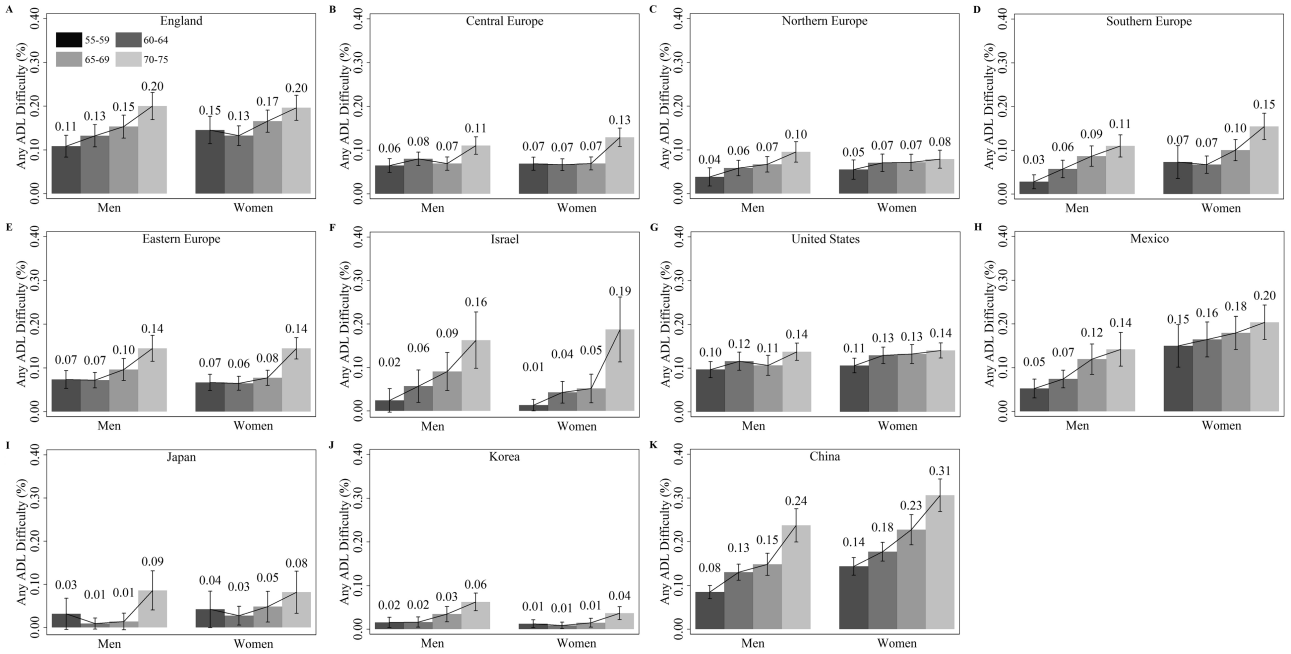

Figure 1. Any activities of daily living (ADL) difficulty (in %) for both men and women in four different age groups for 11 different countries/regions: (**A**) England, (**B**) Central Europe which includes France, Belgium, Germany, Austria, Netherlands, Switzerland, and Luxembourg, (**C**) Northern Europe which includes Denmark and Sweden, (**D**) Southern Europe which includes Spain and Italy, (**E**) Eastern Europe which includes Estonia, Slovenia, and Czech Republic, (**F**) Israel, (**G**) United States, (**H**) Mexico, (**I**) Japan, (**J**) Korea, and (**K**) China. Data represent mean with 95% confidence intervals.

While subject to these caveats and their descriptive nature, the results of this study add to our knowledge about the variability in the prevalence of disability and morbidity across countries. Generally, the prevalence of disability and morbidity exhibits substantial cross-country heterogeneity. Even the health outcome with the lowest observed variability, hypertension, has a prevalence rate varying twofold across the selected countries. For arthritis, the prevalence rate in some countries is over 10 times larger than others. Such astonishing differences suggest that there is room to improve population health in many countries. An important next step is to learn from the better performing countries and to design effective policies for improving health.

Our results add geographic breadth to the existing literature documenting cross-country variation in health (14,15). They also contribute to our understanding of the persistence of sex differences in health outcomes around the world (16) and of the changing links between economic progress and increases in health and life expectancy (17). The Gateway to Global Aging Data supports in-depth analyses of international differences in health and supports further investigation of factors that may contribute to such cross-country differences, such as health behaviors, economic circumstances, and other sociodemographic characteristics.

Conclusions

Cross-country disparities in mortality and life expectancy are well-documented but much less is known about other dimensions of health. Using harmonized data from the Gateway to Global Aging Data that provides comparable measures of health and other key characteristics of individuals and households, we find that both disability and morbidity vary greatly across countries, and that the level of economic development is not the main driver of these differences. Substantial variation in population health calls for attention from both scientists and policy makers. As some countries do much better than others as far as disability and morbidity prevalence rates are concerned, it is important to identify what contributes to such cross-country differences so as to reduce existing gaps and to improve population health world-wide. Internationally harmonized data provide a unique opportunity to deepen our understanding of aging, particularly of what might contribute to observed heterogeneity in aging processes across countries around the world, and to represent a promising avenue for future research.

Supplementary Material

Supplementary data is available at *The Journals of Gerontology, Series A: Biological Sciences and Medical Sciences* online.

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Conflict of Interest

None reported.

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