imaginary populations, imaginary understanding

Seminar at Department of Epidemiology - Erasmus MC

Ilya Kashnitsky

4 October 2021

The title

Ilya Kashnitsky
@ikashnitsky

Help needed

I'm trying to think of a catchy title for a talk on life expectancy, some pun revolving around expectations. I'm mentally stuck on 'expecto patronum' 🤦

Any ideas that you'd like to share? (I promise to attribute credit properly in the talk) #poptwitter #epitwitter

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> So why do we talk about "expectancy"?
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expectation vs reality:

1 1

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Unexpected and unaware of it.

Maarten Bijlsma @MJBijlsma · Sep 23
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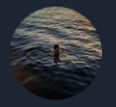
Expect more from life(span) than from life expectancy

Ingrid van Dijk @IngridvanDij · Sep 23
Replying to @ikashnitsky
Expectation Management: Nuances of Life Expectancy



Mateu Bastos @MBRodamilans · Sep 23
Replying to @ikashnitsky
How much time do I have left?

…and other questions life expectancy can't answer!

Carl Schmertmann @CSchmert · Sep 23
Replying to @ikashnitsky
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Current expectations: demystify the misunderstandings surrounding life expectancy

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Lowered expectations (tribute to '90s classic MADtv)

Dr. Kerry MacQuarrie @KerryMacQua · Sep 23
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Not What You'd Expect:…

Sebastiaan van Liempd @sebvanliempd · Sep 23
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dead wrong: why life expectancy is not what it seems

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https://twitter.com/ikashnitsky/status/1441026012897320962

Life expectancy: the ultimate measure of current mortality

- Free from population age structure effect
- No need to choose standard
- Widely used and accepted

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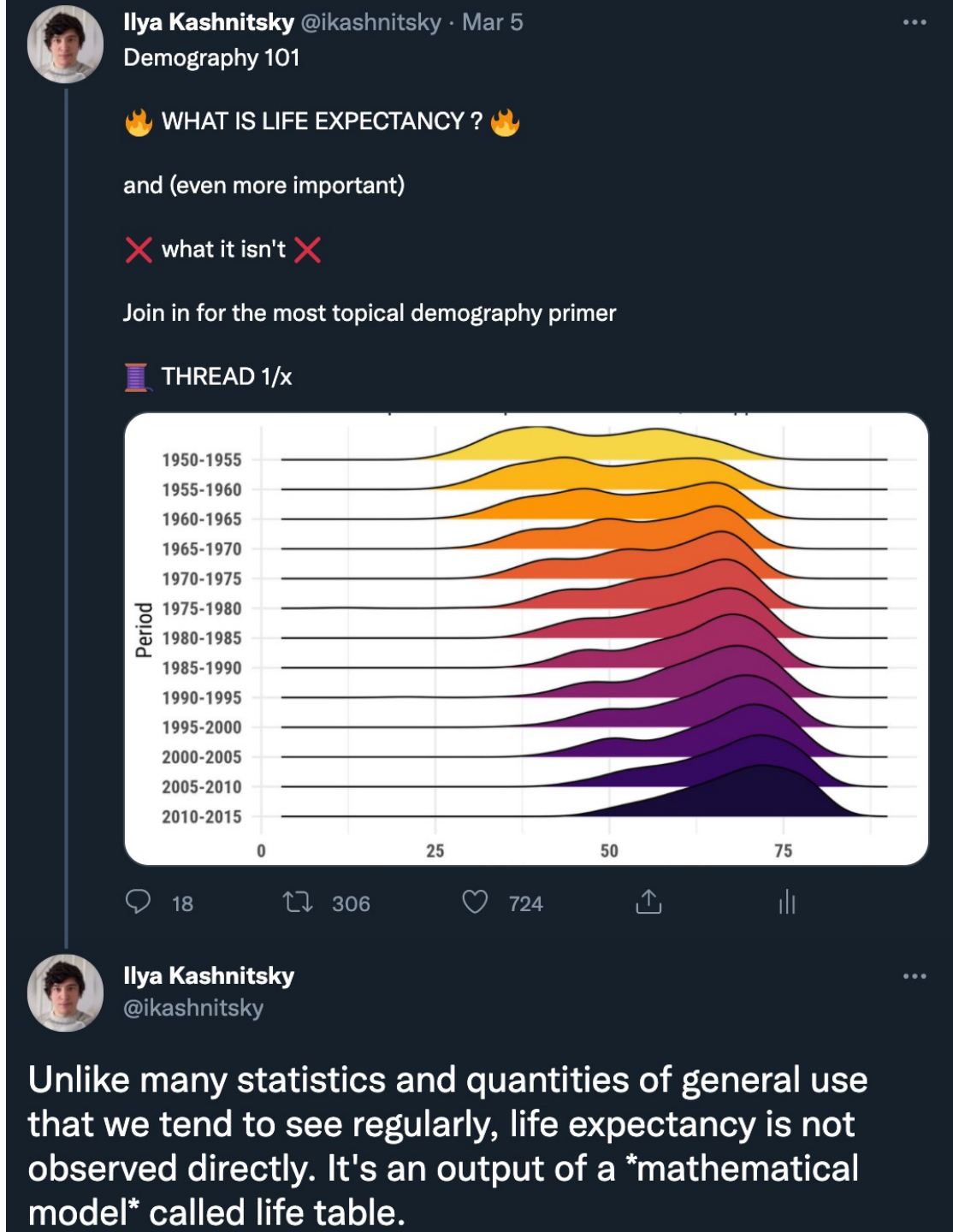

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- WILDLY MISINTERPRETED

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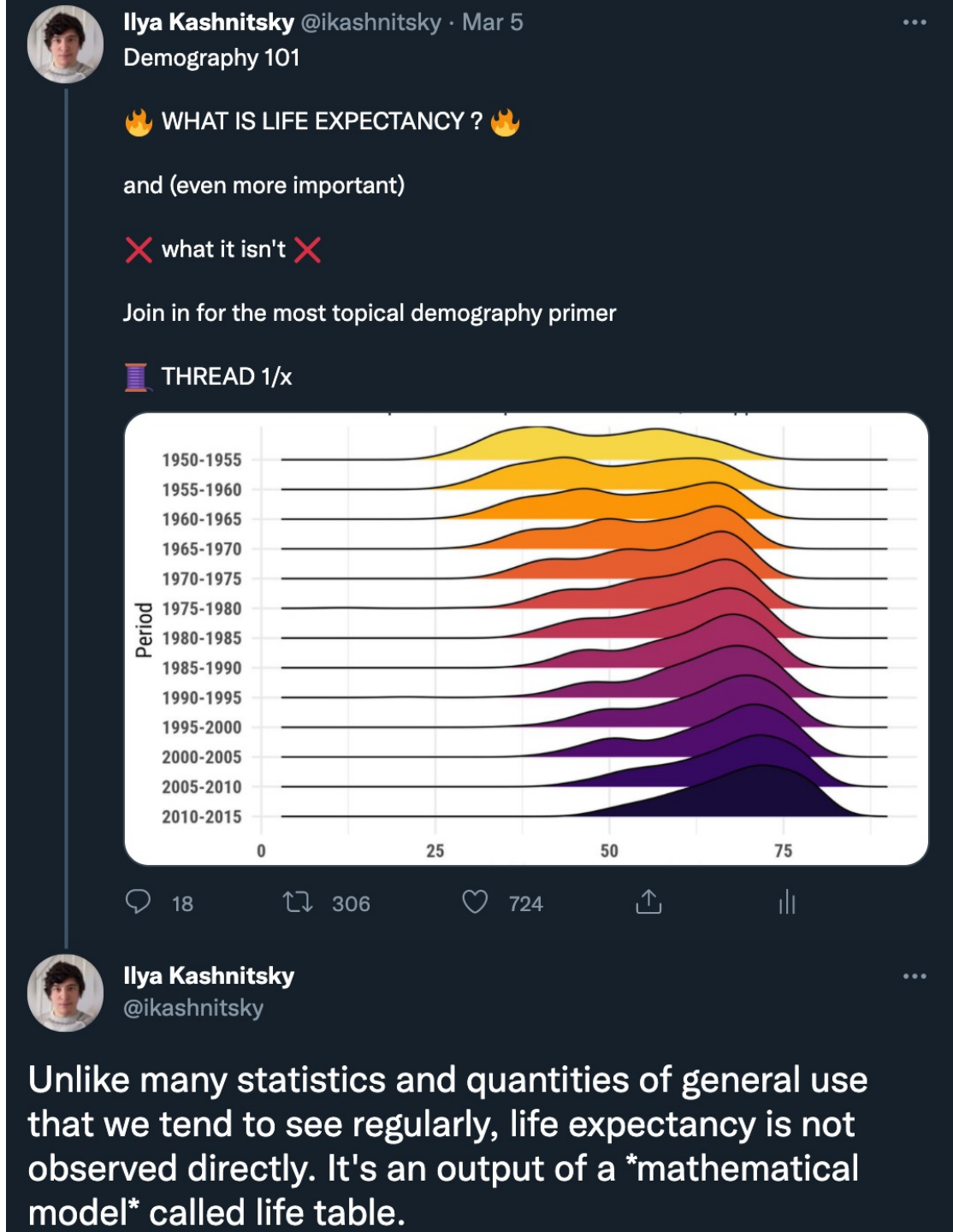
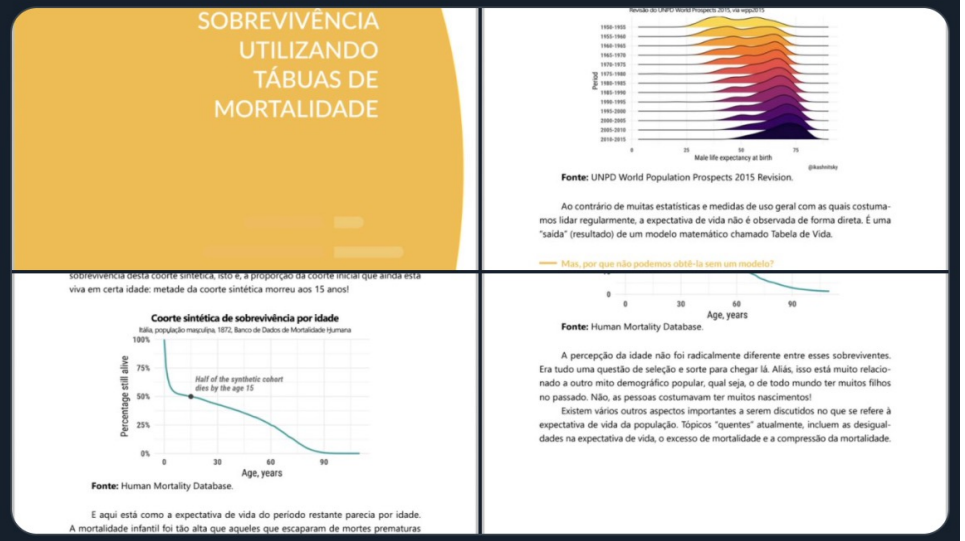


Beyond Twitter

Ilya Kashnitsky
@ikashnitsky

This is so weird and cool. Thanks to Gustavo Brusse my twitter thread on life expectancy, translated to Portuguese, became part of a demography textbook 🤩

twitter.com/ikashnitsky/st...



Raphael M. Guimarães, DSc PhD and Geovane Máximo

> **Ilya Kashnitsky** @ikashnitsky · Mar 5
> Demography 101
>
> 🔥 WHAT IS LIFE EXPECTANCY ? 🔥
>
> and (even more important)
>
> ❌ what it isn't ❌
>
> Join in for the most topical demography primer
>
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What is life expectancy? And, even more important, what it isn't

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Conflict of Interest: No | Public Data: Not applicable | Preregistration: Available

Page: 1 of 10 — Automatic Zoom

Ilya Kashnitsky @ikashnitsky
5 Mar · 30 tweets · ikashnitsky/status/1367856010476613632

Demography 101

🔥 WHAT IS LIFE EXPECTANCY ? 🔥

and (even more important)

❌ what it isn't ❌

Join in for the most topical demography primer

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Abstract

It really is a remarkable achievement and maybe a lot of luck that the world mundanely operates with such a complex indicator as life expectancy. Unlike many statistics and quantities of general use that are being monitored and reported regularly, life expectancy is not observed directly. It's an output of a mathematical model called life table. ...

See more

Preprint DOI

10.31219/osf.io/s2nrp

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Disciplines

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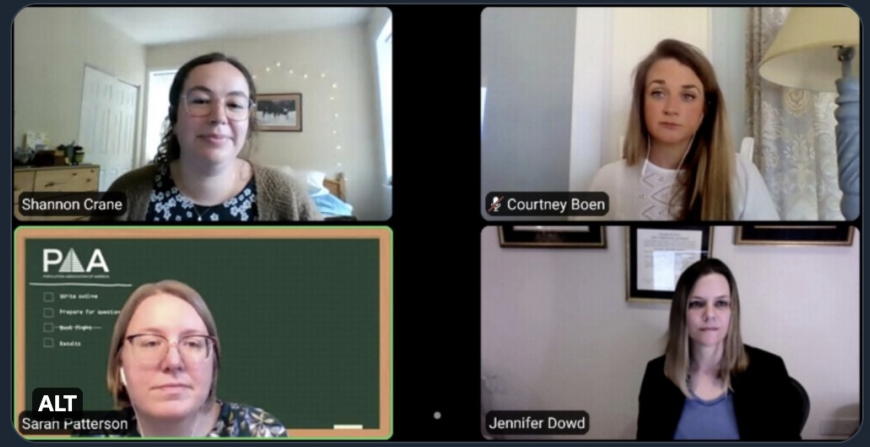
Happening now! Twitter for Population Science Researchers. Didn't register? Join us LIVE on YouTube: youtu.be/ghUglr3mlLo

7:05 PM · Apr 28, 2021 · Twitter Web App

Ilya Kashnitsky @ikashnitsky · Apr 29
Twitter for population science
Yesterday in anticipation of #PAA2021 Shannon Crane, the person behind the lovely @PopAssocAmerica, organised an insightful discussion of **Twitter**'s role in how we do science today
Let's do a bit of preaching to the choir here



Jenn Dowd and Sarah E. Patterson

Why don’t we get to the point?

The plan for today

~~Pitch Twitter~~

Life expectancy refresher

Main caveats in interpreting life expectancy

Overview several recent papers

Why do we “expect”?

Anti-social social scientist
@therealrchung

Replying to @DrTomEmery @ikashnitsky and @RELenski

The histories of demography and statistics are intertwined, so we use "expectation" and "expected value" the same way: they're weighted means of rv's. So I'm not sure it's fair to call the labelling shoddy; no one else cared about LE before now and we always knew what it was.

3:52 PM · Feb 26, 2021 · Twitter for Android

A typical error

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European Commission > Eurostat > Products Eurostat News > Life expectancy decreased in 2020 across the EU

Life expectancy decreased in 2020 across the EU

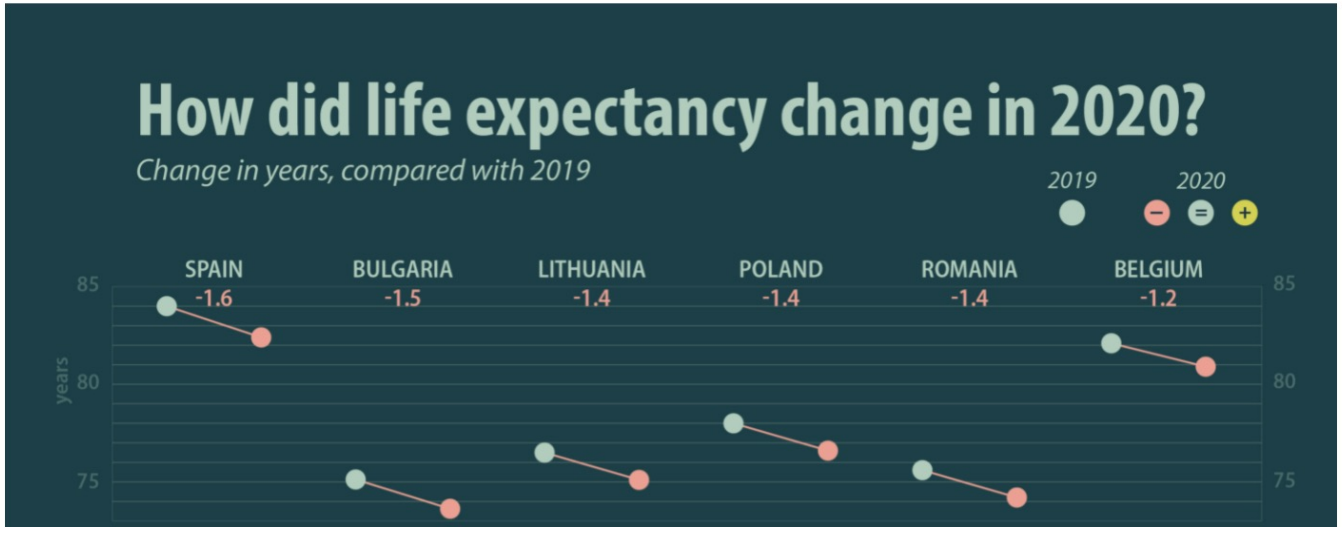
???

07/04/2021

Life expectancy at birth has been increasing over the past decade in the EU: official statistics reveal that life expectancy has risen, on average, by more than two years per decade since the 1960s. However, the latest available data suggest that life expectancy stagnated or even declined in recent years in several EU Member States.

Mo , following the outbreak of the COVID-19 pandemic last year, life expectancy at birth fell in the vast majority of the EU Member States with available 2020 data. The largest decreases were recorded in Spain (-1.6 years compared with 2019) and Bulgaria (-1.5), followed by Lithuania, Poland and Romania (all -1.4).

This information comes from recently published provisional estimates on life expectancy in 2020.



The essence

If there is just one take-home message from this thread let it be

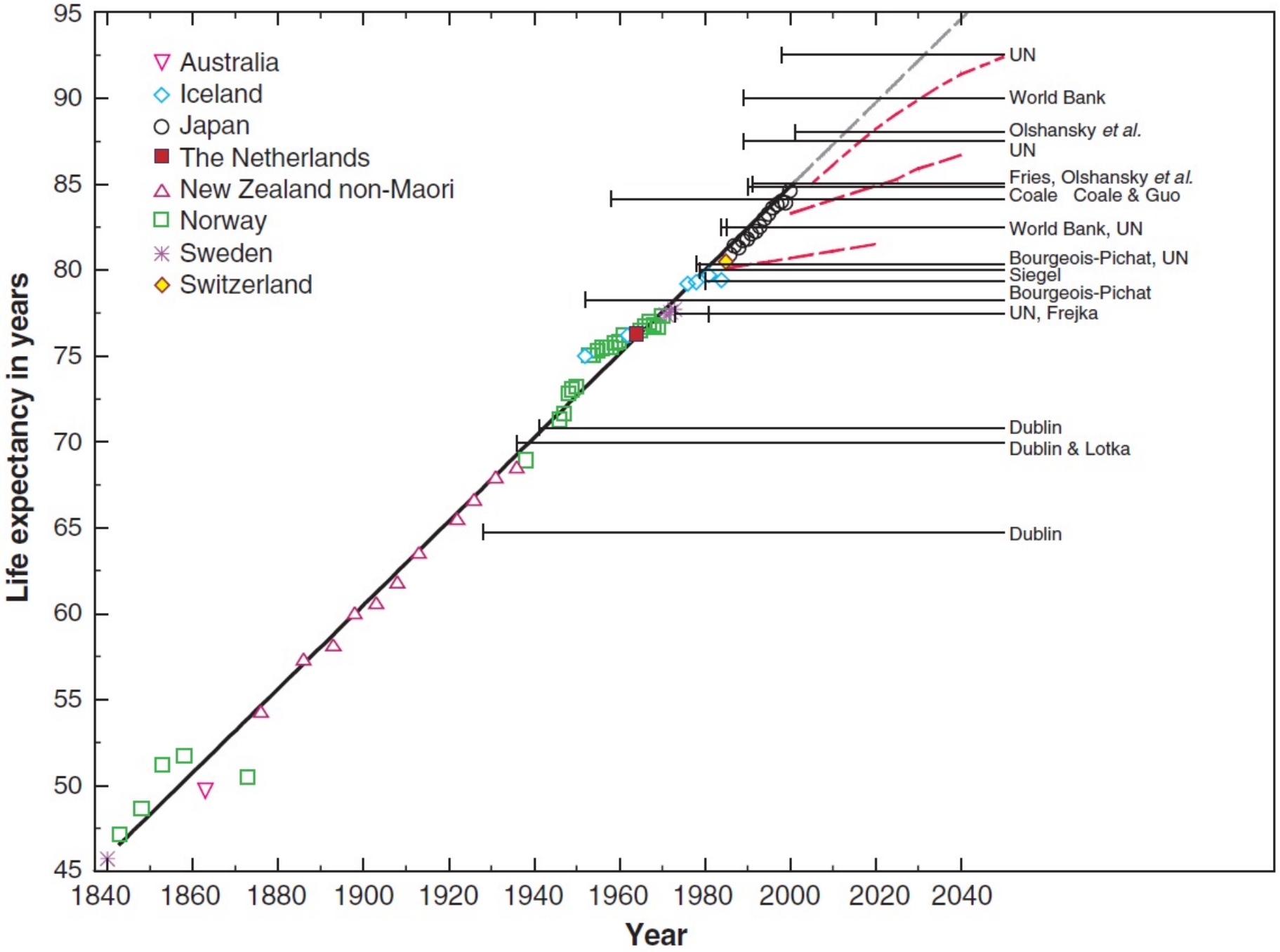
✅ Life expectancy is a snapshot of the *current* mortality

❌ It's not a projection/forecast of the actual experience of the newborn cohorts

Life Table

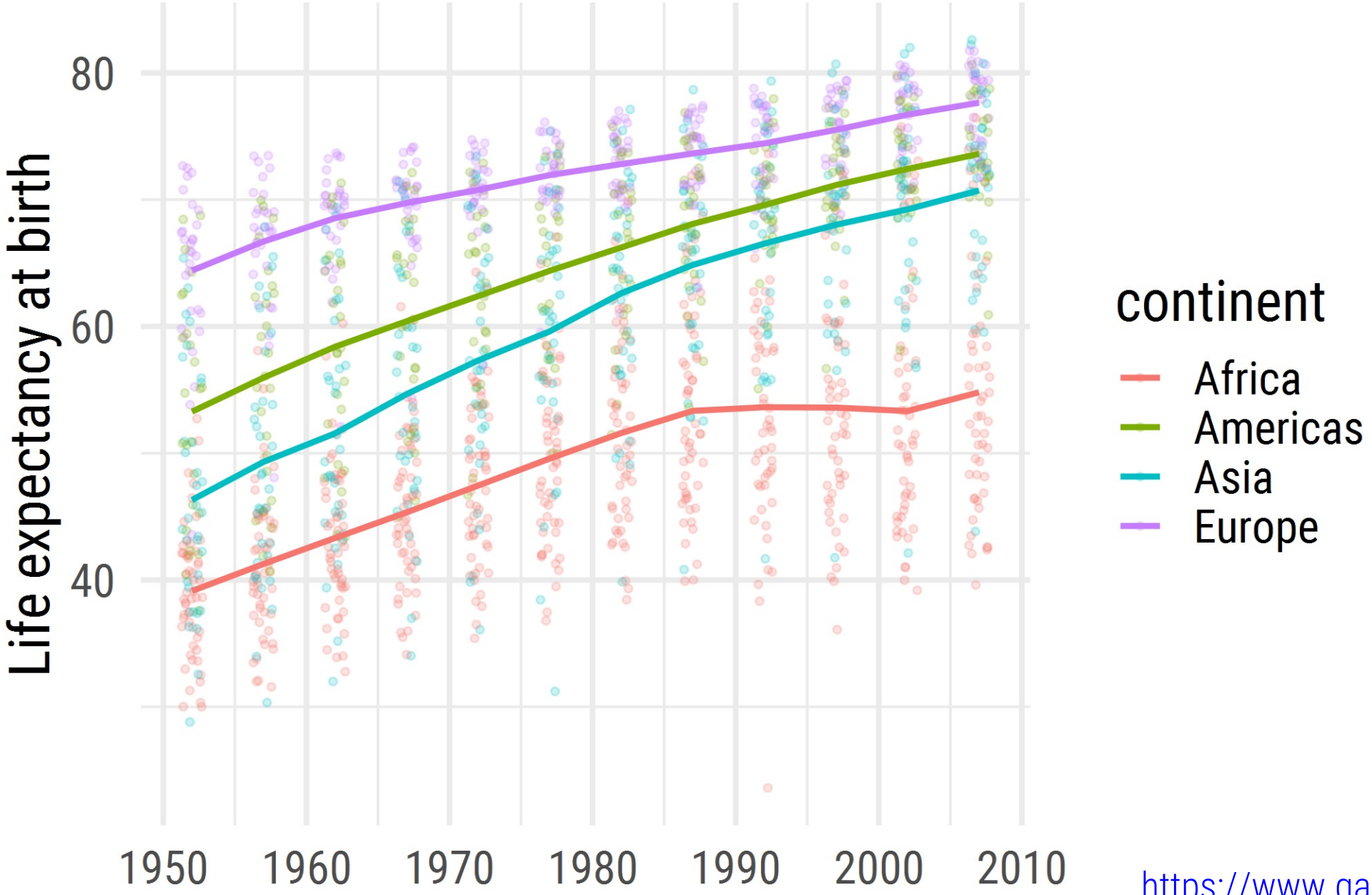
Age	Dx	Nx	mx	ax	qx	lx	dx	Lx	Tx	ex
0	3315	17789	0.18635	0.35	0.166217	100000	16621.66	89195.92	4021643	40.22
1	866	15432	0.05612	0.5	0.054588	83378.34	4551.478	81102.6	3932447	47.16
2	582	14137	0.04117	0.5	0.04034	78826.86	3179.845	77236.94	3851344	48.86
3	366	13247	0.02763	0.5	0.027253	75647.02	2061.645	74616.19	3774107	49.89
4	243	12985	0.01871	0.5	0.018537	73585.37	1364.022	72903.36	3699491	50.27
5	202	12973	0.01557	0.5	0.01545	72221.35	1115.8	71663.45	3626588	50.21
6	180	12990	0.01386	0.5	0.013765	71105.55	978.7403	70616.18	3554924	50
7	161	13166	0.01223	0.5	0.012156	70126.81	852.4382	69700.59	3484308	49.69
8	145	13438	0.01079	0.5	0.010732	69274.37	743.4595	68902.64	3414607	49.29
9	132	13633	0.00968	0.5	0.009633	68530.91	660.1839	68200.82	3345705	48.82
10	122	13872	0.00879	0.5	0.008752	67870.73	593.9732	67573.74	3277504	48.29
11	113	13947	0.0081	0.5	0.008067	67276.75	542.7436	67005.38	3209930	47.71
12	104	13742	0.00757	0.5	0.007541	66734.01	503.2716	66482.38	3142925	47.1
13	96	13498	0.00711	0.5	0.007085	66230.74	469.2324	65996.12	3076442	46.45
14	88	13224	0.00665	0.5	0.006628	65761.51	435.8648	65543.57	3010446	45.78
15	82	13060	0.00628	0.5	0.00626	65325.64	408.9609	65121.16	2944903	45.08
16	77	12920	0.00596	0.5	0.005942	64916.68	385.7539	64723.8	2879781	44.36
17	74	12677	0.00584	0.5	0.005823	64530.93	375.7634	64343.05	2815058	43.62
18	74	12334	0.006	0.5	0.005982	64155.16	383.7796	63963.27	2750715	42.88
19	75	11770	0.00637	0.5	0.00635	63771.38	404.934	63568.92	2686751	42.13
20	78	11022	0.00708	0.5	0.007055	63366.45	447.0519	63142.92	2623182	41.4
...	...	...	...	...	...	...	...	...	...	...

Period life table, Danish females, 1835
Source: Human Mortality Database



Oeppen, J., & Vaupel, J. W. (2002) Broken limits to life expectancy. *Science*, 296(5570), 1029–1031. https://doi.org/10.1126/science.1069675

Life expectancy at birth in the World



https://www.gapminder.org

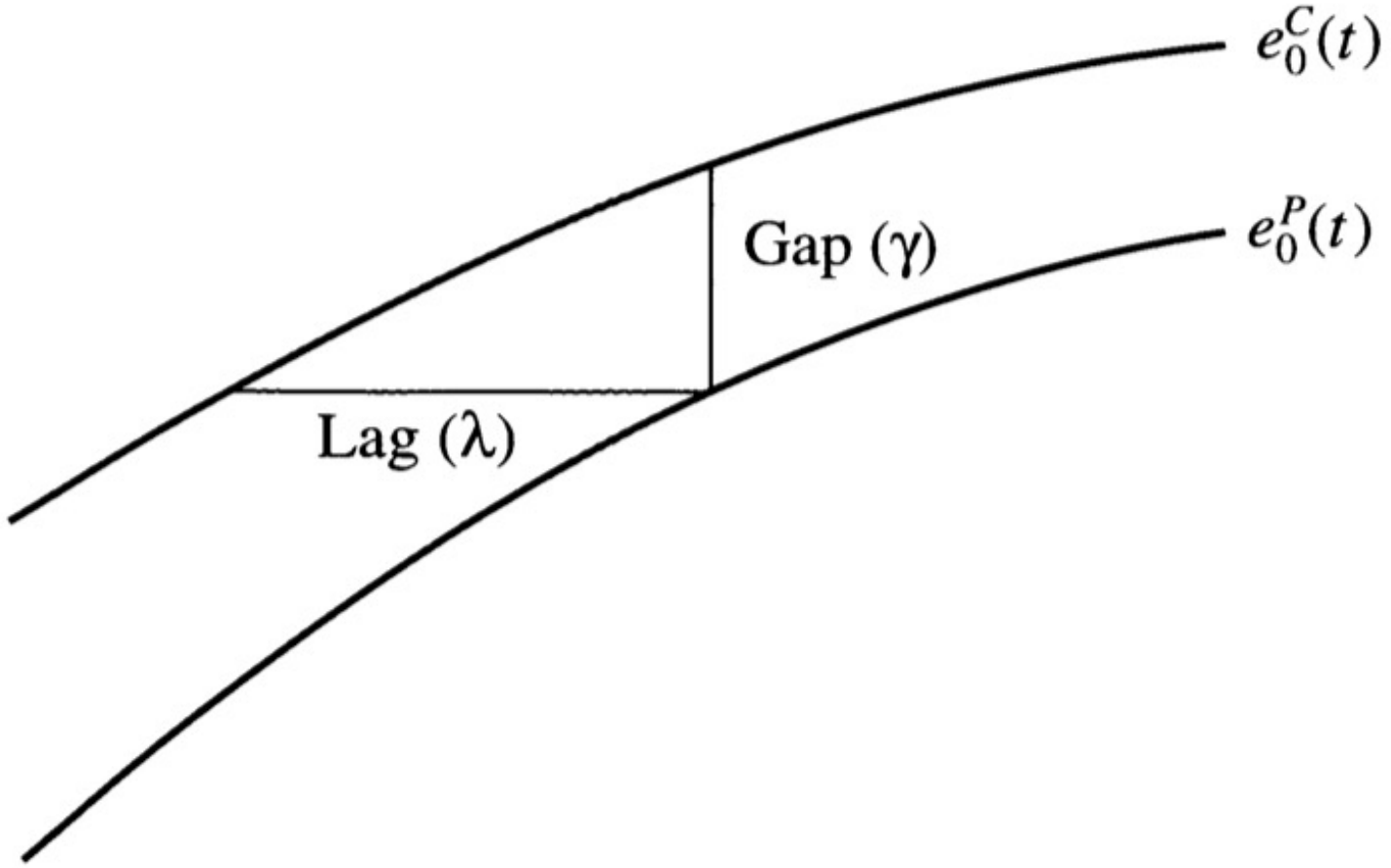
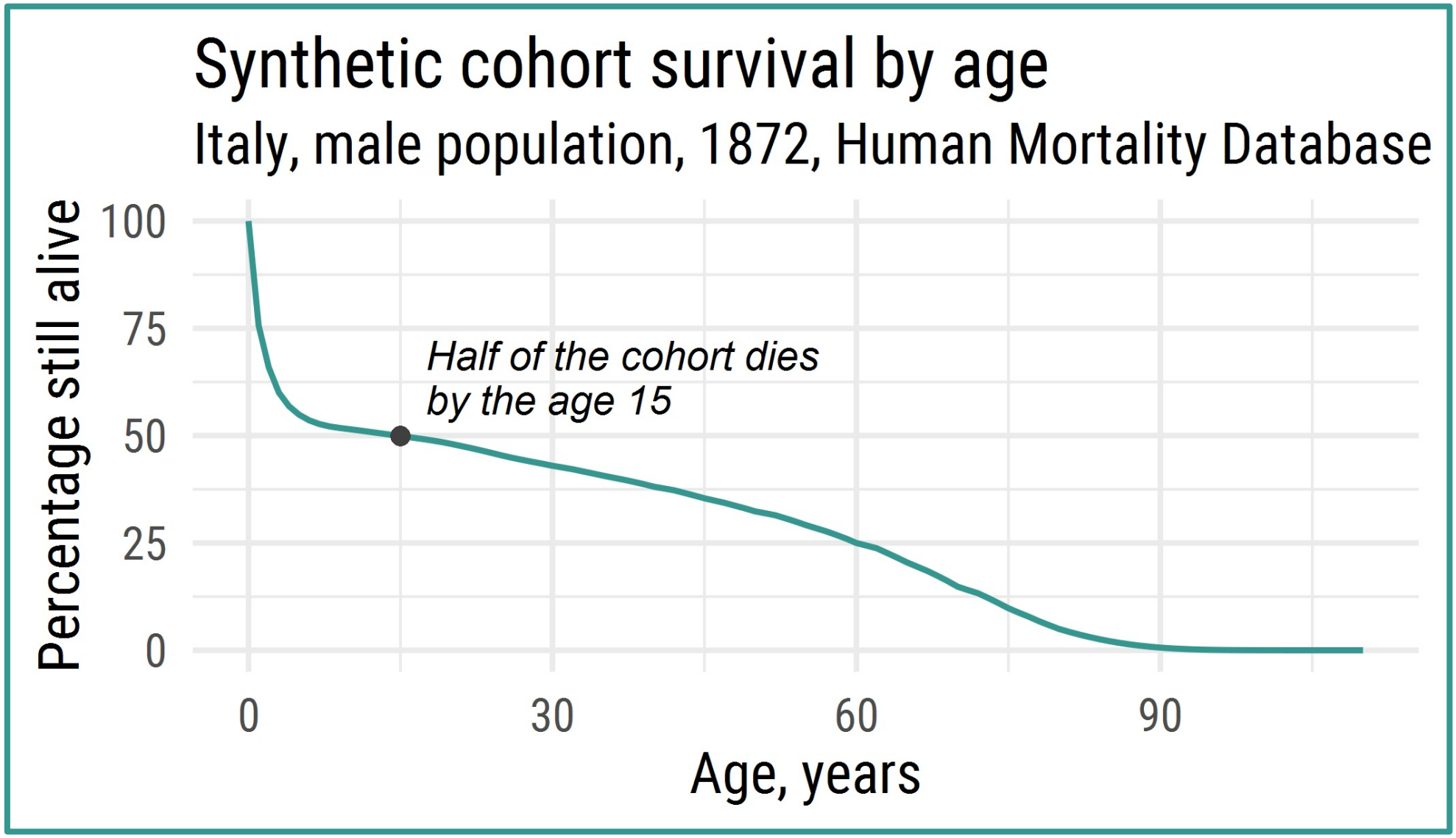


Figure 1 Sketch of gap (γ) and lag (λ) between cohort and period life expectancy when mortality and entropy are decreasing with time

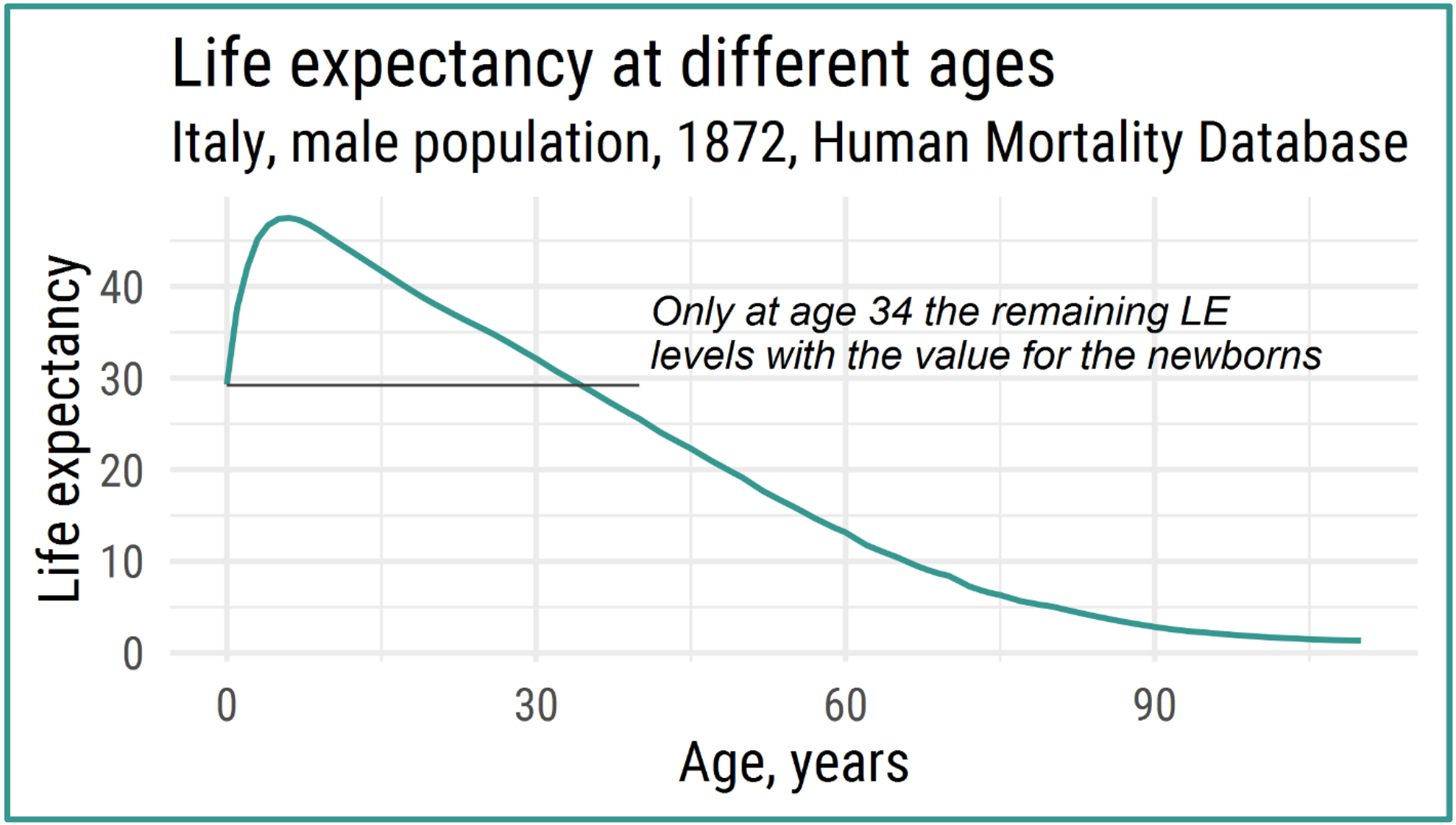
Goldstein, J. R., & Wachter, K. W. (2006). Relationships between Period and Cohort Life Expectancy: Gaps and Lags. Population Studies, 60(3), 257–269. https://doi.org/10.1080/00324720600895876

A very common misconception

She was 40, a very elderly lady by the standards of that time as people lived on average about 30 years back then

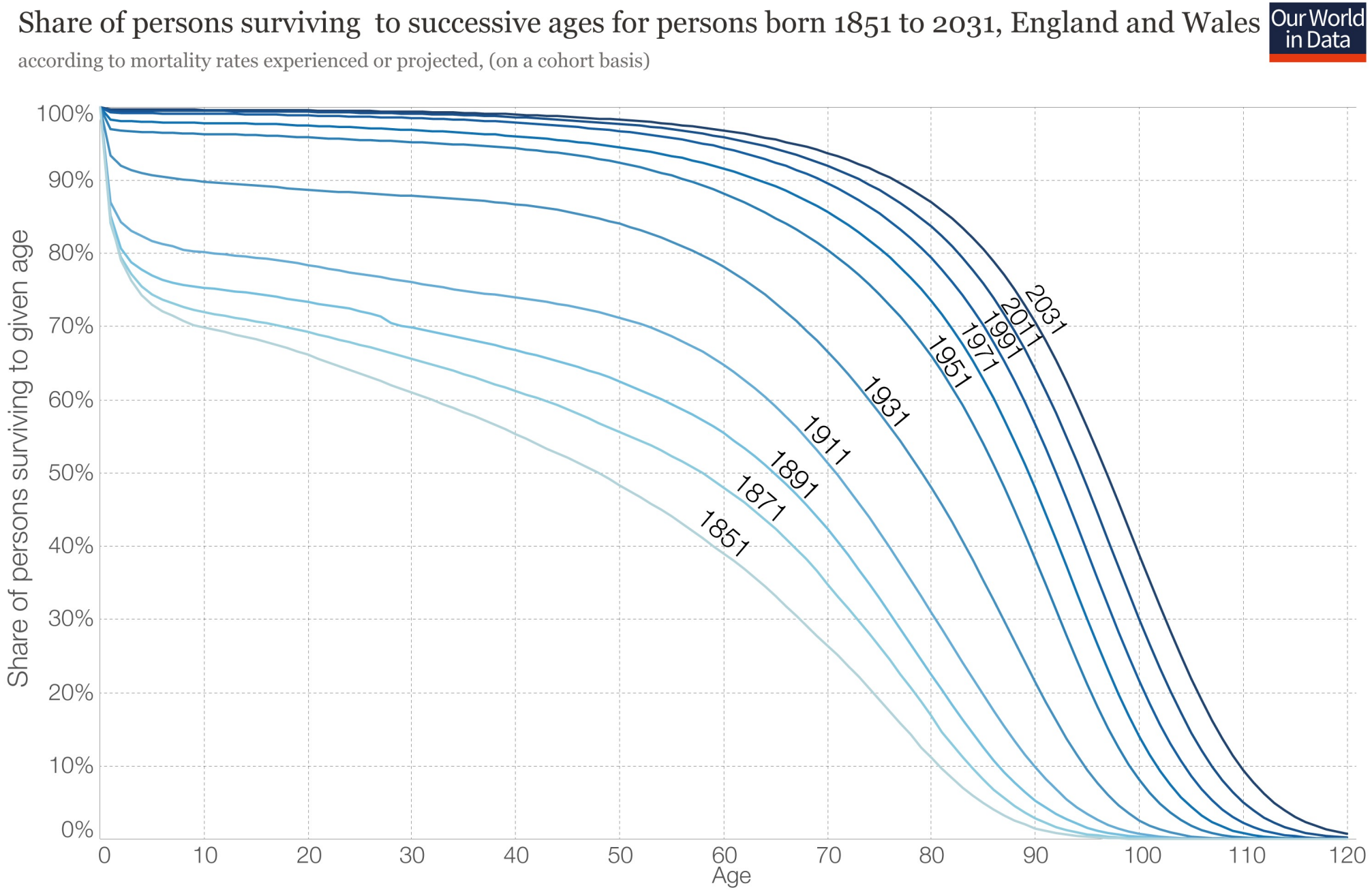


High mortality regime



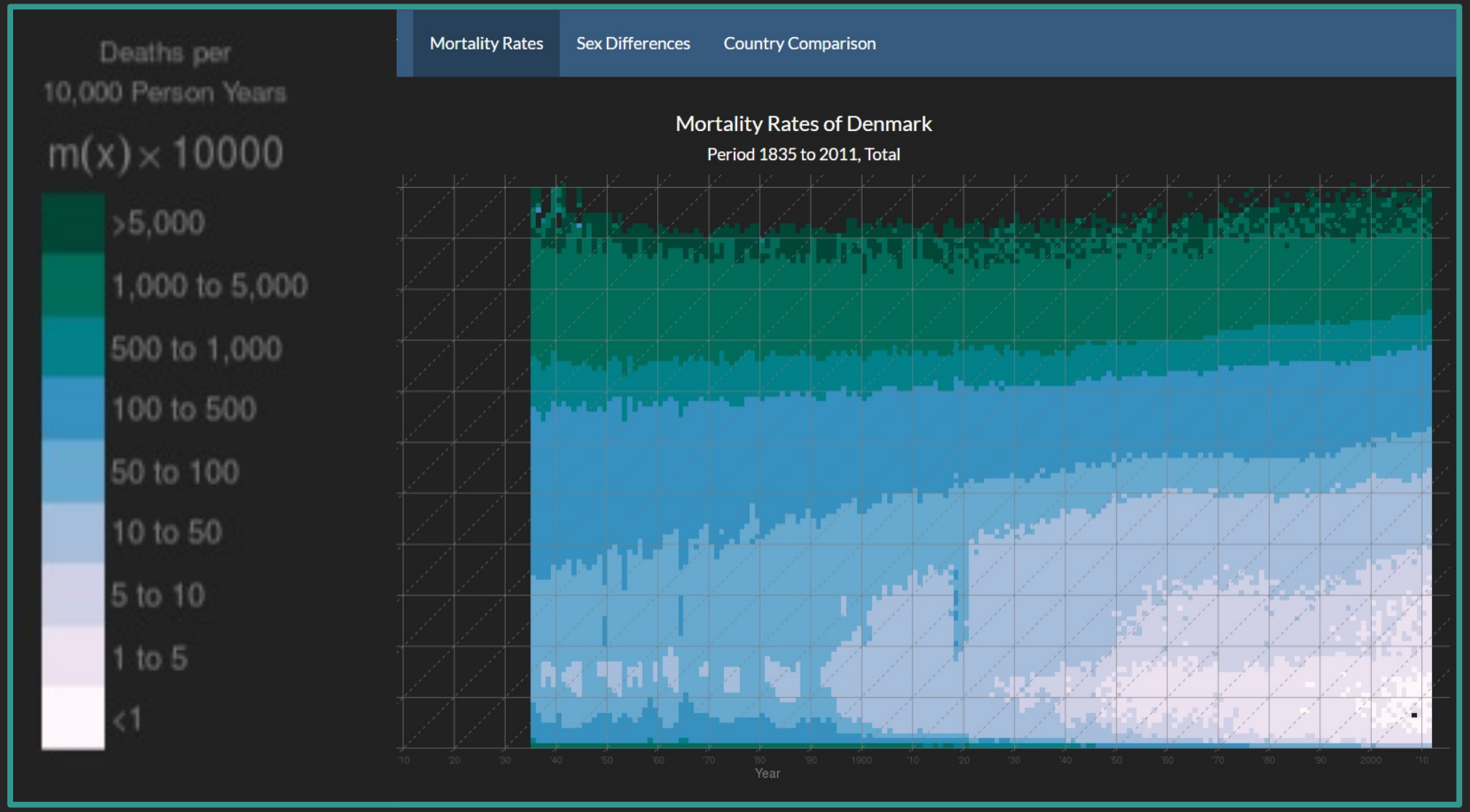
High mortality regime

Rectangularization of survival



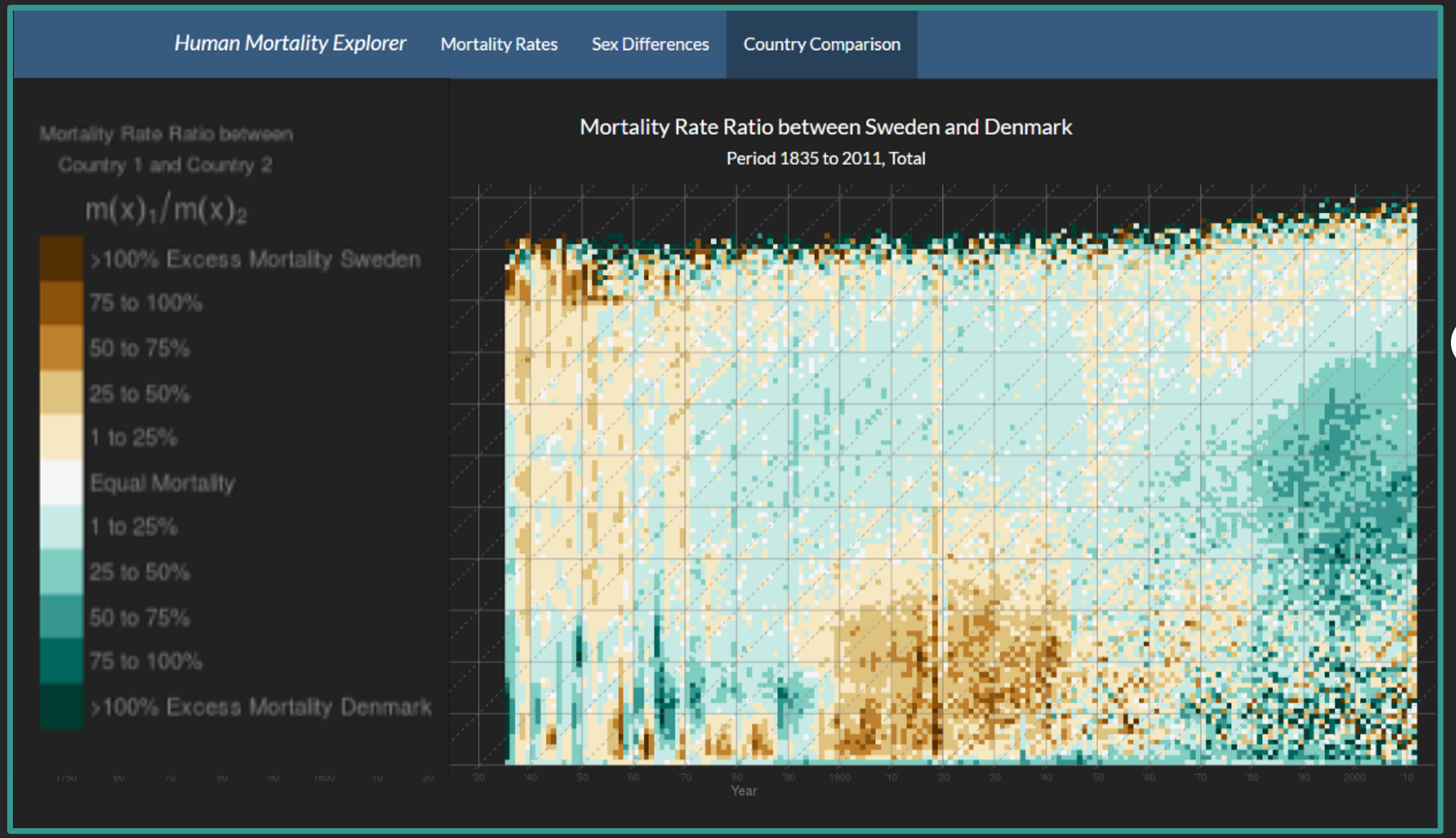
Data source: Office for National Statistics (ONS). Note: Life expectancy figures are not available for the UK before 1951; for long historic trends England and Wales data are used
The interactive data visualization is available at OurWorldinData.org. There you find the raw data and more visualizations on this topic.

https://ourworldindata.org/life-expectancy



HMD explorer

https://jschoeley.shinyapps.io/hmdexp/



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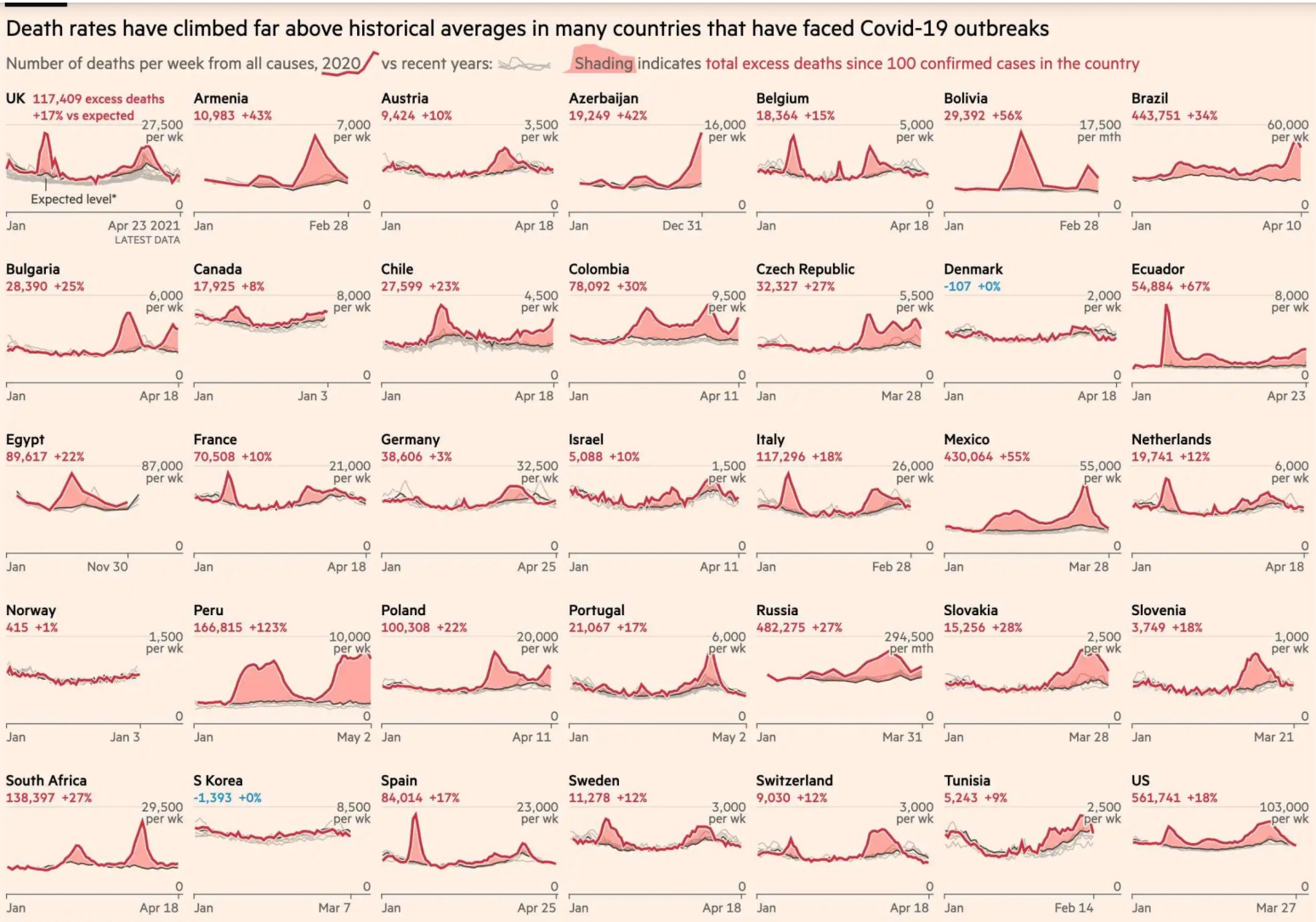
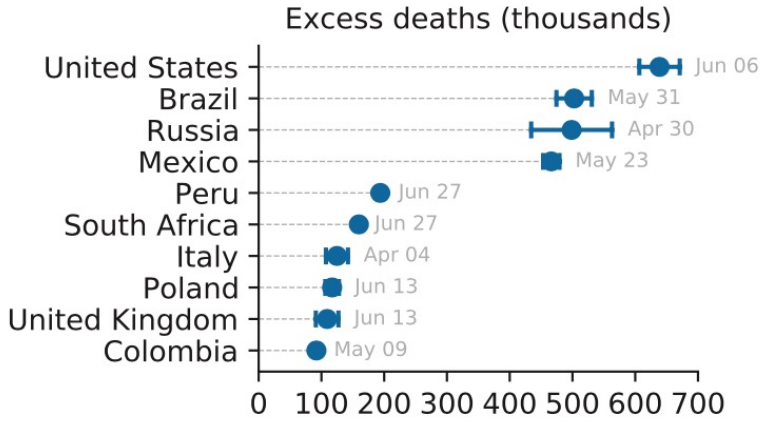
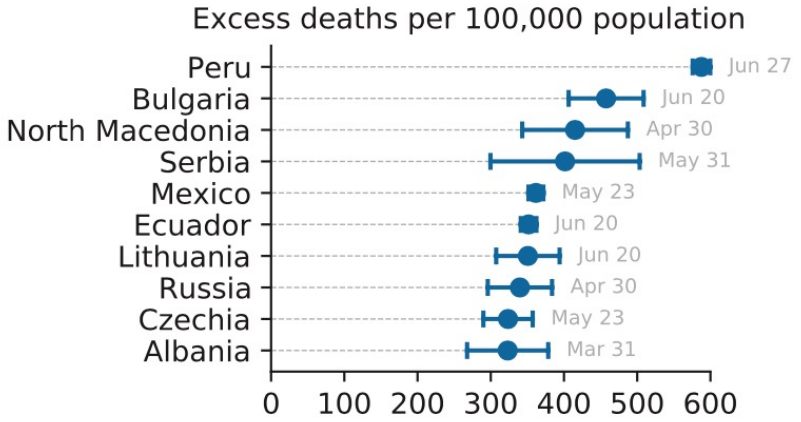
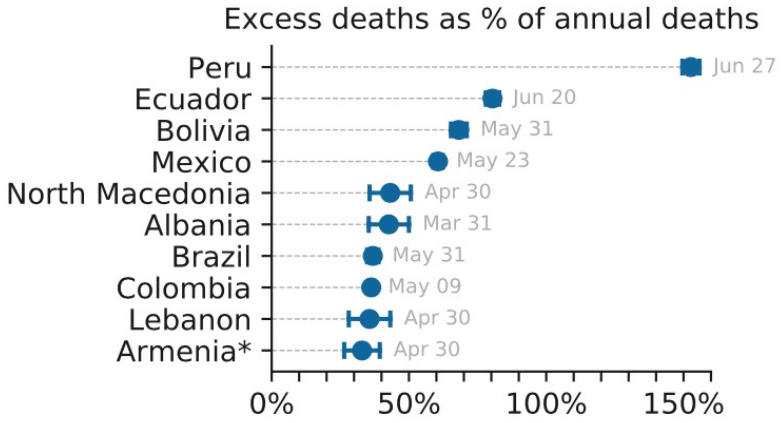
Why bother explaining?

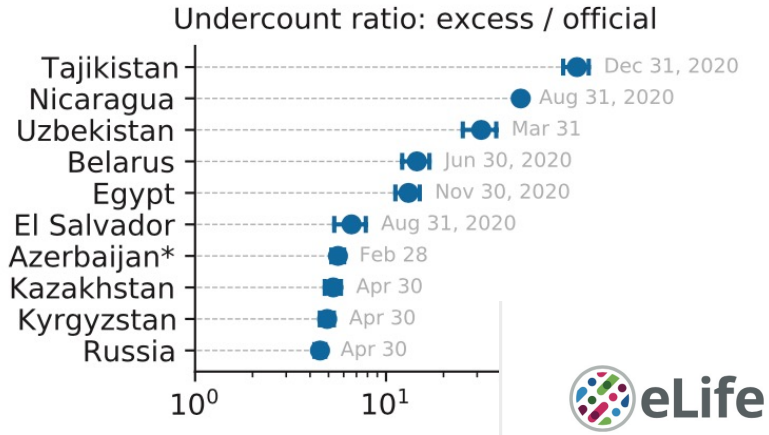
Measuring the impact of c19











Measuring the impact of c19

doi.org/10.7554/eLife.69336

eLife

TOOLS AND RESOURCES

Tracking excess mortality across countries during the COVID-19 pandemic with the World Mortality Dataset

Ariel Karlinsky[1]*, Dmitry Kobak[2]*

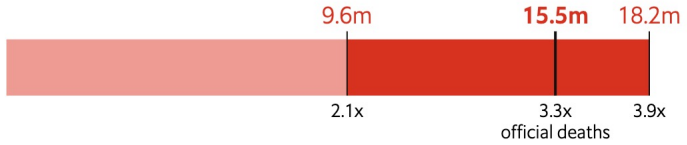
[1]Hebrew University, Jerusalem, Israel; [2]Institute for Ophthalmic Research, University of Tübingen, Tübingen, Germany

Covid-19 data

The pandemic's true death toll

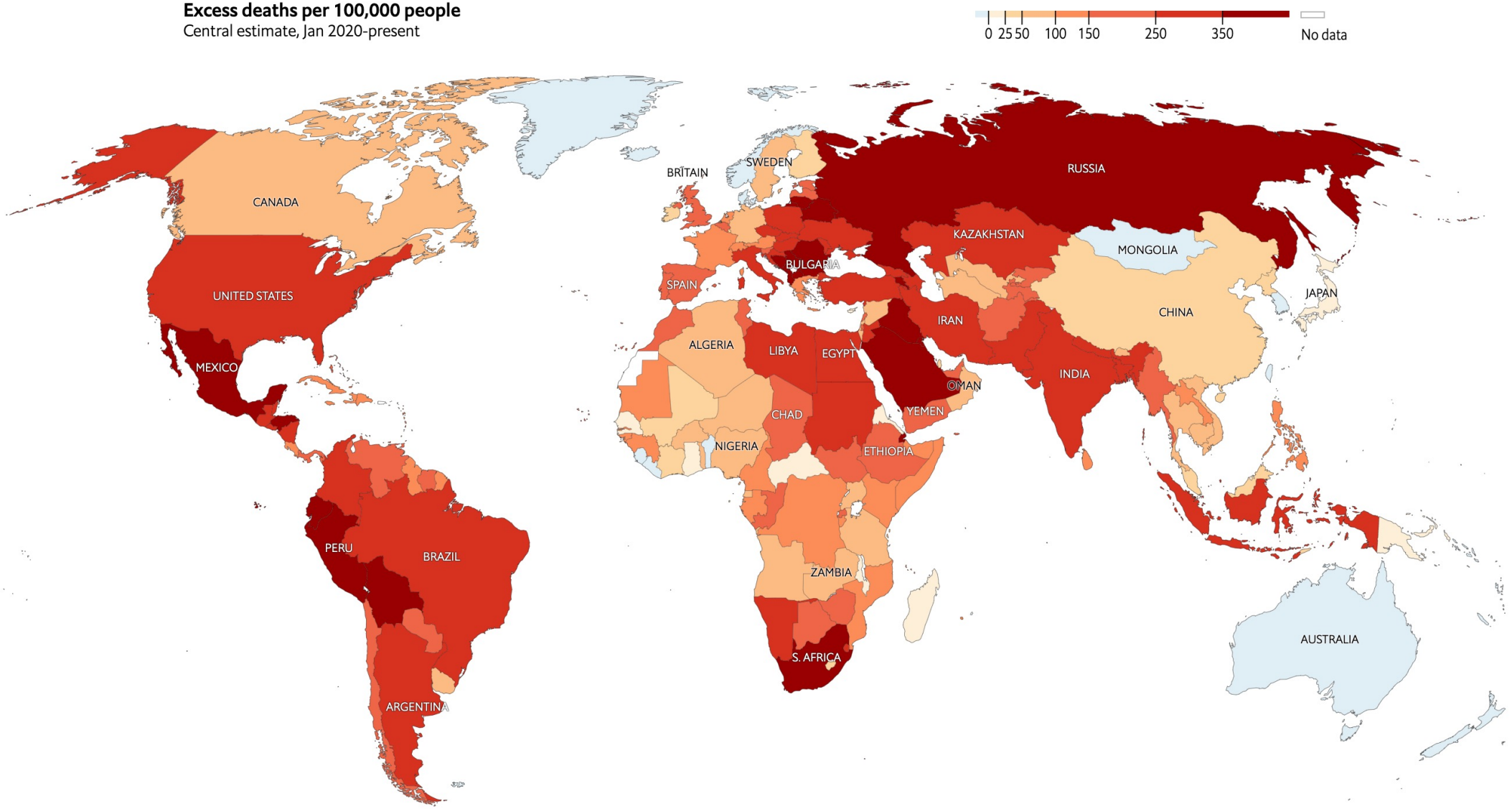
excess deaths around the world

Estimated global excess deaths
With 95% confidence interval



Official global covid-19 deaths

Excess deaths per 100,000 people
Central estimate, Jan 2020-present



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Quantifying impacts of the COVID-19 pandemic through life expectancy losses: a population-level study of 29 countries

José Manuel Aburto, Jonas Schöley, Ilya Kashnitsky, Luyin Zhang, Charles Rahal, Trifon I. Missov, Melinda C. Mills, Jennifer B. Dowd, Ridhi Kashyap

doi: https://doi.org/10.1101/2021.03.02.21252772

This article is a preprint and has not been peer-reviewed [what does this mean?]. It reports new medical research that has yet to be evaluated and so should *not* be used to guide clinical practice.

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Abstract

Variations in the age patterns and magnitudes of excess deaths, as well as differences in population sizes and age structures make cross-national comparisons of the cumulative mortality impacts of the COVID-19 pandemic challenging. Life expectancy is a widely-used indicator that provides a clear and cross-nationally comparable picture of the population-level impacts of the pandemic on mortality. Life tables by sex were calculated for 29 countries, including most European countries, Chile, and the USA for 2015-2020. Life expectancy at birth and at age 60 for 2020 were contextualised against recent trends between 2015-19. Using decomposition techniques, we examined which specific age groups contributed to reductions in life expectancy in 2020 and to what extent reductions were attributable to official COVID-19 deaths. Life expectancy at birth declined from 2019 to 2020 in 27 out of 29 countries. Males in the USA and Lithuania experienced the largest losses in life expectancy at birth during 2020 (2.2 and 1.7 years respectively), but reductions of more than an entire year were documented in eleven countries for males, and eight among females. Reductions were mostly attributable to increased mortality above age 60 and to official COVID-19 deaths. The COVID-19 pandemic triggered significant mortality increases in 2020 of a magnitude not witnessed since WW-II in Western Europe or the breakup of the Soviet Union in Eastern Europe. Females from 15 countries and males from 10 ended up with lower life expectancy at birth in 2020 than in 2015.

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Article Navigation

Quantifying impacts of the COVID-19 pandemic through life-expectancy losses: a population-level study of 29 countries

José Manuel Aburto ✉, Jonas Schöley, Ilya Kashnitsky, Luyin Zhang, Charles Rahal, Trifon I Missov, Melinda C Mills, Jennifer B Dowd, Ridhi Kashyap Author Notes

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Published: 26 September 2021 **Article history** ▾

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Misinterpreting life expectancy

Peter B. Bach, MD @peterbachmd · Feb 25

Ty @statnews. I fretted over this one. Should we ask @CDCgov to consider what people will understand when they make announcements, particularly when a technical measure is so far off when judged against its plain language meaning? I think so

CDC estimated a one-year decline in life expectancy. Try five days - S...
Relying on an assumption it had to know was wrong, the CDC erroneously estimated a one-year decline in life expectancy in 2020.
statnews.com

Ilya Kashnitsky
@ikashnitsky

Replying to @peterbachmd @statnews and @CDCgov

Take hurricane Katrina w/ estimated damage of 70 billion. Let's apply your logic. The average US worker earns ~100k per year and works for 40 years. With ~300m in 2005 that gives about 1200 trillion lifetime earnings. Katrina costed the avg person roughly 0.006% lifetime earnings

8:30 AM · Feb 26, 2021 · Twitter for Android

Ilya Kashnitsky @ikashnitsky · Apr 20

Replying to @ikashnitsky @MBRodamilans and 5 others

Comparing against the inner subpopulation inequalities is similarly problematic. e0 shocks are temporal. And the temporal drop comes from increased risk in the small subpopulation of those infected. Income, education, racial differences are more systematic factors affecting c19

1 2

Ilya Kashnitsky @ikashnitsky · Apr 20

Take a super **dry** bodybuilder. Over years of training he gains muscle mass. Then he gets into a car crash and losses half a leg. Can we say he rolled back 10 years of training by looking at his muscle mass decrease? Technically, yes. Does it inform us on his remaining muscles fit?

Not only c19 related

Long live the monarchy! British royals tend to survive a full three decades longer than their subjects

April 13, 2021 1.41pm BST

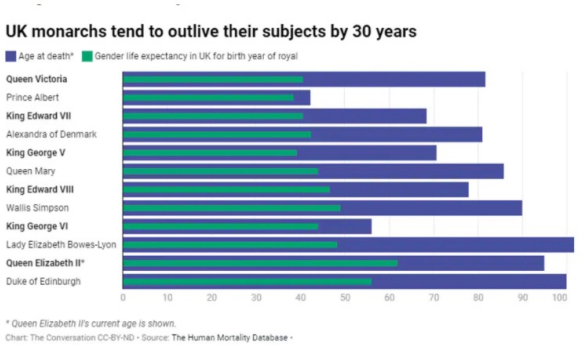
He who laughs last, lives longest? Leon Neal-WPA Pool/Getty Images

Email
Twitter 14
Facebook 758
LinkedIn
Print

In the U.K. it is customary to receive a personalized message from the queen on your 100th birthday – such is the relative rarity of reaching the milestone.

Prince Philip was just a couple months off, dying at the age of 99 years and 10 months on April 9, 2021. The last notable royal death before his was that of the queen mother in 2002. She was 101 years old.

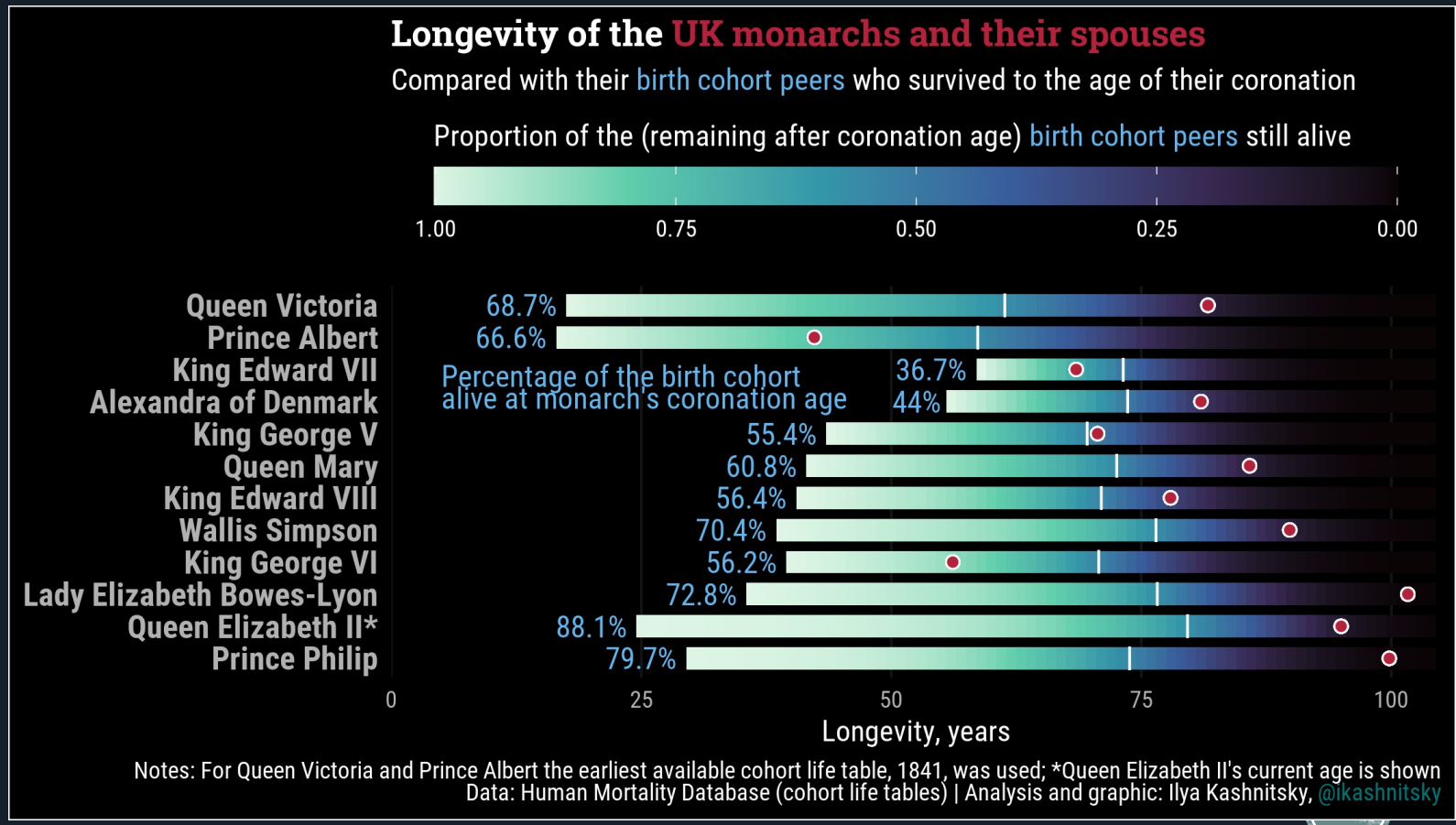
Reaching such a ripe old age isn't uncommon among the British ruling family – in fact, my analysis shows that on average they live an additional 30 years compared with their subjects.



The Conversation/Data from the Human Mortality Database, CC BY-NC-ND

Ilya Kashnitsky @ikashnitsky · Apr 15

Okay. I did a proper comparison of the UK monarchs longevity against their people



https://twitter.com/ikashnitsky/status/1382595766552821761

Demographers:

Life expectancy is
the **ultimate**
measure
of **current**
mortality

Demographers:

Life expectancy is the **ultimate** measure of **current** mortality

World:

Recent papers

Death rates at specific life stages mold the sex gap in life expectancy

Virginia Zarulli[a,1], Ilya Kashnitsky[a], and James W. Vaupel[a,1]

[a]Interdisciplinary Centre on Population Dynamics, University of Southern Denmark, DK-5230 Odense, Denmark

Contributed by James W. Vaupel, March 17, 2021 (sent for review May 26, 2020; reviewed by Shiro Horiuchi and John Wilmoth)

Why do women live longer than men? Here, we mine rich lodes of demographic data to reveal that lower female mortality at particular ages is decisive—and that the important ages changed around 1950. Earlier, excess mortality among baby boys was crucial; afterward, the gap largely resulted from elevated mortality among men 60+. Young males bear modest responsibility for the sex gap in life expectancy: Depending on the country and time, their mortality accounts for less than a quarter and often less than a 10th of the gap. Understanding the impact on life expectancy of differences between male and female risks of death by age, over time, and across populations yields insights for research on how the lives of men and women differ.

sex gap | life expectancy | decomposition

Between ages 15 and 40, death rates for men are usually two or three times higher than death rates for women. This disparity has fueled widespread interest in the ratio of male to female death rates over the life course and in why it is exceptionally high for younger adults (1–6). Between ages 15 and 40, however, numbers of deaths are relatively low, so the high ratio of male to female death rates has a modest impact on the gap between female and male life expectancies. The sex difference in life expectancy hinges on differences in mortality risks at the ages when deaths are relatively common (7). Up through the early decades of the 20th century, these ages were at both extremes of life, infancy and old age. Afterward, death mostly struck after age 60. Here, we investigate variation across populations, over time, and over the life course in absolute and relative differences in mortality for men and women. We discuss what insights can be gained by scrutinizing relative risks compared to what can be learned by analyzing absolute risks.

Materials and Methods

We used sex-specific mortality data from the Human Mortality Database (8). We computed absolute and relative differences between male and female probabilities of death over age and over time. We decomposed the sex difference in life expectancy into age-specific contributions by applying a stepwise replacement discrete age-decomposition method (9). We also decomposed the change over time in the sex gap in life expectancy. More detailed information about data and methods is reported in *SI Appendix*.

For simplicity, the next section reports only results for the United States, Japan, Russia, and Sweden; results for other populations are included in *SI Appendix*. We highlighted the four countries because Japan is the world longevity leader; the United States struggles to keep up with the survival improvements of other high-income countries; Sweden, the gold standard for demographic data quality, has serviceable records of mortality back to 1751; Russia suffered mortality stagnation and deterioration during the transition from socialism to a market economy, recently seeing improvements in life expectancy.

Results

Age Patterns of Sex Differences in Probabilities of Death. Age patterns of male/female mortality ratios radically differ from age patterns of male–female mortality differences. The ratios at older ages decline toward zero, with modest declines in the smaller ratios in 1900 and stronger declines in the larger ratios in 1960 and today (Fig. 1 *A* and *B* and *SI Appendix*, Fig. S1). The differences at older ages increase (Fig. 1*C* and *SI Appendix*, Fig. S2*F*). True since 1900 for all the countries and regions we studied, this is a fundamental finding about age trajectories of male vs. female mortality: Ratios of male to female death rates decline at older ages, whereas differences increase.

Male/female mortality ratios currently show a peak around age 20 or 25 and often a second peak roughly around age 70. In the countries and regions we studied, the peak of excess male mortality risks at young adult ages tended to be lower half a century ago (Fig. 1*B* and *SI Appendix*, Fig. S1*B*) and of minor importance or nonexistent in 1900 and earlier (Fig. 1*B* and *SI Appendix*, Fig. S1*C*). Currently in Japan excess mortality peaks at a higher level at age 70 than at age 20 (Fig. 1*A*). Strong second peaks around age 70 also occur in recent years in other, but not all, countries (*SI Appendix*, Fig. S1*A*). During most of the 20th century, the mortality ratio rose for most ages and in most high-income countries (10).

After emerging in many countries during the 20th century, the second peak tended to shift to older ages (*SI Appendix*, Fig. S1 *A–C*) (11). It tended to decline in recent decades with the reduction of the sex gap in life expectancy, due to convergence of the prevalence of smoking for men and women (12, 13). While in some countries the second peak is still pronounced (for example, Japan, Spain, and France), in others the peak has become less pronounced or negligible (for example, in Sweden and the United States) (Fig. 1*A* and *SI Appendix*, Fig. S1*A*). In Belarus, Russia, and Ukraine, the sex ratio is roughly constant between ages 25 and 65, reflecting high male mortality at young adult ages that continues to middle ages (14).

Excess male mortality at young adult ages differs from country to country. Currently in Japan, young adult men suffer risks of death that are twice as high as those for women; in Sweden and in the

Significance

Female life expectancy exceeds male life expectancy. Males at ages 15 to 40 die at rates that are often three times female levels, but this excess mortality is not the main cause of the life expectancy gap. Few deaths occur at younger adult ages compared with mortality after age 60 or, historically, among newborns. Our demographic analysis shows that, up through the early decades of the 20th century, the life expectancy gap largely resulted from excess deaths of infant boys. Afterward, higher mortality among men 60+ became crucial. The higher mortality of males at ages 15 to 40 has played a modest role.

Author contributions: V.Z. and J.W.V. designed research; V.Z. performed research; V.Z. and I.K. analyzed data; and V.Z., I.K., and J.W.V. wrote the paper.

Reviewers: S.H., City University of New York; and J.W., United Nations Population Division.

The authors declare no competing interest.

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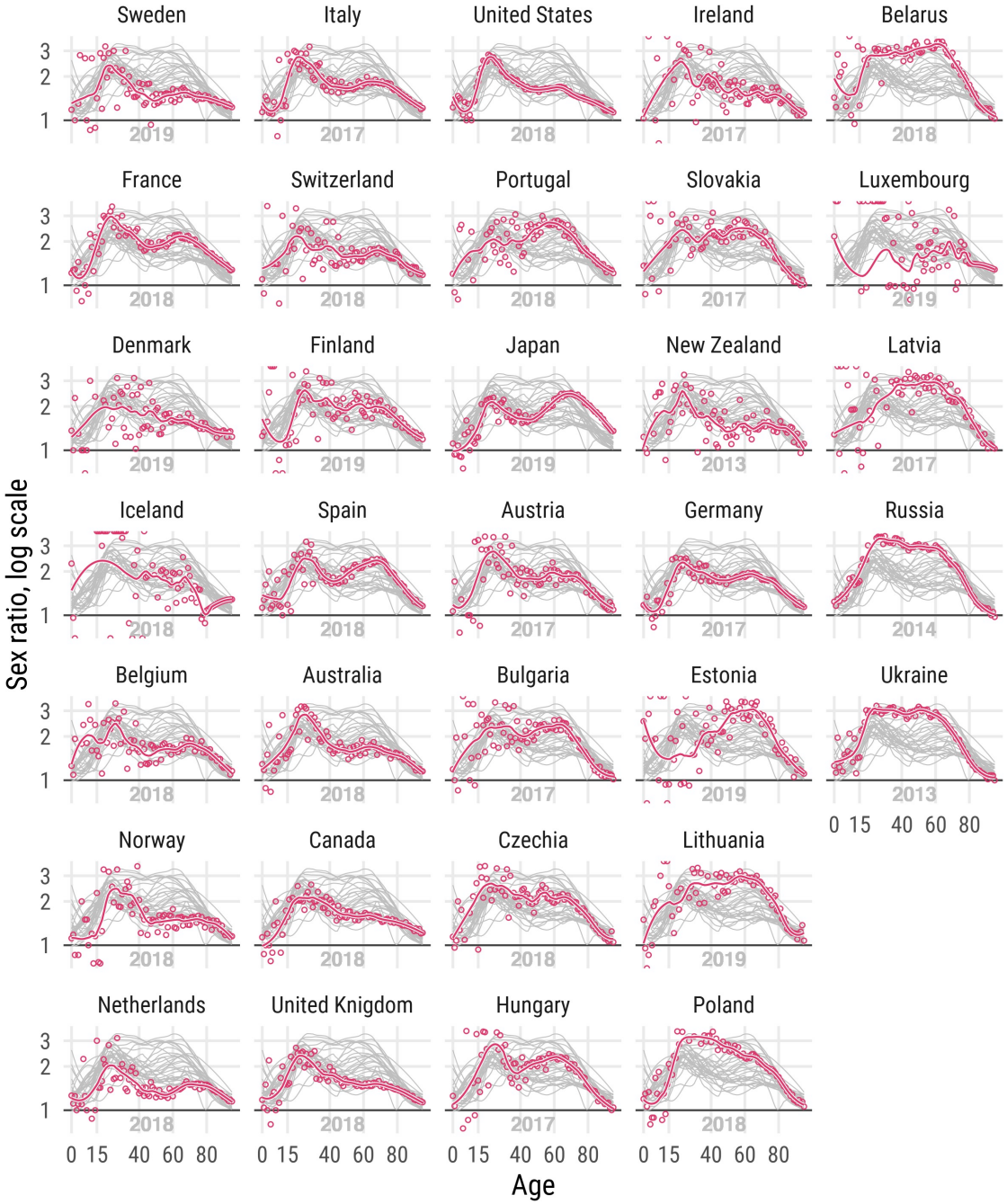
Published May 10, 2021.

SOCIAL SCIENCES

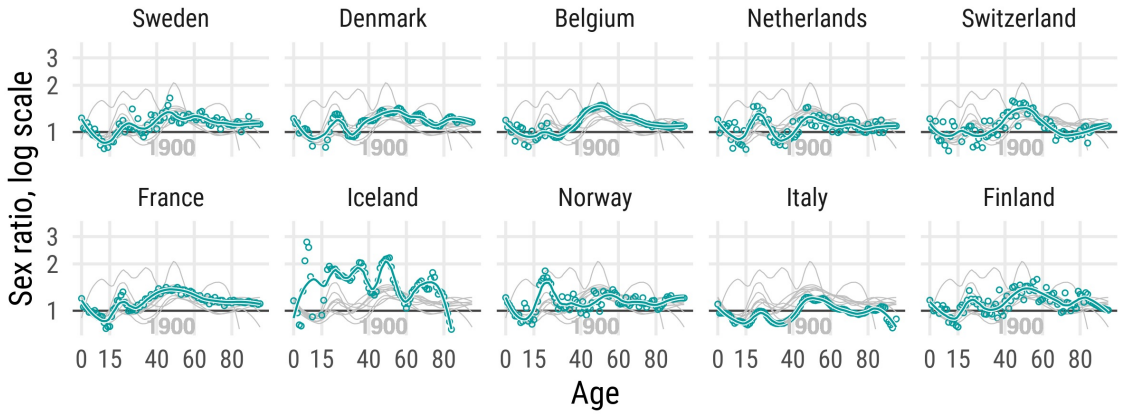
Sex gap

Zarulli, V., Kashnitsky, I., & Vaupel, J. W. (2021). Death rates at specific life stages mold the sex gap in life expectancy. *Proceedings of the National Academy of Sciences, 118*(20). https://doi.org/10.1073/pnas.2010588118

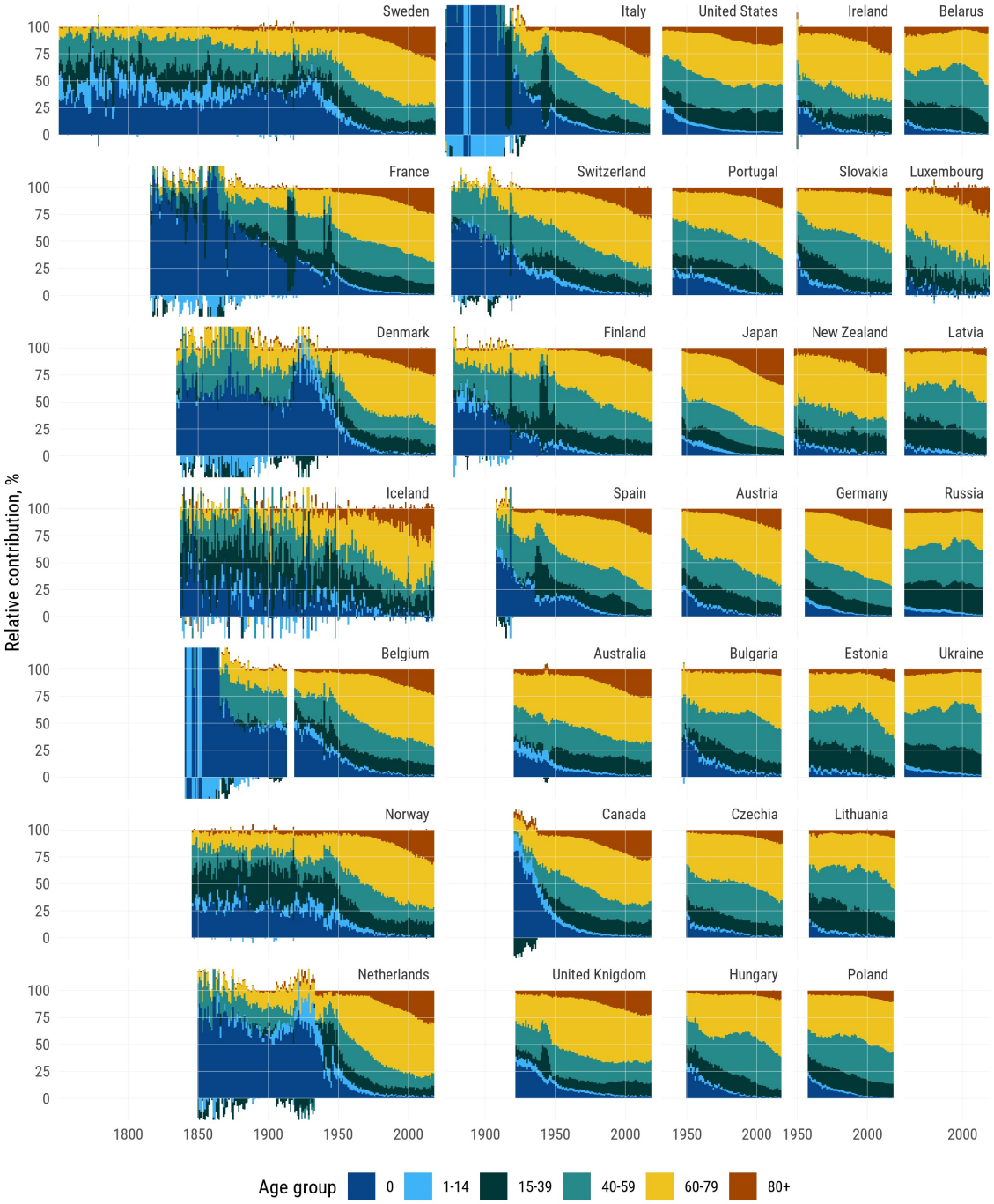
A. Ratio of male to female probability of death, last available year



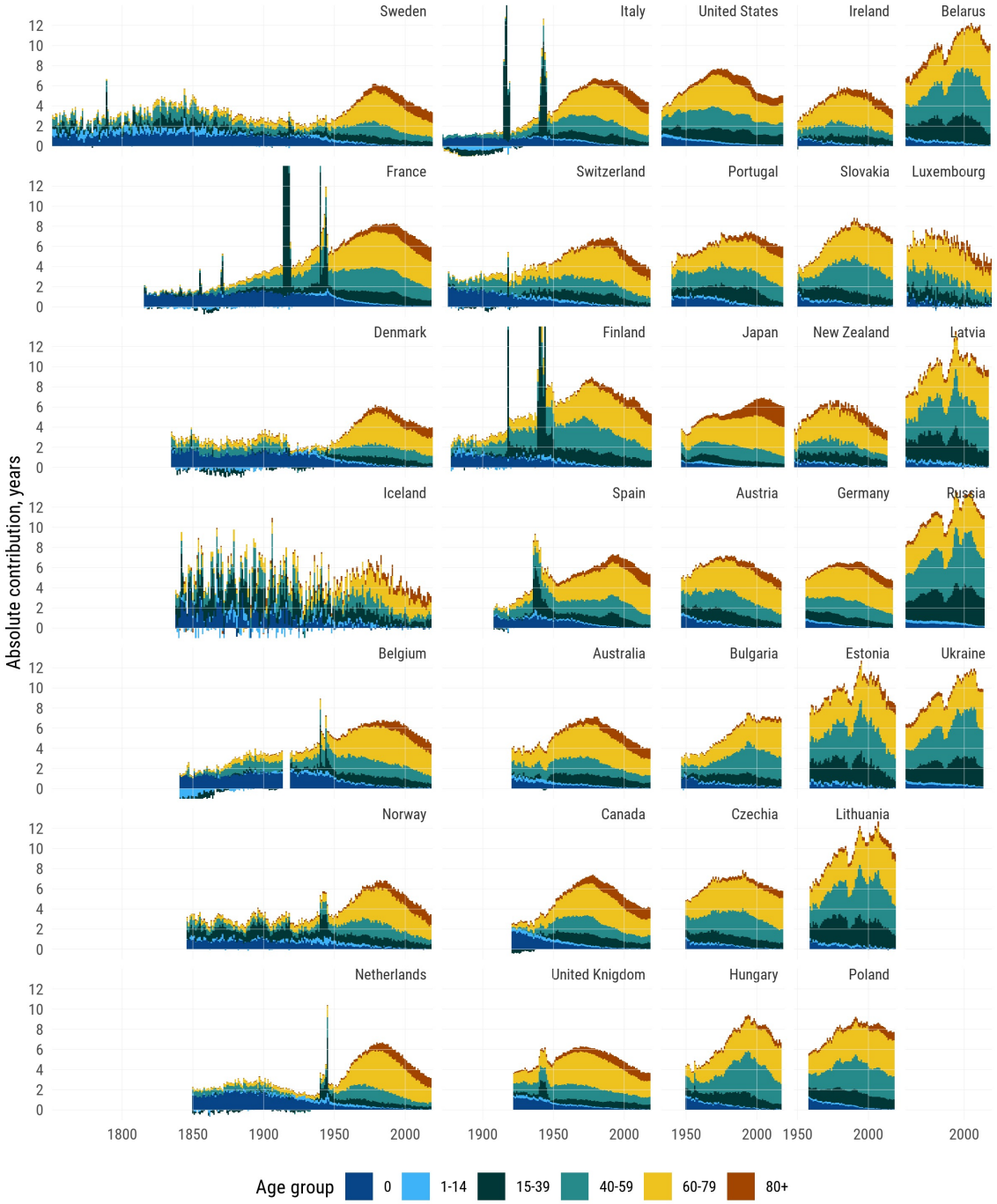
C. Ratio of male to female probability of death, 1900

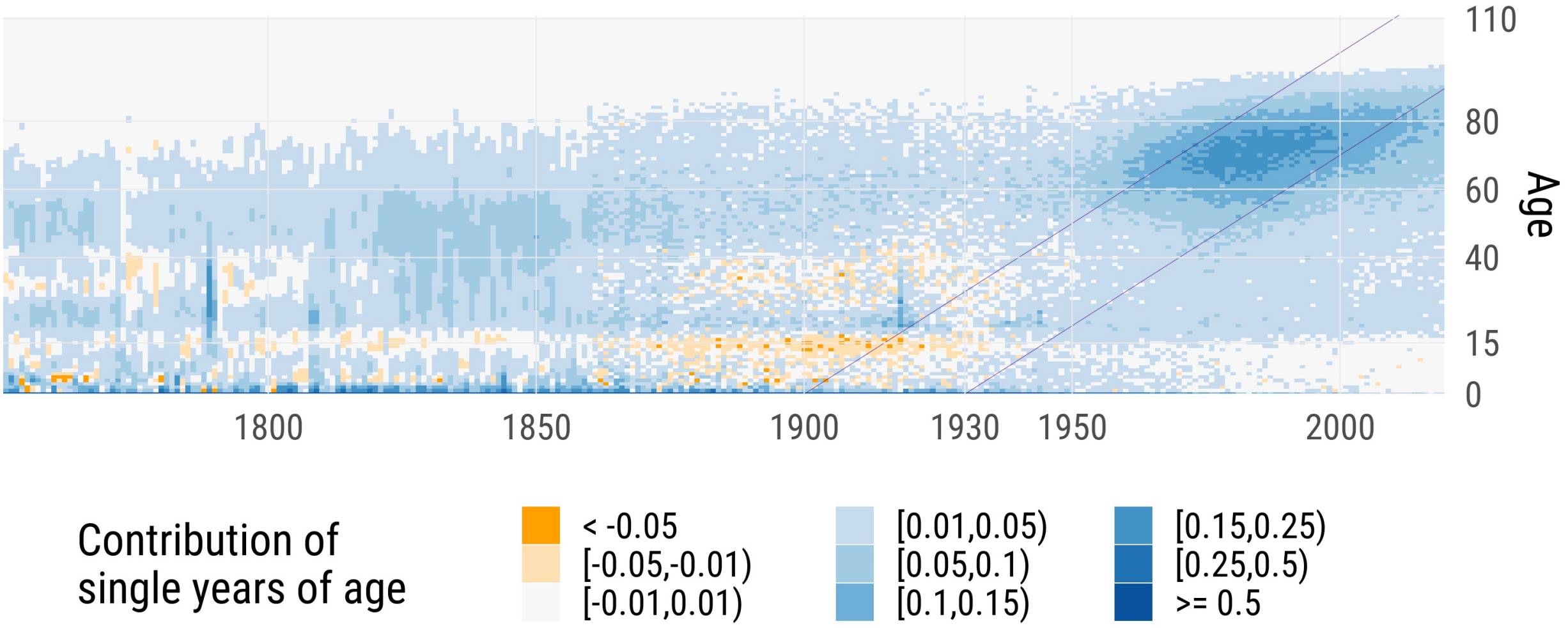


Relative age-specific contribution to sex gap in life expectancy at birth



Age-specific contribution to sex gap in life expectancy at birth




110
80
60
40
15
0
Age
1800
1850
1900
1930
1950
2000
Contribution of single years of age
< -0.05
[-0.05,-0.01)
[-0.01,0.01)
[0.01,0.05)
[0.05,0.1)
[0.1,0.15)
[0.15,0.25)
[0.25,0.5)
>= 0.5

2020 drops of life expectancy

IEA International Epidemiological Association

International Journal of Epidemiology, 2021, 1–12
doi: 10.1093/ije/dyab207
Original article

Original article

Quantifying impacts of the COVID-19 pandemic through life-expectancy losses: a population-level study of 29 countries

José Manuel Aburto [1,2,3,4*†] **Jonas Schöley** [3,4†] **Ilya Kashnitsky** [3] **Luyin Zhang** [1,5] **Charles Rahal** [1,2] **Trifon I Missov** [3] **Melinda C Mills** [1,2] **Jennifer B Dowd** [1,2] **and Ridhi Kashyap** [1,2†]

[1]Leverhulme Centre for Demographic Science and Department of Sociology, University of Oxford, Oxford, UK, [2]Nuffield College, Oxford, UK, [3]Interdisciplinary Centre on Population Dynamics, University of Southern Denmark, Odense, Denmark, [4]Laboratory of Population Health, Max Planck Institute for Demographic Research, Rostock, Germany and [5]St Cross College, Oxford, UK

*Corresponding author. 42–43 Park End Street, Oxford, OX1 1JD, UK. E-mail: aburto@demogr.mpg.de; jose-manuel.aburto@sociology.ox.ac.uk
†These authors contributed equally to this manuscript.

Editorial decision 6 September 2021; Accepted 8 September 2021

Abstract

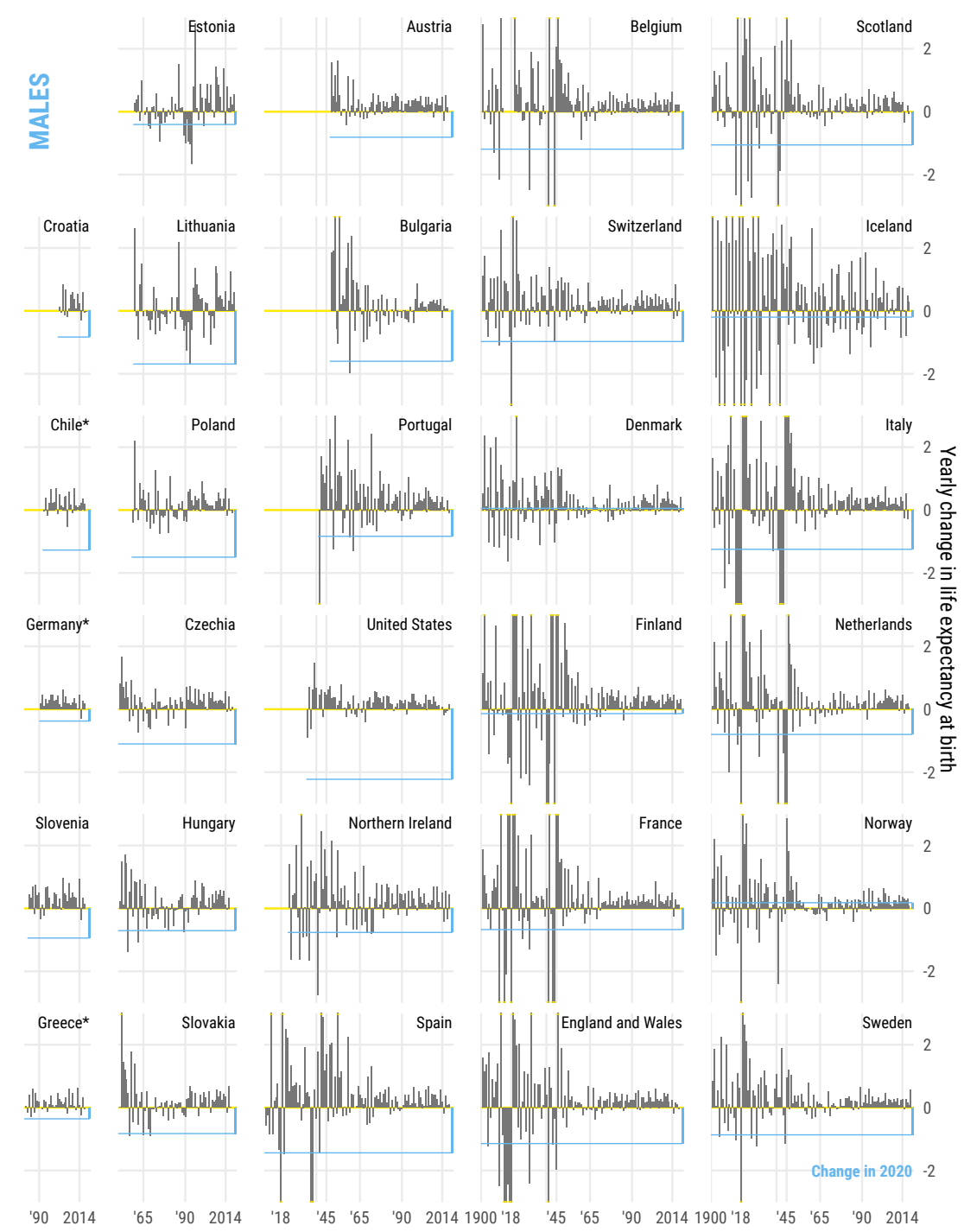
Background: Variations in the age patterns and magnitudes of excess deaths, as well as differences in population sizes and age structures, make cross-national comparisons of the cumulative mortality impacts of the COVID-19 pandemic challenging. Life expectancy is a widely used indicator that provides a clear and cross-nationally comparable picture of the population-level impacts of the pandemic on mortality.
Methods: Life tables by sex were calculated for 29 countries, including most European countries, Chile and the USA, for 2015–2020. Life expectancy at birth and at age 60 years for 2020 were contextualized against recent trends between 2015 and 2019. Using decomposition techniques, we examined which specific age groups contributed to reductions in life expectancy in 2020 and to what extent reductions were attributable to official COVID-19 deaths.
Results: Life expectancy at birth declined from 2019 to 2020 in 27 out of 29 countries. Males in the USA and Lithuania experienced the largest losses in life expectancy at birth during 2020 (2.2 and 1.7 years, respectively), but reductions of more than an entire year were documented in 11 countries for males and 8 among females. Reductions were mostly attributable to increased mortality above age 60 years and to official COVID-19 deaths.
Conclusions: The COVID-19 pandemic triggered significant mortality increases in 2020 of a magnitude not witnessed since World War II in Western Europe or the breakup of the Soviet Union in Eastern Europe. Females from 15 countries and males from 10 ended up with lower life expectancy at birth in 2020 than in 2015.

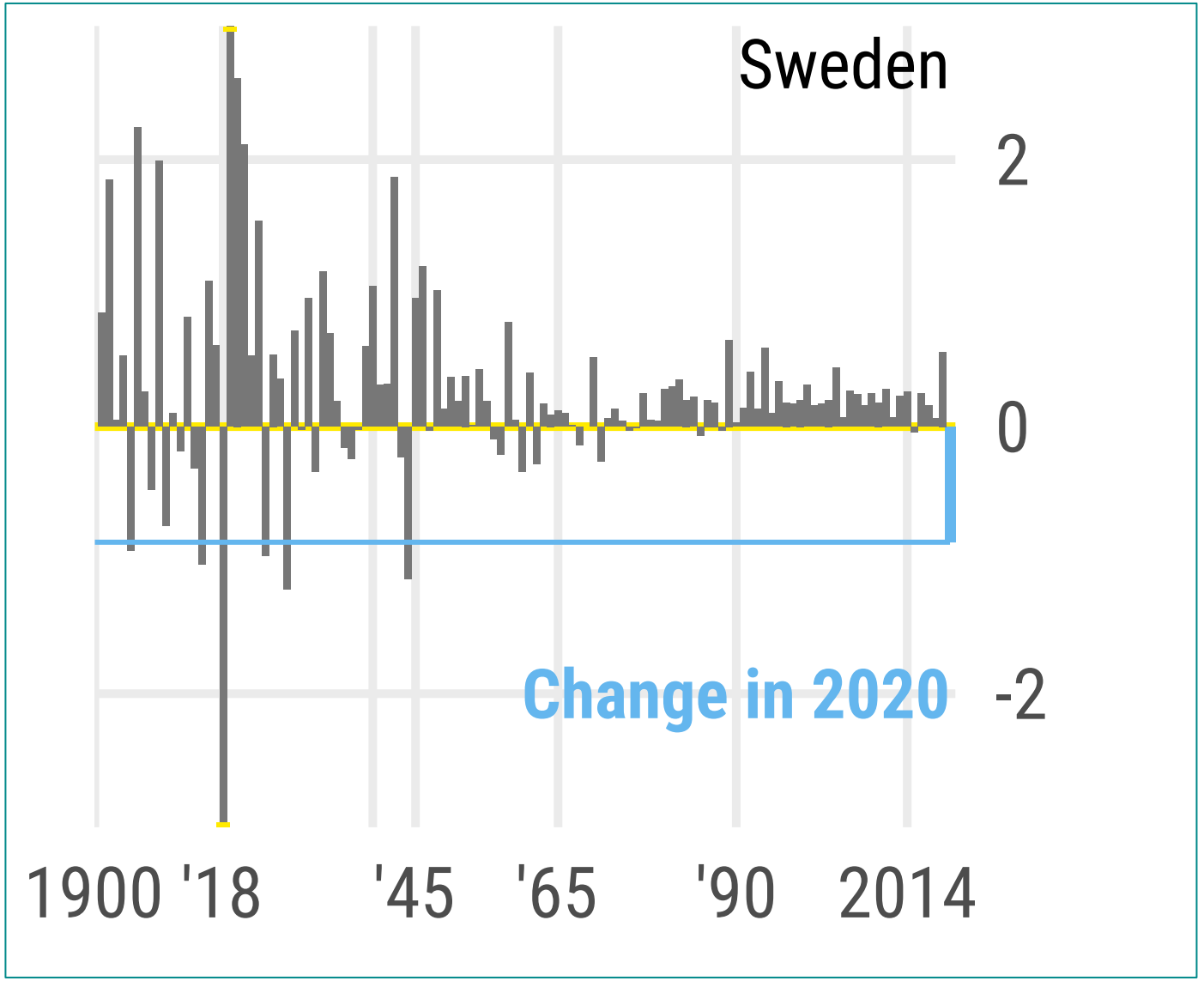
Key words: COVID-19, demography, life expectancy, mortality

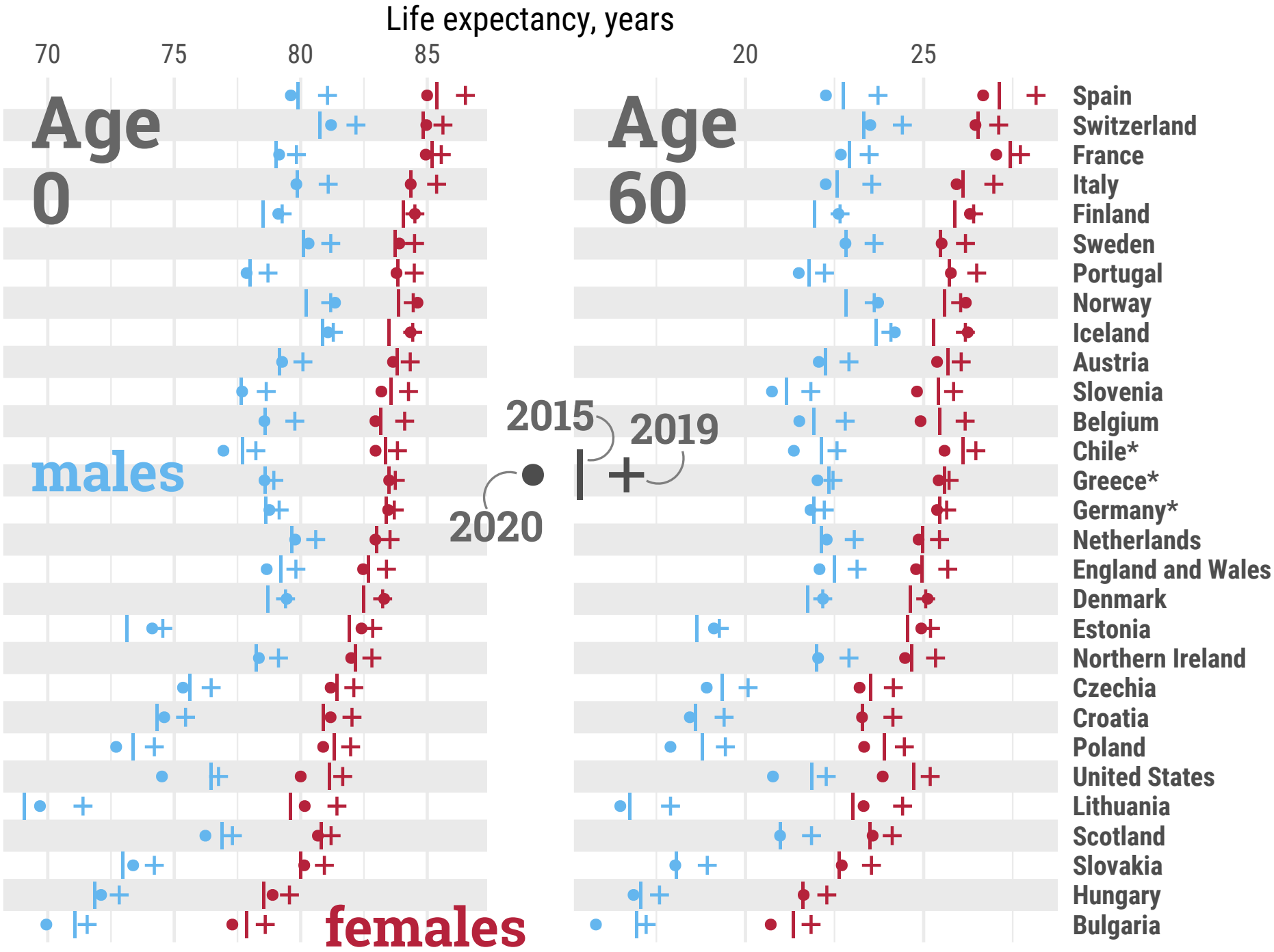
Key Messages

- This is the first study to assemble a high-quality data set of harmonized mortality estimates, life tables and age by cause decomposition for 29 countries representing most of Europe, Chile and the USA to provide novel evidence of the cumulative, comparative impacts of the pandemic on population health.
- Out of 29 countries analysed, the COVID-19 pandemic led to losses in life expectancy in 27, with large losses of life expectancy of >1 year in 11 countries for males and 8 among females.
- Losses in life expectancy observed in Central and Eastern European countries in 2020 exceeded those observed around the dissolution of the Eastern Bloc (with the exception of Lithuania and Hungary), whereas similar magnitudes of losses in Western Europe were last seen around World War II.
- Compared against recent trends, females from 15 countries and males from 10 ended up with lower life expectancy at birth in 2020 than in 2015—a year when life expectancy was adversely impacted already due to an especially bad flu season.
- Losses in life expectancy were largely attributable to increased mortality above age 60 years and linked to official COVID-19 deaths.

Aburto, J. M., Schöley, J., Kashnitsky, I., Zhang, L., Rahal, C., Missov, T. I., Mills, M. C., Dowd, J. B., & Kashyap, R. (2021). Quantifying impacts of the COVID-19 pandemic through life-expectancy losses: A population-level study of 29 countries. *International Journal of Epidemiology, dyab207*. https://doi.org/10.1093/ije/dyab207


MALES
Estonia
Austria
Belgium
Scotland
Croatia
Lithuania
Bulgaria
Switzerland
Iceland
Chile*
Poland
Portugal
Denmark
Italy
Germany*
Czechia
United States
Finland
Netherlands
Slovenia
Hungary
Northern Ireland
France
Norway
Greece*
Slovakia
Spain
England and Wales
Sweden
Yearly change in life expectancy at birth
2
0
-2
Change in 2020
'90 2014
'65 '90 2014
'18 '45 '65 '90 2014
1900 '18 '45 '65 '90 2014


Sweden
2
0
-2
Change in 2020
1900 '18 '45 '65 '90 2014


Life expectancy, years
70
75
80
85
20
25
Age
0
Age
60
males
females
2015
2019
2020
Spain
Switzerland
France
Italy
Finland
Sweden
Portugal
Norway
Iceland
Austria
Slovenia
Belgium
Chile*
Greece*
Germany*
Netherlands
England and Wales
Denmark
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Croatia
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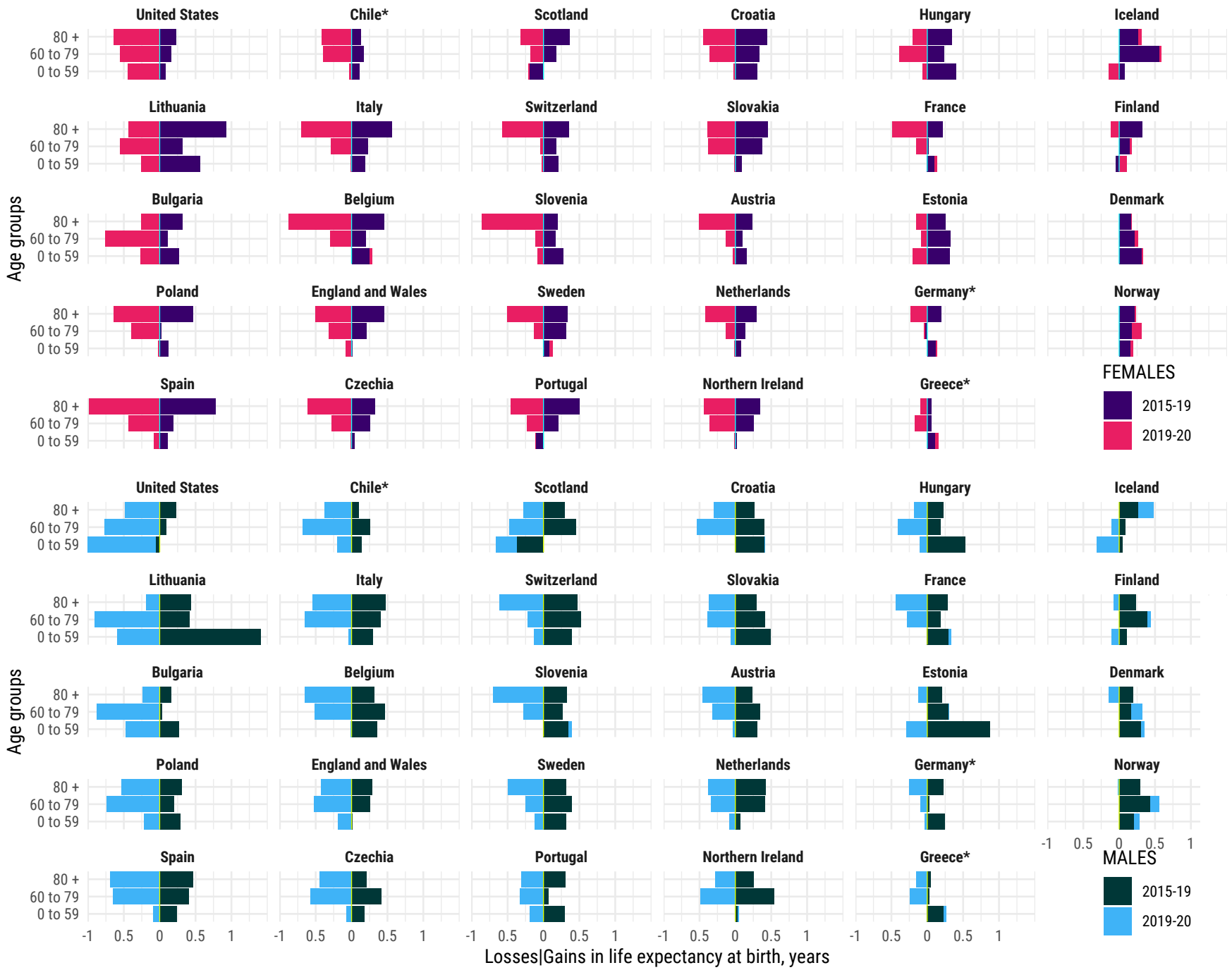
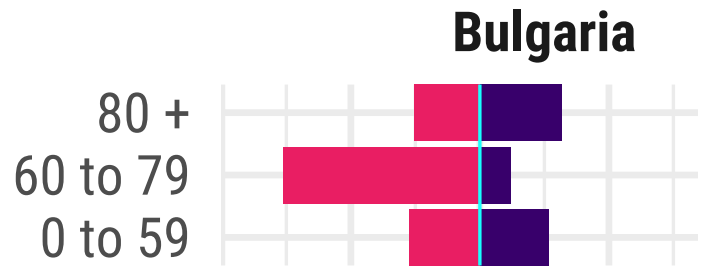
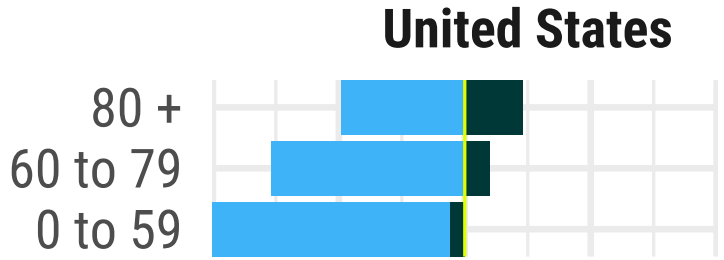
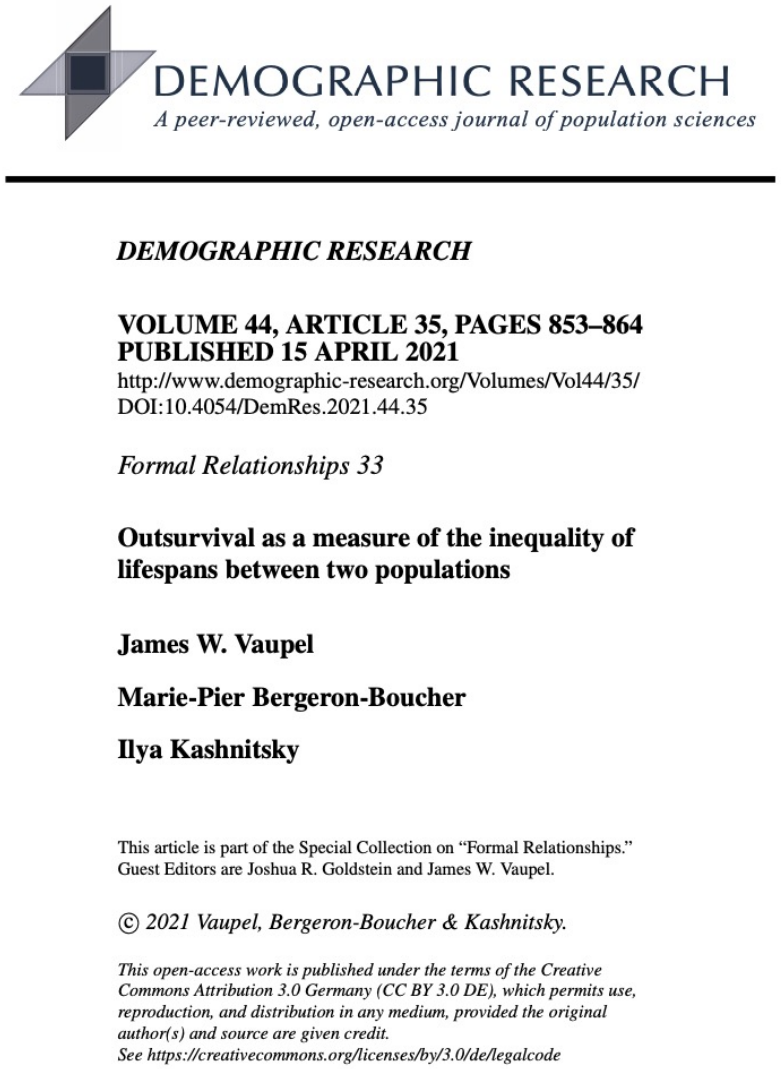

United States
Chile*
Scotland
Croatia
Hungary
Iceland
Lithuania
Italy
Switzerland
Slovakia
France
Finland
Bulgaria
Belgium
Slovenia
Austria
Estonia
Denmark
Poland
England and Wales
Sweden
Netherlands
Germany*
Norway
Spain
Czechia
Portugal
Northern Ireland
Greece*
80 +
60 to 79
0 to 59
Age groups
FEMALES
2015-19
2019-20
MALES
2015-19
2019-20
-1
0.5
0
0.5
1
Losses|Gains in life expectancy at birth, years


Bulgaria
80 +
60 to 79
0 to 59


United States
80 +
60 to 79
0 to 59

Beyond single summary measure



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DOI:10.4054/DemRes.2021.44.35

Formal Relationships 33

Outsurvival as a measure of the inequality of lifespans between two populations

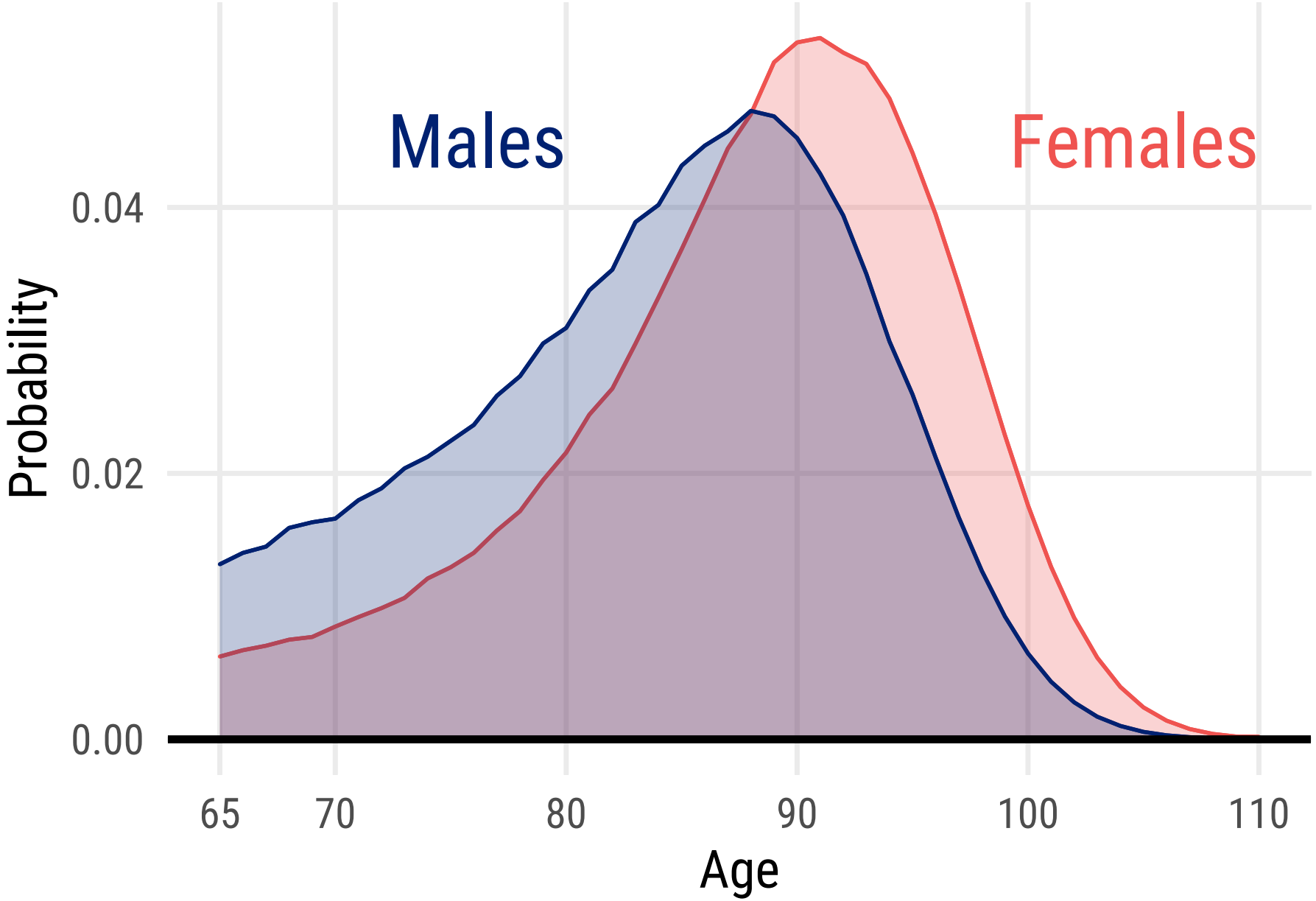
James W. Vaupel

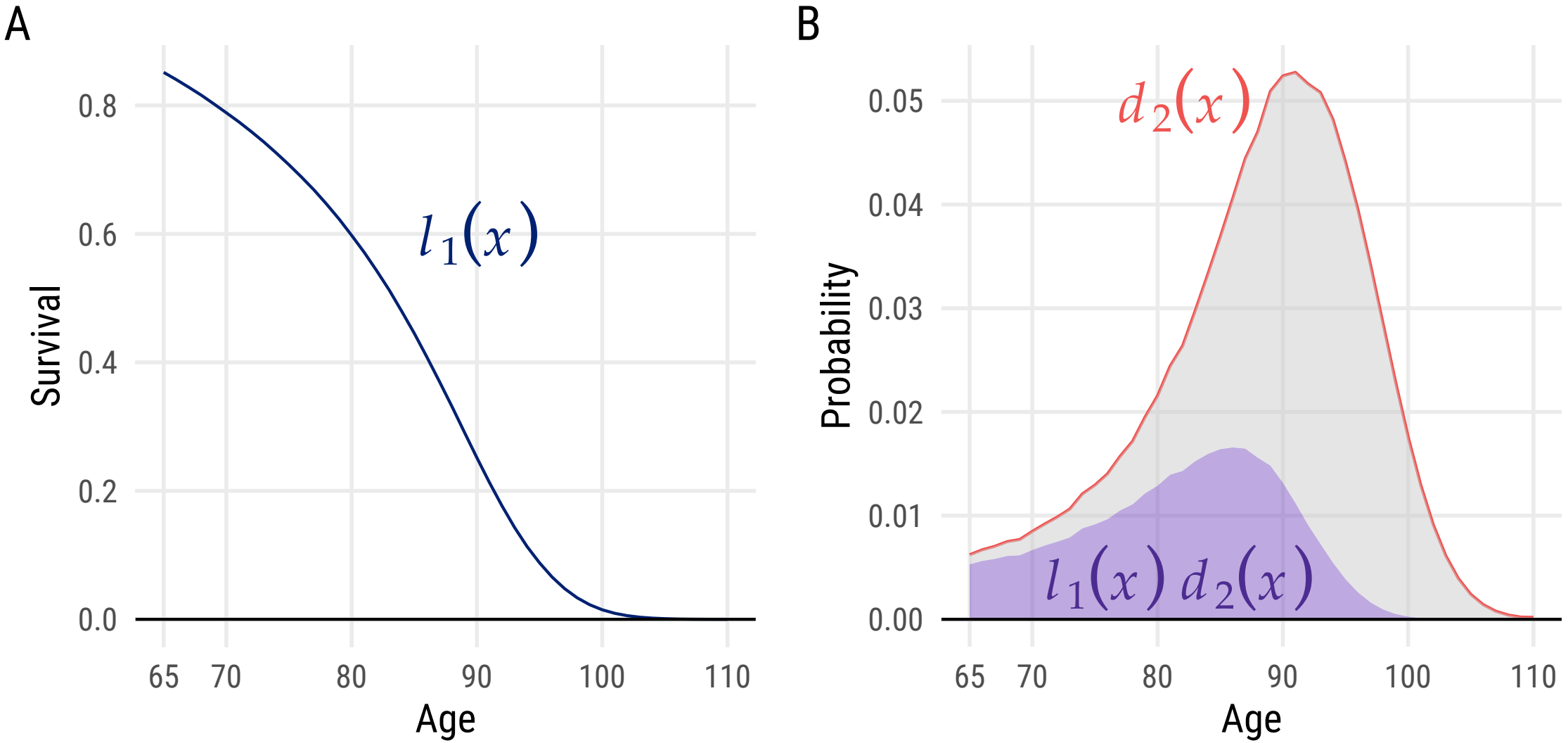
Marie-Pier Bergeron-Boucher

Ilya Kashnitsky

This article is part of the Special Collection on "Formal Relationships." Guest Editors are Joshua R. Goldstein and James W. Vaupel.

Vaupel, J., Bergeron-Boucher, M.-P., & Kashnitsky, I. (2021). Outsurvival as a measure of the inequality of lifespans between two populations. *Demographic Research*, *S8*(35), 853–864. https://doi.org/10.4054/DemRes.2021.44.35


Males
Females
0.04
0.02
0.00
Probability
65
70
80
90
100
110
Age


A
0.8
0.6
0.4
0.2
0.0
Survival
$l_1(x)$
65
70
80
90
100
110
Age
B
0.05
0.04
0.03
0.02
0.01
0.00
Probability
$d_2(x)$
$l_1(x)\,d_2(x)$
65
70
80
90
100
110
Age

Thank you!

Ilya Kashnitsky

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