

The scope of human experience

Author: Joao Fabiano and Stephen Clare

[How many people have ever lived?](#)

[How many life-years were ever experienced?](#)

[How many life-years have we spent in different activities?](#)

[References](#)

How many people have ever lived?

In the Introduction, we discuss the scope of human experience - the cumulative memories of every person who has ever lived. Our estimates of the amount of time people have spent doing various activities rely on estimates of the size of the human population throughout history. The tradition of demographers trying to estimate the number of people ever born is centuries old.¹ Recent estimates suggest that people currently alive make up a surprisingly large share of all those that have ever existed. Though humans have been around for 300,000 years, close to one in ten of those ever born are currently alive.

The basic approach to this question is fairly simple: we can use the current population and historical birth rates to estimate the total number of people born in the past. The earliest estimate made like this assumed two people were alive a million years ago, that population had grown steadily to its current size, and that births per capita had been constant, and derived the total ever born (Winkler, 1959). However, such estimates are very sensitive to historical variations in fertility (Keyfitz, 1966).² Rather than growing steadily, the human population has grown in fits and starts, and even temporarily shrunk, throughout history. A better estimate of the number of past people, therefore, must rely on uncertain estimates of the population size and birth rates throughout all of history.

For recent times, we can simply aggregate data from national censuses to get a global total (UN, 2019). As we move further into the past, official censuses become sparse. Luckily, populous societies tend to be complex and record census data for taxation.

¹ The earliest attempt was perhaps by the 17th century English economist William Petty: "20,000,000,000, as the full number of all that died from the beginning of the world to the year 1682, unto which, if 320,000,000, the number of those who are now alive, be added, the total of the quick and the dead will amount but unto one fifth part of the graves which the surface of Ireland will afford" (Petty, 1682, p. 54)

² That is, there's a big difference between using one smooth growth curve and a series of different growth curves. To illustrate, compare a scenario of constant growth to that of growth, decline and explosive growth.

Even for societies lacking records, demographers can still place upper and lower bounds on their population by drawing inferences from anthropological findings. For instance, the extent and type of farming can be paired with dietary needs to infer maximal population density; that is, population can be estimated by dividing the total amount of farmland in an area by the amount of farmland required to feed one person. Hunter-gatherers can be estimated similarly. Accounts of household size and residential ruins can be used to infer how many people lived in a given urban settlement. Human remains tell us about mortality and fertility. These indirect methods can at least suggest rough upper and lower bounds for ancient populations.

Another challenge is deciding who counts as human and figuring out when they first emerged. Fortunately for us, early humans lived in small populations that grew slowly, so they don't contribute very much to the total human population, or totality of human experience.³

Recent plausible estimates of total population are within the range of 50 to 150 billion (Cohen, 2014, p. 1563; Goldberg, 1983, p. 28).⁴ Demographers from the Population Reference Bureau have updated their estimates since 1995 as new data have emerged (Haub & Kaneda, 2021). Their latest work suggests that 117 billion people total have lived. However, this estimate implicitly assumes a prehistoric life expectancy that is drastically lower than comparable recent estimates.⁵ That said, the Population Reference Bureau works also presents the most detailed period breakdown available, with population and births per person estimated for 12 periods between 190,000 BCE and AD 2020. The current world population of about 7.7 billion comprises about 6.7 percent of all humans, living or dead. The Population Reference Bureau's detailed period breakdown is reproduced in the table below.

³ For instance, adding four in-between periods reduced the ever-lived figure by a factor of 80 (Keyfitz, 1966). Meanwhile, moving the start date from 50,000 to 190,000 BC only increased the figure by a factor of 1.1 (Haub & Kaneda 2018, 2021).

⁴ In a rapid review of primary sources, we found seven sources whose estimates ranged from 46 to 117 billion (Deevey, 1960; Desmond, 1964; Keyfitz, 1966; Westing, 1981; Goldberg, 1983; Sanchez-Romero et al., 2017; Haub & Kaneda, 2018, 2021). As *Homo Sapiens* emergence has been pushed back recently (Schlebusch et al., 2017; Hublin et al., 2017; Galway-Witham & Stringer, 2018), recent estimates tend to be on the higher end of this range.

⁵ They claim it "averaged only about 10 years" (Haub & Kaneda, 2021) but do not include specifics in their data table. Sanchez-Romero et al. (2017) calculated that the implied prehistoric life expectancy in their 2011 estimate is 13 years. PRB's figure comes from assuming a linear increase from prehistory to now. However, there's substantial archaeological evidence that life expectancy decreased with the inception of agriculture (Diamond 1999; Gurven & Kaplan 2007). The average life expectancy among hunter-gatherer societies is over 30 years (Kaplan et al. 2010; Gurven & Kaplan 2007), whereas the life expectancy in Ancient Rome and Greece was 28 (Scheidel 2001; Morris 2004). See next section for life expectancy data.

Period	Ending Population	Births within period	Percentage of those ever born alive at end
190,000-50,000 BC	2,030,625	7,856,100,000	0%
50,000-8,000 BC	5,000,000	1,137,789,769	0.1%
8,000 BC-1 AD	300,000,000	46,025,332,354	0.5%
1-1200	450,000,000	26,591,343,000	0.6%
1200-1650	500,000,000	12,782,002,453	0.5%
1650-1750	795,000,000	3,171,931,513	0.8%
1750-1850	1,265,000,000	4,046,240,009	1.2%
1850-1900	1,656,000,000	2,900,237,856	1.6%
1900-1950	2,516,000,000	3,390,198,215	2.3%
1950-1995	5,760,000,000	5,427,305,000	5.1%
1995-2011	6,987,000,000	2,130,327,622	6.1%
2011-2020	7,772,850,162	1,302,594,620	6.7%

Table 1: People that ever lived, 12 periods (Source: [PRB](#))

How many life-years were ever experienced?

A life of 75 years typically contains three times as many experiences as a life of 25 years. So, to estimate the number and distribution of total life-years, we have to consider life expectancy in addition to population size.⁶ This has varied a lot throughout history. Some estimates have life expectancy in Ancient Rome as low as 25 years (Scheidel, 2001), whereas today it is over 73 years globally (WHO, 2020). The 26 billion people born between, say, AD 1 and AD 1200 had substantially shorter lives than those born more recently. We can construct our own estimate of total life-years ever lived by adding life expectancy data to the Population Reference Bureau data. Multiplying a period's births by the average length of a life within that period will tell us about how many life-years were lived in that time.

⁶ The current life expectancy is a projection of how long a currently alive cohort is expected to live on average. It uses current observed mortality rates at different ages adjusted by observed past trends in mortality to account for future changes. Historical life expectancy is something of a misnomer given that it refers to past populations that are all dead; instead, it is a retroactive estimative of how long people lived on average.

Unfortunately, historical life expectancy is even harder to estimate than historical population. While rare, we do at least have some census data from the ancient world; one of the earliest is a Chinese record from the year AD 2 (Nishijima, 1986). In contrast, life expectancy has only been recorded in the last couple of centuries. The very idea of estimating how long a cohort will live only came about in the 17th century, when it couldn't even be calculated due to a lack of mortality data (Greenwood, 1938; Tattersall 1996, pp. 333-334).⁷

Thus, to estimate historical life expectancy we must turn to indirect measures, such as life expectancy in current hunter-gatherer societies, estimated age of death of human remains, and tombstone inscriptions. Unsurprisingly, the available evidence suggests that life expectancy has generally increased. But it also shows that this increase has been punctuated by the shocks of the agricultural and industrial revolutions.⁸

Period/Year	Life expectancy	Source
300,000-15,000BC	35.5	Kaplan et al. (2000) ⁹
15,000-7,000BC	30	Galor & Moav (2005)
7,000-3,000BC	20	Galor & Moav (2005)
3,000BC-650BC	35	Galor & Moav (2005)
650BC-500AD	28	Scheidel (2001), Morris (2004)
500-1500	28*	*No sources, repeating above
1543 (UK)	34	Zijdeman & Ribeira da Silva (2015)
1751 (Sweden)	35	Finch (2010)
1800	28.5	Riley (2005)

⁷ Given that censuses were conducted in order to levy taxes, it's understandable there was little motivation to record deaths.

⁸ More precisely, the data evince multiple temporary dips in life expectancy, and in fact suggest there may have been two dips prior to industrialization. The first occurs between 7,000BC and 3,000 BC, and the second between 650 BC and AD 1500. The first dip is very plausible and coincides with the transition to agriculture during the Neolithic Revolution, when multiple sources attest an increase in mortality. However, the second dip is uncertain and might be a spurious result from using different sources, which use different estimation techniques for the pre-historical (Galor & Moav) and historical (Scheidel) periods. It is still plausible that early urbanisation is responsible for the second dip.

In the end, historical populations are small enough, and the range of plausible values for life expectancy narrow enough, that different plausible estimates don't change our main conclusions.

⁹ Extrapolating from at 15 expectancy of 54.1 and 60% survival to 15 (Kaplan et al., 2000, p. 158). Assuming who died before 15 lived 7.5 years (if 0, we get 32.5). Another source by the same main author has 31 years life expectancy at birth (Gurven & Kaplan, 2007). A more recent source has an average life expectancy of 27.5 and median of only 25.9 (Page & French, 2020, [Tab. S1](#)). However, it includes data on several groups that are sedentary or have unusually low fertility that could not have been sustained long-term (see [comments here](#)).

1900	32	Riley (2005)
1950	48	Riley (2005)
1973	60	Riley (2005)
2001	66.6	Riley (2005)
2016	72	WHO (2020)
2019	73.4	WHO (2020)
2020	73.4	WHO (2020)

Table 2: Life expectancy timeline

By adding these life expectancies to the population data, we can derive life-years lived in each of the Population Research Bureau’s 12 periods, the total life-years ever lived, and how much of the total was lived by the end of each period.¹⁰

Period	Births within period (bi)	Life Exp.	Life-years in period (bi)	Life-years till period's end (bi)	Life-years lived	Ever born at start
190,000-50,000BC	7.9	35.5	278.6	278.6	7.60%	
50,000-8,000BC	1.1	34.6	39.3	317.9	8.67%	
8,000 BC-1AD	46	26.3	1,200	1,529	41.69%	0.1%
1-1200	26.6	28.0	744.6	2,273	62.00%	0.5%
1200-1650	12.8	29.8	381.3	2,654	72.40%	0.6%
1650-1750	3.2	34.5	109.4	2,764	75.38%	0.5%
1750-1850	4	31.0	125.4	2,889	78.81%	0.8%
1850-1900	2.9	30.3	87.7	2,977	81.20%	1.2%
1900-1950	3.4	40.0	135.6	3,113	84.90%	1.6%
1950-1995	5.4	58.5	317.7	3,430	93.56%	2.3%
1995-2011	2.1	67.1	143	3,573	97.46%	5.1%
2011-2020	1.3	71.4	93	3,666	100.00%	6.1%
2020						6.7%
Total	116.8		3,666			

¹⁰ The years in life expectancy data do not neatly correspond to the years in PRB’s periods. Therefore, we calculated life expectancy within PRB’s periods using two simplifying assumptions. If the life expectancy data was for a period, we used a simple weighted average, adding up periods’ life expectancy weighted by how many years were within a given PRB’s period. If the life expectancy data was for point years, we assumed that the life expectancy between point years is the average of both points’ life expectancy. We used the method for periods over that if necessary.

Life-years by the currently alive (1950-)			553.7		15%	

Table 3: Life-years ever lived ([see detailed spreadsheet here](#))

We get a total tally of 3.7 trillion life-years, with people currently alive expected to contribute half a trillion. That means that about one of every seven life-years ever experienced has, or will be, experienced by someone currently alive. Over a third of existing life-years happened after 1200, and about one in five after 1650.

If we use the implausibly low life expectancy implied by the PRB model, life-years become even more concentrated in the present, with 22% belonging to those currently alive.¹¹ The total life-years ever lived total 2.5 trillion. Using a lower-end estimate for hunter-gatherers' life expectancy of 26 years decreases life-years from early periods by a couple percentage points, with everything else remaining roughly the same.¹²

How many life-years have we spent in different activities?

To get a sense of how humans have spent these life-years, we also made rough estimates of the amount of time people have spent doing various activities such as giving birth, having sex, drinking coffee and being enslaved.

Giving birth

Currently, labour lasts about 6 hours for hospital births and 10.6 hours for at-home births (Laughon et al., 2012; Kilpatrick & Garrison, 2018; Hildingsson et al., 2015). Let us assume, for simplicity, that all births prior to 1950 took place at home and all after were at a hospital. By multiplying all post-1950 births in our table by 6 hours and all pre-1950 births by 10.6 hours, we get a total of 1.2 trillion hours or 137 million years spent in labour. However, 10.6 hours is the length of time spent in labour during at home births for modern, low-risk pregnancies in wealthy countries. It likely underestimates the duration of labour in other conditions. As an upper bound, we can assume active labour of home births lasted five times longer pre-1950, resulting in a total of 659 million life-years spent in active labour from the dawn of humanity until now. That represents between 0.004% and 0.018% of all human life-years.

Having sex

¹¹ See footnote 5.

¹² See footnote 8. As mentioned, this life expectancy figure seems likely wrong.

To estimate the total amount of time humans have spent having sex, we combine our data on the number of historical births with an estimate of how many times people have sex for each birth and data on how long intercourse usually lasts.¹³

From our earlier estimates, we know that about 117 billion humans have been born. How many intimate acts occurred for each birth? Well, 89% of US couples using no contraception become pregnant within one year (Trussell, 2011, p. 398). Let's assume that, of the remaining 11%, half take two years to become pregnant and half are infertile.

One study found that married couples at the age of fertility have sex about 2.5 times per week (130 per year) on average (Call et al., 1995, p. 646). This would imply that the 89% of couples who get pregnant within one year have sex about 130 times per pregnancy. The 5.5% who, we assumed, take two years to get pregnant have sex 260 times per pregnancy. And we have to account for the remaining 5.5% of couples, who have sex about 130 times per year without getting pregnant. This averages out to about 142 intercourses for each pregnancy.

Unfortunately, around 35% of pregnancies result in miscarriage (McNair & Altman, 2012, p. 438), so this would correspond to about 220 times having sex for each live birth (this ignores stillbirths, which occur about 1.39% of the time (Danzhen et al., 2020, p. 11)). Finally, we can multiply this by the average duration of sexual intercourse: about 7.4 minutes, according to a 2004 study (Miller & Byers, 2004, p. 304). This adds up to about 1600 minutes of sex for each live birth. Assuming two partners are involved, this is 3200 minutes of experience. So, with 117 billion live births so far, we can estimate that people have spent about 374 trillion minutes, or 700 million years, having sex. That's about 0.01% of all 3.7 trillion life-years so far.

Drinking coffee

Coffee consumption only became widespread around the middle of the 19th century (Wikipedia, 2022). In 2019, 168 million 60-kg bags of coffee were consumed by the 7.69 billion people alive (International Coffee Organization, 2020, p. 7). That works out to 1.31kg consumed per life-year. People probably drink more coffee today than they did in the past. So let's assume, quite arbitrarily, that the average yearly coffee consumption since 1850 is half of what it was in 2019. A cup of coffee uses about 10g of beans (Giovanisci, 2021). And let's say it takes about 30 minutes to drink. That gives us about 2000 minutes drinking coffee per life-year. According to our table above, about 780

¹³ This is probably not what you expected to read about when you bought this book. All we can say is that it's not what we expected to be researching when we were asked to help research it!

billion life-years have been lived since 1850. So, a rough estimate for the amount of years spent drinking coffee is 3 billion life-years, which is about 0.8% of all life-years ever lived.

I note that that's *much* more time than humans have spent having sex. People really like drinking coffee!

Time spent enslaved

This may be the trickiest estimate of all. We know that the prevalence of slavery has varied widely throughout history and across societies, but we don't know much about where it was high and where it was low. So any estimate of the average prevalence of slavery over all of human history is going to be very uncertain.

Our broad assumptions, which seem relatively solid, are as follows. Slavery only started with agriculture, likely peaked in the 18th century, and drastically declined in the 20th century. Nearly two-thirds of the life-years ever lived were from before the 13th century, so most of the life-years spent enslaved occurred before 1200 AD. However, over one-fifth of life-years enslaved are from the 17-19th centuries even though less than one-tenth of all life-years are from this period. This shows how widespread slavery was in the early modern era.

The sources and calculations we used to get a rough estimate are described in note 6 to the Introduction of *What We Owe The Future*. Using that data, we calculate that 850 million life-years have been lived as a slave; nearly a quarter of all life-years.¹⁴ This number is different than what appears in the text as we have continued to work on this question long after the book was published.

References

- Bacci, M. L. (2017). *A Concise History of World Population*. John Wiley & Sons.
- Biraben, J. N. (1980). An essay concerning mankind's demographic evolution. *Journal of Human Evolution*, 9(8), 655–663. [https://doi.org/10.1016/0047-2484\(80\)90099-8](https://doi.org/10.1016/0047-2484(80)90099-8)
- Call, V., Sprecher, S., & Schwartz, P. (1995). The Incidence and Frequency of Marital Sex in a National Sample. *Journal of Marriage and the Family*, 57(3), 639. <https://doi.org/10.2307/353919>
- Clarke, J. I. (1977). Population geography. *Progress in Human Geography*, 1(1), 136–141. <https://doi.org/10.1177/030913257700100110>

¹⁴ See *What We Owe The Future*'s Introduction note (6) *Slavery* (p. 265) for some rough preliminary results of these estimations and sources used. This is a work in progress, email me for additional details and dataset.

- Cohen, J. E. (2014). Is the fraction of people ever born who are currently alive rising or falling? *Demographic Research*, 30, 1561–1570.
<https://doi.org/10.4054/DemRes.2014.30.56>
- Danzhen, Y., Hug, L., Mishra, A., Blencowe, H., & Moran, A. (2020). *A neglected tragedy: The global burden of stillbirths*. United Nations Children's Fund.
<https://data.unicef.org/wp-content/uploads/2020/10/UN-IGME-2020-Stillbirth-Report-updated.pdf>
- Deevey, E. S. (1960). The Human Population. *Scientific American*, 203(3), 194–204.
<https://doi.org/10.1038/scientificamerican0960-194>
- Desmond, A. (1964). How Many People Have Ever Lived on Earth? In S. Mudd (Ed.), *The Population Crisis and the Use of World Resources* (pp. 27–46). Springer Netherlands.
https://doi.org/10.1007/978-94-017-5910-6_4
- Diamond, J. (1999, May 1). The Worst Mistake in the History of the Human Race. *Discover Magazine*.
<https://www.discovermagazine.com/planet-earth/the-worst-mistake-in-the-history-of-the-human-race>
- Finch, C. E. (2010). Evolution of the human lifespan and diseases of aging: Roles of infection, inflammation, and nutrition. *Proceedings of the National Academy of Sciences*, 107(suppl_1), 1718–1724. <https://doi.org/10.1073/pnas.0909606106>
- Galor, O., & Moav, O. (2006). Natural Selection and the Evolution of Life Expectancy. *CEPR Discussion Papers*, 5373. <https://papers.ssrn.com/abstract=885956>
- Galway-Witham, J., & Stringer, C. (2018). How did Homo sapiens evolve? *Science*, 360(6395), 1296–1298. <https://doi.org/10.1126/science.aat6659>
- Giovanisci, M. (2021, March 3). *Coffee to Water Ratio Calculator* [Web Page]. Roasty Coffee. <https://www.roastycoffee.com/measure-coffee/>
- Goldberg, S. (1983). How Many People Have Ever Lived? In S. Goldberg, *Probability in Social Science* (pp. 19–31). Birkhäuser Boston.
https://doi.org/10.1007/978-1-4612-5616-8_2
- Greenwood, M. (1938). The first life table. *Notes and Records of the Royal Society of London*, 1(2), 70–72. <https://doi.org/10.1098/rsnr.1938.0017>
- Gurven, M., & Kaplan, H. (2007). Longevity Among Hunter- Gatherers: A Cross-Cultural Examination. *Population and Development Review*, 33(2), 321–365.
<https://doi.org/10.1111/j.1728-4457.2007.00171.x>
- Hildingsson, I., Blix, E., Hegaard, H., Huitfeldt, A., Ingversen, K., Ólafsdóttir, Ó. Á., & Lindgren, H. (2015). How Long Is a Normal Labor? Contemporary Patterns of Labor and Birth in a Low-Risk Sample of 1,612 Women from Four Nordic Countries. *Birth*, 42(4), 346–353. <https://doi.org/10.1111/birt.12191>
- Hublin, J.-J., Ben-Ncer, A., Bailey, S. E., Freidline, S. E., Neubauer, S., Skinner, M. M., Bergmann, I., Le Cabec, A., Benazzi, S., Harvati, K., & Gunz, P. (2017). New

- fossils from Jebel Irhoud, Morocco and the pan-African origin of Homo sapiens. *Nature*, 546(7657), 289–292. <https://doi.org/10.1038/nature22336>
- International Coffee Organization. (2020). *Coffee Market Report—August 2020* [Report]. International Coffee Organization. <https://www.ico.org/documents/cy2019-20/cmr-0820-e.pdf>
- Kaneda, T., & Haub, C. (2018, March 9). *How Many People Have Ever Lived on Earth?* [Web Page]. Population Reference Bureau. <https://web.archive.org/web/20210524121206/https://www.prb.org/articles/how-many-people-have-ever-lived-on-earth/>
- Kaneda, T., & Haub, C. (2021, May 18). *How Many People Have Ever Lived on Earth?* [Web Page]. Population Reference Bureau. <https://web.archive.org/web/20210524121206/https://www.prb.org/articles/how-many-people-have-ever-lived-on-earth/>
- Kaplan, H., Hill, K., Lancaster, J., & Hurtado, A. M. (2000). A theory of human life history evolution: Diet, intelligence, and longevity. *Evolutionary Anthropology: Issues, News, and Reviews*, 9(4), 156–185. [https://doi.org/10.1002/1520-6505\(2000\)9:4<156::AID-EVAN5>3.0.CO;2-7](https://doi.org/10.1002/1520-6505(2000)9:4<156::AID-EVAN5>3.0.CO;2-7)
- Keyfitz, N. (1966). How many people have lived on the earth? *Demography*, 3(2), 581–582. <https://doi.org/10.2307/2060184>
- Kilpatrick, S., & Garrison, E. (2018). Normal Labor and Delivery. In M. B. Landon, D. A. Driscoll, E. R. M. Jauniaux, H. L. Galan, W. A. Grobman, & V. Berghella (Eds.), *Gabbe's Obstetrics Essentials: Normal & Problem Pregnancies* (pp. 80–89). Elsevier Health Sciences.
- Laughon, S. K., Branch, D. W., Beaver, J., & Zhang, J. (2012). Changes in labor patterns over 50 years. *American Journal of Obstetrics and Gynecology*, 206(5), 419.e1-419.e9. <https://doi.org/10.1016/j.ajog.2012.03.003>
- Maddison, A. (2010). *Historical Statistics of the World Economy: 1-2006 AD* [Dataset]. Maddison Database. http://www.ggdcd.net/maddison/Historical_Statistics/horizontal-file_02-2010.xls
- McEvedy, C., & Jones, R. (1978). *Atlas of World Population History*. Penguin.
- McNair, T., & Altman, K. (2012). Miscarriage and Recurrent Pregnancy Loss. In K. J. Hurt, M. W. Guile, J. L. Bienstock, H. E. Fox, & E. E. Wallach (Eds.), *The Johns Hopkins Manual of Gynecology and Obstetrics* (4th ed., pp. 438–447). Lippincott Williams & Wilkins.
- Miller, S. A., & Byers, E. S. (2004). Actual and desired duration of foreplay and intercourse: Discordance and misperceptions within heterosexual couples. *The Journal of Sex Research*, 41(3), 301–309. <https://doi.org/10.1080/00224490409552237>
- Morris, I. (2004). Economic Growth in Ancient Greece. *Journal of Institutional and Theoretical Economics*, 160(4), 709. <https://doi.org/10.1628/0932456042776050>

- Nishijima, S. (1986). The economic and social history of Former Han. In D. Twitchett & M. Loewe (Eds.), *The Cambridge History of China* (1st ed., pp. 545–607). Cambridge University Press. <https://doi.org/10.1017/CHOL9780521243278.012>
- Page, A. E., & French, J. C. (2020). Reconstructing prehistoric demography: What role for extant hunter-gatherers? *Evolutionary Anthropology: Issues, News, and Reviews*, 29(6), 332–345. <https://doi.org/10.1002/evan.21869>
- Petty, W. (1682). *Essays on mankind and political arithmetic* (H. Morley, Ed.; 1888 edition). Cassell & Company.
<http://archive.org/details/essaysonmankindp00pettuoft>
- Riley, J. C. (2005). Estimates of Regional and Global Life Expectancy, 1800-2001. *Population and Development Review*, 31(3), 537–543.
<https://doi.org/10.1111/j.1728-4457.2005.00083.x>
- Sánchez-Romero, M., Ediev, D., Feichtinger, G., & Prskawetz, A. (2017). How many old people have ever lived? *Demographic Research*, 36, 1667–1702.
<https://doi.org/10.4054/DemRes.2017.36.54>
- Scheidel, W. (2001). Progress and Problems in Roman Demography. In W. Scheidel (Ed.), *Debating Roman Demography* (pp. 1–81). BRILL.
https://doi.org/10.1163/9789004351097_002
- Schlebusch, C. M., Malmström, H., Günther, T., Sjödin, P., Coutinho, A., Edlund, H., Munters, A. R., Vicente, M., Steyn, M., Soodyall, H., Lombard, M., & Jakobsson, M. (2017). Southern African ancient genomes estimate modern human divergence to 350,000 to 260,000 years ago. *Science*, 358(6363), 652–655.
<https://doi.org/10.1126/science.aao6266>
- Tattersall, J. (1996). How many people ever lived? In R. Calinger (Ed.), *Vita mathematica: Historical research and integration with teaching* (pp. 331–337). Mathematical Association of America.
- Thomlinson, R. (1967). *Demographic Problems: Controversy Over Population Control*. Dikenson Publishing Company.
- Trussell, J. (2011). Contraceptive failure in the United States. *Contraception*, 83(5), 397–404. <https://doi.org/10.1016/j.contraception.2011.01.021>
- UN. (2019). *World Population Prospects—Probabilistic Projections, Total Population* [Dataset]. United Nations, Department of Economic and Social Affairs.
<https://population.un.org/wpp/Graphs/Probabilistic/POP/TOT/900>
- Westing, A. H. (1981). A Note on How Many Humans That Have Ever Lived. *BioScience*, 31(7), 523–524. <https://doi.org/10.2307/1308496>
- WHO. (2020). *Life expectancy at birth (years)* [Dataset]. WHO.
[https://www.who.int/data/gho/data/indicators/indicator-details/GHO/life-expectancy-at-birth-\(years\)](https://www.who.int/data/gho/data/indicators/indicator-details/GHO/life-expectancy-at-birth-(years))
- Wikipedia. (2022). History of coffee. In *Wikipedia*.
https://en.wikipedia.org/w/index.php?title=History_of_coffee&oldid=1081472613

Winkler, W. (1959). Wieviele Menschen ha-ben bisher auf der Erde gelebt. *International Population Conference*, 73–76.

Zijdeman, R., & Ribeira da Silva, F. (2015). *Life Expectancy at Birth (Total)* (V1 ed.). IISH Data Collection. <https://hdl.handle.net/10622/LKYT53>