

A Literature Review on Extension of Human Life Span

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Abstract: Human life span is observed from birth to death. There is a long-lasting debate about a natural limit to human life span, and it has been argued that the maximum reported age at death, which has not increased for a 25 years, fluctuates around 115 years, even if some persons live beyond this age. We argue that the close connection of species-specific longevity with life history strategies explains why human life span is limited and cannot reach the considerably longer life spans of several other species. Our finding that the mortality of centenarians has not decreased noticeably in recent decades (despite a significant mortality decline in younger age groups) is consistent with this suggestion. However, there is no convincing evidence that we have reached the limit of human life span. The future of human longevity is not fixed and will depend on human efforts to extend life span.

Keywords: Life span, Longevity, Life expectancy.

1. Introduction

The human life span is defined by the longest observed human life from birth to death, it is a figure that has changed over the years. For humans, the current accepted maximum life span is 122 years. This age was achieved by Jeane Louise Calment of France. Until she was exactly 122 years and 164 day7s old. Though there has been claims of longer lives, none of the claims were acceptably documented and verified. Clament remains the first verified person to reach any age between 116 to 122 and the only verified person to reach the age of 122.

A. Humans can live naturally

Humans can live naturally to their life span which means it is highly unlikely any one will ever live for more than 125 years. The countries with largest numbers super centenarians those who are age of 100 may or more. We feel that the observed trajectories are compelling and strongly suggest that human life span has a natural limit.

B. Life expectancy

It is a statistical measure of the average time on organism is expected to live, based on the year of its birth. It is based on by estimate the average age that members of particular population group will when they die. It is perfectly possible that a given

population has a low life expectancy at birth, and has a large proportion of old people. Economic development and the improvement in some social environmental conditions, improved life style, advances in health care and medicine continuous increase in life expectancy at birth during last century. Significant factors in life expectancy include gender, hygiene, diet and nutrition, exercise, life style. In addition, it found that the no any factors are involved in life style after 80 years.

C. Life span from the 1800 to today

From the 1500s onward, till around the year 1800, life expectancy throughout Europe hovered between 30 and 40 years of age. Since the early 1800s, Finch writes that life expectancy at birth has doubled in a period of only 10 or so generations. Improved health care, sanitation, immunizations, access to clean running water, and better nutrition are all credited with the massive increase. Though it's hard to imagine, doctors only began regularly washing their hands before surgery in the mid-1800s. A better understanding of hygiene and the transmission of microbes has since contributed substantially to public health. Disease was still common, however, and impacted life expectancy.

D. Humans can live longer

Humans can live longer around the world. There has some ups and downs, at life expectancy at birth overall has been steadily increasing for many years. It has more than doubled in the last two centuries. The increase was previously driven by reductions in mortality. But since around the 1950s, the main driver has been reductions in mortality at older ages. In Sweden for example where national population data have been collected since the mid-16th century and are of a very high quality, the maximum lifespan has been increasing for almost 150 years. Increasing lifespans have been observed in many other countries, including in Western Europe, North America and Japan.

Life expectancy can be increased simply by going outside. See, what happens when you go outside is that your skin gets exposed to sunlight. That exposure triggers cells in your skin to produce vitamin D. This vitamin is essential for bone health and

is turning out to be important in depression, heart disease, diabetes, and just about everything. Some estimate that 50% of adults have low levels of vitamin D because we simply don't get outside that much (sitting by a window doesn't count, the glass filters too much of the sunlight). This is a shame because maintaining vitamin D levels has to be the easiest and cheapest way to improve your health and increase your life expectancy.

E. *Surviving past 100 years*

Although these upward lifespan trends widespread, they are not a given. Recent improvements in Danish mortality after a period of stagnation has led to the suspicion that centenarian lifespans could be increasing there. This is rather different from what has been recently observed in Sweden, where there has been some slow down at the highest ages. Denmark and Sweden are similar in many ways, yet these lifespan trends are very different. The disparity could be due to several causes, which are not easy to fully disentangle. But we have a few ideas. Although Sweden generally has lower mortality rates than Denmark at most ages, no evidence of an increase in Sweden was not found in recent years. In Denmark, however, the very oldest were observed to die at higher and higher ages, at the age at which only 6% centenarians survive rose consistently over the period.

F. *Possible life span*

The observed expression of the life span and not to the span of life itself. The actual length of life itself is shorter than the possible life span, since the former reflects the effect of unfavorable environmental factors. In the absence of any biological data from which the maximum limit of the span of life can be determined precisely, an estimate of the limit must be obtained from observation of the actual length of life of persons who already have died. But such observations cannot establish a fixed limit for the span of life. Some malformations like cardiovascular defects are developmental rather than genetic in the strict of the word and can be corrected so that the length of life of such persons is extended.

In the past the length of life of most individuals has been considerably shorter than the possible span of life because of unhealthful environmental factors. As these factors are increasingly brought under control or eliminated, the actual length of life will approach more closely the life span.

G. *Longevity*

Longevity is defined as long life or great duration of life. The term comes from Latin word longevity. Long life implies longer than something and that something is the average life span. If any person can live longer than the average person, then you could be said to have longevity. Striving for your maximum potential age is the goal of longevity. Its very possible that humanity true longevity may be much higher. Humans might live if they can create the ideal conditions of a healthy diet and exercise. Don't smoke, don't binge drink, eat a healthy diet and take regular exercise. This can add 10 years to your life.

Maintain and develop strong social networks, with family or friends. Some studies suggest this has a protective effect on health. Take advantage of any educational opportunities available in your adult life, even if you didn't do well at school. This seems to have health benefits. Life expectancy can be messed up by stress in two major ways. The first way is through the direct, unhealthy effects of stress on your body in the long term. The second way stress may shorten your life expectancy is through the negative behaviors that being stressed triggers. These behaviors include comfort eating and smoking. Learn to relax through de-stressing techniques or meditation to keep your life expectancy.



Fig. 1. Some of the longest living people

H. *Ways for maximize longevity*

- Exercise regularly.
- Best and good nutrition food with vegetable in diet can increase life span.
- People should get enough sleep.
- Carefully manage stress and avoid unhealthy effects on body.
- Avoid unhealthy behavior, as well as over eating and smoking.

Life span in 2014: He added that the amount of the decrease in life expectancy is actually less alarming than the fact that addiction and a decline in the emotional wellbeing of Americans have been significant enough to drag down the country's average length of life.

The research points to the opioid epidemic, backing up a CDC report from last year that linked the drop directly to a 21% increase in overdose deaths from the year before and cited a 137% increase in opioid-related deaths between 2000 and 2014. The increase in deaths caused by drugs and alcohol, particularly among white Americans, is "unclear, complex, and not explained by opioids alone," according to Woolf.

I. *Maximum life at now-a-days*

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Extending life beyond about 125 would require new science beyond simply improving people’s health, the paper said, noting that some potential techniques were currently being explored. Evidence shows that alcoholism or chronic alcohol consumption can cause both in which symptoms of aging appear earlier than normal index in which the symptoms appear at the appropriate time but in a more exaggerated form. The effects of alcohol abuse/misuse on the aging process include hypertension, cardiac dysrhythmia, cancers, gastrointestinal disorders, neurocognitive deficits, bone loss, and emotional disturbances especially depression. On the other hand, research also shows that drinking moderate amounts of alcohol may protect healthy adults from developing coronary heart disease. The American Heart Association cautions people not to start drinking, if you are not already drinking

J. *Maximum life expectancy*

Since the 19th century, average life expectancy has risen almost continuously improve health, diet, the environment and other areas. But when the researchers looked at survival improvements since 1900 for people aged and above, they found that gains in survival peaked at around 100 and they declined rapidly, regardless of the year people were born. The researchers calculated 125 years as the absolute limit of human lifespan. In other way that the probability in a given year of seeing one person live to 125 anywhere in the world is less than 1 in 10000. Further progress against infectious and chronic disease may continue average life expectancy but not the maximum life span.

Maximum life span here means the life span of the most long lived 10 percent. Caloric restriction has not yet been shown to break world record for longevity. Based on the diet like which an increase lifespan like nutrients, fruits, healthy drinks etc.. India also recorded an improvement in life expectancy at birth. The life expectancy at birth in 1969 was 47 years and in 2019, it is 69 years. India’s populations in 2019 stood at 1.36 billion, growing from 942.2 million in 1969.

Longitudinal variations of physiological indices, such as complete blood counts (CBC), along individual aging trajectories revealed a linear increase of the organism state fluctuations range with age. The broadening could be explained by a progressive loss of physiological resilience measured by the individual blood factors inverse auto-correlation times. Extrapolation of this data suggested that organism state recovery time and variance would simultaneously diverge at a critical point of 120 – 150 years of age corresponding to a complete loss of resilience and hence should be incompatible with survival. The criticality resulting in the end of life is an intrinsic biological property of an organism that is independent of stress factors and signifies a fundamental or absolute limit of

human lifespan

K. *Women’s live longer than men*

Everywhere in the world women live longer than men, we know that biological, behavioral and environmental factors all contribute to the fact that women live longer than men. This male –female life span gap is not a new phenomenon. The men can have many factors to decrease life span compared to women are men can smoke, drink, and many physical and mental conditions some life threatening risks like car accidents. May if men cause any cardiac disease he can die but women can survive with cardiac disease. A women’s body has evolved to withstand and bounce back from physical trauma of pregnancy and child birth.

Women generally live longer than males on average by six to eight years. The difference is partly due to an inherent biological advantages. The advantages are overridden by gender based discrimination so that female life expectancy at birth is lower than or equal to that of males. New born girls are more likely to survive to their first birth but the newborn boys cannot. Women tend to have lower rates of mortality at all age. Women longevity advantage becomes become most apparent in old age. Women as a rule normally outlive men, and this was as true in pre-industrial times as today. Reasons for this include smaller bodies (and thus less stress on the heart), a stronger immune system (since testosterone acts as an immunosuppressant), and less tendency to engage in physically dangerous activities. It is also theorized that women have an evolutionary reason to live longer so as to help care for grandchildren and great grandchildren.

2. **Factors affecting life span**

Life expectancy is affected by many factors such as: socioeconomic status, including employment, income, education and economic wellbeing; the quality of the health system and the ability of people to access it; health behavior such as tobacco and excessive alcohol consumption, poor nutrition and lack of exercise; social factors; genetic factors; and environmental factors including overcrowded housing, lack of clean drinking water and adequate sanitation.

A. *Dietary influences*

The Mediterranean Diet has been widely studied and proven through numerous epidemiological studies to contribute to exceptional health and longevity. The main components of this diet are mostly plant-based with the bulk of meals consisting of whole grains, vegetables, fruits, legumes, and moderate amounts of dairy, mainly low-fat yogurt and cheese. Nuts and seeds are regularly consumed and olive oil is the main source of fat. Less often consumed are chicken, fish and eggs, with red meat and sweets rarely eaten. Wine is consumed in moderation and water in copious amounts, typically 1-2 liters each day.

3. Approaches to improve life expectancy

Improvement of life-expectancy with any maneuver essentially depends on:

Severity of disease – Baseline mortality is the most important factor operative on lifespan-gain from any procedure. Diseases with a higher baseline annual mortality rate demonstrated more lifespan gained. Thus, therapeutic maneuvers provide more survival benefit in secondary prevention than primary or primordial prevention. Duration for which intervention is applied – age of the patient.

A. Protein consumption

Weight loss among the 70 and older population is a common occurrence and contributes to increased mortality, limited mobility, frailty, and institutionalization. The current recommendation for optimal protein intake for this population is .8g/kg/day but some research has concluded that protein intake prevents the loss of lean body mass in the elderly when consumed in amounts closer to 1.2 g/kg/day. However, studies have also concluded that protein consumption in excess of .8g/kg/day prior to age 70 can have negative health effects (Gray-Donald et al. 2013).

There are some vegetarians who are "junk food vegetarians." These types of vegetarians eat cheese pizzas and ice cream all day long. That is not good for health or life expectancy. What we mean is the person who is eating lots of vegetables prepared in healthy fats (such as olive oil) while limiting animal products, such as cheese and cream. We'll call this type of vegetarian a "whole foods vegetarian."

The leading cause of death and the number one shorter of life expectancy in the U.S. is heart disease. As your heart ages there can be a build of gunk in your arteries and your arteries themselves can become harder. This causes your blood pressure to rise and your heart to work harder, leaving you at risk for heart disease. Vegetarians (whole foods vegetarians) have some of the best arteries around because eating healthy vegetables avoids bad fats and other unhealthy foods.

B. Genetics

Studies conducted on the aging process have concluded that 20-30% of an individual's longevity is determined by genetics, and the remaining percent is affected by environmental factors that have a direct effect on gene expression

A recent avenue of research related to longevity is the study of epigenetics and the dietary components that have the ability to promote or inhibit the stability of cellular DNA strands and telomere length, thus slowing down or speeding up the aging process. DNA is continuously modifying itself based upon outside environmental factors. Therefore, it is vital to protect DNA in order to prevent or delay a myriad of adverse health conditions by allowing the continuous process of DNA damage and repair to be kept at a minimum, reducing the chances of early cell death and premature aging. Epigenetics is important as it controls the genetic expression by transferring information from the environment to the DNA strand.

C. Gender

According to the Institute and Faculty of Actuaries, mortality rates for females are lower at each age than those of men. Women live longer than men, on average.

The current overall life expectancy for U.S. men is 76.4 years, and 82.9 years for men at age 65. Overall life expectancy for U.S. women is 81.2 years, or 85.5 years for women at age 65. Some studies attribute this gap in part to riskier behavior among men that may lead to higher rates of accidents.

D. Avoid stress

Anxiety and stress may significantly decrease your lifespan.

For instance, women suffering from stress or anxiety are reportedly up to two times more likely to die from heart disease, stroke, or lung cancer. Similarly, the risk of premature death is up to three times higher for anxious or stressed men compared to their more relaxed counterparts. If you're feeling stress laughter and optimism could be two key components of the solution. Studies show that pessimistic individuals have a 42% higher risk of early death than more optimistic people. However, both laughter and a positive outlook on life can reduce stress, potentially prolonging your life.

Life expectancy can be messed up by stress in two major ways. The first way is through the direct, unhealthy effects of stress on your body in the long term. The second way stress may shorten your life expectancy is through the negative behaviors that being stressed triggers. These behaviors include comfort eating and smoking. Learn to relax through de-stressing techniques or meditation to keep your life expectancy.

E. Avoid smoking

Smoking is strongly linked to disease and early death. Overall, people who smoke may lose up to 10 years of life and be 3 times more likely to die prematurely than those who never pick up a cigarette. Keep in mind that it's never too late to quit. One study reports that individuals who quit smoking by age 35 may prolong their lives by up to 8.5 years. Furthermore, quitting smoking in your 60s may add up to 3.7 years to your life. In fact, quitting in your 80s may still provide benefits.

F. Floss daily for a longer life expectancy

When you floss, you help prevent your gums from becoming inflamed. That's a good thing. What is happening when your gums are inflamed is that you have a chronic bacterial infection in your mouth. This harms your arteries through two mechanisms: the bacteria find their way into your arteries and hang out (causing plaques), and your body mounts an immune response to the bacteria in your mouth, causing inflammation (which in turn can cause your arteries to narrow). This makes it hard for your heart to do its job and can lead to heart disease.

G. Eat plenty of healthy plants

Consuming a wide variety of plant foods, such as fruits, vegetables, nuts, seeds, whole grains, and beans, may decrease disease risk and promote longevity. For example, many studies

link a plant-rich diet to a lower risk of premature death, as well as a reduced risk of cancer, metabolic syndrome, heart disease, depression, and brain deterioration. These effects are attributed to plant foods' nutrients and antioxidants, which include polyphenols, carotenoids, folate, and vitamins. Accordingly, several studies link vegetarian and vegan diets, which are naturally higher in plant foods, to a 12–15% lower risk of premature death. Vegetarians and vegans also generally tend to be more health-conscious than meat eaters, which could at least partly explain these findings. Overall, eating plenty of plant foods is likely to benefit health and longevity.

H. Fiber can improve health conscious

Fiber is incredibly important. It leaves your stomach undigested and ends up in your colon, where it feeds friendly gut bacteria, leading to various health benefits. Certain types of fiber may also promote weight loss, lower blood sugar levels and fight constipation.

The recommended daily intake is 25 grams for women and 38 grams for men. However, most people are only eating around half of that, or 15–17 grams of fiber per day. Fortunately, increasing your fiber intake is relatively easy — simply integrate foods into your diet that have a high percentage (%) of fiber per weight. Here are 22 high-fiber foods that are both healthy and satisfying.

I. Develop a good sleeping pattern

Sleep duration also seems to be a factor, with both too little and too much being harmful. For instance, sleeping less than 5–7 hours per night is linked to a 12% greater risk of early death, while sleeping more than 8–9 hours per night could also decrease your lifespan by up to 38 percent. Too little sleep may also promote inflammation and increase your risk of diabetes, heart disease, and obesity. These are all linked to a shortened lifespan. On the other hand, excessive sleep could be linked to depression, low physical activity, and undiagnosed health conditions, all of which may negatively affect your lifespan

J. Turn off TV for longer life

If life expectancy and television watching aren't linked, I'd be shocked. Of course, I can't prove that TV and life expectancy are linked (no one has done a study comparing the life expectancy of TV-watchers and non-watchers, probably because they can't find enough non-watchers for a good study). I really do think that cutting back on television watching would improve most people's health and (therefore) increase their life expectancy. Here a couple of reasons:

- Watching TV makes you inactive. You just sit there burning as few calories as possible, which could lead to weight problems.
- TV makes you eat more junk food. People who are watching TV eat more than those who don't. It's a fact.
- TV makes you antisocial. You are at home, zoned in, instead of talking with real people, face-to-face.
- TV is stressful. The news and many shows are filled with

stressful stories. Avoid these, and you may feel things are not so bad after all.

- TV keeps you from doing other things. This is the big one for me. The average person watches something like four hours of TV.

K. Medicines can increase life span

We deeply invested in the myth that medicine has drastically increased the human lifespan and will continue to do so. As Lieberman pointed out, the health care industry heavily markets its own importance and pushes treating illness over preventing it with lifestyle modification. And humans are lazy; it's easier to take pills than exercise.

L. Metformin

A study by Bannister and co-workers revealed that patients with type 2 diabetes mellitus (DM) initiated with metformin mono therapy not only had 38% better survival than those with DM and treated with sulphonyl urea (0.62, 0.58–0.66), but unexpectedly also survived 15% longer than even matched, non-diabetic controls (0.85, 95% CI 0.81–0.90). This brings out an interesting prospect of metformin as first-line therapy and may imply that metformin may confer benefit even in non-DM.

4. Factors decrease human life span

Smoking is a fantastic way to not only to shorten your life but to reduce your quality of life too.

Not only will smokers have up to 10 years less life on average, they will also suffer from side effects like insomnia shortness of breath and agitation from almost day one. Best of all, they get to pay thousands of dollars a year for these results. And if you want to shorten your lifespan don't think you can let up on smoking as you age—even in middle age or later, when people quit smoking their health improves greatly.

A. Don't exercise

Being a couch potato shortens your life expectancy by as much as 9 years. Basically, when you don't work out regularly, your cells tend to age faster (not to mention the extra weight that seems to stick to you more). Not exercising is also a great way to increase your stress level while decreasing your energy level. Not exercising even helps you not fall asleep at night.

B. Dislike aging

People can get really worked up about growing older. It makes them depressed and even angry (they look at aging as "unfair" in some way). Turns out those attitudes are a great way to avoid excessive aging. People with a negative attitude toward aging live more than 7 years less than those with a very positive attitude. So if aging really bothers you, dwell on it a lot and maybe you won't have as many birthdays to worry about.

C. Don't get screened

Many people say "they just don't want to know." Avoiding these tests is another fantastic way to shorten your life. By

avoiding screening, you can also avoid accessing the fabulous advances in early treatment and diagnosis that have saved millions of lives.

D. *Be stressed*

Being stressed is a fantastic way to shorten your life. Not only does chronic stress damage tissues in the body through the continual exposure to harmful stress hormones, but it also makes you no fun to be around and even interferes with your sleep. This can lead to having fewer friends and a negative outlook.

E. *Based on disease*

1) *Glaucoma*

Glaucoma (primary open-angle glaucoma) is associated with aging. Glaucoma is characterized by loss of visual field, changes in the appearance of the optic nerve, and increased intraocular pressure (pressure higher than a given eye can tolerate). Intraocular pressure is regulated by a balancing of the rate of aqueous humor formation and the rate at which it leaves the eye, filtering through the trabecular meshwork. In glaucoma, ultra-structural factors in the meshwork slow the filtration and increase the intraocular pressure.

Clinical observations have suggested that the prevalence of glaucoma is greater in blacks than in whites. Recent findings of a large, well-designed survey in Baltimore indicate that the overall prevalence of glaucoma among blacks is 5.8%, distributed as follows: in 1.9% of those aged 40–49, 4.7% of those 50–59, 7.4% of those 60–69, and 12% of those aged 70 and older. Data from a comparable white population are under analysis.

A morphometric study of trabecular meshwork specimens collected from normal eyes demonstrated a progressive decrease in cellularity with aging (Alvarado et al., 1981). Comparable measurements of tissues from glaucomatous eyes indicated that the process is accelerated in glaucoma (Alvarado et al., 1984a,b), which suggests premature aging of the meshwork in glaucoma.

F. *Diabetic retinopathy*

Diabetic retinopathy affects the central macular area of the retina—the region of greatest visual acuity—more severely than peripheral areas. Major clinical signs of retinopathy are closure of blood vessels, vessel leakage, and growth of new vessels that tend to be fragile and leaky. The resulting hemorrhages often lead to scar-tissue formation, tension on the retina, its detachment, and blindness.

Some 90% of people with insulin-dependent diabetes that has lasted 15 years show some degree of retinopathy; after 30 years, about 50% have proliferative retinal vascular changes. To the extent that diabetes can be attributed to environmental factors such as diet, diabetic retinopathy might be avoidable.

G. *Related macular degeneration*

Aging-related macular degeneration, formerly known as senile macular degeneration, affects the central high-acuity area

of the retina and leads to severe loss of vision. The disease is a major cause of visual impairment in people over 60. About 90% of elderly people have some form of retinal degeneration. Most of them have the mild “dry” or non-exudative type, which generally progresses slowly. In the more severe “wet” form of the disease, exudative maculopathy, neovascularization occurs abnormal new vessels grow inward from the choroid, through Bruch's membrane, and lie beneath the retinal pigment epithelium.

H. *Induce disease and disorders*

The neurologic effects of aging and of chemical substances overlap considerably. This overlap might indicate only that the nervous system has a limited repertoire of biologic expression or that the mechanisms involved in neural aging can be traced to toxic effects of circulating metabolites derived from both endogenous and exogenous sources.

Specific environmental influences (such as effects of exposure to chemical toxicants and environmental toxins) on aging have been proposed as a general mechanism for the cause of major degenerative diseases of the elderly that affect intellectual and motor function dementia of the Alzheimer type, Parkinson's disease, and amyotrophic lateral sclerosis are proposed to derive from environmental subclinical damage to specific regions of the central nervous system that are particularly vulnerable to age-related neuronal attrition. For parkinsonism, the hypothesis is being tested in people with subclinical damage to the substantia nigra after exposure to. Because nigral neurons decline with age, it is likely that characteristic features of the disease will evolve in later life.

I. *Bone deficiency*

One of the major problems associated with aging is the loss of bone mass. It is estimated that upwards of 10 million elderly Americans suffer from marked reduction in bone mass that compromises the architectural integrity of the skeleton and puts them at substantial risk of breaking bones. One loss in the elderly has many causes; among them are inadequate vitamin D and calcium absorption (influenced by estrogen concentration). Although it is well documented in Great Britain (a country that does not routinely fortify foods with vitamin D) that over 40% of males and 30% of females with hip fractures are deficient in vitamin D (Aaron et al., 1974; Chalmers et al., 1967), it has been assumed that vitamin D deficiency is not an important health problem in the United States because foods are fortified with vitamin D.

If an elderly person does not consume milk or other foods that contain vitamin D or take a vitamin D supplement, it is essential for that person to sunbathe to generate enough vitamin D3 to maintain a healthy skeleton. However, because of the increased awareness that exposure to sunlight can cause skin cancer and dry and wrinkled skin, the elderly is often advised to cover their skin with clothing or a sunscreen before going outdoors. Those measures prevent not only the damaging effect of solar irradiation, but also the beneficial effect the production

of vitamin D3 in the skin.

5. Conclusion

Over the past 25 years, life expectancy has been rising in the United States at a slower pace than has been achieved in many other high-income countries. Consequently, the United States has been falling steadily in the world rankings for level of life expectancy, and the gap between the United States and countries with the highest achieved life expectancies has been widening. Life expectancy at birth in the United States for both sexes combined now ranks 28th in the world, just behind the United Kingdom, Korea, and Malta and more than 2 years behind Australia, Canada, France, Iceland, Italy, Japan, and Switzerland.

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