Peiran Zhang,
Miss Hall's School, Pittsfield, MA
E-mail: peiran.zhang@misshalls.org

AN INVESTIGATION OF THE CAUSES BEHIND LONGEVITY

Abstract. Life expectancy around the globe is a significant indicator for living conditions, economic development, healthcare system, and equality in society. The data used in this research includes information on life expectancy among 223 countries and different genders. By comparing the disparity between regions and genders, along with other resources, we can investigate the impact of different aspects on people's lives. These aspects include prosperity, the healthcare system, and living style. It has been found that several biological and psychological factors – including social expectations, influences of masculinity and femininity, and living and working conditions – might contribute to the differences between genders. The goal of the analysis is to reveal the causes behind the difference in people's longevity. These causes are hopefully thought-provoking and can help people and governments make decisions in different areas.

Keywords: life-expectancy, health, gender, country.

Introduction

As humans, life expectancy is an important indicator of living standards, medical advancement, access to education, economic security, and government effectiveness. Due to various external factors, however, the expected length of life could vary depending on our living regions or genders.

The dataset used in this research is from the world health organization in 2019. It contains 6 columns and 223 Rows. Each row represents a country with their life expectancy rank. Out of the 6 columns, 4 have the numeric data-type. They are "Rank", "Overall Life Expectancy", "Male Life Expectancy" and "Female Life Expectancy". The two object-type columns are "Country" and "Continent" which shows where the country is located. The male and female life expectancies are shown separately for each country which poses interesting questions for analysis. The data include 223 unique values in the "Country" column which includes several non-sovereign entities. The countries correspond to six continents that are "Europe", "Asia", "Oceania", "North America", "Africa", and "South America".

While analyzing the differences, it's been found out that there are factors that might play an important role here. Intriguing what actually causes the differences between life expectancy, with the use of data analysis, the real cause of this discrepancy in life expectancy and the intersections of factors that might have affected the results have been further investigated.

Analysis

Since the life expectancy data vary due to countries and genders, in order to better analyze the data, different plots were made to visualize different countries and genders. With the data collected and the results shown by graphs, the analysis will help explain what various psychological factors might contribute to the differences.

The (Figure 1) below shows the histogram of "Overall life expectancy", "female life", "male life", and "Continent". They illustrate the distribution of data in these four columns. Female life expectancies, peaking around 80, are 5–10 years longer than their counterparts, in general. Europe, Asia, and Africa have the most data due to their population size.
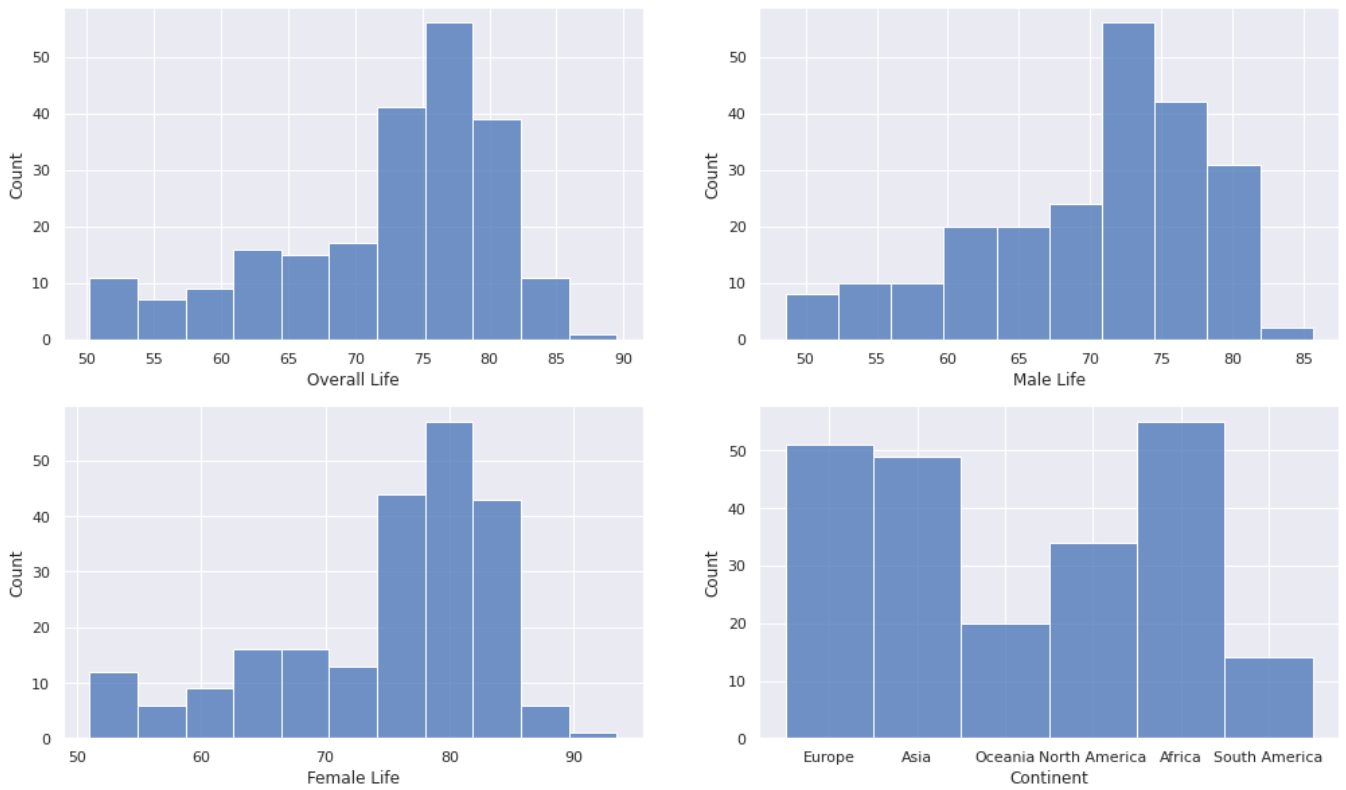
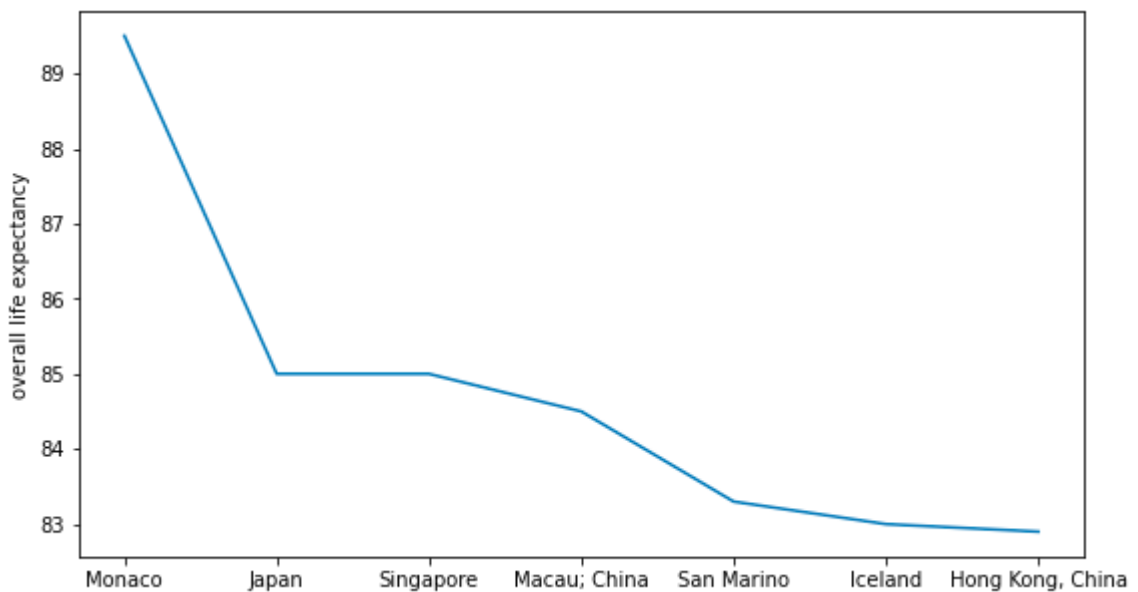Figure 1. Histogram of every feature column in the dataset

Figure 2. Overall Life-expectancy

As (Figure 2) shown above, people residing in different countries have different life expectancies, and the Top 5 are Monaco, Japan, Singapore, Macau(China), and San Marino, ranging from 89.5 to 83.3. According to the research, the differences of life expectancy among countries could simply be attributed to the differences in diet, public health, and healthcare services. For instance, the sanitation conditions include the access to clean drinking water which is crucial for one's living condition;

the medical services allow its citizens to receive appropriate medical treatments, and the healthy eating habits contribute to the wellness of people. In Monaco, for instance, people have an overall life expectancy around 89.5, the longest in the world. Monaco is located along the Mediterranean Sea, with its economic prosperity and a temperate climate, people there have access to the healthiest diet – seafood, fruit, and vegetables, which thus leads to the rise of life-expectancy. Monaco also offers an excellent healthcare system. Another example is Japan, whose overall life-expectancy is 85, the second longest. Due to its location, Japanese people enjoy seafood and vegetables on a daily basis; in addition, people there tend to be better at controlling the portion of their diets, helping them to live healthier than others. The other example that emphasizes the importance of healthcare systems in countries is Singapore. People in Singapore check for their health periodically, which helps in discovering chronic illness as well as ensuring overall health. As these three countries demonstrated above, having balanced diets and quality healthcare systems can help boost the overall life-expectancy of citizens. In addition, the reduction of inequality, social-political and economic improvement, female education, civil society organizations, political participation, and social security all reflect on a country's overall wealth and prosperity. The inequalities of wealth between countries have also led to the differences in life-expectancy. There's an example of how poverty influences life-expectancy. According to the data provided by the WHO, among the top 30 countries which have higher life-expectancies, most of them are from Europe, some of them are from Asia, North America, and Oceanic, but none of them are from Africa. Due to the harsh conditions African people live in, most people there are living in environments that hardly provide basic sanitation. Since it's hard for them to access clean water or fresh meals, the life-expectancy is unable to increase. For wealthier countries, on the contrary, they are able to provide

higher standards of living for their citizens and invest more in healthcare systems to improve its efficiency. Only countries that are able to address these problems, could their citizens' overall life-expectancy increase. However, that doesn't mean that all wealthier countries tend to have higher life-expectancy, or countries that have lower income couldn't achieve higher life-expectancy; there're still a few exceptions such as the United States, which only has a 79.8, ranked at the 43rd, and Jersey, which has a 81.9 of overall life-expectancy at the 18th. The overall life-expectancy, in fact, is truly based on the combination of these factors. Countries with lower income can also achieve higher life-expectancy by investing more in healthcare systems, committing to support the health of their people, ensuring social equality and community participation, and providing equivalent education opportunities for women. With effective policies issued to maintain the country's overall stability, the health of citizens could then be improved.

In terms of the discrepancy between genders' life expectancy, biology and psychology play a huge role. In general, females have higher life-expectancies than males. For almost all the countries listed above, females' life-expectancies in average are much higher than males'. mostly, as the histogram shows, females tend to have a 5–6 years more lifespan than males. The average of life-expectancy for males concentrates more on the range from 70.8 to 74.5 and reaches 85.6 as its highest, but for females, it concentrates more on the range from 76.50 to 80.75 and even reaches 93.5 as the highest. Many factors might contribute to this distinction, which are all influenced by the physiological and psychological differences between men and women. Females face a lower death rate; they have a second X chromosome which could compensate for the mutation of the first one – something that males (with only one X chromosome) can't. In addition, reproduction contributes to longevity – the needs of pregnancy prevents females from overeating; the estrogen they have is also believed to help protect them

from heart diseases. The testosterone, on the other hand, has contributed to violence and risky behaviors that males often take, like smoking, drinking, illegal abuse, and hazardous occupation. These behaviors eventually lead to a higher mortality rate(about 25–30 percent higher than females). However, the gap between females and males is narrowed in some underdeveloped countries.
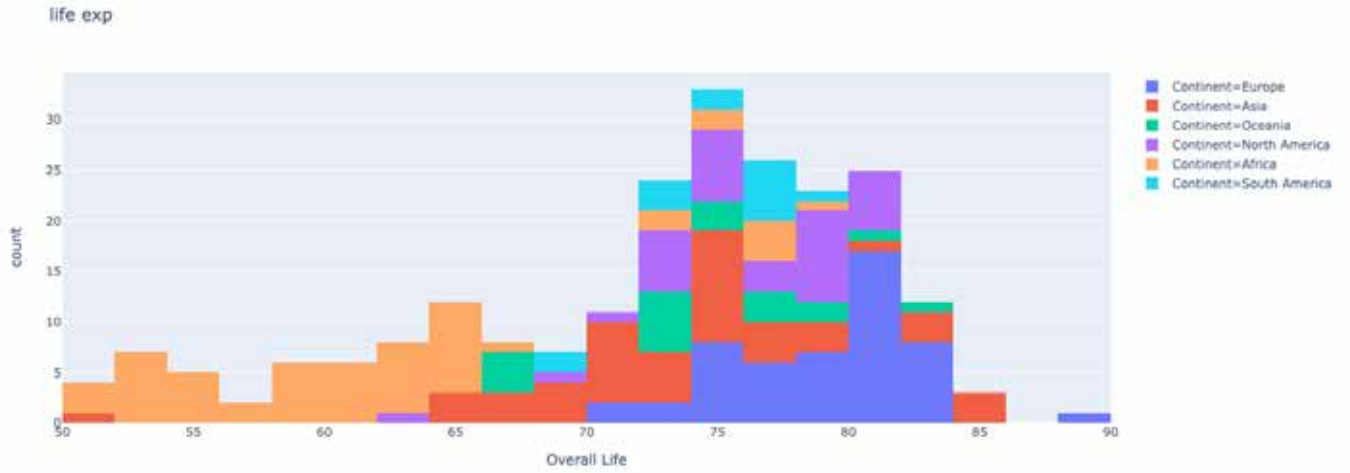

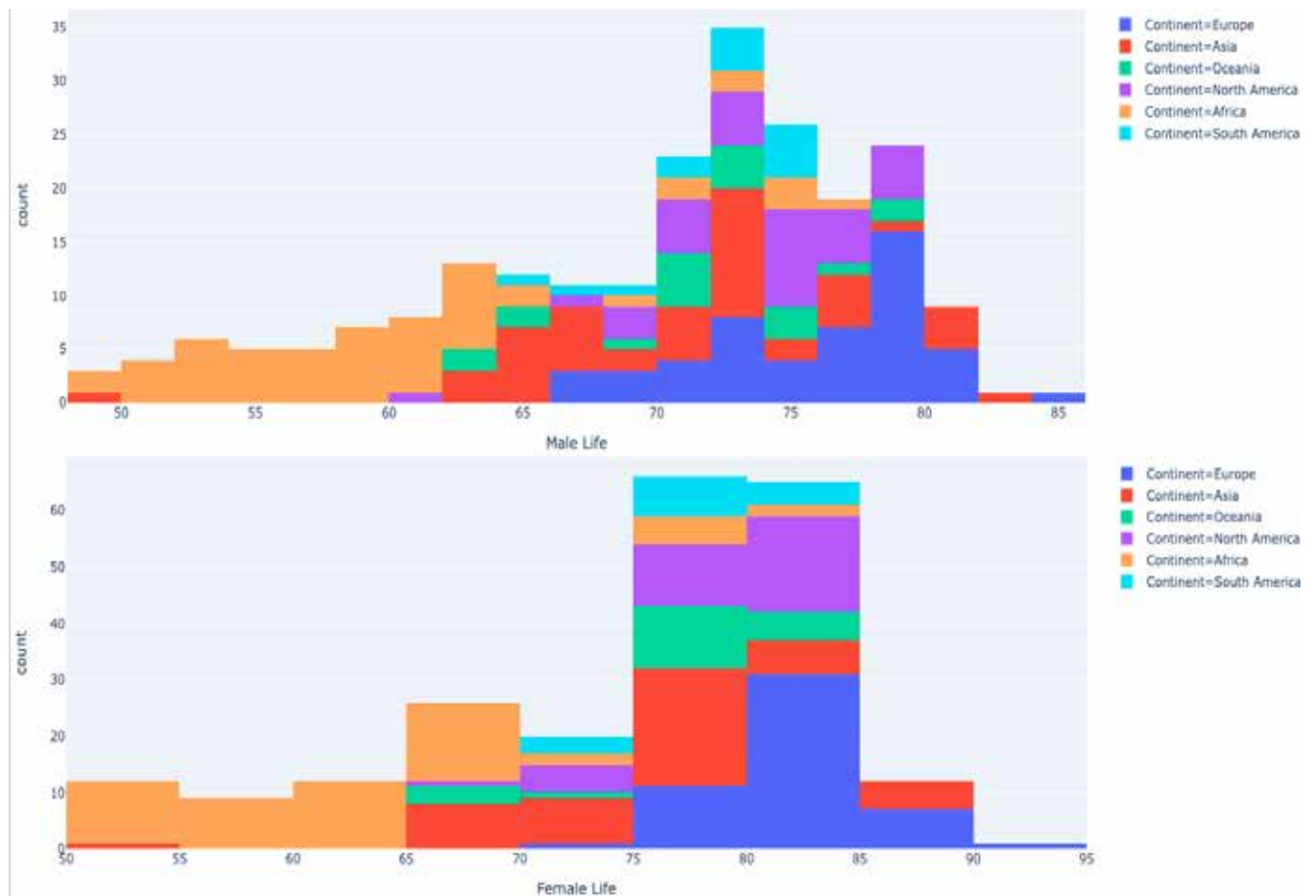Figure 3. Histogram of overall life-expectancy colored by continent

Figure 4. Histograms of female and male life expectancy colored by continent

As Figure 3 and Figure 4 show above, when the life expectancy of females and males has then been categorized based on the continents, it's clear that Africa and some parts of Asia have the lowest life expectancy, no matter for the graph of overall life, male life or female life. Part of this might be due to poverty which hinders countries from providing quality healthcare systems. It's obvious that Europe and some other parts of Asia have the highest life expectancy in either males or females, which exemplifies how prosperity of a country play a role here (and also the high level of economic inequality exists among Asian countries); despite that, in these underdeveloped countries, the equality among genders is still lacking, so the status of women might nullify the differences of life expectancy among genders as other countries might have. Females did not live longer than males, back in the 19th century; but in many countries nowadays, they outlive males, though they are more likely to become victims of crimes. This might largely be attributed to the social changes and progress. Women's status has been improved, which widens the female advantage in life expectancy. The social expectation towards masculinity gives rise to men's risky behaviors – like participating in dangerous jobs and engaging in perilous activities; women, however, who tend to overestimate the risk, are thus more likely to engage in deeper conversations with their doctors, which enables them to benefit from current medical advances and to prevent life threatening diseases. Compared to women, while having health issues, men are less likely to go to see a doctor, which prevents early detection and might even worsen their conditions – especially when dealing with mental illness. According to the research, people with severe mental health disorders might experience a 5–10 years reduction in longevity; it is important to talk about and share feelings, as most women do, when facing a problem; but as men often suffer from stress but tend to avoid communication, a higher suicide rate casued by their disengagement might then contribute to their higher mortality. In conclusion, there's not a single factor that could directly lead to the higher life expectancy of females; it is the combination of all the reasons mentioned above that contributes to this difference between genders, under the same living conditions.

Conclusion

Through analyzing the life expectancy based on the data provided by the WHO in groups, it has been found that the intersection of multiple factors might play a role in the disparity of life expectancy among humans. Differences among countries might be caused by their economic capability, effectiveness of the healthcare system, and living conditions and styles; differences between genders might be associated with physiological and psychological differences, gender roles, and personal characteristics. Only by understanding the differences and their causes, people could eventually address these issues and enjoy healthy and enriched lives.

References:

1. Freeman T., Gesesew H. A., Bambra C., Giugliani E. R. J., Popay J., Sanders D., … & Baum F. Why do some countries do better or worse in life expectancy relative to income? An analysis of Brazil, Ethiopia, and the United States of America. International journal for equity in health, – 19(1). 2020. – P. 1–19.
2. Stibich M. Learn How Aging Is Different for Men and Women. Verywell Health. January, 28. 2020. URL: https://www.verywellhealth.com/is-aging-different-for-men-and-women-2224332
3. Hull M. Mental Health's Impact on Life Expectancy. The Recovery Village Drug and Alcohol Rehab. November 29. 2021. URL: https://www.therecoveryvillage.com/mental-health/news/mental-health-impact-on-life-expectancy

4. Golden Charter. Which countries have the longest life span and why? | Golden Charter. Goldencharter. Co.Uk. January 24. 2017. URL: https://www.goldencharter.co.uk/news-and-info/2017/which-countries-have-the-longest-life-span-and-why

5. World Health Organization. (2018). Life expectancy and Healthy life expectancy, data by WHO region. WHO, Geneva [accessed 6 apr 2019]. URL: http://apps. who. int/gho/data/view. main. SDG-2016LEXREGv

6. Mayor E. Gender roles and traits in stress and health. Frontiers in psychology,– 6. 2015.– 779 p.

7. Desjardins B. Why is life expectancy longer for women than it is for men?. Scientific American,– 291(6). 2004.– P. 120–120.

8. Ortiz-Ospina E. & Beltekian D. Why do women live longer than men. Our World in Data. 2018.

9. Yin S. Gender disparities in health and mortality. Population Reference Bureau. 2007.

10. Assari S. If men are favored in our society, why do they die younger than women. The Conversation,– 8. 2017.

11. Luy M. & Minagawa Y. Gender gaps-Life expectancy and proportion of life in poor health. Health Reports,– 25(12), 2014.– 12 p.