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Written Report

Gender Differences in Life Expectancies Across U.S. States

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Introduction

Life expectancy is the average number of years a person is expected to live. For this research project, we wanted to explore the differences in life expectancy between men and women across the United States. It can reflect factors such as access to healthcare, lifestyle habits, environmental conditions, and disease prevention. Differences in life expectancy can also show health inequalities between groups and locations. Because of this, studying life expectancy helps researchers and policymakers better understand where health systems are working well and where improvements are needed.

For our research project we wanted to explore the differences between men and women life expectancies across the United States. One of the reasons we wanted to research this was because of the increasing gap between life expectancy between these two genders. It is said that women on average live longer than men and have the tendency to have lower cardiovascular and lung cancer rates due to differences in smoking. Learning this we thought it would be important to understand how each state compares in life expectancy between men and women. This could show us health gaps between states and can be used to make better health care policies. For example, once we know what states are doing well in terms of healthcare, we could use this information and implement better practices in states that are not doing as well.

Area	Total Rank	Total Life Expectancy (years)	Male Rank	Male Life Expectancy (years)	Female Rank	Female Life Expectancy (years)
Hawaii	1	79.9	1	77	1	83.1
Massachusetts	2	79.6	2	76.9	2	82.2
Connecticut	3	79.2	4	76.3	3	82
New York	4	79	7	76.3	4	81.6
New Jersey	5	79	5	76.3	5	81.6
Minnesota	6	78.8	3	76.3	6	81.4
New Hampshire	7	78.5	8	76.1	9	81.1
Rhode Island	8	78.5	9	75.9	10	81
Vermont	9	78.4	11	75.7	8	81.2
Georgia	41	74.3	41	71.6	41	77.1
South Carolina	42	73.5	42	70.4	43	76.7
New Mexico	43	73	46	69.4	42	77
Oklahoma	44	72.7	43	70	45	75.6
Arkansas	45	72.5	44	69.7	46	75.6
Tennessee	46	72.4	47	69.4	47	75.5
Kentucky	47	72.3	45	69.6	49	75.3
Louisiana	48	72.2	49	68.8	44	75.9
Alabama	49	72	48	68.9	48	75.3
West Virginia	50	71	50	68.1	51	74.2
Mississippi	51	70.9	51	67.7	50	74.3

Figure

1: 2021 Exported Data from the Centers for Disease Control and Prevention (CDC)

Methodology

To study the difference in life expectancy between men and women in the United States, we used 2021 data from the Centers for Disease Control and Prevention (CDC). The data included life expectancy values for both men and women in all 50 states and Washington, D.C., giving us a total of 51 total observations. Life expectancy for men and women was the dependent variable, and the independent variable was the U.S. state. We created a new variable called the life expectancy gap by subtracting male life expectancy from female life expectancy for each state. To test our idea that women live longer than men, we ran a paired one-tailed t-test in R. This test was used because male and female life expectancy values come from the same state. Our null hypothesis stated that there is no difference in life expectancy between men and women, while our alternative hypothesis stated that women live longer than men on average. This test assumes that the data are paired, the differences are roughly normally distributed, and that each state's data is independent. After confirming a significant difference, we used a linear regression to see if states with lower overall life expectancy had larger gaps between male and female life expectancy. We also created graphs, including a box plot and a scatter plot with a trend line, to help visualize and explain our results.

Data

To test our hypothesis, we analyzed life expectancy data from a 2021 report published by the Centers for Disease Control and Prevention (CDC), which includes gender-specific life expectancy estimates for all U.S. states and Washington, D.C. The dependent variable, life expectancy of men and women, relies on the independent variable, states across the U.S. The

data is also ranked from 1 to 51 with 1 being the state with the most life expectancy and 51 the least. Hawaii is at the number one ranking for both men and women with a life expectancy of 77 and 83.1 years respectively. Mississippi is 51 with a life expectancy of men and women at 67.7 and 74.3 years respectively. This shows us that women have a higher life expectancy in the top and bottom most ranking. The mean for women life expectancy is about 79 years and for men 73, which confirms that women tend to outlive their male counterparts. Something interesting about the data is that men and women have the same ranking for life expectancy. For example, both genders at number 1 in Hawaii, then 2 in Massachusetts, and the trend is consistent going all the way down to 51, which shows that men and women tend to follow a similar pattern with life expectancy in each state.

Results

The results of our tests proved our hypothesis. We ran a T-test in R, which returned $t = 68.011$. This is a large t value, meaning that there was a large difference between male and female life expectancies across all states. Additionally, the mean difference in female and male life expectancies was 5.68 years. There was a 95% confidence interval that the true population mean is greater than 5.54 years. This proves our hypothesis that women on average live over 5 years longer than men across the United States.

Once we had proven our hypothesis, we went a step further to see if states with lower average life expectancies had a larger female-male expectancy age gap. We ran a linear regression test and found that there is evidence that the gap increases as average life expectancy decreases. Our p-value was extremely low, at $7.688e-06$, which rejects our null hypothesis that there is no relationship between average life expectancy and age gap. The correlation was -0.577, which shows a moderately strong negative linear relationship. These findings back up our initial assumption that there is a negative relationship between average life expectancies and female-male expectancy age gaps. Our findings are visualized through a box-plot and a graph.

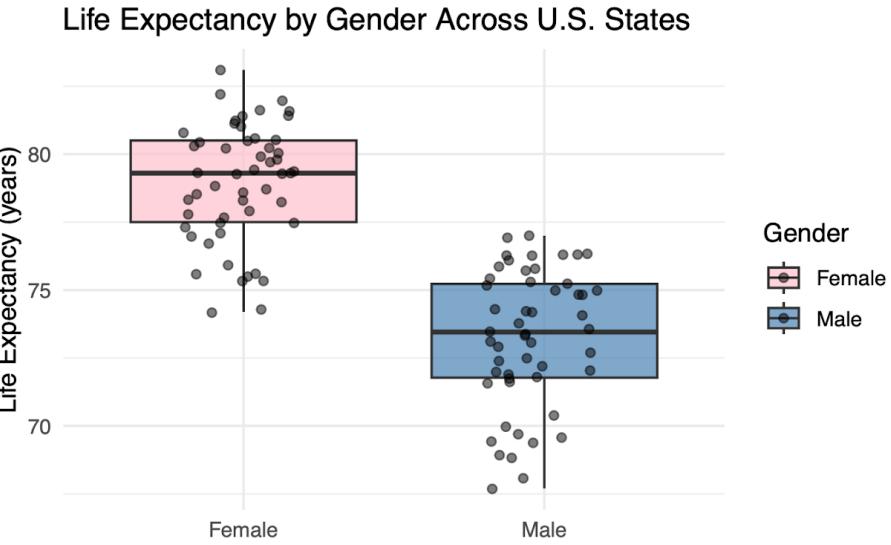


Figure 2: Life Expectancy by Gender Across U.S. States

Gender Life Expectancy Gap vs Total Life Expectancy by State

States with lower total life expectancy tend to have higher female-male gaps

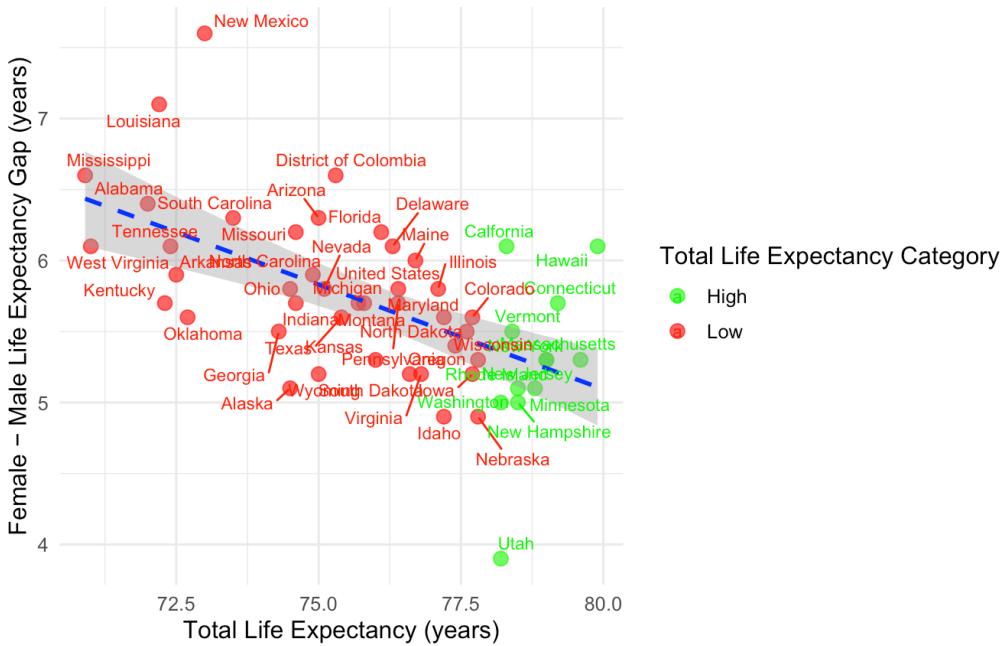


Figure 3: Gender Life Expectancy Gap vs. Total Life Expectancy by State

Discussion

The results of this study support our original hypothesis that women live longer than men across the United States. The paired t-test showed a strong and statistically significant difference in life expectancy, with women living about 5.7 years longer than men on average. This difference appeared in every state, showing that the life expectancy gap is a nationwide pattern rather than a result of just a few states. The box plot also showed that women generally have higher and more consistent life expectancy values, while men's life expectancy is lower and varies more across states. These findings match previous research, including a 2023 study published in JAMA Internal Medicine, which found that the life expectancy gap between men and women reached its highest level in decades during this same time period.

In addition to confirming the gender difference, our regression results showed that states with lower overall life expectancy tend to have larger gaps between women and men. This means that as total life expectancy decreases, the difference between female and male life expectancy increases. The JAMA study helps explain this pattern by showing that men are more affected by factors such as heart disease, drug overdoses, unintentional injuries, and COVID-19 deaths. These causes of death were found to increase the life expectancy gap, especially in recent years. Other factors, such as higher smoking rates, stress, dangerous or physically demanding jobs, and limited access to healthcare, may also affect men more strongly than women in certain states. However, while our study and the JAMA study show strong relationships, they both show correlation rather than causation. This means we cannot say for sure which factors directly cause the life expectancy gap to increase.

Conclusion

In conclusion, this study shows that women live longer than men in every U.S. state, and that the gap between women's and men's life expectancy is larger in states with lower overall life expectancy. Using CDC data and statistical tests, we found strong evidence supporting our hypothesis, with women living over five years longer than men on average. These results show important health differences based on gender and location, and they suggest that improving overall health conditions could also help reduce the life expectancy gap between men and women. While this study gives useful information, future research could look at other factors such as income, pollution, health habits, and access to healthcare to better understand why these differences exist. Learning more about these factors could help leaders create better health policies and improve life expectancy for everyone.

References

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