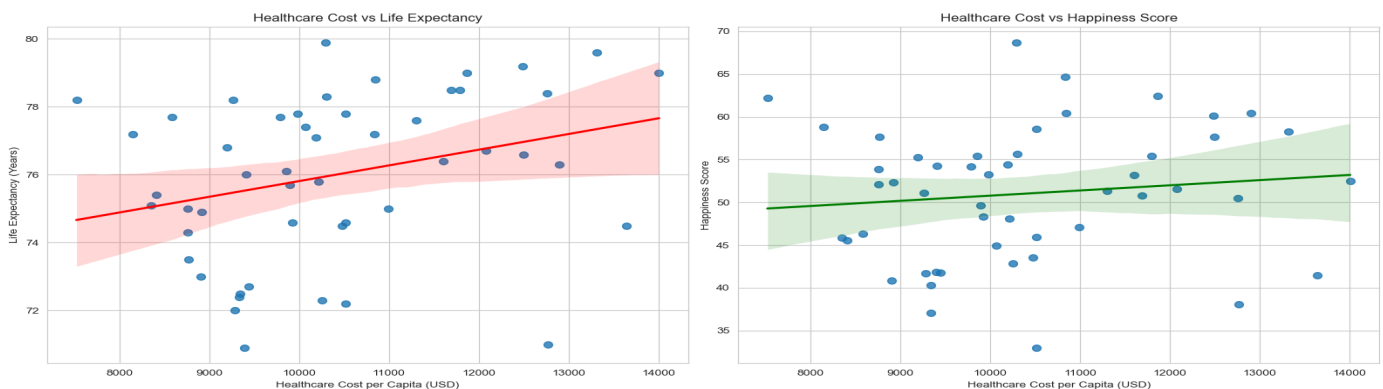


Does Higher Healthcare Spending Lead to Longer Lives? Analyzing the Relationship Between Per-Capita Healthcare Expenditures and Life Expectancy Across U.S. States

By: Emily Jimenez, Robin Li, Krithika Shetty, and Srijan Gupta (Group-40)

The rising cost of healthcare in the United States has sparked intense debate over the value and efficiency of public health programs, particularly Medicare. As one of the largest federal expenditures, Medicare plays a crucial role in providing health coverage to individuals with disabilities and those aged 65 and older. However, the question remains as to whether higher per-capita healthcare spending under Medicare—or more broadly, public health spending—leads to better life outcomes. This research investigates the relationship between per-capita healthcare expenditures and average life expectancy and happiness across the U.S. states. We emphasize that the expenditure data used reflect **total state-level healthcare spending per capita**, not Medicare-specific outlays. While this distinction limits our ability to isolate Medicare's role, the analysis still provides valuable insights into how public health investments relate to well-being and longevity across geographic and demographic contexts. By analyzing publicly available data on healthcare expenditures, life expectancy, and happiness, this report seeks to identify patterns, test correlations, and explore potential causal relationships. In doing so, we consider regional fixed effects between the Northeast, Midwest, South, and West, as well as potential confounding variables and limitations of observational data. Our findings contribute to the broader discussion on healthcare policy and offer insights into whether higher spending aligns with improved longevity and quality of life for Americans.

This research utilizes three datasets sourced from World Population Review: state-level data on healthcare costs, average life expectancy, and happiness scores, spanning the years 2020 to 2023. Initial correlations suggest a **weakly positive relationship between healthcare spending and both life expectancy and happiness**, while the correlation between happiness and life expectancy appears stronger. We visualize these results using side-by-side regression plots (Figure 1). The left panel shows a modest but positive association between healthcare cost and life expectancy. The right panel displays a flatter slope for healthcare cost versus happiness score, suggesting that while states spending more on healthcare may see higher happiness levels, the relationship is relatively weak.



To assess the impact of spending more formally, we run an OLS regression of life expectancy on healthcare cost alone. The coefficient is **0.0005 and statistically significant**, indicating that each \$1 increase in per-capita spending is associated with a 0.0005-year gain in life expectancy. However, this model may suffer from omitted variable bias. Happiness is a likely confounder: people in states with better healthcare may also experience better well-being, which in turn could influence longevity. We therefore include the happiness score in a second regression.

In the multivariate model, both healthcare cost and happiness score remain statistically significant, but the coefficient on healthcare cost falls to **0.0003**, confirming **positive omitted variable bias** in the simpler model. Table 1 presents the coefficient estimates, standard errors, and p-values for both models.

--- OLS Results: LifeExpectancy ~ HealthcareCost ---
OLS Regression Results

Dep. Variable:	LifeExpectancy	R-squared:	0.089
Model:	OLS	Adj. R-squared:	0.070
Method:	Least Squares	F-statistic:	4.696
Date:	Sat, 26 Apr 2025	Prob (F-statistic):	0.0352
Time:	01:21:04	Log-Likelihood:	-111.90
No. Observations:	50	AIC:	227.8
Df Residuals:	48	BIC:	231.6
Df Model:	1		
Covariance Type:	nonrobust		

	coef	std err	t	P> t	[0.025	0.975]
const	71.1938	2.241	31.768	0.000	66.688	75.700
HealthcareCost	0.0005	0.000	2.167	0.035	3.33e-05	0.001

Omnibus:	3.240	Durbin-Watson:	1.855
Prob(Omnibus):	0.198	Jarque-Bera (JB):	3.085
Skew:	-0.584	Prob(JB):	0.214
Kurtosis:	2.659	Cond. No.	7.20e+04

Notes:
[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.
[2] The condition number is large, 7.2e+04. This might indicate that there are strong multicollinearity or other numerical problems.

--- OLS Results: LifeExpectancy ~ HealthcareCost + HappinessScore ---
OLS Regression Results

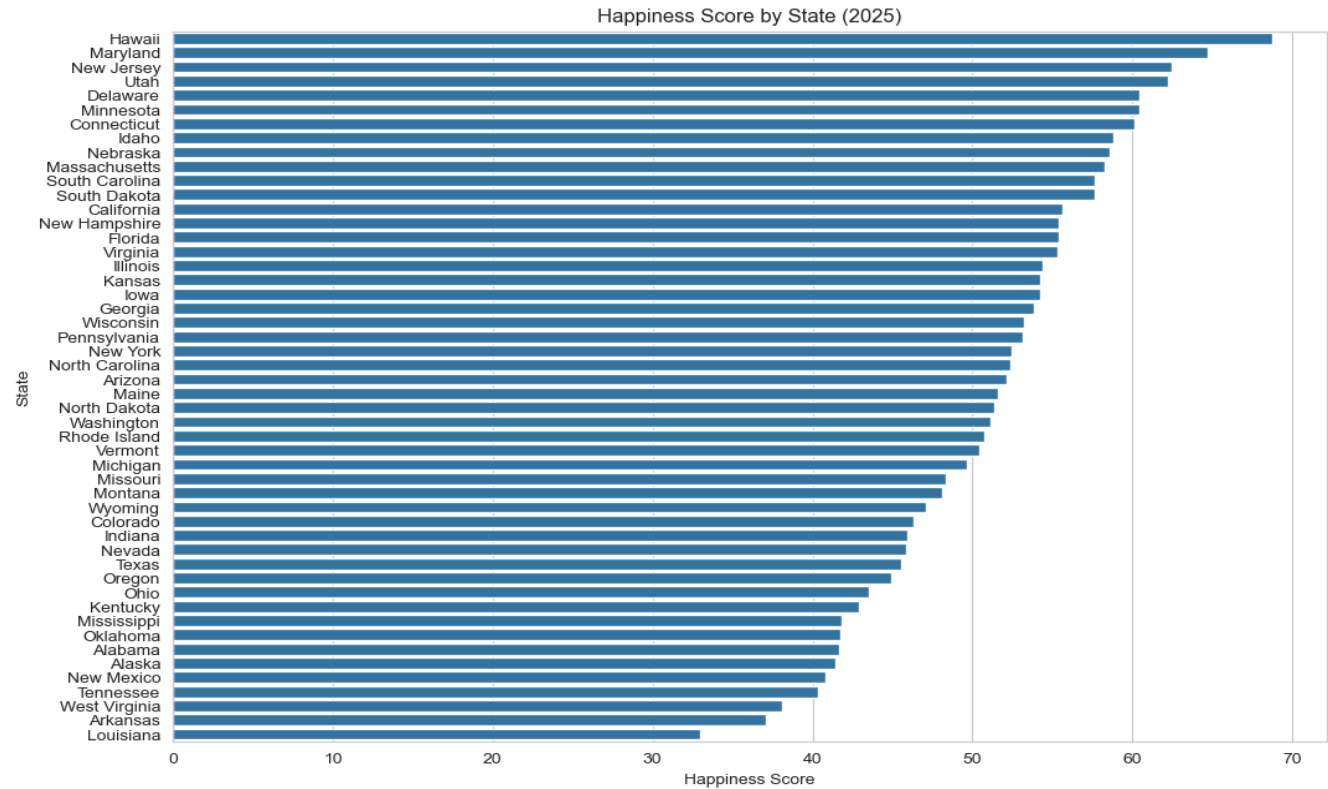
Dep. Variable:	LifeExpectancy	R-squared:	0.635
Model:	OLS	Adj. R-squared:	0.619
Method:	Least Squares	F-statistic:	40.86
Date:	Sat, 26 Apr 2025	Prob (F-statistic):	5.21e-11
Time:	01:21:04	Log-Likelihood:	-89.042
No. Observations:	50	AIC:	184.1
Df Residuals:	47	BIC:	189.8
Df Model:	2		
Covariance Type:	nonrobust		

	coef	std err	t	P> t	[0.025	0.975]
const	60.9098	1.887	32.276	0.000	57.113	64.706
HealthcareCost	0.0003	0.000	2.349	0.023	4.64e-05	0.001
HappinessScore	0.2299	0.027	8.382	0.000	0.175	0.285

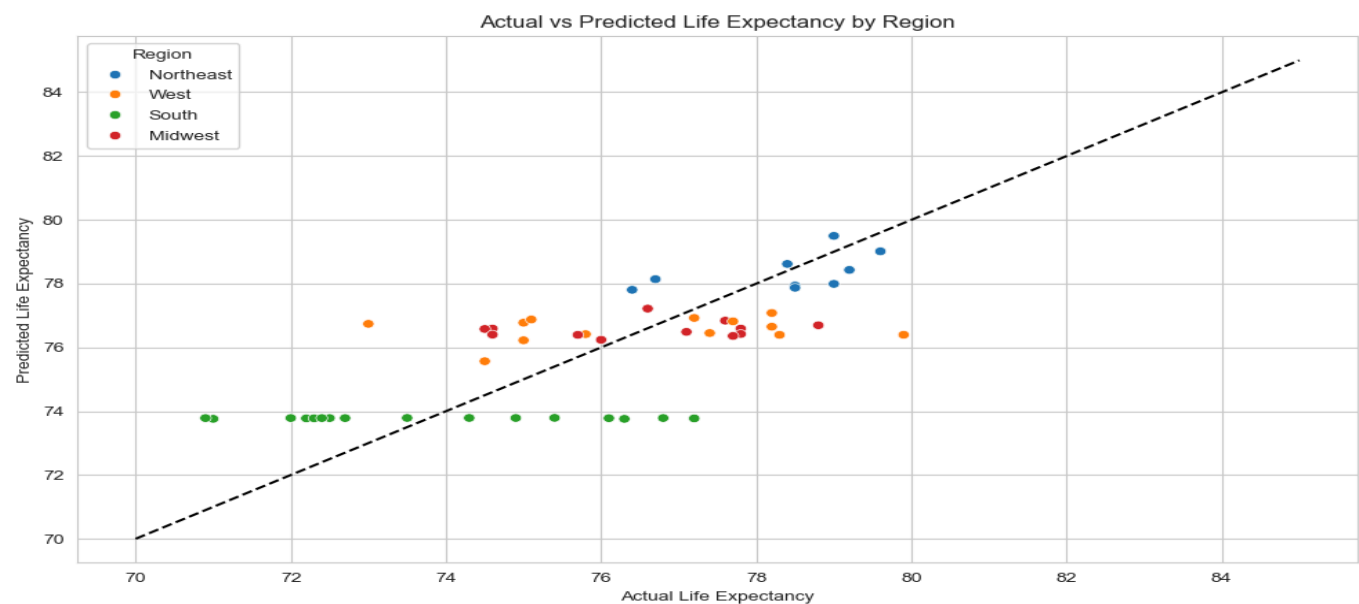
Omnibus:	0.562	Durbin-Watson:	1.826
Prob(Omnibus):	0.755	Jarque-Bera (JB):	0.192
Skew:	-0.141	Prob(JB):	0.908
Kurtosis:	3.110	Cond. No.	9.47e+04

Notes:
[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.
[2] The condition number is large, 9.47e+04. This might indicate that there are strong multicollinearity or other numerical problems.

To further explore patterns in well-being, Figure 2 shows happiness scores across all states. Hawaii ranks the highest, followed by many Northeastern states. This pattern suggests that regional climate, income, and social cohesion may influence happiness and potentially life expectancy. Notably, many Southern states rank lower, which aligns with their weaker healthcare-to-longevity correlation discussed below.



Regional disparities in the effectiveness of healthcare spending are visualized in Figure 3. In the **Northeast**, there is a **strong positive relationship** between healthcare cost and life expectancy. The **Midwest** shows a modest positive slope, while the **South** is nearly flat, indicating no benefit to increased spending. The **West** even shows a slight **negative trend**, suggesting that higher spending may not be translating into better outcomes in those states. The wide shaded confidence intervals in the South and West reflect greater unexplained variance, possibly due to cultural, policy, or behavioral factors.



We evaluate the model's predictive performance using a plot of actual vs. predicted life expectancy by region (Figure 4). States in the **Northeast** closely follow the 45-degree reference line, indicating accurate predictions. In contrast, the **South** exhibits systematic over-prediction, meaning the model expects higher life expectancy than observed. The **West** shows wider scatter, implying less consistency.

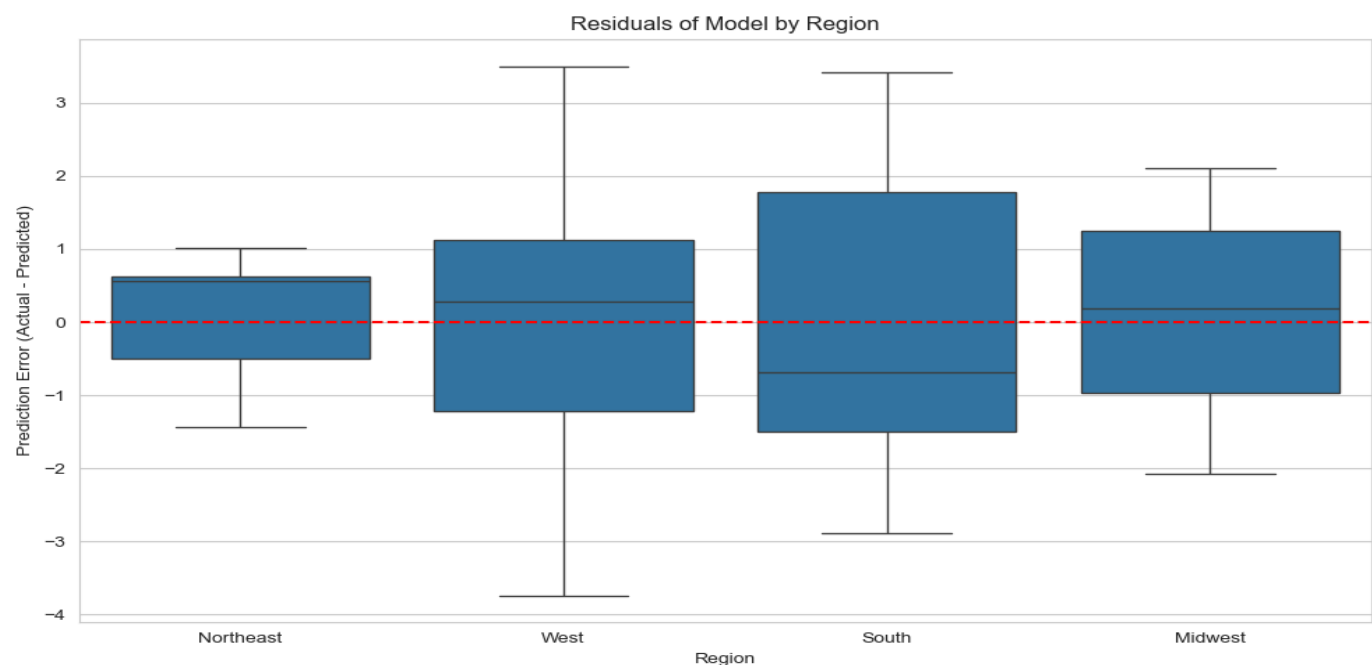
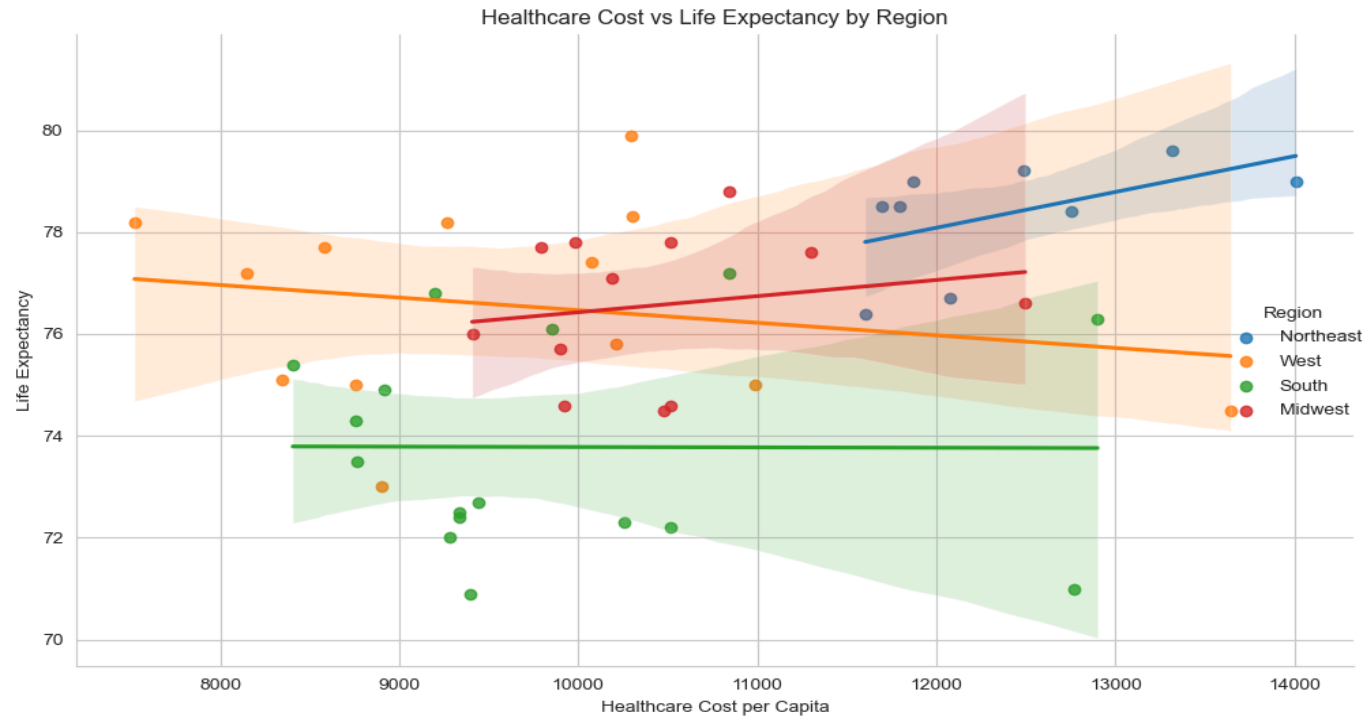


Figure 5 displays residuals—actual minus predicted life expectancy—by region. A residual of zero indicates a perfect prediction. The **Northeast** has the narrowest spread and a median close to zero. The **South** has a negative median residual and wide dispersion, confirming model overestimation. The **West** also has high variability and outliers. The **Midwest** shows moderate performance with a central tendency near zero. These results highlight that **model performance is strongly region-dependent**, with the Northeast being best fit and the South and West demonstrating bias.



To test whether a region systematically alters the effect of spending, we include regional dummy variables and their interactions with healthcare cost in a third model. As shown in Table 2, these interactions are **not statistically significant**, and the base coefficient for healthcare cost also loses significance ($p = 0.638$). This suggests that once regional heterogeneity is modeled explicitly, the national average effect of healthcare spending becomes less clear, reinforcing the idea that regional context matters significantly.

--- OLS Results: LifeExpectancy ~ HealthcareCost + Region Dummies + Interactions ---

OLS Regression Results

Dep. Variable:	LifeExpectancy	R-squared:	0.504
Model:	OLS	Adj. R-squared:	0.422
Method:	Least Squares	F-statistic:	6.104
Date:	Sat, 26 Apr 2025	Prob (F-statistic):	5.97e-05
Time:	01:21:04	Log-Likelihood:	-96.687
No. Observations:	50	AIC:	209.4
Df Residuals:	42	BIC:	224.7
Df Model:	7		
Covariance Type:	nonrobust		

	coef	std err	t	P> t	[0.025	0.975]
const	73.2567	6.998	10.468	0.000	59.133	87.380
HealthcareCost	0.0003	0.001	0.474	0.638	-0.001	0.002
Northeast	-3.6051	11.974	-0.301	0.765	-27.770	20.560
South	0.5935	7.843	0.076	0.940	-15.233	16.421
West	5.6819	7.711	0.737	0.465	-9.879	21.243
HealthcareCost_Northeast	0.0004	0.001	0.375	0.709	-0.002	0.002
HealthcareCost_South	-0.0003	0.001	-0.428	0.671	-0.002	0.001
HealthcareCost_West	-0.0006	0.001	-0.756	0.454	-0.002	0.001

Omnibus: 0.920 Durbin-Watson: 2.100

Prob(Omnibus): 0.631 Jarque-Bera (JB): 0.859

Skew: 0.076 Prob(JB): 0.651

Kurtosis: 2.376 Cond. No. 6.84e+05

Notes:
[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.
[2] The condition number is large, 6.84e+05. This might indicate that there are strong multicollinearity or other numerical problems.

This report explores the nuanced relationship between healthcare spending and quality-of-life outcomes across U.S. states, focusing on life expectancy and happiness as primary indicators. Our findings suggest that while increased healthcare expenditures are associated with marginal improvements in life expectancy, the strength and direction of this relationship vary significantly by region. States in the Northeast demonstrate a clear and consistent positive return on healthcare investment, while the South and West show weaker or even inconsistent outcomes, likely due to underlying socioeconomic, cultural, and policy-related factors.

Moreover, the inclusion of happiness scores reveals that well-being is itself a significant predictor of longevity, and that the impact of healthcare spending may be partially influenced by factors that contribute to emotional and psychological health. The weakening of the healthcare spending coefficient when happiness is included indicates the presence of omitted variable bias in simpler models and underscores the complexity of drawing causal inferences from observational data.

Limitations: This study relies on cross-sectional, observational data and does not include granular controls such as age distribution, racial composition, insurance access, or chronic disease prevalence. The healthcare spending data represent **total per-capita expenditures**, not program-specific costs like Medicare or Medicaid. Happiness scores are self-reported and may vary by survey design or cultural norms. Lastly, unobserved variables such as climate, inequality, and urban-rural differences may affect both spending efficiency and well-being.

Taken together, our results point to the importance of tailoring healthcare policy to regional needs rather than relying on a one-size-fits-all increase in spending. Improving longevity and happiness may require a more holistic approach that considers mental health, economic security, climate, and community infrastructure alongside traditional healthcare services. While more detailed, Medicare-specific data would offer sharper insights into the efficiency of federal programs, this analysis still contributes meaningfully to discussions about public health investments and their broader societal impact.

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