The Effect of Personal Healthcare spending per capita in dollars on Age Adjusted Mortality in the United States

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Introduction to Econometrics

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Introduction

The intricate relationship between healthcare expenditures and mortality rates continues to be a focal point of scholarly inquiry. In the United States, mandatory healthcare spending is projected to rise from 10.8 percent of the federal budget in 2025 to 12.6 percent by 2034. This projection, when adjusted for anticipated inflation, underscores the escalating financial commitment to healthcare (U.S. Department of the Treasury, n.d.). Such a significant increase prompts a rigorous examination of the returns on this investment, particularly regarding health outcomes. This paper seeks to evaluate the influence of per capita personal healthcare spending on age-adjusted mortality rates within the United States. I hypothesize that variations in personal healthcare spending will not be significantly associated with changes in mortality rates, suggesting other factors may play a more critical role in determining health outcomes.

Literature Review

Research exploring the impact of healthcare spending on mortality rates has identified complex relationships that differ across socio-economic environments. In their 1999 study, Anderson and Poullier noted that despite the United States having the highest healthcare spending among OECD countries, it did not correspond with improved health outcomes. The U.S. displayed the lowest percentage of government-assured health insurance and ranked unfavorably in health outcomes, underscoring a disconnect between expenditure and health quality (Anderson & Poullier, 1999).

Recent studies, such as the one by Owusu, Sarkodie, and Pedersen (2021), have expanded this analysis globally, finding that healthcare spending significantly reduces infant and maternal mortality in developing countries. However, the effect is less pronounced in high-income nations, suggesting that factors beyond financial inputs are at play in improving health outcomes. For high-income regions like the U.S., additional spending is less impactful, indicating the need for systemic improvements alongside financial investments (Owusu, Sarkodie, & Pedersen, 2021).

These findings set the stage for the current study, which seeks to determine the influence of personal healthcare spending on age-adjusted mortality in the U.S. The literature suggests that increased spending alone may not be sufficient to enhance mortality rates, implicating economic, infrastructural, and systemic factors as critical determinants of health outcomes. This paper aims to contribute to this discourse by examining whether these trends hold true in the context of the United States' unique healthcare landscape.

Empirical Model

This paper utilizes linear regression analysis to explore the association between state-level mortality rates and healthcare spending per capita, measured in dollars. Our analysis considers four key variables:

- Mortality Rate: This is the dependent variable, representing the number of deaths per 100,000 population, age adjusted.
- HealthCare Spending: Our primary independent variable of interest, this captures the per capita dollar amount spent by individuals on Personal Health Care (PHC).

- Income: This variable encompasses two aspects: the median income for each state and the proportion of the population below the federal poverty line.
- Uninsured Rate: This measures the proportion of the state's population without health insurance.

In addition, our model accounts for geographic variations by including regional variables. The estimated regression model is as follows:

$$Mortality = \alpha + \beta 1 HealthCareSpending + \beta 2 Income + \beta 3 Uninsured + \beta 4 Region + u$$

Through this model, we aim to quantify the impact of healthcare spending on mortality rates, controlling for income, insurance coverage, and regional factors.

Data

Our analysis on the relationship between personal healthcare spending and state-level mortality rates in the United States for the year 2020 and 2021 is informed by data sourced from authoritative national databases. The specific datasets and their respective contributions are outlined below

- Mortality Data: The primary dataset for mortality rates comes from the Centers for Disease Control and Prevention (CDC), with mortality counts provided by the National Center for Health Statistics. This data is critical to our study as it is adjusted for age, allowing for unbiased comparisons between states' mortality rates. This age-adjusted mortality data can be found on the CDC's FastStats portal under State and Territorial Data (CDC FastStats)
- State Socioeconomic Characteristics: We include key socioeconomic indicators such as poverty rates, median income, and the percentage of uninsured individuals within each

state. These metrics are derived from U.S. Census Bureau estimates and aggregated by the Kaiser Family Foundation. Such socioeconomic data for 2021 is essential to control for variables that may affect health outcomes and is accessible through the Kaiser Family Foundation's state data profiles (KFF State Data)

- Healthcare Expenditure: Healthcare spending data, sorted by state of residence, was obtained from the National Health Expenditure accounts. This data is pivotal in evaluating the financial resources allocated to healthcare per capita and its potential impact on mortality rates. Detailed expenditure information can be explored at the Centers for Medicare & Medicaid Services website (CMS State Residence)

Table 1. Descriptive Statistics

Variable	Obs	Mean	Std. dev.	Min	Max
Ageadju~2021	51	904.0353	135.8999	630	1229.1
PerCapitaP~s	51	10477.08	1633.646	7522	14381
Mediana~2021	51	69439.84	11272.45	48716	90203
Poverty202~f	51	12.63137	2.738649	7	19.6
Uninsur~2021	51	9.282353	3.57814	2.9	20.5
West	51	.254902	.4401426	0	1
Midwest	51	.2352941	.4284033	0	1
Northeast	51	.1764706	.3850134	0	1
South	51	.3333333	.4760952	0	1

Table 1 presents the descriptive statistics for the variables under consideration. There is considerable variation in age-adjusted mortality rates across states, ranging from a low of 630 deaths per 100,000 population in Hawaii to a high of 1,229.1 in West Virginia. The mean age-adjusted mortality rate stands at 904.04 deaths per 100,000 population.

Similarly, there is a notable disparity in healthcare spending. Per capita personal healthcare expenditure varies significantly from $7,522 in Utah to $14,381 in the District of Columbia, with an average spending of $10,477.08 across states.

Empirical Results

Table 2. Regression Results

Source	SS	df	MS		
Model	754202.385	7	107743.198	Number of obs	= 51
Residual	169237.132	43	3935.74725	F(7, 43)	= 27.38
				Prob > F	= 0.0000
				R-squared	= 0.8167
				Adj R-squared	= 0.7869
Total	923439.516	50	18468.7903	Root MSE	= 62.736

Ageadjustedmortality2021	Coefficient	Std. err.	t	P>|t|	[95% conf.	interval]
PerCapitaPersonalHealthCares	.0028083	.0075904	0.37	0.713	-.0124991	.0181158
Medianannualincome2021	-.0076289	.0013705	-5.57	0.000	-.0103926	-.0048651
Poverty2021kff	6.12668	5.674775	1.08	0.286	-5.317595	17.57095
Uninsured2021	.7677341	3.48254	0.22	0.827	-6.255478	7.790946
West	-70.57609	26.25143	-2.69	0.010	-123.5171	-17.63504
Midwest	-98.88519	30.81098	-3.21	0.003	-161.0215	-36.74892
Northeast	-106.6072	35.32346	-3.02	0.004	-177.8438	-35.37067
_cons	1379.914	176.1504	7.83	0.000	1024.673	1735.155

The empirical results in Table 2 indicate that per capita personal healthcare spending in 2020 is not significantly correlated with age-adjusted mortality in 2021 in the United States, as evidenced by a p-value of 0.713, with a small positive coefficient of 0.0028. On the other hand, median annual income is negatively associated with age-adjusted mortality; as median annual income increases, age-adjusted mortality decreases significantly (p-value < 0.001). Poverty rates and the uninsured rate, however, do not appear to have a significant effect on mortality, with p-values of 0.286 and 0.827 respectively. Regional differences are also significant, with the West, Midwest, and Northeast all showing lower age-adjusted mortality rates than the baseline region

in the South, as indicated by statistically significant negative coefficients. The model has a high R-squared value of 0.8167, suggesting that it explains approximately 81.67% of the variability in age-adjusted mortality rates, with an adjusted R-squared of 0.7869, indicating a good fit even after adjusting for the number of predictors. The intercept is also statistically significant (p-value < 0.001), suggesting other significant factors influencing mortality rates that are not included in the model.

Conclusion

The findings of this study offer a clear indication that personal healthcare spending per capita from 2020 does not significantly impact age-adjusted mortality rates in the United States for the year 2021. This aligns with emerging research that challenges the assumption that higher health expenditure directly correlates with improved mortality outcomes. Instead, median annual income emerges as a critical factor, with its negative association with mortality highlighting the role of economic status in public health.

The lack of significant effects from poverty and uninsured rates on mortality could suggest that these variables may interact with mortality in more complex ways than captured by the model, or that their impacts are mediated through other unaccounted variables. The regional disparities observed underscore the importance of local context in health outcomes, emphasizing the need for region-specific health policies and interventions.

With an R-squared value indicative of a strong model fit, the study nevertheless points to the existence of other significant determinants of mortality not included in the model, as suggested by the statistically significant intercept. These could include factors such as healthcare quality, lifestyle, and environmental influences, among others.

As this study's findings challenge traditional assumptions about the efficacy of increased healthcare spending, it calls for a pivotal shift in government policy. Given the projected rise in healthcare's share of the federal budget, it is crucial to reassess how these funds are distributed, focusing more on enhancing economic conditions and addressing regional disparities that significantly impact health outcomes. This change in approach could lead to more targeted and effective use of resources, ultimately fostering a healthier society that benefits from a stronger economy and a more equitable healthcare system.

References

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