HRP203 Final Project

Analysis of Hospitalization Costs for Smokers

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Github

This project can be found at this Github link

Introduction

Risks and complications of smoking have been well-documented, which include developing heart disease, chronic obstructive pulmonary disease (COPD), stroke and lung cancer. Despite these known risks, it remains one of the most signiificnat causes of morbidity and mortality worldwide. Given the wide ranges of diseases and conditions that patients could develop, these can severly reduce quality of life and are a significant public health concern.

There is a signficant economic cost and burden for this patient population due to healthcare utilization. This study aims to analyze and compare hospitalization costs among smokers and non-smokers. Understanding the cost differentials is crucial in health policy as policymakers can make informed decisions on resource allocation and design targeted interventions to reduce smoking rates and associated healthcare costs.

Methods

Setting and Data Collection

A data set containing a patient-level data from a single community hospital in San Francisco, CA was obtained. All patients admitted to the internal medicine hospitalist team between January 2023 to December 2023 were included. The data set included an individual's smoking status, gender, age, presence of cardiac conditions on admission and total hospitalization cost. The key variables were: - `smoke`: Smoking status (0 = Non-smoker, 1 = Smoker) - `female`: Gender (0 = Male, 1 = Female) - `age`: Age of the individual - `cardiac`: History of cardiac events (0 = No, 1 = Yes) - `cost`: Medical costs for hospitalizations

Statistical Analysis

We employed a statistical regression analysis to study the relationship between smoking status and hospitalization costs. We controlled for age, gender and history of cardiac disease prior to admission. The regression model used was as follows:

$$Cost = \hat{\beta}_0 + \hat{\beta}_1 \cdot smoke + \hat{\beta}_2 \cdot age + \hat{\beta}_3 \cdot female + \hat{\beta}_4 \cdot cardiac + \epsilon$$

Where:

- $\hat{\beta}_0$ is the intercept of the regression model.
- $\hat{\beta}_1$ represents the effect of smoking status on total hospitalization costs.
- $\hat{\beta}_2$ represents the effect of age on total hospitalization costs.
- $\hat{\beta}_3$ represents the effect of gender on total hospitalization costs.
- $\hat{\beta}_4$ represents the effect of history of cardiac disease prior to admission on total hospitalization costs.
- ϵ is the error term.

Results

There were a total of 5,000 patient encounters that met the inclusion criteria. There were 508 smokers (10.2%) out of the patient population with a mean hospitalization cost of $10,245.02 as seen in Table 1. This was significantly different from the mean hospitalization cost of $9,607.50 for non-smokers. There was also a significant difference of pre-existing cardiac disease between smokers and non-smokers (15.2% vs 2.5%). There was no statistical difference in age and gender between smokers and non-smokers.

	Smoker	Non-Smoker	p-value
Patient Encounters (n)	508	4492	
Mean Age (SD)	41.42 (13.82)	41.48 (13.52)	0.926
Mean Total Hospitalization Cost in USD (SD)	$10,245.02 (371.31)	$9607.50 (351.54)	<0.001
Female Gender (%)	233 (45.9)	2202 (49.0)	0.193
History of Cardiac Disease (%)	77 (15.2)	113 (2.5)	<0.001

Table 1: Patient Characteristics stratified by smoking status

There was a wide distribution of total hospitalization costs in general with outliers in both groups. When stratified by smokers vs non-smokers, Figure 1 illustrates that the distribution of hospitalization costs were significant between the two groups. There was

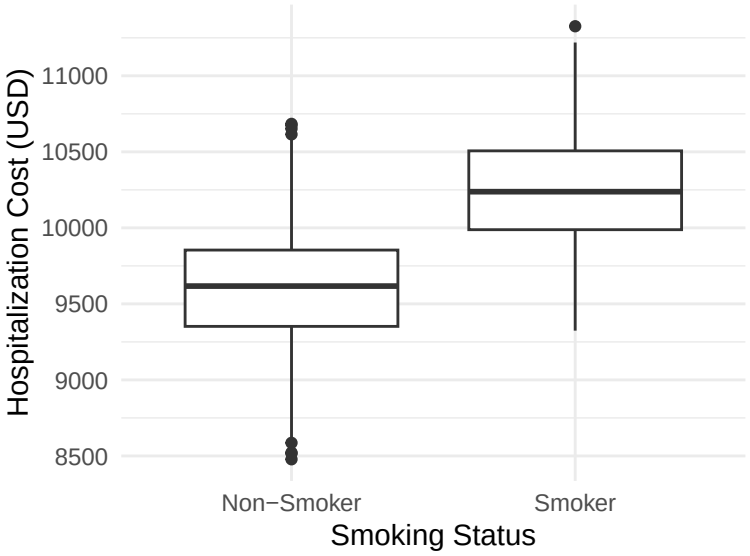

Figure 1: Medical Costs by Smoking Status

When examining the relationship between costs and age, there was a notable trend of increasing hospitalization costs as age increases. This was evident in both the smoker and non-smoker groups as demonstrated in Figure 2.

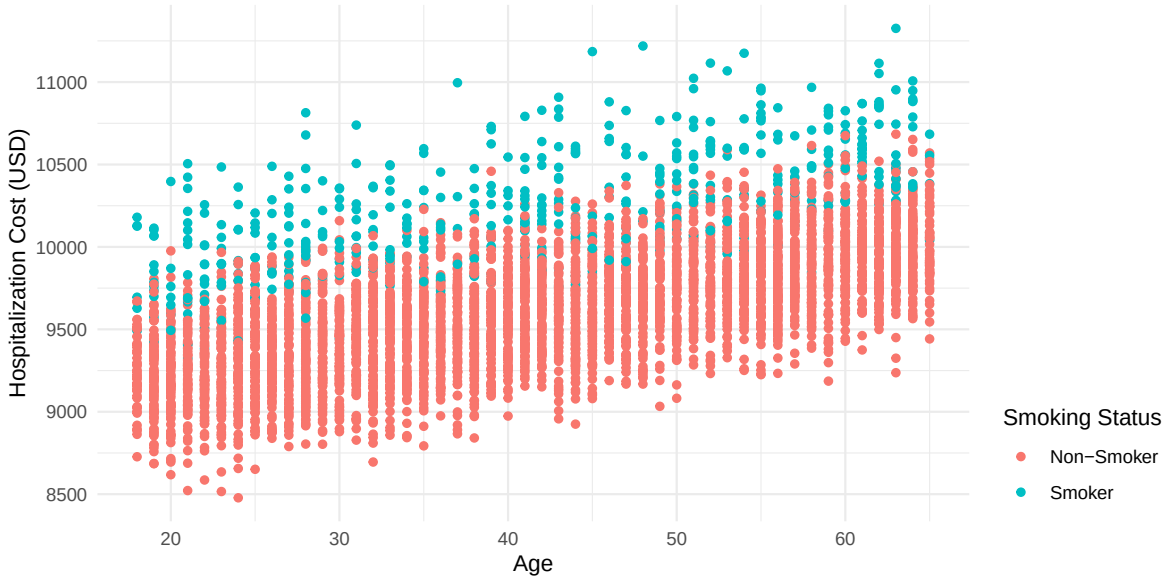

Figure 2: Age vs Hospitalizatiton Costs by Smoking Status

The regression model shows that smoking status is a significant predictor of total hospitalization costs. Specifically, smokers incur higher costs by approximately $592.76 compared to non-smokers, when holding other factors constant. Our addiitional co-variates of age, gender, and history of cardiac disease were all significant predictors that affect hospitalization costs. However, being a smoker had the highest effect in increased cost when compared to all other variables.

Regression Analysis Results

	Hospitalization Costs
Smoking Status (1 = Smoker)	592.758***
	(9.515)
Gender (1 = Female)	-293.655***
	(5.704)
Age	18.212***
	(0.208)
Cardiac History (1 = Yes)	289.224***
	(15.219)
Constant	8,988.798***
	(9.539)
Note:	*p<0.1; **p<0.05; ***p<0.01

Discussion

Our findings reveal significant differences in total hospitalization costs between smokers and non-smokers, with smokers incurring higher costs. This finding is consistent with existing literature, which demonstrates that smokers have higher healthcare utilization such as more intensive or prolonged medial care secondary to developing smoking-related diseases.

The regression model indicates that being a smoker increases total hospitalization costs on average of $592.76. This result aligns with prior studies that have shown smokers have increased incidences of lung cancer, heart disease and respiratory illnesses. These co-morbidities are likely to result in hospital complications or prolonged recovery from illnesses that cause higher hospitalization costs.

Age is another critical factor that impacts hospitalization costs. The positive relationship between age and costs suggests that older individuals are likely to incur higher medical expenses.

This trend can be explained by the natural increase in health problems with aging, leading to greater healthcare utilization. The presence of cardiac conditions also significantly raises hospitalization costs, reflecting the high cost of treating cardiovascular diseases, which are prevalent among smokers. Additionally, females incur lower hospitalization costs compared to males, which is likely due to various factors related to gender-specific health trends.

A limitation in this study includes a limited data set from a single hospital system and findings may not be generalizable to the broader population. We also did not account for additional variables that could be confounders such as insurance type.

Overall, these findings reveal the significant economic burden of smoking on healthare systems and have important implications for public health policies. This study reinforces the need for robust smoking cessation programs to help curb costs. Policymakers should focus their efforts on effective interventions to reduce smoking prevalence because this could lead to cost savings.