

# Healthcare Utilization Disparities Among Lung Cancer Patients in US Hospitals During 2010–2014: Evidence from the US Hispanic Population's Hospital Charges and Length of Stay

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**Purpose:** There is a lack of research focused on understanding the differences in the healthcare utilization of lung cancer patients between ethnic groups. This study aims to characterize disparities in healthcare utilization for Hispanic lung cancer patients compared to non-Hispanic patients.

**Methods:** National Inpatient Sample was used to identify nationwide lung cancer patients (n=141,675, weighted n=702,878) from 2010 to 2014. We examined the characteristics of the study sample by race (Hispanic vs non-Hispanic) and its association with healthcare utilization, measured by discounted hospital charges and length of stay. Multivariate survey regression models were used to identify predictors by racial groups.

**Results:** Among 702,878 lung cancer patients, 5.1% were Hispanic. Descriptive statistics showed that Hispanics have higher hospital charges and length of stay. Survey regression results also suggested that Hispanic lung cancer patients were associated with higher hospital charges (26.6%) and length of stay (3.5%) than non-Hispanic lung cancer patients. Subgroup analysis displayed a similar trend to the full model.

**Conclusion:** Healthcare utilization disparities may exist for lung cancer Hispanic patients due to insurance status and early detection. Thus, our findings support providing financial assistance and targeted programs for minority patients. Future health policy consideration should be given to those vulnerable populations where limited healthcare resources are available.

**Keywords:** lung cancer, Hispanic patients, NIS sample, healthcare utilization

## Introduction

Lung cancer remains a leading cause of death in the United States as the second most common cancer.<sup>1</sup> In 2018, there were 218,520 new lung cancer cases, and it was the leading cause of cancer death that year.<sup>2</sup> That same year, 10,183 lung cancer cases were from Hispanic patients, and 5540 Hispanic patients died.<sup>2</sup> Comparatively, there were 23,417 new lung cancer Black patients, 1353 new cases in American Indian and Alaskan natives, and 6590 new cases in Asian and Pacific Islander patients.<sup>2</sup> Despite advances in screening, treatment, and tobacco prevention, lung cancer attributed to over 1.8 million worldwide deaths in 2018 and was about 23.5% of all cancer deaths in 2019 in the United States.<sup>1</sup> Worldwide, in 2020, there were 2,206,771 new lung cancer cases and 1,796,144 new lung cancer deaths, second in both categories only to female breast cancer.<sup>3</sup> Lung cancer also has the highest cancer mortality rate in men worldwide.<sup>3</sup> By 2021, the estimated number of new lung cancer cases in the United States will be 12.4% of all cancer cases and contribute to 21.7% of cancer deaths.<sup>4</sup>

From 2011 to 2017, the 5-year survival rate of lung cancer in the United States was 21.7%, and 34.4% of new cases occurred in patients aged 65–74.<sup>5</sup> Notably, most patients are diagnosed at late stages, with 56% of lung cancer cases having already metastasized,<sup>5</sup> contributing to sub-par survival rates compared to other cancers.<sup>6</sup> Early detection is ideal, but current screening tests have not been effective at catching the early stages of lung cancer.<sup>6,7</sup> As a result, patients no longer can undergo surgery or curative treatment at later stages of the disease and are often treated with chemotherapy.<sup>8</sup> Significantly, minority patients are more often diagnosed at such late stages, thus decreasing survival rates.<sup>9</sup> Such aggressive end-of-life treatment has been known to affect cancer patients' quality of life with negligible effects on survival improvement.<sup>10</sup> More significant research is required to pinpoint lung-cancer patient-specific health needs by race and ethnicity.<sup>11</sup>

Racial disparities in the United States have affected access to healthcare and lung cancer screening, treatment, and survival rates.<sup>9,12</sup> Hispanic patients are less likely to receive cancer treatment for leading cancers in the United States, including lung cancer.<sup>11</sup> Further, race and ethnicity have been correlated with differences in socioeconomic status.<sup>9,12,13</sup> Low socioeconomic status inhibits healthcare access, screening, and treatment before and during the disease.<sup>12</sup> Socioeconomic status affects residence, and a high proportion of Hispanic people live in highly polluted areas – another risk factor for lung cancer.<sup>12</sup> Lung cancer remains the leading cause of cancer death in Hispanic men,<sup>14</sup> despite advancements in tobacco control.<sup>15</sup> Considerable tobacco control has led to a decline in lung cancer-related deaths with greater educational outreach on the risks of nicotine, the legal smoking age, and cancer prevention.<sup>15</sup>

Lung cancer cost in the United States is estimated at \$20.1 billion and is expected to rise by over 30% by 2030 because of an aging population and costly new therapies.<sup>16</sup> In 2017, the average monthly cost of terminal lung cancer in the final 6 months of life was \$12,987.<sup>17</sup> Aggressive end-of-life care has become more prevalent for lung cancer patients, increasing cost.<sup>18</sup> While cheaper hospice options have also increased, they are often utilized too late to lower costs.<sup>18</sup> Most end-of-life care for cancer patients comes from hospitalizations, and racial minorities are more likely to be cared for in emergency rooms, intensive care units, and inpatient facilities.<sup>18</sup> Hispanic patients tend to visit the ER and ICU more and receive more aggressive chemotherapy towards their end of life than non-Hispanic white patients.<sup>18</sup>

Further, in 2019, the Hispanic population had the most significant percentage of uninsured people at 16.7% compared to 5.2% of non-Hispanic white being uninsured.<sup>19</sup> The disparity in insurance coverage for Hispanic patients has limited their access to health and mental health services.<sup>20,21</sup> Lack of insurance can drive patients, notably ethnic minorities, to be treated in emergency rooms rather than private offices.<sup>22</sup> Further exacerbating the lack of access, Hispanic patients often face language barriers, low education rates, and a lack of providers with similar cultural and ethnic backgrounds.<sup>23</sup> In addition, cancer screening is more deficient in minority patients, possibly due to insurance as even Medicaid screening coverage varies by state and does not guarantee lung cancer screening.<sup>20</sup>

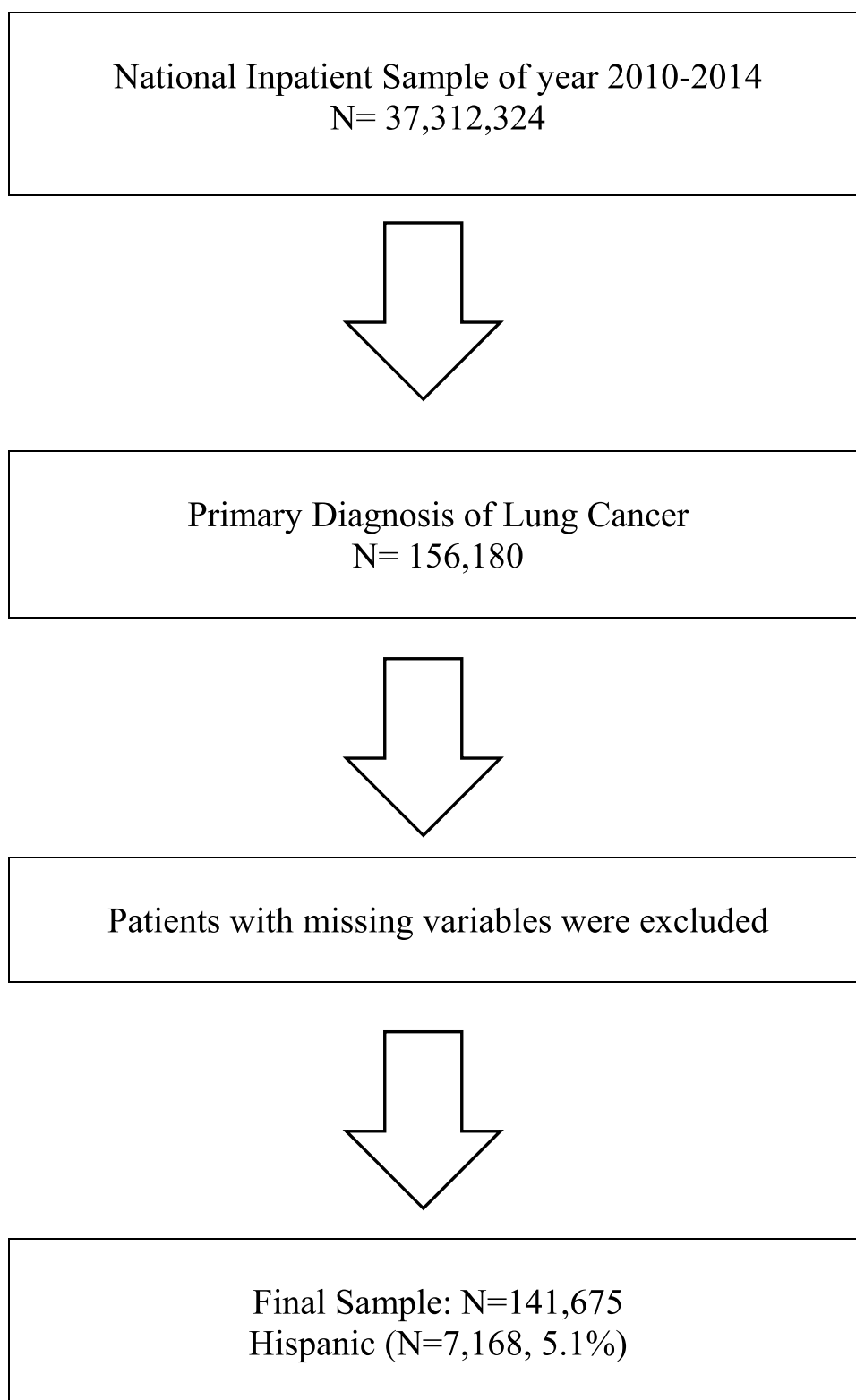
As Medicaid physician fees are cut or frozen, fewer patients visit their doctors, and more Medicaid patients turn to a hospital or emergency room care, which are obligated to treat without regard to insurance status.<sup>24</sup> Primary care physicians often do not accept Medicaid patients for various reasons, like decreased reimbursement compared to private insurance.<sup>25</sup> Higher Medicaid fees tend to increase the amount of Medicaid patients seen by a primary care physician.<sup>26</sup>

There is a lack of research focused on understanding the differences in the healthcare utilization of lung cancer patients between ethnic groups. With lung cancer being a leading cause of cancer death in the United States and among Hispanic male patients, it is essential to determine how Hispanic patients are affected by the rising healthcare costs. Such research can pave the way for economic programs targeting low-income minority cancer patients and further highlight the connection between ethnicity, low socioeconomic status, and the burden of cancer. This study aims to characterize disparities in healthcare utilization as measured by discounted hospital charges and length of stay for Hispanic lung cancer patients compared to non-Hispanic patients.

## Materials and Methods

### Data Collection

The 2010–2014 National Inpatient Sample (NIS) database was used to obtain a population-based estimate for nationwide patients with lung cancer. This was the available dataset in possession when we were conducting this research. Among all 2010–2014 NIS samples (N=37,312,324), as shown in [Figure 1](#), we first identified a primary diagnosis of



**Figure 1** Flow chart of patient sample selection.

lung cancer (n=156,180) using the International Classification of Diseases Ninth Revision, Clinical Modification (ICD-9-CM) codes for lung cancer. Then, after patients with missing variables were excluded, we finally obtained patients with lung cancer (n=141,675).

## Variables

The primary outcome of this study was to investigate the difference in hospital charges and length of stay for Hispanic vs Non-Hispanic patients. Total hospital charges were calculated after adjusting the annual inflation rate using Centers for Medicare and Medicaid Services estimates.<sup>27</sup> Due to the skewing of distribution for hospital charges and length of stay, we conducted the natural log of those variables.

We adjusted for various patient-level confounders that other previous researchers used to investigate healthcare utilization using NIS.<sup>28–30</sup> Patient characteristics included age, race, annual median household income, primary payer (Medicare, Medicaid, Self-Pay/No Charge, Other, Private insurance), number of comorbidities, the severity of illness using all-patient refined diagnosis-related group (APRDRG-number of coexisting medical conditions that are not directly related to lung cancer), and whether the patient received surgery, radiation, chemotherapy.

## Statistical Analysis

To represent all lung cancer patients, sampling weights were applied to all statistical analyses. First, we examined the characteristics of the final dataset, which included patient characteristics by racial groups (Hispanic vs non-Hispanic). Patient characteristics were presented as weighted frequency (percentage) or means (SD). To investigate groups, Rao-Scott Chi-Square tests were used for categorical variables.

Then, we investigated how racial differences were associated with discounted hospital charges and length of stay using multivariate survey linear regression analysis. Finally, we conducted a subgroup analysis where we ran the models multiple times to investigate each subgroup's association. All subgroup models were performed by adjusting all other variables. All analyses were conducted using SAS statistical software (version 9.4; SAS Institute Inc., Cary, NC, USA). All statistical tests were two-sided and statistical significance was determined at  $p$ -value  $<0.05$ .

## Results

### Patient Characteristics and Descriptive Statistics

A total 141,675 lung cancer patients were identified in the 2010–2014 NIS data (weighted  $n=702,878$ , Table 1). Among them, 7168 (weighted  $n=35,823$ , 5.1%) were Hispanic patients. The general characteristics of patient characteristics are presented in Table 1.

Table 2 shows different racial groups' temporal trends of hospital charges and length of stay among lung cancer patients during 2010–2014. Overall mean discounted hospital charges and length of stay were \$73,941 and 6.82 days for Hispanic patients and \$60,378 and 6.48 days for non-Hispanic patients. Thus, although hospital charges were discounted, hospital charges were somewhat increased in the Hispanic population; however, the length of stay was not volatile during the study period.

### Association of Racial Difference with Hospital Charges and Length of Stay

The associations of racial difference with discounted total hospital charges and LOS from survey logistic regression models are shown in Table 3. After controlling for all other variables, hospitalization of the Hispanic population was associated with a statistically significant increase in hospital charges ( $\beta = 0.266$ ,  $p < 0.001$ ), which means 26.6% higher discounted total costs than non-Hispanic patients. Furthermore, length of stay was associated with a statistically significant increase ( $\beta = 0.035$ ,  $p < 0.001$ ) in Hispanic patients, which means 3.5% higher length of stay than non-Hispanic patients.

Higher hospital charges were also associated with lower age, male, high income, metastatic stage, surgery, radiation, chemotherapy, etc. Higher length of stay was associated with older age, lower income, metastatic stage, surgery, radiation, and chemotherapy.

### Results of Subgroup Analysis

Table 4 shows the association of racial groups with discounted total hospital charges and length of stay for each subgroup in the model. The results in the table are Hispanic patients' hospital charges and length of visit for each subgroup

**Table I** General Characteristics of Patient Sample

	Hispanic		Non-Hispanic		P
	N/Mean	%/SD	N/Mean	%/SD	
<b>Unweighted N</b>	7168	5.1%	134,507	94.9%	<0.0001
<b>Weighted N (National estimates)</b>	35,823	5.1%	667,056	94.9%	
<b>Age Group</b>					<0.0001
<40	2227	17.5%	10,504	82.5%	
40–49	2773	8.0%	31,947	92.0%	
50–59	6770	5.3%	120,380	94.7%	
60–69	9714	4.6%	200,999	95.4%	
≥70	14,339	4.5%	303,225	95.5%	
<b>Sex</b>					<0.0001
Female	16,413	4.8%	328,304	95.2%	
Male	19,410	5.4%	338,752	94.6%	
<b>Median household income</b>					<0.0001
0–25th percentile	13,448	6.6%	189,289	93.4%	
26th to 50th percentile	8659	4.8%	170,242	95.2%	
51st to 75th percentile	8465	5.1%	156,893	94.9%	
76th to 100th percentile	5250	3.4%	150,632	96.6%	
<b>Primary Payer</b>					<0.0001
Medicare	17,090	4.1%	400,311	95.9%	
Medicaid	7226	11.1%	57,786	88.9%	
Self-pay/No charge	2370	10.0%	21,231	90.0%	
Other	1181	5.8%	19,206	94.2%	
Private insurance	7955	4.5%	168,521	95.5%	
<b>Metastatic</b>					0.002
No	25,460	5.0%	485,050	95.0%	
Yes	10,362	5.4%	182,006	94.6%	0.538
<b>In-Hospital Death</b>					
No	32,304	5.1%	603,010	94.9%	
Yes	3519	5.2%	64,046	94.8%	<0.0001
<b>Severity of Illness Subclass</b>					
APR-DRG 0, 1, lowest	7840	5.7%	130,112	94.3%	
APR-DRG 2	12,599	4.9%	244,053	95.1%	
APR-DRG 3	12,145	5.1%	227,988	94.9%	
APR-DRG 4, highest	3238	4.8%	64,903	95.2%	<0.0001
<b>Surgery</b>					
No	30,773	5.5%	531,405	94.5%	
Yes	5050	3.6%	135,650	96.4%	0.005
<b>Radiation</b>					
No	34,528	5.1%	638,364	94.9%	
Yes	1294	4.3%	28,691	95.7%	<0.0001
<b>Chemotherapy</b>					
No	33,763	5.0%	637,756	95.0%	
Yes	2059	6.6%	29,299	93.4%	0.904
<b>Number of Comorbidities*</b>	2.405	1.921	2.570	1.923	

Note: \*Mean/SD.

compared with non-Hispanic patients. Results in the subgroup analysis were aligned with the full model, which we assume higher hospital charges and length of stays were presented in all Hispanic patient groups. Hispanic patients over 40 years old were associated with higher discounted total costs, while longer length of stay was associated with Hispanic patients over 60 years old. This trend carries over all other confounders including sex, income, and payer, as the Hispanic

**Table 2** Temporal Trend of Healthcare Utilization Among Lung Cancer Patients: Hispanic vs Non-Hispanic

	Total	2010	2011	2012	2013	2014	P
<b>Unweighted N</b>	141,675	28,237	30,592	25,821	28,098	28,927	
<b>Weighted N (National estimates)</b>	702,878	142,344	146,304	129,105	140,490	144,635	
<b>Race</b>							
Hispanic	35,822	7579	7038	6310	7315	7580	0.016
Non-Hispanic	667,055	134,765	139,265	122,795	133,175	137,055	
% of Hispanic	5.1%	5.3%	4.8%	4.9%	5.2%	5.2%	
<b>Discounted Total Charges [USD]*</b>							
Hispanic	73,941	64,588	72,439	76,420	80,288	76,436	<0.0001
Non-Hispanic	60,376	54,671	58,841	60,334	62,725	65,305	
<b>Length of Stay [Days]</b>							
Hispanic	6.82	6.94	7.03	6.81	6.80	6.51	<0.0001
Non-Hispanic	6.48	6.74	6.57	6.52	6.32	6.27	

Notes: \*CMS's hospital care (inpatient) inflation rate applied. All are discounted at the 2010 level.

population was associated with higher discounted total charges for all those factors. A few groups did not have statistically significant differences in terms of length of stay, including female, income, and different types of payers. The severity of illness subclass was not statistically significant; however, many subgroups did show a higher length of stay for the Hispanic population.

## Discussion

When considering the high healthcare utilization of lung cancer, it is essential to characterize how different ethnic groups, like Hispanics, are impacted by the financial burden of this disease. In this study, we have illuminated the disparity felt by Hispanic lung cancer patients in healthcare utilization, represented by their length of hospital stays and hospital charges. Hispanic patients paid between an estimated \$10–18,000 more than non-Hispanic patients during the study years. On average, Hispanic patients paid \$13,565 more than non-Hispanic patients between 2010 and 2014. Considering that Hispanic patients accounted for only 5.1% of the patients during the study period, the \$13,000 price tag discrepancy is jarring. Further, in 2020, the Hispanic population had a median household income of \$55,321, which is more than \$10,000 less than the median US household income for 2020 of \$67,521.<sup>31</sup> Thus, when compared to non-Hispanic whites, who have a median household income above the national median at \$74,912, the financial cost of lung cancer disproportionately burdens Hispanic families.<sup>31</sup>

With the average cost at the end of life for lung cancer patients in the United States around \$12,000,<sup>17</sup> Hispanic patients are paying an average of \$3000 more than the national average. Hispanic patients typically have lower socioeconomic backgrounds, a known limitation for healthcare access,<sup>9,12</sup> and a risk factor for lung cancer.<sup>12</sup> The discrepancy in end-of-life costs for Hispanic patients can be an undue, increased burden. Most patients were also in the 0–25th percentile for median household income in both test groups. Thus, there is a significant financial disparity for Hispanic lung cancer patients despite similarities in economic backgrounds to non-Hispanic patients.

Insurance status is also an essential factor for healthcare access,<sup>20,21</sup> and our study found that most Hispanic and non-Hispanic patients were insured through Medicare, Medicaid, or private insurance. Medicare was the largest insurance group in total. One possible reason for the increased cost in Hispanic patients may have come from the use of Medicaid. Medicaid does not guarantee lung cancer screenings,<sup>20</sup> and patients with Medicaid are often barred from primary care physician offices because of decreased reimbursement, moving patients towards emergency rooms and hospitals for treatment.<sup>22,24,25</sup> The lack of screening has been implied in our study as most patients had higher severity of illness, demonstrating a lack of early screening and prevention. The increased cost for Hispanic patients seen in the current study may reflect increased emergency room visits, ICU stays, inpatient treatment, and aggressive chemotherapy treatment – trends more commonly seen in minority patients.<sup>8,9,22</sup>

**Table 3** Results of Survey Regression Models: Log Transformed Hospital Charges and LOS by Racial Groups

	Log of Hospital Charges		Log of LOS	
	EST.	P-value	EST.	P-value
<b>Race</b>				
Hispanic	0.266	<0.0001	0.035	<0.0001
Non-Hispanic	Reference			
<b>Age Group</b>				
<40	Reference			
40–49	–0.181	<0.0001	–0.016	0.357
50–59	–0.196	<0.0001	0.023	0.147
60–69	–0.236	<0.0001	0.045	0.005
≥70	–0.324	<0.0001	0.070	<0.0001
<b>Sex</b>				
Female	–0.011	0.021	0.002	0.538
Male	Reference			
<b>Median household income</b>				
0–25th percentile	–0.164	<0.0001	0.074	<0.0001
26th to 50th percentile	–0.120	<0.0001	0.055	<0.0001
51st to 75th percentile	–0.040	<0.0001	0.036	<0.0001
76th to 100th percentile	Reference			
<b>Primary Payer</b>				
Medicare	0.164	<0.0001	0.096	<0.0001
Medicaid	0.129	<0.0001	0.177	<0.0001
Self-pay/No charge	–0.014	0.352	0.168	<0.0001
Other	–0.475	<0.0001	–0.054	<0.0001
Private insurance	Reference			
<b>Metastatic</b>				
No	Reference			
Yes	0.033	<0.0001	0.056	<0.0001
<b>In-Hospital Death</b>				
No	Reference			
Yes	–0.408	<0.0001	–0.014	0.110
<b>Severity of Illness Subclass</b>				
APR-DRG 0, 1, lowest	Reference			
APR-DRG 2	–0.107	<0.0001	–0.010	0.090
APR-DRG 3	–0.025	0.001	0.166	<0.0001
APR-DRG 4, highest	0.494	<0.0001	0.535	<0.0001
<b>Surgery</b>				
No	Reference			
Yes	0.811	<0.0001	0.384	<0.0001
<b>Radiation</b>				
No	Reference			
Yes	0.540	<0.0001	0.502	<0.0001
<b>Chemotherapy</b>				
No	Reference			
Yes	0.637	<0.0001	0.622	<0.0001
<b>Number of Comorbidities</b>	0.044	<0.0001	0.029	<0.0001
<b>Year</b>	0.023	<0.0001	0.012	<0.0001

Length of stay between Hispanic and non-Hispanic lung cancer patients had a minor variation; however, Hispanic patients across the study period did have a greater length of stay in hospitals. Furthermore, increased length of stay may also be connected to increased hospital use.<sup>22,24</sup> Thus, Hispanic lung cancer patients are hospitalized for more extended

**Table 4** Results of Subgroup Analysis

	Log of Hospital Charges		Log of LOS	
	EST.	P-value	EST.	P-value
<b>Age Group</b>				
<40	0.090	0.052	-0.016	0.715
40–49	0.209	<0.0001	0.032	0.372
50–59	0.215	<0.0001	0.030	0.171
60–69	0.251	<0.0001	0.043	0.016
≥70	0.321	<0.0001	0.035	0.015
<b>Sex</b>				
Female	0.280	<0.0001	0.021	0.122
Male	0.251	<0.0001	0.048	0.000
<b>Median household income</b>				
0–25th percentile	0.272	<0.0001	0.038	0.015
26th to 50th percentile	0.277	<0.0001	0.029	0.131
51st to 75th percentile	0.294	<0.0001	0.053	0.005
76th to 100th percentile	0.193	<0.0001	0.012	0.627
<b>Primary Payer</b>				
Medicare	0.312	<0.0001	0.036	0.006
Medicaid	0.204	<0.0001	0.041	0.075
Self-pay/No charge	0.199	<0.0001	0.065	0.082
Other	0.238	0.001	0.027	0.631
Private insurance	0.212	<0.0001	0.012	0.555
<b>Metastatic</b>				
No	0.260	<0.0001	0.033	0.003
Yes	0.279	<0.0001	0.041	0.018
<b>In-Hospital Death</b>				
No	0.246	<0.0001	0.026	0.007
Yes	0.391	<0.0001	0.104	0.006
<b>Severity of Illness Subclass</b>				
APR-DRG 0, 1, lowest	0.260	<0.0001	0.044	0.029
APR-DRG 2	0.230	<0.0001	0.023	0.120
APR-DRG 3	0.230	<0.0001	0.061	0.000
APR-DRG 4, highest	0.261	<0.0001	0.024	0.461
<b>Surgery</b>				
No	0.281	<0.0001	0.051	<0.0001
Yes	0.182	<0.0001	-0.048	0.010
<b>Radiation</b>				
No	0.266	<0.0001	0.034	0.000
Yes	0.267	<0.0001	0.085	0.064
<b>Chemotherapy</b>				
No	0.264	<0.0001	0.031	0.001
Yes	0.284	<0.0001	0.106	0.003

**Note:** Adjusted for all other variables.

periods and are paying more for care despite similarities in financial backgrounds and disease severity compared to non-Hispanic patients. Patients with longer lengths of stay tended to be of lower income. Considering that Hispanic patients tend to be of lower socioeconomic classes,<sup>9,12,13</sup> the trend of more extended stays for poorer patients again highlights a financial burden targeting the Hispanic population.

Both lengths of stay and the increased hospital charges were associated with a higher incidence of radiation and chemotherapy. Increased cost and differences in healthcare utilization are reflected in previous studies and have a strong connotation for Hispanic patients. Minority patients are often treated with more aggressive chemotherapy without



improving their quality of life.<sup>8–10,18</sup> Thus, the more aggressive treatment may increase cost and length of stay without improving outcomes and is a disparity more greatly seen in minorities like Hispanic patients.

The results of this study have demonstrated that Hispanic lung cancer patients, on average, utilize healthcare more than non-Hispanic patients. Notably, Hispanic lung cancer patients between 2010 and 2014 significantly spent 26.6% more on healthcare and were hospitalized 3.5% longer than non-Hispanic patients. This finding is significant because it denotes the financial barriers affecting Hispanic lung cancer patients. They may face an increased cost for more aggressive end-of-life treatment than non-Hispanic patients without seeing improvements in survival rates. Thus, our results support financial assistance programs for minority patients and more outstanding promotion of palliative care utilization to reduce the cost of treatment towards end-of-life.

To reduce the financial burden and increase the quality of end-of-life, palliative care should be considered. Palliative care usage has increased since 2000, and its positive effects on lung cancer patients have been well documented.<sup>32–35</sup> Multiple studies have described the improvements to patient quality of life and mood improvement from end-of-life palliative care.<sup>32–35</sup> Further, in one study, cancer patients who started palliative care earlier in their treatment had reduced healthcare usage near end-of-life, reflective of less intensive care yet more outstanding quality outcomes and reduced cost.<sup>32</sup> As a result, there is a growing movement to integrate palliative care into treatment standards and discuss palliative treatment options earlier with cancer patients.<sup>32–35</sup> The integration of palliative care, especially if programs can be tailored to meet the needs of minority patients, is significant because minority groups are less likely to utilize palliative care and hospice treatments due to language differences, religious beliefs, low health literacy, and lack of healthcare access.<sup>36</sup> Targeted programs for minority groups like Hispanic patients should account for such differences and conduct outreach in multiple languages, with sensitivity to cultural and religious differences, and promote access to various services.

This study has described various significant aspects of financial and treatment barriers targeting Hispanic patients; however, this research has limitations. First, this study used 2010–2014 data, which may not represent the current situation. Further research with more recent data is required. The national inpatient dataset utilized depends on ICD-9-CM codes, which may or may not have a restricted patient selection. The dataset also does not include clinical information like the cancer stage or pharmacologic treatments. Lung cancer patients at more advanced cancer stages are associated with higher healthcare spending and length of stay. Lack of information on advanced stages and spending or length of stay may weaken the result of this study. However, the study did contain control variables like APR-DRG, surgery, radiation, and chemotherapy, which may be used as a proxy role of patient stage status. Due to dataset limitations, substantial lung cancer risk factors like smoking, diet, and pollution were not included. Another limitation is that the dataset utilized does not describe if patients are treated in an outpatient or inpatient setting and the views patients or physicians have towards palliative care. Further research is required to determine how patient and physician perspectives on palliative care affect the delivery of palliative care and how it is associated with utilization and cost. The timing of palliative care delivery was also not captured and could be important for terminal lung cancer patients. Despite these limitations, our research is still generalizable to most deceased lung cancer patients in the United States because we utilized a well-sampled dataset with multiple study periods. Thus, our research denotes the benefits of palliative care for lung cancer patients and further discusses targeted minority end-of-life treatment.

## Conclusion

This study has explored the targeting financial burden of lung cancer on the Hispanic population by identifying differences in healthcare utilization, represented by discounted hospital charges and length of hospital stay. On average, Hispanic patients spend more and are hospitalized longer than their non-Hispanic counterparts. This burden is felt on all levels of society as families suffer financial obstacles for treatment and society struggles to rectify racial health disparities. Previous research has discussed how disparities in healthcare utilization for Hispanic patients are caused by insurance status leading to lack of primary care providers, increased hospital use, lack of early screening, lower socioeconomic status, and exposure to pollution. Our findings reflect such disparities and illuminate the financial need of Hispanic lung cancer patients. In addition, past studies have characterized palliative care's economic and quality of life

benefits.<sup>32–35</sup> Considering that our findings align with current economic and treatment disparities, trends for Hispanic lung cancer patients, our research promotes the early integration of palliative care in cancer treatment and calls for financial assistance programs for minority patients. Targeted programs and financial assistance will benefit the individual patient, their families, and the larger society as gaps in treatment and racial equality are narrowed.

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## Disclosure

The authors declare that they have no competing interests.

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