

Costs and Length of Stay in Hospitalized Patients with Idiopathic Pulmonary Fibrosis: Analysis of the National Inpatient Sample

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BACKGROUND

- Idiopathic pulmonary fibrosis (IPF) is a chronic, progressive, interstitial pneumonia of unknown cause and poor prognosis, occurring predominantly in older adults.¹
- Overall US prevalence is estimated to be between 13 and 63 per 100,000 persons.²
- IPF patients are often hospitalized for disease progression and respiratory failure and such hospitalizations may be a major driver of healthcare cost.³

OBJECTIVE

- To estimate the economic impact of hospital care in IPF, and to identify factors associated with cost and length of stay (LOS) in a cohort of IPF patients admitted for respiratory illnesses to short-stay hospitals in the US.

METHODS

Design and data source

- Cross-sectional retrospective cohort study using the National Inpatient Sample (NIS), the largest publicly available all-payer US inpatient database
 - NIS contains claims data from > 7 million hospital stays/year from a nationally representative sample of acute care hospitals.
- Study included all hospitalizations in the NIS from 2009 to 2011 with
 - a claim for IPF (ICD-9-CM code 516.3, 516.31) and
 - a principal diagnosis of respiratory disease (ICD-9-CM 460-519),
- Admissions for lung transplant were excluded.

Statistical Analysis

- All variables weighted to represent national estimates.
- Costs calculated using cost-to-charge ratios and adjusted to 2011 US\$.
- Linear regression to identify factors associated with cost and LOS.
- Domain analysis to account for the use of subpopulations rather than the entire sample.
- Statistical analyses performed using SAS® version 9.4.

RESULTS

- From 2009 to 2011 22,350 patients with IPF were admitted to US hospitals with a principal diagnosis of respiratory disease and did not undergo lung transplant.
- Mean (SE) age was 70.0 (0.32), and 50.9% were male.
- 43.1% of admissions had a principal diagnosis of IPF

Table 1. Patient Demographics, Hospital Characteristics, and Admission Type

	N = 22,350 Mean(+/-SE) / no.(%)
Age	70.0 (+/-0.32)
Female	11,374 (50.9)
Race	
White	14,404 (64.4)
Black	1,707 (7.6)
Hispanic	2,110 (9.4)
Other or missing	4,130 (18.5)
Primary payer type	
Medicare	15,297 (68.4)
Medicaid	1,531 (6.9)
Private (including HMO)	4,590 (20.5)
Other	932 (4.2)
Hospital region	
Northeast	3,897 (17.4)
Midwest	5,644 (25.3)
South	9,169 (41.0)
West	3,641 (16.3)
Teaching hospital	9,687 (43.3)

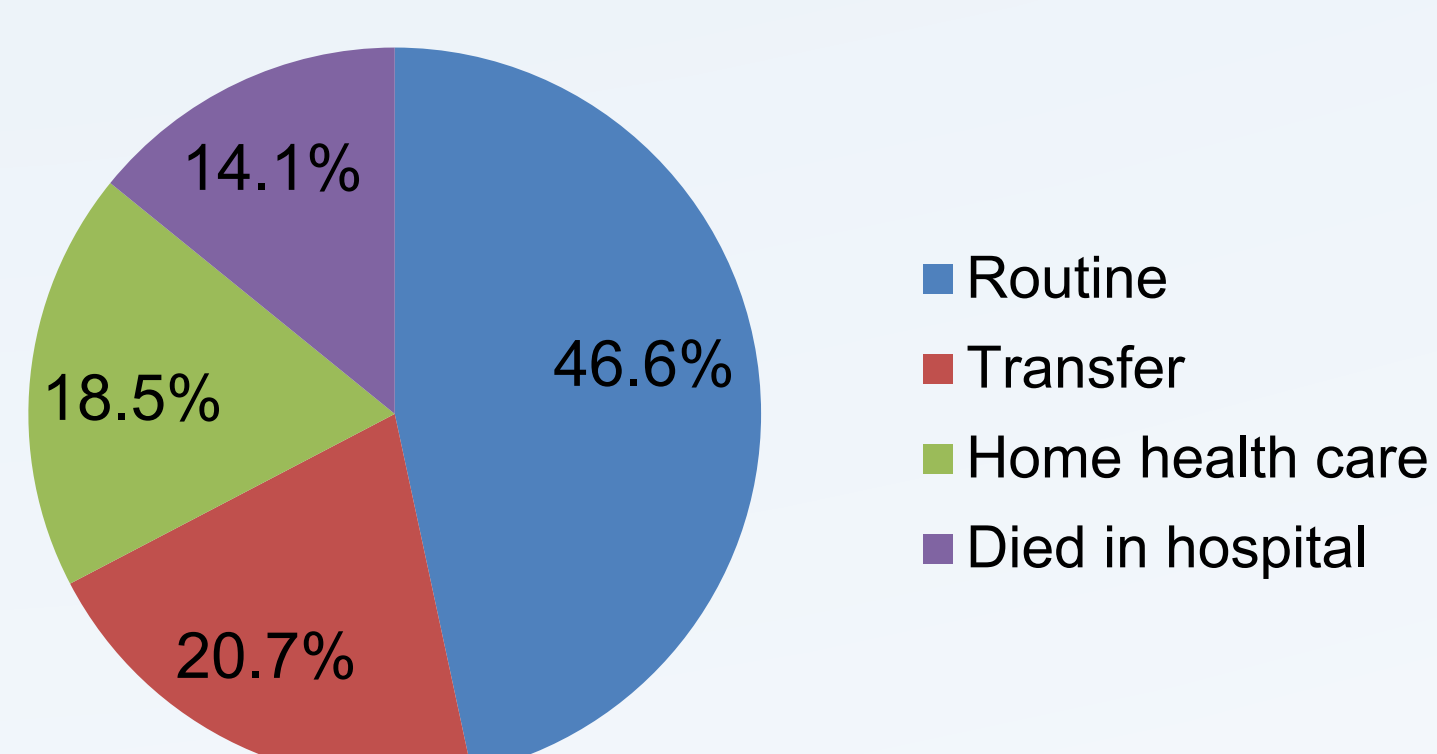
- Respiratory and cardiovascular comorbidities were common, including bacterial pneumonia (38.5%), COPD (38.2%), congestive heart failure (27.8%), and ischemic heart disease (28.4%).
- Invasive mechanical ventilation used in 11.4% of patients and non-invasive ventilation in 8.9%.

Table 2: Patient Clinical Characteristics and Treatment

	N = 22,350 Mean(+/-SE) / no.(%)
No. of chronic conditions	4.3 (+/-0.03)
Chronic obstructive pulmonary disease^a	8,535 (38.2)
Bacterial pneumonia	8,604 (38.5)
Cardiovascular conditions	10,063 (45.0)
Congestive heart failure	6,219 (27.8)
Ischemic heart disease	6,339 (28.4)
Myocardial Infarction	1,345 (6.0)
Pulmonary hypertension	84 (0.4)
Invasive Mechanical Ventilation	2,546 (11.4)
Non-invasive Ventilation	1,995 (8.9)

^a including emphysema

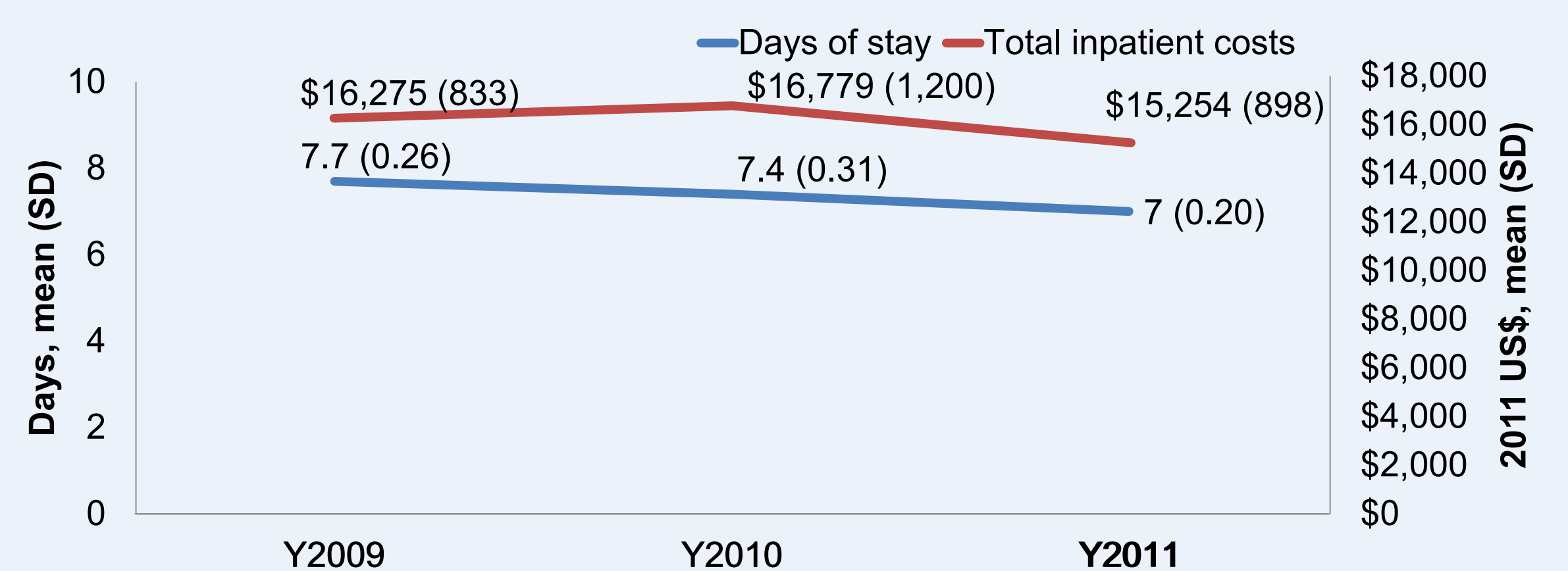
Figure 1. Discharge Status



RESULTS (CONT.)

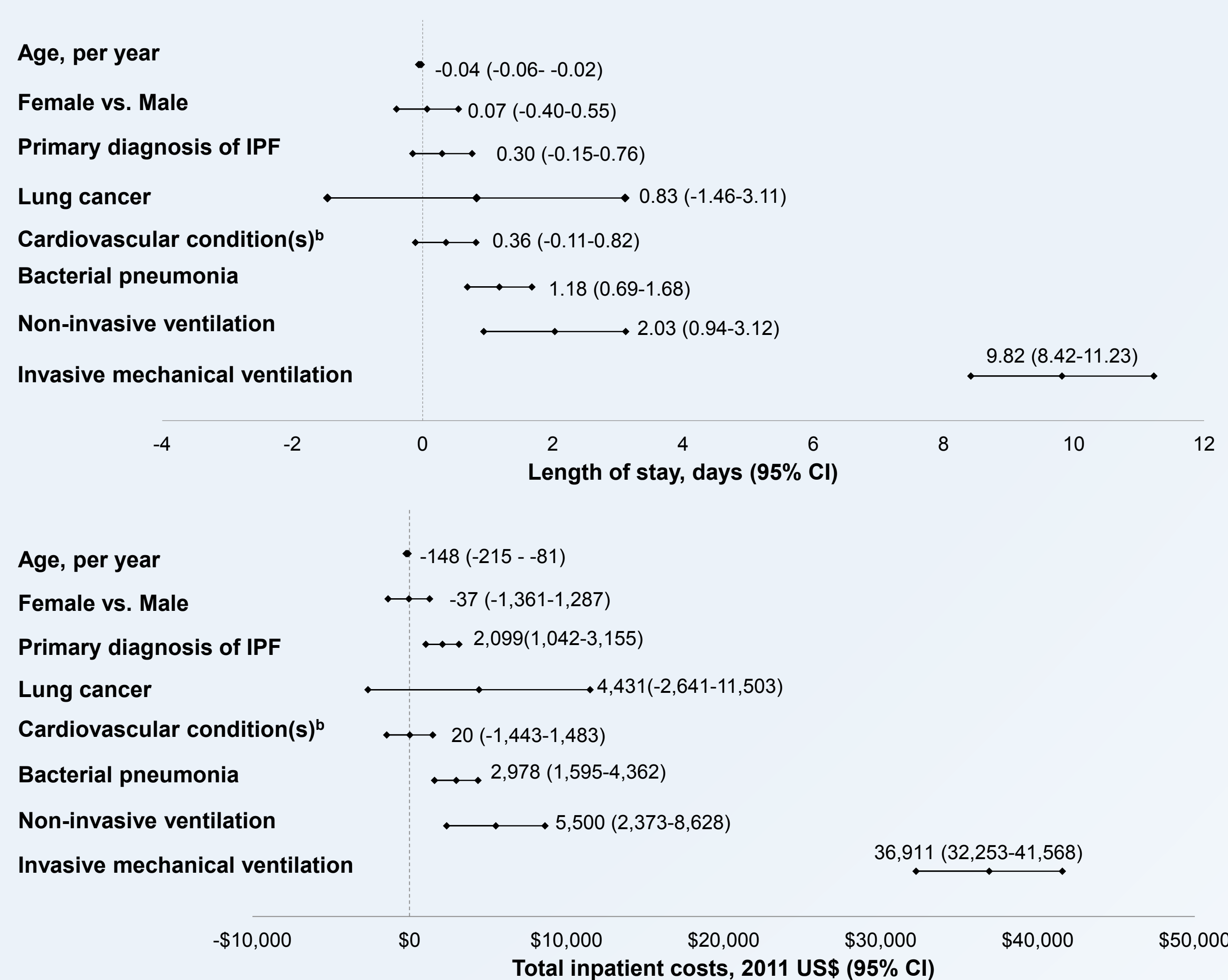
- Mean (SE) LOS for these respiratory-related hospitalizations was 7.4 (0.15) days overall: 7.7 (0.26) in 2009, 7.4 (0.31) in 2010, and 7.0 (0.20) in 2011. (Figure 2)
- Total hospitalization costs were mean (SE) \$16,042 (631) over the entire study period per event; \$16,275 (833) in 2009, \$16,779 (1,200) in 2010, and \$15,254 (898) in 2011.

Figure 2. Length of Stay and Total Costs



- Age, bacterial pneumonia, and use of non-invasive or invasive mechanical ventilation were statistically significantly ($p < .001$) associated with cost and LOS.
- Admission with a primary diagnosis of IPF was significantly associated with cost but not LOS.
- Use of invasive mechanical ventilation had the largest effect on LOS and cost, with an increase of 9.82 days [95%CI 8.42 - 11.23] and \$36,911 [32,253 - 41,568] respectively.
- Non-invasive ventilation was associated with an increase of 2.03 days [0.94 - 3.12] in LOS and \$5,500 [2,373 - 8,628] in cost.

Figure 3. Linear Regression Models for LOS and Costs^a



CI: confidence interval; ^a Point estimates and 95% CI for LOS and cost are adjusted for all listed variables. ^b Ischemic heart disease, myocardial infarction, and congestive heart failure.

LIMITATIONS

- Only costs and comorbidity claims data from hospitalization captured which likely underestimates both overall patient cost and comorbidities.
- Patients transferred to other facilities may have died before discharge from those facilities, possibly leading to underreporting of deaths.
- Common chronic IPF comorbidities that do not lead to hospitalization (e.g. GERD, sleep apnea and obesity) are likely underreported in this database of inpatient services.

CONCLUSIONS

- There are about 7,000 respiratory-related IPF admissions every year.
- Hospital charges average more than \$55,000 per admission and costs (calculated using cost-charge ratios) are more than \$16,000, suggesting an overall annual IPF hospitalization cost of more than \$110 million per year.
- Although there is some evidence of decrease in LOS over the last several years, means costs are not decreasing.
- The in-hospital death rate was 14%, and an additional 35% of patients were transferred to other facilities or required home health care after discharge.
- These findings highlight the need for further investigation into treatments and care processes that reduce the rate and cost burden of IPF hospitalizations.

REFERENCES

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- Ley B. J Clin Epidemiol. 2013;5:483-92.
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