

**In-hospital mortality following surgical lung biopsy for
interstitial lung disease in the USA: 2000-2011**

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Online Data Supplement

Methods – further details

Source of data

The Nationwide Inpatient Sample (NIS) is an anonymised stratified yearly sample of US community hospitals, developed for the Healthcare Cost and Utilization Project (HCUP) by the Agency for Healthcare Research and Quality (AHRQ). Community hospitals are defined by the American Hospital Association (AHA) as ‘all non-Federal, short-term, general and other specialty hospitals, excluding hospital units of institutions’. This definition includes public hospitals and academic medical centers. Prior to a 2012 re-design, the NIS reported all discharges from a sample of 20% of hospitals in the overall ‘hospital universe’ (all states that made their data available to HCUP, comprising 97% of the US population in 2011), meaning approximately 1,000 hospitals and 8,000,000 hospital stays per year.

The NIS provides details of diagnoses and procedures using coding based on the International Classification of Diseases, 9th Revision, Clinical Modification (ICD-9-CM). This includes over 14,000 diagnosis codes and over 3,800 procedure codes (E1). Details are available on sex and age of patients, their admission and discharge dates (and consequently length of stay), and their disposition (for example, discharge home, transfer to another facility, or died). This latter category provides the basis for the variable ‘DIED’, which reflects in-hospital mortality.

In most states, an ELECTIVE variable (0=non-elective, 1=elective) was derived from ‘admission type’ (ATYPE) codes. Elective admissions were those with admission type code 3 (elective) and non-elective admissions were those with admission type codes of 1 (emergency) or 2 (urgent). If the admission type was missing or invalid, then the elective/non-elective code was also missing or invalid. For data from California, there was no ‘admission type’ variable; records were allocated as

‘elective’ or ‘non-elective’ based on whether an admission was ‘scheduled’ or ‘unscheduled’ respectively.

Further information on the NIS database is available from HCUP (E2).

Choice of diagnosis codes

We selected the following ICD-9-CM codes for interstitial lung disease: 515 (post-inflammatory pulmonary fibrosis), 516.3 (idiopathic fibrosing alveolitis), 517.2 (lung involvement in systemic sclerosis), 714.81 (rheumatoid lung), 517.8 (lung involvement in diseases classified elsewhere), 495 (extrinsic allergic alveolitis), 500-505 (pneumoconiosis, including asbestosis) and 135 (sarcoidosis). These are listed with disease synonyms in the table below. We have also included ICD-10-CM equivalent codes, which are the current standard used in the US.

The ICD-9-CM code 515 (post-inflammatory fibrosis) matches to an ICD-10-CM code specifying ‘pulmonary fibrosis, unspecified’, and is therefore likely to be a common choice for patients prior to their biopsy result. The ICD-9-CM code 516.3 was most specific for idiopathic pulmonary fibrosis (IPF), but in October 2011 (the end of our study) this code was subdivided to include other idiopathic interstitial pneumonia, and we have therefore labelled this category as ‘idiopathic pulmonary fibrosis clinical syndrome’ (IPF-CS) in our results section.

We grouped ICD-9-CM codes 517.2, 714.81 and 517.8 together as ‘connective tissue disease associated interstitial lung disease’ (CTD-ILD). Lung sarcoidosis is listed as a synonym under this category, however we labelled the more specific code 135 as sarcoidosis. We grouped together the subdivisions of code 495 (extrinsic allergic alveolitis) as ‘hypersensitivity pneumonitis’, and also grouped together the various pneumoconioses (codes 500-505).

We did not include the ICD-9-CM codes 516.0 (pulmonary alveolar proteinosis), 516.1 (idiopathic pulmonary hemosiderosis), 516.2 (pulmonary alveolar microlithiasis), 516.8 (other specific alveolar

and parietoalveolar pneumopathies) and 516.9 (unspecified alveolar and parietalalveolar pneumopathy).

Further details on ICD-9-CM codes are available from the Centers for Disease Control and Prevention website (<http://www.cdc.gov/nchs/icd/icd9cm.htm>) and online coding guides such as ICD9data.com (<http://www.icd9data.com/>).

Table of ICD-9-CM codes used in the study, disease synonyms and ICD-10-CM equivalents

ICD-9-CM code	Descriptor	Disease synonyms	ICD-10-CM equivalent code
515	Post-inflammatory pulmonary fibrosis	n/a	- J84.10: Pulmonary fibrosis, unspecified. - J84.89: Other specified interstitial pulmonary diseases.
516.3	Idiopathic fibrosing alveolitis	- Diffuse (idiopathic) (interstitial) pulmonary fibrosis. - Hamman-Rich syndrome. - Cryptogenic fibrosing alveolitis. - Chronic fibrosing alveolitis. - Diffuse alveolar fibrosis.	- J84.111: Idiopathic interstitial pneumonia, not otherwise specified. - J84.112: Idiopathic pulmonary fibrosis. - J84.113: Idiopathic non-specific interstitial pneumonitis. - J84.114: Acute interstitial pneumonitis. - J84.115: Respiratory bronchiolitis interstitial lung disease. - J84.2: Lymphoid interstitial pneumonia. - J84.116: Cryptogenic organising pneumonia. - J84.117: Desquamative interstitial pneumonia.
517.2	Lung involvement in systemic sclerosis	- Lung disease with systemic sclerosis. Scleroderma of lung.	- M34.81: Systemic sclerosis with lung involvement.
714.81	Rheumatoid lung	- Rheumatoid lung disease. - Rheumatoid fibrosing alveolitis. - Rheumatoid pneumoconiosis.	- M05.10: Rheumatoid lung disease with rheumatoid arthritis of unspecified site.
517.8	Lung involvement in disease classified elsewhere	- Juvenile dermatomyositis with lung involvement. - Lung disease due to connective tissue disorder. - Lung disease with polymyositis. - Lung disease with Sjogren's disease. - Lung disease with systemic lupus erythematosus. - Lung disorder due to autoimmune disorder. - Lung sarcoidosis. - Pulmonary amyloidosis.	- J99: Respiratory disorders classified elsewhere.

ICD-9-CM code	Descriptor	Disease synonyms	ICD-10-CM equivalent code
495	Extrinsic allergic alveolitis	Includes subdivisions of: <ul style="list-style-type: none"> - Farmers' lung - Bagassosis - Bird-fanciers' lung - Suberosis - Malt workers' lung - Maple bark-strippers' lung - Ventilation pneumonitis - Other specified allergic alveolitis and pneumonitis - Unspecified allergic alveolitis and pneumonitis. 	<ul style="list-style-type: none"> - J67.1: Farmers' lung. - J67.2: Bagassosis. - J67.3: Bird fanciers' lung. - J67.4: Suberosis. - J67.5: Malt workers' lung. - J67.6: Maple bark-strippers' lung. - J67.7: air conditioner and humidifier lung. - J67.8: Hypersensitivity pneumonitis due to other organic dusts. - J67.9: Hypersensitivity pneumonitis due to unspecified organic dusts.
500	Coal workers' pneumoconiosis		<ul style="list-style-type: none"> - J60: Coal workers' pneumoconiosis.
501	Asbestosis		<ul style="list-style-type: none"> - J61: Pneumoconiosis due to asbestos and other mineral fibres.
502	Pneumoconiosis due to silica or silicates		<ul style="list-style-type: none"> - J62.8: Pneumoconiosis due to other dust containing silica.
503	Pneumoconiosis due other inorganic dust	<i>Lung disease caused by exposure to metallic beryllium or its soluble salts</i>	<ul style="list-style-type: none"> - J63.0: aluminosis of lung. - J63.1: bauxite fibrosis of lung. - J63.2: Berylliosis. - J63.3: Graphite fibrosis of lung. - J63.4: Siderosis. - J63.5: Stannosis. - J63.6: Pneumoconiosis due to other specified organic dusts.
504	Pneumopathy due to inhalation of other dust	<i>Airway obstruction due to the dust inhaled during the processing of cotton</i>	<ul style="list-style-type: none"> - J66.0: Byssinosis. - J66.1: Flax-dressers' disease. - J66.2: Cannabinosis. - J66.8: Airways disease due to other specific organic dusts.
505	Pneumoconiosis unspecified		<ul style="list-style-type: none"> - J64: Unspecified pneumoconiosis.
135	Sarcoidosis		<ul style="list-style-type: none"> - D86.9: Sarcoidosis, unspecified

Choice of operation codes

ICD-9-CM code 33.20 (thoracoscopic lung biopsy) was introduced in October 2007. Prior to this, the code 33.28 (open biopsy of lung) was used for all lung biopsies. Similarly, code 32.20 (thoracoscopic excision of lesion or tissue of lung) was introduced in 2007 to add clarity to cases coded previously as code 32.29 (other local excision or destruction of lesion or tissue of lung). Therefore it was not possible to specify the type of operation (thoracoscopic or open) in data prior to October 2007. Although we adjusted for type of operation in our analysis, the lack of data prior to 2007 significantly reduced the number of records available, and therefore we did not include this in our primary multivariable model. Clinical coders select precise codes, including whether the procedure is coded as a biopsy or excision, based on documentation by the operating surgeon.

Assessment of co-morbidity

We assessed co-morbidity using additional diagnostic codes, using the updated Charlson index (E3), a modified version of the widely used Charlson co-morbidity index (E4). The updated Charlson index takes account of advances in disease management since the original score was published almost 30 years ago, giving extra weight to conditions such as congestive cardiac failure and dementia, and less weight to conditions such as myocardial infarction and peptic ulcer disease. Figure E1 (below) demonstrates how to calculate the updated Charlson score (used with permission of Oxford University Press).

Figure E1: How to calculate the Updated Charlson score

Co-morbidity	Score
Chronic pulmonary disease	1
Rheumatologic disease	1
Renal disease	1
Diabetes with chronic complications	1
Congestive heart failure	2
Dementia	2
Mild liver disease*	2
Hemiplegia or paraplegia	2
Any malignancy† (including leukaemia and lymphoma)	2
Moderate or severe liver disease*	4
AIDS/HIV	4
Metastatic solid tumour†	6

*Patients can score for either 'mild liver disease' or 'moderate to severe liver disease'

†Patients can score for either 'any malignancy' or 'metastatic solid tumour'

Quan H *et al.* Updating and Validating the Charlson Comorbidity Index and Score for Risk Adjustment in Hospital Discharge Abstracts Using Data from 6 Countries. *Am J Epidemiol* 2011; 173: 676-682

We used published guidance to match ICD-9-CM codes to the disease categories (E5), but reviewed all matches ourselves and identified rare occasions where we disagreed with the decisions, and in these cases we took the consensus view of three clinicians (JH, AF, RH), as outlined below:

- For the co-morbidity of dementia, we chose to include codes for Alzheimer's disease (331.0), fronto-temporal dementia (331.1), and dementia with Lewy bodies (331.82).
- For the co-morbidity category of chronic pulmonary disease, we included codes for 'Cor Pulmonale' (415.0, 416.8, 416.9), but did not include 'bronchitis – not specified acute or chronic' (490).

- For the co-morbidity category of connective tissue disease, we chose to include codes for polyarteritis nodosa (446.0) and granulomatosis with polyangiitis (Wegener's) (446.4).
- For the co-morbidity category of liver disease, we considered viral hepatitis *with hepatic coma* (070.22, 070.23, 070.44, 070.6) to be 'moderate-to-severe' liver disease, rather than 'mild' liver disease.
- For the co-morbidity category of cancer, we included the code for malignant carcinoid (209.0).

Assessment of complications

We limited our assessment of complications to those conditions where we were confident that the code represented an acute post-operative complication. Some codes such as post-operative stroke were unambiguous, whereas codes for conditions such as atrial fibrillation may have represented chronic problems, and were therefore not assessed.

We assessed the following conditions: pneumonia (ICD-9-CM 481, 482, 485, 486), post-operative respiratory failure (518.5), pulmonary collapse (518.0), post-operative pneumothorax (512.1), pleural effusion (511.1, 511.9), empyema (510), iatrogenic pulmonary embolism (415.11), post-operative pulmonary oedema (518.4), cardiac and respiratory arrest (799.1, 427.5), surgical emphysema (998.81), acute kidney injury (584), hepatic failure (570), post-operative stroke (997.02), wound problems including disruption of wound (998.3), persistent post-operative fistula (998.6), and non-healing surgical wound (998.83), post-operative infection (998.5, E8720), and bleeding complications including accidental puncture, laceration, bleeding, haemorrhage or haematoma complicating the procedure (998.2, 998.1, E8700). We grouped ventilator-associated pneumonia, chemical

pneumonitis and transfusion-related acute lung injury together as ‘other respiratory’ (997.3, 997.31, 997.39, 518.7). Codes for haemothorax and hydrothorax came into use during 2008 and were less specific before, and these conditions were therefore excluded. We classified as ‘other’ specific codes that were clearly related to an operation but not linked to the procedure (for example retained foreign bodies and failure of instruments – 998.4, 998.7, E8710, E8740, E8762, E8763, E8765) and also generic codes for other specified or unspecified complications (998.9, 998.89, 998.0).

References

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Results – Additional tables

Table E1A: Demographics of biopsy cohort using weighted data

	Total admissions		Elective admissions		Non-elective admissions	
	Number (95% CI)	Percent (95% CI)	Number (95% CI)	Percent (95% CI)	Number (95% CI)	Percent (95% CI)
Total	151,857 (147,283-156,430)	-	79,068 (76,533-81,602)	-	72,789 (70,424-75,154)	-
Sex						
Male	72,789 (70,423-75,154)	47.9 (47.4-48.5)	47,147 (45,283-49,010)	46.8 (46.1-47.5)	24,497 (23,540-25,454)	50.1 (49.1-51.1)
Female	79,068 (76,533-81,602)	52.1 (51.5-52.6)	53,552 (51,481-55,622)	53.2 (52.5-53.9)	24,388 (23,406-25,370)	49.9 (48.9-50.9)
Age group (years)						
<45	24,638 (23,649-25,628)	16.2 (15.8-16.7)	14,985 (14,226-15,745)	14.9 (14.4-15.4)	9,267 (8,746-9,787)	19.0 (18.1-19.8)
45-54	29,711 (28,587-30,835)	19.6 (19.1-20.0)	20,073 (19,161-20,985)	19.9 (19.4-20.5)	9,218 (8,702-9,734)	18.9 (18.1-19.7)
55-64	38,288 (36,899-39,676)	25.2 (24.7-25.7)	26,680 (25,539-27,822)	26.5 (25.9-27.1)	11,045 (10,490-11,600)	22.6 (21.8-23.4)
65-74	38,657 (37,245-40,070)	25.5 (25.0-26.0)	26,702 (25,537-27,867)	26.5 (25.9-27.1)	11,408 (10,840-11,976)	23.3 (22.5-24.2)
75-84	19,183 (18,339-20,028)	12.6 (12.2-13.0)	11,547 (10,919-12,175)	11.5 (11.0-11.9)	7,300 (6,875-7,726)	14.9 (14.2-15.7)
>84	1,378 (1,213-1,544)	0.9 (0.8-1.0)	711 (594-828)	0.7 (0.6-0.8)	647 (537-757)	1.3 (1.1-1.6)
Level of co-morbidity (Updated Charlson score)						
0	65,903 (63,660-68,146)	43.4 (42.8-44.0)	50,389 (48,395-52,384)	50.0 (49.3-50.8)	14,330 (13,613-15,047)	29.3 (28.3-30.3)
1	51,430 (49,701-53,159)	33.9 (33.3-34.4)	33,949 (32,573-35,384)	33.7 (33.0-34.4)	16,885 (16,161-17,608)	34.5 (33.6-35.5)
2	15,706 (14,983-16,430)	10.3 (10.0-10.7)	8,222 (7,720-8,724)	8.2 (7.8-8.6)	7,238 (6,812-7,664)	14.8 (14.1-15.5)
3 or greater	18,817 (17,952-19,682)	12.4 (12.0-12.8)	8,139 (7,561-8,717)	8.1 (7.6-8.6)	10,432 (9,880-10,985)	21.3 (20.5-22.2)

Higher Updated Charlson score = greater co-morbidity.

95% CI: 95% confidence intervals. Numbers rounded to nearest integer.

Table E1B: Total number of records in Nationwide Inpatient Sample (NIS) from 2000-2011, with number of contributing states, number of hospitals in 20% sample, number of records with interstitial lung disease (ILD), and number of ILD records with a code for surgical lung biopsy (SLB) – by year.

Year	Total records	Total states	Total hospitals	Records with ILD	Records with ILD & SLB
2000	7,450,992	28	994	57,186	2,499
2001	7,452,727	33	986	57,539	2,844
2002	7,853,982	35	995	65,534	3,105
2003	7,977,728	37	994	69,247	2,975
2004	8,004,571	37	1,004	68,317	2,843
2005	7,995,048	37	1,054	74,218	2,968
2006	8,074,825	38	1,045	77,565	3,011
2007	8,043,415	40	1,044	76,356	2,870
2008	8,158,381	42	1,056	78,144	2,853
2009	7,810,762	44	1,050	79,581	2,883
2010	7,800,441	45	1,051	79,276	2,742
2011	8,023,590	46	1,049	88,438	2,937
Total	94,646,462	n/a	n/a	871,401	34,530

Table E2A: Demographics of biopsy cohort – ‘biopsy’ codes only (unweighted data)

	Total admissions (<i>n</i> =15,265)	Elective admissions (<i>n</i> =9,049)	Non-elective admissions (<i>n</i> =5,903)
	Number (%)	Number (%)	Number (%)
Sex			
Male	7,302 (47.83)	4,291 (47.42)	2,858 (48.42)
Female	7,963 (52.17)	4,758 (52.58)	3,045 (51.58)
Age group (years)			
<45	2,473 (16.20)	1,376 (15.21)	1,041 (17.64)
45-54	2,858 (18.72)	1,723 (19.04)	1,077 (18.24)
55-64	3,858 (25.27)	2,421 (26.75)	1,365 (23.12)
65-74	3,902 (25.56)	2,394 (26.46)	1,434 (24.29)
75-84	2,053 (13.45)	1,085 (11.99)	920 (15.59)
>84	121 (0.79)	50 (0.55)	66 (1.11)
Level of co-morbidity (Updated Charlson score)			
0	6,489 (42.51)	4,547 (50.25)	1,784 (30.22)
1	4,924 (32.26)	3,039 (33.58)	1,805 (30.58)
2	1,776 (11.63)	782 (8.64)	955 (16.18)
3 or greater	2,076 (13.60)	681 (7.53)	1,359 (23.02)

Excludes those with any code for ‘excision’ procedure. Higher Updated Charlson score = greater co-morbidity. ‘Biopsy’ codes: ICD-9-CM procedure codes for ‘open biopsy of lung’ (33.28) or ‘thoracoscopic lung biopsy’ (33.20; introduced October 2007).

‘Excision’ codes: ICD-9-CM procedure codes for ‘other local excision or destruction of tissue of lung’ (32.29) or ‘thoracoscopic excision of lesion or tissue of lung’ (32.20; introduced October 2007).

Table E2B: Demographics of biopsy cohort using weighted data – ‘biopsy’ codes only

	Total admissions		Elective admissions		Non-elective admissions	
	Number (95% CI)	Percent (95% CI)	Number (95% CI)	Percent (95% CI)	Number (95% CI)	Percent (95% CI)
Total	74,703 (72,287-77,119)	-	44,510 (42,726-46,295)	-	28,685 (27,571-29,798)	-
Sex						
Male	35,793 (34,476-37,110)	47.9 (47.1-48.7)	21,145 (20,162-22,128)	47.5 (46.4-48.6)	13,917 (13,272-14,561)	48.5 (47.3-49.8)
Female	38,910 (37,513-40,307)	52.1 (51.3-52.9)	23,365 (22,320-24,411)	52.5 (51.4-53.6)	14,768 (14,090-15,446)	51.5 (50.2-52.7)
Age group (years)						
<45	12,135 (11,537-12,733)	16.2 (15.6-16.9)	6,781 (6,353-7,210)	15.2 (14.5-16.0)	5,086 (4,726-5,445)	17.7 (16.7-18.8)
45-54	14,007 (13,365-14,649)	18.8 (18.1-19.4)	8,510 (8,027-8,994)	19.1 (18.3-19.9)	5,222 (4,861-5,583)	18.2 (17.2-19.2)
55-64	18,871 (18,069-19,674)	25.3 (24.6-25.9)	11,882 (11,261-12,502)	26.7 (25.8-27.6)	6,632 (6,232-7,033)	23.1 (22.1-24.2)
65-74	19,028 (18,191-19,864)	25.5 (24.8-26.2)	11,724 (11,084-12,364)	26.3 (25.4-27.3)	6,948 (6,530-7,366)	24.2 (23.1-25.4)
75-84	10,082 (9,539-10,625)	13.5 (12.9-14.1)	5,371 (4,987-5,754)	12.1 (11.4-12.8)	4,479 (4,157-4,801)	15.6 (14.7-16.6)
>84	581 (476-686)	0.8 (0.6-0.9)	242 (175-309)	0.5 (0.4-0.7)	318 (240-395)	1.1 (0.9-1.4)
Level of co-morbidity (Updated Charlson score)						
0	31,544 (30,323-32,765)	42.2 (41.4-43.1)	22,196 (21,171-23,222)	49.9 (48.8-50.9)	8,583 (8,094-9,073)	29.9 (28.7-31.2)
1	24,269 (23,304-25,235)	32.5 (31.8-33.2)	15,052 (14,309-15,795)	33.8 (32.9-34.8)	8,838 (8,368-9,309)	30.8 (29.7-32.0)
2	8,680 (8,210-9,150)	11.6 (11.1-12.1)	3,809 (3,511-4,108)	8.6 (8.0-9.2)	4,681 (4,356-5,006)	16.3 (15.4-17.3)
3 or greater	10,209 (9,682-10,736)	13.7 (13.1-14.3)	3,453 (3,168-3,737)	7.8 (7.2-8.4)	6,582 (6,176-6,988)	22.9 (21.9-24.1)

‘Biopsy’ codes: ICD-9-CM procedure codes for ‘open biopsy of lung’ (33.28) or ‘thoracoscopic lung biopsy’ (33.20; introduced October 2007).

‘Excision’ codes: ICD-9-CM procedure codes for ‘other local excision or destruction of tissue of lung’ (32.29) or ‘thoracoscopic excision of lesion or tissue of lung’ (32.20; introduced October 2007).

Higher Updated Charlson score = greater co-morbidity.

95% CI: 95% confidence intervals. Numbers rounded to nearest integer.

Table E3A: Demographics of biopsy cohort – ‘excision’ codes only (unweighted data)

	Total admissions (n=16,216)	Elective admissions (n=11,799)	Non-elective admissions (n=4,253)
	Number (%)	Number (%)	Number (%)
Sex			
Male	7,780 (47.98)	5,464 (46.31)	2,227 (52.36)
Female	8,436 (52.02)	6,335 (53.69)	2,026 (47.64)
Age group (years)			
<45	2,631 (16.22)	1,726 (14.63)	880 (20.69)
45-54	3,295 (20.32)	2,426 (20.56)	838 (19.70)
55-64	4,087 (25.20)	3,112 (26.38)	931 (21.89)
65-74	4,122 (25.42)	3,141 (26.62)	939 (22.08)
75-84	1,914 (11.80)	1,296 (10.98)	596 (14.01)
>84	167 (1.03)	98 (0.83)	69 (1.62)
Level of co-morbidity (Updated Charlson score)			
0	7,230 (44.59)	5,925 (50.22)	1,214 (28.54)
1	5,704 (35.18)	3,968 (33.63)	1,690 (39.74)
2	1,469 (9.06)	922 (7.81)	535 (12.58)
3 or greater	1,813 (11.18)	984 (8.34)	814 (19.14)

Excludes those with any code for ‘biopsy’ procedure. Higher Updated Charlson score = greater co-morbidity. ‘Biopsy’ codes: ICD-9-CM procedure codes for ‘open biopsy of lung’ (33.28) or ‘thoracoscopic lung biopsy’ (33.20; introduced October 2007).

‘Excision’ codes: ICD-9-CM procedure codes for ‘other local excision or destruction of tissue of lung’ (32.29) or ‘thoracoscopic excision of lesion or tissue of lung’ (32.20; introduced October 2007).

Table E3B: Demographics of biopsy cohort using weighted data – ‘excision’ codes only

	Total admissions		Elective admissions		Non-elective admissions	
	Number (95% CI)	Percent (95% CI)	Number (95% CI)	Percent (95% CI)	Number (95% CI)	Percent (95% CI)
Total	79,697 (76,443-82,952)	-	57,965 (55,215-60,715)	-	20,931 (19,939-21,923)	-
Sex						
Male	38,264 (36,586-39,942)	48.0 (47.2-48.8)	26,883 (25,501-28,265)	46.4 (45.5-47.3)	10,950 (10,355-11,546)	52.3 (50.8-53.9)
Female	41,433 (39,631-43,236)	52.0 (51.2-52.8)	31,082 (29,528-32,636)	53.6 (52.7-54.5)	9,981 (9,392-10,569)	47.7 (46.1-49.2)
Age group (years)						
<45	12,919 (12,225-13,614)	16.2 (15.6-16.8)	8,444 (7,882-9,005)	14.6 (13.9-15.3)	4,356 (4,019-4,693)	20.8 (19.6-22.1)
45-54	16,215 (15,384-17,046)	20.3 (19.7-21.0)	11,934 (11,229-12,639)	20.6 (19.8-21.4)	4,127 (3,796-4,458)	19.7 (18.5-21.0)
55-64	20,116 (19,131-21,102)	25.2 (24.6-25.9)	15,316 (14,467-16,165)	26.4 (25.7-27.2)	4,581 (4,243-4,919)	21.9 (20.7-23.1)
65-74	20,215 (19,205-21,224)	25.4 (24.7-26.1)	15,394 (14,519-16,270)	26.6 (25.8-27.4)	4,619 (4,280-4,958)	22.1 (20.8-23.4)
75-84	9,431 (8,851-10,011)	11.8 (11.3-12.4)	6,409 (5,942-6,875)	11.1 (10.5-11.7)	2,914 (2,660-3,169)	13.9 (12.9-15.0)
>84	802 (676-928)	1.0 (0.9-1.2)	469 (372-566)	0.8 (0.7-1.0)	333 (255-411)	1.6 (1.3-2.0)
Level of co-morbidity (Updated Charlson score)						
0	35,237 (33,626-36,849)	44.2 (43.3-45.1)	28,916 (27,435-30,397)	49.9 (48.9-50.9)	5,893 (5,467-6,320)	28.2 (26.7-29.6)
1	28,181 (26,948-29,414)	35.4 (34.5-36.2)	19,611 (18,596-20,626)	33.8 (32.9-34.8)	8,344 (7,859-8,828)	39.9 (38.3-41.4)
2	7,309 (6,807-7,810)	9.2 (8.7-9.7)	4,526 (4,148-4,904)	7.8 (7.3-8.3)	2,716 (2,460-2,973)	13.0 (12.0-14.1)
3 or greater	8,970 (8,344-9,596)	11.3 (10.7-11.8)	4,912 (4,433-5,391)	8.5 (7.9-9.1)	3,977 (3,640-4,314)	19.0 (17.7-20.3)

‘Biopsy’ codes: ICD-9-CM procedure codes for ‘open biopsy of lung’ (33.28) or ‘thoracoscopic lung biopsy’ (33.20; introduced October 2007).

‘Excision’ codes: ICD-9-CM procedure codes for ‘other local excision or destruction of tissue of lung’ (32.29) or ‘thoracoscopic excision of lesion or tissue of lung’ (32.20; introduced October 2007).

Higher Updated Charlson score = greater co-morbidity.

95% CI: 95% confidence intervals. Numbers rounded to nearest integer.

Table E4: Estimated total number of surgical lung biopsies performed for interstitial lung disease nationwide

Year of biopsy	Total admissions	Elective admissions	Non-elective admissions
	Number (95% CI)	Number (95% CI)	Number (95% CI)
2000	10,889 (9,859-11,919)	6,292 (5,523-7,061)	3,568 (3,114-4,021)
2001	12,843 (11,537-14,148)	7,868 (6,870-8,867)	3,916 (3,424-4,407)
2002	13,324 (11,962-14,686)	9,151 (8,048-10,254)	4,163 (3,682-4,644)
2003	12,750 (11,522-13,979)	8,397 (7,394-9,400)	4,335 (3,879-4,792)
2004	12,433 (11,202-13,663)	8,450 (7,489-9,411)	3,973 (3,536-4,409)
2005	13,259 (11,914-14,603)	8,872 (7,801-9,934)	4,370 (3,846-4,894)
2006	13,367 (11,984-14,750)	8,898 (7,778-10,017)	4,455 (3,980-4,930)
2007	12,877 (11,352-14,402)	8,739 (7,450-10,028)	4,104 (3,636-4,571)
2008	12,404 (11,141-13,668)	8,526 (7,519-9,533)	3,860 (3,358-4,362)
2009	12,932 (11,564-14,300)	8,495 (7,432-9,558)	4,433 (3,842-5,023)
2010	12,278 (10,908-13,648)	8,380 (7,237-9,523)	3,893 (3,412-4,374)
2011	12,502 (11,108-13,896)	8,631 (7,483-9,779)	3,817 (3,371-4,262)
<i>Total</i>	<i>151,857 (147,283-156,430)</i>	<i>100,698 (97,024-104,373)</i>	<i>48,885 (47,207-50,563)</i>

95% CI: 95% confidence intervals. Numbers rounded to nearest integer.

Table E5: Estimated number of surgical lung biopsies performed for interstitial lung disease nationwide (using 'biopsy' codes only)

Year of biopsy	Total admissions	Elective admissions	Non-elective admissions
	Number (95% CI)	Number (95% CI)	Number (95% CI)
2000	5,992 (5,347-6,636)	3,105 (2,655-3,556)	2,253 (1,942-2,565)
2001	7,269 (6,480-8,057)	3,987 (3,412-4,563)	2,560 (2,205-2,914)
2002	7,221 (6,488-7,953)	4,517 (3,955-5,080)	2,694 (2,358-3,029)
2003	7,255 (6,483-8,028)	4,371 (3,763-4,979)	2,870 (2,562-3,179)
2004	6,747 (6,005-7,490)	4,211 (3,658-4,765)	2,530 (2,222-2,839)
2005	7,220 (6,412-8,028)	4,464 (3,860-5,069)	2,747 (2,376-3,117)
2006	7,050 (6,263-7,836)	4,315 (3,710-4,919)	2,721 (2,377-3,064)
2007	6,306 (5,602-7,009)	3,811 (3,307-4,315)	2,475 (2,132-2,818)
2008	4,376 (3,846-4,906)	2,600 (2,227-2,974)	1,771 (1,504-2,038)
2009	4,661 (4,094-5,228)	2,687 (2,297-3,076)	1,970 (1,675-2,264)
2010	4,208 (3,678-4,738)	2,386 (2,027-2,745)	1,822 (1,518-2,125)
2011	3,855 (3,359-4,350)	2,277 (1,926-2,628)	1,541 (1,303-1,780)

Excludes those with any code for 'excision' procedure.

95% CI: 95% confidence intervals. Numbers rounded to nearest integer.

'Biopsy' codes: ICD-9-CM procedure codes for 'open biopsy of lung' (33.28) or 'thoracoscopic lung biopsy' (33.20; introduced October 2007).

'Excision' codes: ICD-9-CM procedure codes for 'other local excision or destruction of tissue of lung' (32.29) or 'thoracoscopic excision of lesion or tissue of lung' (32.20; introduced October 2007).

Table E6: Estimated number of surgical lung biopsies performed for interstitial lung disease nationwide (using 'excision' codes only)

Year of biopsy	Total admissions	Elective admissions	Non-elective admissions
	Number (95% CI)	Number (95% CI)	Number (95% CI)
2000	4,676 (4,109-5,243)	3,061 (2,611-3,511)	1,238 (1,011-1,465)
2001	5,279 (4,549-6,009)	3,680 (3,097-4,263)	1,279 (1,042-1,516)
2002	5,805 (4,903-6,708)	4,420 (3,664-5,176)	1,385 (1,148-1,623)
2003	5,193 (4,474-5,912)	3,796 (3,197-4,395)	1,393 (1,142-1,644)
2004	5,492(4,704-6,281)	4,092 (3,447-4,737)	1,396(1,168-1,623)
2005	5,782 (4,906-6,658)	4,243 (3,515-4,970)	1,531(1,254-1,807)
2006	6,110 (5,213-7,007)	4,427 (3,673-5,181)	1,683 (1,435-1,931)
2007	6,374 (5,233-7,514)	4,792 (3,766-5,819)	1,566 (1,335-1,797)
2008	7,874 (6,912-8,837)	5,805 (5,004-6,605)	2,056 (1,717-2,396)
2009	8,158 (7,107-9,209)	5,738 (4,871-6,605)	2,420 (2,022-2,818)
2010	7,932 (6,787-9,077)	5,909 (4,906-6,912)	2,018 (1,700-2,336)
2011	8,479 (7,348-9,609)	6,226 (5,262-7,189)	2,235 (1,916-2,554)

Excludes those with any code for 'biopsy' procedure.

95% CI: 95% confidence intervals. Numbers rounded to nearest integer.

'Biopsy' codes: ICD-9-CM procedure codes for 'open biopsy of lung' (33.28) or 'thoracoscopic lung biopsy' (33.20; introduced October 2007).

'Excision' codes: ICD-9-CM procedure codes for 'other local excision or destruction of tissue of lung' (32.29) or 'thoracoscopic excision of lesion or tissue of lung' (32.20; introduced October 2007).

Table E7: Estimated total number of surgical lung biopsies performed for interstitial lung disease per region, 2000-2011

Region	Number of records (95% CI)	Person-years	Biopsies per 100,000 population per year
Midwest	38,504 (36310-40699)	791,106,362	4.87 (4.82-4.92)
Northeast	32,835 (30286-35384)	656,063,179	5.00 (4.95-5.06)
South	54,197 (51614-56780)	1,198,517,748	4.52 (4.48-4.56)
West	26,321 (24603-28039)	820,412,146	3.21 (3.17-3.25)

95% CI: 95% Confidence Intervals.

Person-years: Cumulative annual population estimates, US Census Bureau, Population Division, accessed October 2015 from <http://www.census.gov/popest/data/historical/index.html>.

Table E8: Estimated total number of elective surgical lung biopsies performed for interstitial lung disease per region, 2000-2011

Region	Number of records (95% CI)	Person-years	Biopsies per 100,000 population per year
Midwest	26,824 (25,042-28,606)	791,106,362	3.39 (3.35-3.43)
Northeast	22,108 (20,020-24,197)	656,063,179	3.37 (3.33-3.41)
South	35,345 (33,329-37,361)	1,198,517,748	2.95 (2.92-2.98)
West	16,421 (15,037-17,805)	820,412,146	2.00 (1.97-2.03)

95% CI: 95% Confidence Intervals.

Person-years: Cumulative annual population estimates, US Census Bureau, Population Division, accessed October 2015 from <http://www.census.gov/popest/data/historical/index.html>.

Table E9: Estimated total number of non-elective surgical lung biopsies performed for interstitial lung disease per region, 2000-2011

Region	Number of records (95% CI)	Person-years	Biopsies per 100,000 population per year
Midwest	11,506 (10,693-12,319)	791,106,362	1.45 (1.43-1.48)
Northeast	10,702 (9,948-11,456)	656,063,179	1.63 (1.60-1.66)
South	18,803 (17,688-19,917)	1,198,517,748	1.57 (1.55-1.59)
West	7,874 (7,285-8,463)	820,412,146	0.96 (0.94-0.98)

95% CI: 95% Confidence Intervals.

Person-years: Cumulative annual population estimates, US Census Bureau, Population Division, accessed October 2015 from <http://www.census.gov/popest/data/historical/index.html>.

Table E10: Multivariable analysis – associations with in-hospital death after surgical lung biopsy – all procedures

Variables	Cases	Deaths (%)	Unadjusted OR (95% CI)	p value	Adjusted OR (95% CI)	p value
Sex						
Female	79,068	4,398 (5.6)	1.00		1.00	
Male	72,789	5,302 (7.3)	1.33 (1.22-1.46)	<0.001	1.28 (1.16-1.41)	<0.001
Age (years)						
<45	24,638	818 (3.3)	1.00	<0.001	1.00	<0.001
45-54	29,711	996 (3.4)	1.01 (0.82-1.24)	(p for trend)	0.95 (0.77-1.18)	(p for trend)
55-64	38,288	2,036 (5.3)	1.64 (1.36-1.96)		1.44 (1.19-1.74)	
65-74	38,657	3,207 (8.3)	2.63 (2.21-3.14)		2.25 (1.88-2.71)	
75-84	19,183	2,410 (12.6)	4.19 (3.49-5.02)		3.16 (2.60-3.83)	
>84	1,378	232 (16.9)	5.90 (4.17-8.36)		4.62 (3.15-6.77)	
Updated Charlson score						
0	65,903	2,210 (3.4)	1.00	<0.001	1.00	<0.001
1	51,430	2,475 (4.8)	1.46 (1.28-1.66)	(p for trend)	1.50 (1.31-1.71)	(p for trend)
2	15,706	2,022 (12.9)	4.26 (3.71-4.89)		3.83 (3.31-4.43)	
3 or more	18,817	2,994 (15.9)	5.46 (4.79-6.21)		4.95 (4.31-5.68)	
Geographical region						
South	54,197	3,553 (6.6)	1.00		1.00	
Northeast	32,835	1,921 (5.9)	0.89 (0.77-1.02)	0.093	0.78 (0.67-0.92)	0.002
Midwest	38,504	2,214 (5.8)	0.87 (0.76-0.99)	0.036	0.86 (0.75-0.98)	0.025
West	26,321	2,012 (7.6)	1.18 (1.03-1.35)	0.015	1.06 (0.92-1.23)	0.409
Year group						
2000-2002	37,056	2,707 (7.3)	1.00	<0.001	1.00	<0.001
2003-2005	38,441	2,685 (7.0)	0.95 (0.84-1.08)	(p for trend)	0.97 (0.85-1.12)	(p for trend)
2006-2008	38,648	2,287 (5.9)	0.80 (0.70-0.91)		0.84 (0.72-0.97)	
2009-2011	37,712	2,021 (5.4)	0.72 (0.62-0.83)		0.71 (0.61-0.84)	
Type of operation (post-October 2007 patients only)						
VATS	37,739	1,418 (3.8)	1.00		-	-
Open	15,732	1,562 (9.9)	2.82 (2.36-3.37)	<0.001	-	-
Provisional diagnosis (patients with single ILD diagnostic code only)						
PIF	115,832	6,339 (5.5)	1.00		1.00	
IPF-CS	13,387	2,056 (15.4)	3.13 (2.78-3.54)	<0.001	2.71 (2.38-3.09)	<0.001
CTD-ILD	2,208	238 (10.8)	2.08 (1.54-2.82)	<0.001	1.62 (1.18-2.22)	0.003
Sarcoid	7,848	199 (2.5)	0.45 (0.32-0.62)	<0.001	0.65 (0.47-0.91)	0.012
HP	1,532	44 (2.9)	0.52 (0.26-1.01)	0.053	0.48 (0.24-0.95)	0.036
Pneumo	3,545	62 (1.7)	0.30 (0.17-0.53)	<0.001	0.19 (0.11-0.33)	<0.001

Multivariable analysis excludes type of operation due to lower numbers; type of operation remained significant if included.

Higher Updated Charlson score reflects greater degree of co-morbidity.

Estimated numbers of cases and deaths rounded to nearest integer.

VATS: video-assisted thoracoscopic surgery. OR: Odds Ratio; 95% CI: 95% confidence interval.

PIF: post-inflammatory fibrosis; IPF-CS: idiopathic pulmonary fibrosis clinical-syndrome; CTD-ILD: connective tissue disease related interstitial lung disease; HP: hypersensitivity pneumonitis; Pneumo: pneumoconioses, including asbestosis.

Table E11: Multivariable analysis – associations with in-hospital death after surgical lung biopsy – non-elective procedures

Variables	Cases	Deaths (%)	Unadjusted OR (95% CI)	p value	Adjusted OR (95% CI)	p value
Sex						
Female	24,388	3,574 (14.7)	1.00		1.00	
Male	24,497	4,222 (17.3)	1.21 (1.09-1.35)	<0.001	1.17 (1.04-1.32)	0.008
Age (years)						
<45	9,267	696 (7.5)	1.00	<0.001	1.00	<0.001
45-54	9,218	812 (8.8)	1.19 (0.95-1.50)	(p for trend)	1.13 (0.89-1.43)	(p for trend)
55-64	11,045	1,606 (14.6)	2.10 (1.71-2.57)		1.86 (1.50-2.31)	
65-74	11,408	2,554 (22.4)	3.56 (2.92-4.33)		3.12 (2.53-3.84)	
75-84	7,300	1,932 (26.5)	4.44 (3.61-5.46)		3.62 (2.90-4.52)	
>84	647	196 (30.3)	5.34 (3.54-8.04)		4.49 (2.88-7.02)	
Updated Charlson score						
0	14,330	1,745 (12.2)	1.00	<0.001	1.00	<0.001
1	16,885	1,935 (11.5)	0.93 (0.80-1.09)	(p for trend)	1.00 (0.85-1.17)	(p for trend)
2	7,238	1,596 (22.1)	2.04 (1.73-2.41)		1.81 (1.52-2.16)	
3 or more	10,432	2,519(24.2)	2.30 (1.97-2.67)		2.06 (1.75-2.42)	
Geographical region						
South	18,803	2,838 (15.1)	1.00		1.00	
Northeast	10,702	1,686 (15.8)	1.05 (0.90-1.23)	0.523	0.88 (0.75-1.05)	0.153
Midwest	11,506	1,722 (15.0)	0.99 (0.84-1.16)	0.886	0.90 (0.76-1.06)	0.208
West	7,874	1,550 (19.7)	1.38 (1.18-1.61)	<0.001	1.21 (1.02-1.43)	0.033
Year group						
2000-2002	11,646	2,008 (17.3)	1.00	<0.001	1.00	<0.001
2003-2005	12,677	2,233 (17.7)	1.03 (0.88-1.20)	(p for trend)	1.06 (0.90-1.25)	(p for trend)
2006-2008	12,419	1,896 (15.3)	0.87 (0.74-1.01)		0.90 (0.76-1.07)	
2009-2011	12,143	1,659 (13.7)	0.76 (0.64-0.90)		0.77 (0.64-0.92)	
Type of operation (post-October 2007 patients only)						
VATS	11,043	1,104 (10.0)	1.00		-	-
Open	6,189	1,344 (21.7)	2.50 (2.04-3.06)	<0.001	-	-
Provisional diagnosis (patients with single ILD diagnostic code only)						
PIF	34,509	5,111 (14.8)	1.00		1.00	
IPF-CS	5,677	1,589 (28.0)	2.23 (1.93-2.58)	<0.001	2.05 (1.76-2.39)	<0.001
CTD-ILD	1,071	171 (16.0)	1.09 (0.76-1.57)	0.624	1.19 (0.82-1.73)	0.370
Sarcoid	2,436	184 (7.6)	0.47 (0.33-0.67)	<0.001	0.72 (0.51-1.04)	0.077
Other	1,854	91 (4.9)	0.30 (0.19-0.48)	<0.001	0.28 (0.17-0.46)	<0.001

Multivariable analysis excludes type of operation due to lower numbers; type of operation remained significant if included.

Higher Updated Charlson score reflects greater degree of co-morbidity.

Estimated numbers of cases and deaths rounded to nearest integer.

VATS: video-assisted thoracoscopic surgery. OR: Odds Ratio; 95% CI: 95% confidence interval.

PIF: post-inflammatory fibrosis; IPF-CS: idiopathic pulmonary fibrosis clinical-syndrome; CTD-ILD: connective tissue disease related interstitial lung disease; 'Other': hypersensitivity pneumonitis and pneumoconioses (including asbestosis) – grouped due to smaller numbers.

Table E12: Multivariable analysis – associations with in-hospital death after surgical lung biopsy, for all procedures – ‘biopsy’ codes only

Variables	Cases	Deaths (%)	Unadjusted OR (95% CI)	p value	Adjusted OR (95% CI)	p value
Sex						
Female	38,910	3,216 (8.3)	1.00		1.00	
Male	35,793	3,828 (10.7)	1.33 (1.20-1.48)	<0.001	1.24 (1.10-1.40)	<0.001
Age (years)						
<45	12,135	593 (4.9)	1.00	<0.001	1.00	<0.001
45-54	14,007	693 (4.9)	1.01 (0.79-1.30)	(p for trend)	0.94 (0.72-1.21)	(p for trend)
55-64	18,871	1,515 (8.0)	1.70 (1.37-2.10)		1.46 (1.17-1.84)	
65-74	19,028	2,306 (12.1)	2.68 (2.18-3.30)		2.19 (1.75-2.74)	
75-84	10,082	1,757 (17.4)	4.11 (3.31-5.10)		3.03 (2.40-3.84)	
>84	581	180 (31.0)	8.74 (5.66-13.48)		6.81 (4.19-11.07)	
Updated Charlson score						
0	31,544	1,682 (5.3)	1.00	<0.001	1.00	<0.001
1	24,269	1,739 (7.2)	1.37 (1.18-1.60)	(p for trend)	1.42 (1.21-1.67)	(p for trend)
2	8,680	1,494 (17.3)	3.70 (3.14-4.36)		3.28 (2.75-3.90)	
3 or more	10,209	2,128 (20.9)	4.68 (4.01-5.47)		4.19 (3.55-4.94)	
Geographical region						
South	26,665	2,600 (9.8)	1.00		1.00	
Northeast	13,825	1,302 (9.4)	0.96 (0.82-1.13)	0.625	0.92 (0.77-1.09)	0.316
Midwest	18,893	1,590 (8.4)	0.85 (0.73-0.99)	0.033	0.81 (0.69-0.95)	0.012
West	15,320	1,553 (10.1)	1.04 (0.90-1.21)	0.593	0.98 (0.83-1.16)	0.819
Year group						
2000-2002	21,295	2,159 (10.1)	1.00	0.043	1.00	0.139
2003-2005	21,974	2,110 (9.6)	0.94 (0.82-1.08)	(p for trend)	0.98 (0.85-1.12)	(p for trend)
2006-2008	18,290	1,591 (8.7)	0.84 (0.72-0.98)		0.88 (0.74-1.04)	
2009-2011	13,143	1,184 (9.0)	0.88 (0.74-1.04)		0.91 (0.75-1.09)	
Type of operation (post-October 2007 patients only)						
VATS	10,952	597 (5.5)	1.00		-	-
Open	8,181	1,183 (14.5)	2.93 (2.32-3.69)	<0.001	-	-
Provisional diagnosis (patients with single ILD diagnostic code only)						
PIF	54,077	4,521 (8.4)	1.00		1.00	
IPF-CS	9,114	1,612 (17.7)	2.35 (2.05-2.71)	<0.001	2.16 (1.86-2.51)	<0.001
CTD-ILD	1,238	160 (13.0)	1.63 (1.12-2.37)	0.011	1.37 (0.93-2.03)	0.115
Sarcoid	3,815	103 (2.7)	0.30 (0.19-0.49)	<0.001	0.46 (0.29-0.75)	0.002
HP	958	33 (3.5)	0.40 (0.19-0.85)	0.017	0.39 (0.18-0.84)	0.017
Pneumo	1,353	41 (3.1)	0.34 (0.18-0.68)	0.002	0.23 (0.11-0.45)	<0.001

‘Biopsy’ codes: ICD-9-CM procedure codes for ‘open biopsy of lung’ (33.28) or ‘thoracoscopic lung biopsy’ (33.20; introduced October 2007).

Multivariable analysis excludes type of operation due to lower numbers; type of operation remained significant if included.

Higher Updated Charlson score reflects greater degree of co-morbidity.

Estimated numbers of cases and deaths rounded to nearest integer.

VATS: video-assisted thoracoscopic surgery. OR: Odds Ratio; 95% CI: 95% confidence interval.

PIF: post-inflammatory fibrosis; IPF-CS: idiopathic pulmonary fibrosis clinical-syndrome; CTD-ILD: connective tissue disease related interstitial lung disease; HP: hypersensitivity pneumonitis; Pneumo: pneumoconioses, including asbestosis.

Table E13: Multivariable analysis – associations with in-hospital death after surgical lung biopsy, for elective procedures – ‘biopsy’ codes only

Variables	Cases	Deaths (%)	Unadjusted OR (95% CI)	p value	Adjusted OR (95% CI)	p value
Sex						
Female	23,365	494 (2.1)	1.00		1.00	
Male	21,145	640 (3.0)	1.45 (1.12-1.86)	0.004	1.30 (1.00-1.70)	0.050
Age (years)						
<45	6,781	48 (0.7)	1.00	<0.001	1.00	<0.001
45-54	8,510	100 (1.2)	1.67 (0.79-3.54)	(p for trend)	1.90 (0.84-4.27)	(p for trend)
55-64	11,882	269 (2.3)	3.26 (1.65-6.43)		2.97 (1.40-6.31)	
65-74	11,724	373 (3.2)	4.63 (2.40-8.94)		4.14 (1.98-8.66)	
75-84	5,371	320 (6.0)	8.93 (4.64-17.18)		7.14 (3.44-14.82)	
>84	242	24 (10.0)	15.61 (5.10-47.76)		11.04 (3.66-33.37)	
Updated Charlson score						
0	22,196	267 (1.2)	1.00	<0.001	1.00	<0.001
1	15,052	333 (2.2)	1.86 (1.31-2.64)	(p for trend)	1.78 (1.24-2.56)	(p for trend)
2	3,809	249 (6.5)	5.74 (3.92-8.42)		5.05 (3.37-7.58)	
3 or more	3,453	285 (8.3)	7.40 (5.08-10.80)		6.08 (4.08-9.05)	
Geographical region						
South	15,920	512 (3.2)	1.00		1.00	
Northeast	7,999	140 (1.7)	0.54 (0.35-0.81)	0.003	0.63 (0.42-0.96)	0.030
Midwest	11,826	317 (2.7)	0.83 (0.60-1.14)	0.251	0.85 (0.60-1.19)	0.338
West	8,766	166 (1.9)	0.58 (0.40-0.85)	0.006	0.63 (0.42-0.95)	0.026
Year group						
2000-2002	12,150	367 (3.0)	1.00	0.110	1.00	0.248
2003-2005	13,589	341 (2.5)	0.83 (0.59-1.15)	(p for trend)	0.84 (0.59-1.20)	(p for trend)
2006-2008	11,139	249 (2.2)	0.74 (0.51-1.05)		0.76 (0.52-1.12)	
2009-2011	7,633	177 (2.3)	0.77 (0.51-1.14)		0.79 (0.52-1.22)	
Type of operation (post-October 2007 patients only)						
VATS	7,123	106 (1.5)	1.00		-	-
Open	4,023	159 (3.9)	2.72 (1.58-4.69)	<0.001	-	-
Provisional diagnosis (patients with single ILD diagnostic code only)						
PIF	33,445	740 (2.2)	1.00		1.00	
IPF-CS	4,716	270 (5.7)	2.69 (1.96-3.69)	<0.001	2.33 (1.65-3.28)	<0.001
CTD-ILD	523	38 (7.2)	3.43 (1.64-7.18)	0.001	2.15 (0.99-4.67)	0.053
Sarcoid	2,467	10 (0.4)	0.18 (0.04-0.72)	0.015	0.30 (0.07-1.21)	0.090
Other	1,323	14 (1.1)	0.49 (0.15-1.56)	0.225	0.33 (0.10-1.07)	0.066

‘Biopsy’ codes: ICD-9-CM procedure codes for ‘open biopsy of lung’ (33.28) or ‘thoracoscopic lung biopsy’ (33.20; introduced October 2007).

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Higher Updated Charlson score reflects greater degree of co-morbidity.

Estimated numbers of cases and deaths rounded to nearest integer.

VATS: video-assisted thoracoscopic surgery. OR: Odds Ratio; 95% CI: 95% confidence interval.

PIF: post-inflammatory fibrosis; IPF-CS: idiopathic pulmonary fibrosis clinical-syndrome; CTD-ILD: connective tissue disease related interstitial lung disease; ‘Other’: hypersensitivity pneumonitis and pneumoconioses (including asbestosis) – grouped due to smaller numbers.

Table E14: Multivariable analysis – associations with in-hospital death after surgical lung biopsy, for non-elective procedures – ‘biopsy’ codes only

Variables	Cases	Deaths (%)	Unadjusted OR (95% CI)	p value	Adjusted OR (95% CI)	p value
Sex						
Female	14,768	2,644 (17.9)	1.00		1.00	
Male	13,917	3,073 (22.1)	1.30 (1.14-1.47)	<0.001	1.22 (1.06-1.41)	0.005
Age (years)						
<45	5,086	523 (10.3)	1.00	<0.001	1.00	<0.001
45-54	5,222	562 (10.8)	1.05 (0.80-1.38)	(p for trend)	0.99 (0.74-1.31)	(p for trend)
55-64	6,632	1,214 (18.3)	2.96 (1.54-2.48)		1.75 (1.36-2.25)	
65-74	6,948	1,895 (27.3)	3.27 (2.60-4.12)		2.79 (2.18-3.58)	
75-84	4,479	1,376 (30.8)	3.87 (3.03-4.95)		3.17 (2.43-4.13)	
>84	318	148 (46.5)	7.58 (4.46-12.87)		7.03 (3.96-12.47)	
Updated Charlson score						
0	8,583	1,379 (16.1)	1.00	<0.001	1.00	<0.001
1	8,838	1,376 (15.6)	0.97 (1.81-1.16)	(p for trend)	1.02 (0.85-1.24)	(p for trend)
2	4,681	1,178 (25.2)	1.76 (1.45-2.14)		1.55 (1.25-1.90)	
3 or more	6,582	1,785 (27.2)	1.95 (1.63-2.33)		1.72 (1.43-2.09)	
Geographical region						
South	10,718	2,088 (19.5)	1.00		1.00	
Northeast	5,829	1,162 (20.0)	1.03 (0.86-1.23)	0.759	0.92 (0.76-1.13)	0.440
Midwest	6,958	1,273 (18.3)	0.92 (0.77-1.11)	0.392	0.83 (0.69-1.01)	0.064
West	5,189	1,194 (23.0)	1.23 (1.03-1.48)	0.026	1.07 (0.88-1.32)	0.488
Year group						
2000-2002	7,744	1,601 (20.7)	1.00	0.065	1.00	0.240
2003-2005	8,358	1,769 (21.2)	1.03 (0.87-1.23)	(p for trend)	1.09 (0.90-1.33)	(p for trend)
2006-2008	7,113	1,341 (18.9)	0.89 (0.75-1.07)		0.94 (0.77-1.15)	
2009-2011	5,470	1,006 (18.4)	0.86 (0.71-1.06)		0.93 (0.75-1.16)	
Type of operation (post-October 2007 patients only)						
VATS	3,797	492 (13.0)	1.00		-	-
Open	4,144	1,024 (24.7)	2.21 (1.70-2.86)	<0.001	-	-
Provisional diagnosis (patients with single ILD diagnostic code only)						
PIF	19,736	3,701 (18.8)	1.00		1.00	
IPF-CS	4,052	1,252 (30.9)	1.93 (1.64-2.29)	<0.001	1.85 (1.55-2.20)	<0.001
CTD-ILD	688	123 (17.8)	0.94 (0.61-1.44)	0.770	1.11 (0.70-1.76)	0.648
Sarcoid	1,270	93 (7.3)	0.34 (0.21-0.57)	<0.001	0.51 (0.30-0.85)	0.009
Other	932	60 (6.5)	0.30 (0.17-0.53)	<0.001	0.28 (0.15-0.50)	<0.001

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