Supplementary Material

Patient Characteristics and Outcome Measures

Baseline characteristics considered for analysis were demographics including age, gender, race, primary expected insurance payer, median household income for patient's ZIP code; relevant Elixhauser comorbidities as defined by the AHRQ [1], and other clinically relevant comorbidities such as coronary artery disease, dyslipidemia, atrial fibrillation/flutter and thyroid disorders. A separate list of ICD-9-CM/ICD-10-CM codes and clinical classification software codes used to define the listed comorbidities is provided in **Supplementary Table 2**. Thrombolysis was characterized by ICD-9 PCS 99.10 in PE patients, except for thrombolysis for other indications, indicated by secondary diagnostic codes for deep venous thrombosis, ST-elevation myocardial infarction, and ischemic stroke **(Supplementary Table 3)**. Patient with ICD codes for both pulmonary arteriography (ICD-9 code 88.43) and thrombolysis were categorized as catheter directed thrombolysis recipients.

We studied differences in clinical characteristics between PE patients with OSA and PE patients without OSA. Our primary outcome was inpatient mortality. Secondary outcome of interest was length of stay (LOS) during index hospitalization for PE. We also studied temporal trends of mortality in PE patients by prevalent OSA and also compared mortality between patients with and without OSA (OSA+ and OSA- respectively).

Statistical Analysis

Weighted data were used for statistical analyses. Continuous variables were reported as mean±SEM or median with interquartile range, while categorical variables were expressed as frequencies. Baseline characteristics were compared by Student's t-test or Wilcoxon rank sum test for continuous variables based on normality. Categorical variables were compared using Pearson's chi-squared test. We accounted for the weighting, clustering and stratification needed in the NIS design in all analyses by using STATA's SVY suite of commands with hospital used as the primary sampling unit. Temporal trends in mortality were assessed using Cochran-Armitage trend test. LOS trend was assessed by multivariable linear regression using log-transformed LOS as the dependent variable and year as a continuous variable. All trend analyses were carried out using NIS provided trend weights to account for NIS redesign in 2012. Association between OSA and inpatient mortality in PE patients was analyzed using multivariable logistic regression. All multivariable regression models were created utilizing generalized estimating equations.

Most variables had <1% missing values except race and median household income quartile (approximately 13% and 2.5% respectively). Missing data for race were handled using multiple imputation as recommended by HCUP [2]. Missing primary payer status in patients ≥65 years age was imputed to Medicare whereas missing data for all other variables were imputed to the dominant category. All statistical analyses were performed using STATA 15.1 (StataCorp, LP, College Station, Texas). To account for multiple testing, Holm-Bonferroni correction was applied such that $p< 0.001$ was considered for statistical significance.

REFERENCES:

1. Elixhauser A, Steiner C, Harris DR, et al. Comorbidity measures for use with administrative data. *Med Care* 1998; 36: 8-27. 1998/02/07.
2. Houchens RL. Missing Data Methods for the NIS and the SID. HCUP Methods Series Report No. 2015-01. Rockville, MD: Agency for Healthcare Research and Quality; January 22, 2015. http://www.hcup-us.ahrq.gov/reports/methods/2015_01.pdf. 2015.

Supplementary Table 1: ICD-9 and ICD-10 codes for pulmonary embolism.

Diagnosis	**ICD-9-CM code**	**ICD-10-CM code**
Pulmonary embolism	415.x	I26.x
History of pulmonary embolism	V12.55	Z86.711
Chronic pulmonary embolism	416.2	I27.82
PE complicating abortion, ectopic or molar pregnancy	634, 638, 639.6	O03.2, O04.7, O07.2, O08.2
PE complicating pregnancy, childbirth or puerperium	673.0, 673.8	O88
PE due to trauma	958.0, 958.1	T79.0, T79.1
PE due to complications of medical or surgical care	415.11, 999.1	T80.0, T81.7, T82.8

Supplementary Table 2: ICD-9 and ICD-10 codes for clinical characteristics

Clinical characteristic	**ICD-9-CM code**	**ICD-10-CM code**
Diabetes without complications	250.0	E10.9, E11.9
Diabetes with complications	250.1, 250.2, 250.3, 250.4, 250.5, 250.6, 250.7, 250.8, 250.9	E10.1, E10.2, E10.3, E10.4, E10.5, E10.7, E10.8; E11.0, E11.1, E11.2, E11.3, E11.4, E11.5, E11.6, E11.7, E11.8
Hypertension	401.9	I10
Dyslipidemia	272.4	E78.4, E78.5
Coronary artery disease	414.01	I25.10
Alcohol abuse	305.0	F10.10
Atrial Fibrillation	427.31	I48.91
Smoking	V15.82, 305.1	Z87.891, F17.200
Drug abuse	305.1, 305.2, 305.3, 305.4, 305.5, 305.6, 305.7, 305.8, 305.9	F19.10
Chronic pulmonary disease	490x-492.x, 493.x, 494x-505.x, 506.4	I27.8, 127.9, J40.x-J47.x, J60.x-J67.x, J68.4, J70.1, J70.3

Supplementary Table 3: ICD-9 and ICD-10 codes used for defining thrombolysis.

Clinical characteristic	**ICD-9-CM/PCS code**	**ICD-10-CM/PCS code**
Thrombolysis	99.10*	3E03317, 3E04317*
Deep venous thrombosis	453.41, 453.2	I82.4x, I82.2x
Acute ST elevation MI	410.x	I21.x
Acute stroke	434.x, 436	I66.x, I67.89
Pulmonary arteriography	88.43*	B31Sx, B31Tx

*- indicates PCS codes.

Supplementary table 4: ICD codes used to define sleep apnea group

Definition	Code
ICD-9 CM	
Obstructive sleep apnea	327.23
Insomnia with sleep apnea, unspecified	780.51
Hypersomnia with sleep apnea, unspecified	780.53
Unspecified sleep apnea	780.57
ICD-10 CM	
Obstructive sleep apnea	G47.33
Sleep related hypoventilation in conditions classified elsewhere	G47.36
Other sleep apnea	G47.39
Unspecified sleep apnea	G47.30

ICD: International classification of diseases

Supplementary table 5: Differences in inpatient mortality by Non-invasive positive pressure ventilation use

Parameter	Total population	PE without OSA	PE with OSA	p
Without CPAP use	735,751	680,075	55,676	
In-patient mortality	47,771 (6.5%)	45,649 (6.7%)	2,122 (3.8%)	<0.0001
With CPAP use	19,781	14,407	5,374	
In-patient mortality	4,181 (21.2%)	3,813 (26.5%)	368 (6.9%)	<0.0001

CPAP: Continuous positive airway pressure. Variables expressed as N (%). Comparisons performed between groups using Pearson's chi-squared test.

Supplementary Table 6: Association between obstructive sleep apnea and in-patient mortality among patients admitted with acute pulmonary embolism stratified by non-invasive positive pressure ventilation use.

Model	Odds ratio	95% CI	p
Without CPAP use			
Unadjusted	0.55	0.53-0.58	<0.0001
Adjusted*	0.56	0.53-0.59	<0.0001
With CPAP use			
Unadjusted	0.21	0.18-0.23	<0.0001
Adjusted*	0.35	0.30-0.40	<0.0001

CPAP: Continuous positive airway pressure. CI: confidence interval. *-adjusted for age, sex, race, primary insurance payer, median income quartile by ZIP code, Elixhauser comorbidities, coronary artery disease, hyperlipidemia, atrial fibrillations/flutter, smoking, non-invasive continuous positive airway pressure ventilator use, thrombolysis, pulmonary hypertension, respiratory failure and hypoxia.