

# Comorbidities Associated with In-hospital Death among Hospitalizations with a Diagnosis of Venous Thromboembolism\*

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## Background



Venous thromboembolism (VTE) is responsible for approximately 100,000–180,000 deaths per year in the US. This study was to determine whether and to what extent medical co-morbidities were associated with in-hospital death among hospitalizations with a diagnosis of VTE.

## Method

We analyzed data from the 2009 National Inpatient Sample developed by the Agency for Healthcare Research and Quality (AHRQ) to estimate the case-fatality rates for in-hospital death among a sample of 156,180 hospitalizations with a VTE diagnosis and among subgroups stratified by demographic and clinical

characteristics, and 29 comorbidities of AHRQ/Elixhauser index. We produced adjusted rate ratios (aRR) and 95% confidence intervals with multivariate regression models by using demographic, clinical characteristics, and comorbidities as predictors; status of in-hospital death was used as an outcome variable.

## Conclusion

The findings of this study underscore the importance of risk assessment and management of hospitalized VTE patients with concurrent medical comorbidities that may place them at an increased risk of death.



## Results

In 2009, approximately 44,500 in-hospital deaths occurred among hospitalizations with a VTE diagnosis in the US, representing an overall case-fatality rate of 5.6%. The likelihoods of in-hospital death increased significantly ( $P < 0.01$ ) among hospitalizations with a VTE diagnosis and comorbidity of congestive heart failure [adjusted rate ratio (aRR)=1.43], chronic pulmonary disease (aRR=1.07), coagulopathy (aRR=1.84), liver disease (aRR=1.18), lymphoma (aRR=1.44), fluid and electrolyte disorders (aRR=1.91), metastatic cancer (aRR=1.90), peripheral vascular disorders (aRR=1.21), pulmonary circulation disorders (aRR=2.06), renal failure (aRR=1.38), solid tumor without metastasis (aRR=1.35), or weight loss (aRR=1.38), when compared to hospitalizations without the corresponding comorbidities.

**Table 1. The International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) codes for identification of Venous Thromboembolism, NIS, 2009**

Venous Thromboembolism	ICD-9-CM Codes <sup>a</sup>
Pulmonary embolism	415.1x, 634.6x, 635.6x, 636.6x, 637.6x, 638.6x, and 673.2x
Deep vein thrombosis	451.1x, 451.2, 451.8x, 451.9, 453.2, 453.4x, 453.8x, 453.9, 671.3x, 671.4x, and 671.9x

<sup>a</sup>5-digit codes were included in the corresponding 4-digit codes (e.g., 453.4x includes 453.40, 453.41, and 453.42).

**Table 2. Sample Distribution and Case-fatality Rates Among Hospitalizations with a Diagnosis of Venous Thromboembolism by Demographic and Clinical Characteristics, NIS, 2009**

Characteristics	Distribution		In-hospital Death			P-value <sup>d</sup>
	n <sup>a</sup>	%	N <sup>b</sup>	Case-fatality (%)	CI <sup>c</sup>	
<b>Overall</b>	156,180	100	44,500	5.6	5.4–5.9	
<b>Age</b>						$P < 0.001$
1–49	35,201	22.4	4,698	2.7	2.5–2.9	
50–79	87,655	56.1	26,415	6.0	5.7–6.2	
≥80	33,324	21.5	13,350	7.9	7.5–8.3	
<b>Sex</b>						$P < 0.001$
Male	74,045	47.4	22,491	6.0	5.8–6.3	
Female	82,084	52.6	21,970	5.3	5.1–5.5	
<b>Race/ethnicity</b>						$P < 0.001$
White	95,067	60.9	26,719	5.6	5.3–5.8	
Black	21,302	13.6	6,124	5.7	5.3–6.1	
Hispanic	9,515	6.1	2,863	6.0	5.4–6.6	
Asian or other race/ethnicity	6,450	4.1	2,521	7.6	6.8–8.5	
Not stated	23,846	15.3	6,235	5.3	4.7–5.9	
<b>Days of hospital stay</b>						$P < 0.001$
< 7 days	85,630	54.9	18,087	4.2	4.0–4.4	
≥ 7 days	70,543	45.1	26,363	7.4	7.1–7.7	
<b>Primary expected payer</b>						$P < 0.001$
Medicare	85,285	54.9	28,716	6.6	6.4–6.9	
Medicaid	14,961	9.6	3,463	4.6	4.2–5.0	
Private including HMO	43,398	27.8	9,535	4.4	4.1–4.7	
Self-pay or other payers	12,177	7.7	2,672	4.4	4.0–4.9	
<b>Major operating room procedure</b>						$P < 0.001$
None at all	62,331	40.0	6,013	1.9	1.8–2.1	
Non-major operating room procedure	49,814	31.9	23,856	9.5	9.1–9.9	
Major operating room procedure	44,035	28.1	14,594	6.6	6.3–6.9	
<b>Number of comorbidities</b>						$P < 0.001$
0	12,128	7.8	970	1.6	1.3–1.9	
1–2	55,227	35.5	10,922	3.9	3.6–4.2	
3–4	55,282	35.4	16,164	5.8	5.5–6.1	
≥5	33,543	21.4	16,406	9.7	9.3–10.2	

<sup>a</sup>Maximum subgroup sample size.  
<sup>b</sup>Estimated number of in-hospital deaths.  
<sup>c</sup>95% confidence interval.  
<sup>d</sup>P-value for Pearson Chi-Square test.

**Table 3. Case-fatality Rates and Rate Ratios for In-hospital death by AHRQ/Elixhauser Comorbidity Index Among Hospitalizations with a Diagnosis of Venous Thromboembolism, NIS, 2009**

AHRQ/Elixhauser comorbidity index <sup>a</sup>	In-hospital Death					
	%	95% CI <sup>c</sup>	RR <sup>d</sup>	95% CI	aRR <sup>e</sup>	95% CI
n <sup>a</sup> =156,112						
Acquired immune deficiency syndrome	4.0	2.6–6.3	0.71	0.46–1.10	0.79	0.50–1.23
Alcohol abuse	4.7	4.2–5.3	0.84	0.74–0.95	0.83	0.73–0.94
Anemia (deficiency)	5.9	5.5–6.2	1.06	1.00–1.13	0.72	0.68–0.76
Arthritis (rheumatoid)/collagen vascular diseases	4.9	4.3–5.5	0.87	0.77–0.98	0.96	0.85–1.08
Chronic blood loss anemia	5.0	4.2–5.8	0.88	0.75–1.03	0.65	0.56–0.76
Congestive heart failure	10.8	10.3–11.4	2.21	2.10–2.32	1.43	1.37–1.50
Chronic pulmonary disease	6.7	6.4–7.1	1.26	1.20–1.33	1.07	1.02–1.12
Coagulopathy	13.5	12.7–14.2	2.72	2.57–2.89	1.84	1.75–1.95
Depression	3.6	3.3–4.0	0.62	0.56–0.68	0.72	0.66–0.78
Diabetes, uncomplicated	5.6	5.3–6.0	0.99	0.94–1.06	0.96	0.91–1.01
Diabetes with chronic complications	5.5	4.9–6.1	0.97	0.87–1.09	0.82	0.74–0.91
Drug abuse	3.3	2.8–4.0	0.58	0.49–0.70	0.80	0.68–0.96
Hypertension (uncomplicated and complicated)	5.0	4.7–5.2	0.78	0.73–0.82	0.70	0.67–0.74
Hypothyroidism	5.0	4.6–5.4	0.87	0.80–0.94	0.88	0.82–0.94
Liver disease	8.0	7.1–8.9	1.42	1.26–1.61	1.18	1.05–1.33
Lymphoma	9.4	8.3–10.6	1.68	1.49–1.90	1.44	1.27–1.62
Fluid and electrolyte disorders	10.8	10.3–11.2	2.95	2.81–3.09	1.91	1.83–1.99
Metastatic cancer	11.4	10.7–12.1	2.18	2.05–2.32	1.90	1.78–2.02
Other neurological disorders	6.2	5.8–6.7	1.12	1.04–1.20	1.05	0.98–1.12
Obesity	3.7	3.4–4.1	0.63	0.58–0.69	0.87	0.80–0.94
Paralysis	6.9	6.2–7.6	1.23	1.12–1.36	1.10	1.00–1.21
Peripheral vascular disorders	8.3	7.7–8.9	1.51	1.40–1.63	1.21	1.13–1.30
Psychoses	4.0	3.5–4.6	0.71	0.62–0.81	0.79	0.69–0.89
Pulmonary circulation disorders	10.9	10.4–11.4	2.50	2.38–2.63	2.06	1.97–2.16
Renal failure	8.2	7.8–8.7	1.59	1.50–1.68	1.38	1.31–1.46
Solid tumor without metastasis	7.6	7.0–8.3	1.37	1.25–1.49	1.35	1.24–1.47
Peptic ulcer disease excluding bleeding	– <sup>f</sup>	–	–	–	–	–
Valvular disease	7.5	6.8–8.2	1.34	1.22–1.48	0.86	0.79–0.94
Weight loss	13.0	12.3–13.7	2.65	2.49–2.81	1.38	1.31–1.46

<sup>a</sup>Maximum subgroup sample size.  
<sup>b</sup>Reference groups were hospitalizations without the corresponding comorbidities.  
<sup>c</sup>95% confidence interval.  
<sup>d</sup>Unadjusted rate ratios.  
<sup>e</sup>Rate ratios from log-linear regression model that adjusted for age, sex, race/ethnicity, days of hospital stay, primary expected payer, major operating room procedure, and all comorbidities listed in table.  
<sup>f</sup>Unstable estimate due to small subgroup size.

## Learning Objective

To learn whether and to what extent medical co-morbidities are associated with in-hospital death among hospitalizations with a diagnosis of venous thromboembolism in the United States.

## Affiliations

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