

# Home Treatment of Deep Venous Thrombosis According to Comorbid Conditions



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## ABSTRACT

**BACKGROUND:** Cautious exploration of the safety of home treatment of deep venous thrombosis has been recommended by many. Our goal was to identify categories of patients with deep venous thrombosis who typically are hospitalized, and categories frequently treated at home.

**METHODS:** The Nationwide Emergency Department Sample and the Nationwide Inpatient Sample, 2007-2012, were used to determine the number of patients seen in emergency departments throughout the US with deep venous thrombosis and no diagnosis of pulmonary embolism, the proportion of such patients hospitalized according to comorbid conditions and age, the proportion discharged early ( $\leq 2$  days), and charges for hospitalization and emergency department visits.

**RESULTS:** From 2007-2012, home treatment was selected for 905,152 of 2,671,452 (33.9%) patients with deep venous thrombosis. Home treatment was more frequent in those with no comorbid conditions than with comorbid conditions, 58.0% compared with 15.5% ( $P < .0001$ ). Early discharge ( $\leq 2$  days) was in 23.9% with no comorbid conditions, compared with 12.8% with comorbid conditions. Among patients aged 18-50 years, home treatment was selected in 62.9% with no comorbid conditions, compared with 24.2% with comorbid conditions ( $P < .0001$ ). Among hospitalized patients with no comorbid conditions, 40.7% were aged 18-50 years. Their charges for hospitalization in 2012 were \$494 million.

**CONCLUSION:** Patients aged 50 years or younger with deep venous thrombosis and no comorbid conditions appear to be a group that can be targeted for more frequent home treatment, which would save millions of dollars.

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**KEYWORDS:** Deep venous thrombosis; Home treatment; Venous thromboembolism

In 1996, 2 randomized controlled trials showed that initial home treatment of deep venous thrombosis with low-molecular-weight heparin was effective and safe.<sup>1,2</sup> Many subsequent investigations that included some or all patients treated entirely at home showed home treatment to be safe and effective.<sup>3-17</sup> There was a high degree of patient satisfaction

with home treatment.<sup>4</sup> However, at least 23 editorials, reviews, and tutorials urged a flexible, sensible, cautious approach to home treatment, or cautioned for careful patient selection, necessary logistical support, infrastructure, organization, patient education and compliance, or monitored outcome.<sup>18</sup> There was no decrease in the actual number of hospitalizations of patients with a principal diagnosis of deep venous thrombosis from 1979-2006.<sup>18</sup> This did not take into account the 33% increase in the population of the US during that period.<sup>18</sup> By 2006, the proportion of the adult population hospitalized with a primary diagnosis of deep venous thrombosis was only 21% less than the proportion hospitalized in 1996.<sup>18</sup> This indicated a slow implementation of home treatment of deep venous thrombosis or perhaps a declining population-based incidence of deep venous thrombosis.<sup>18</sup> Of note, the proportion of hospitalized patients with a primary diagnosis of deep venous thrombosis who were discharged in

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1 or 2 days began to increase in 1994 and increased to 21%-25% between 2004 and 2006.<sup>18</sup>

In view of the potential economic benefit of home treatment of deep venous thrombosis, as well as increased patient satisfaction, we assessed the databases of the Nationwide Emergency Department Sample and Nationwide Inpatient Sample from 2007-2012 to determine the extent of home treatment of patients with deep venous thrombosis according to the most recent available data. Our goal was to identify categories of patients with deep venous thrombosis who typically are hospitalized, and categories frequently treated at home.

## METHODS

The Nationwide Emergency Department Sample was used to determine the number of patients seen in emergency departments throughout the US with deep venous thrombosis and no diagnosis of pulmonary embolism, and the proportion of such patients hospitalized according to age and comorbid conditions.<sup>19</sup> Emergency department charges were also determined. The Nationwide Emergency Department Sample is a database developed as part of the Healthcare Cost and Utilization Project of the Agency for Healthcare Research and Quality. We analyzed the most recent 6 years of data available, which is 2007-2012. This database each year includes 26 million to 29 million emergency department visits from 955-980 hospital-based emergency departments in 24-29 states.

The Nationwide Inpatient Sample was used to determine the proportion discharged early ( $\leq 2$  days), and the charge for hospitalization in patients with deep venous thrombosis. The Nationwide Inpatient Sample contains data from 5 to 8 million hospital stays from about 1000 hospitals.<sup>20</sup> It is designed to approximate a 20% sample of US nonfederal, short-term hospitals as defined by the American Hospital Association.<sup>20</sup> Although the National Emergency Department Sample also gives information on admissions, the Nationwide Inpatient Sample gives the total number of all hospitalizations, so the proportion of patients hospitalized with deep venous thrombosis can be determined.

## Method of Diagnosing Deep Venous Thrombosis

The International Classification of Diseases, 9th Edition, Clinical Modification (ICD-9-CM) codes that were used for identification of patients with deep venous thrombosis are 451.1, 451.2, 451.8, 451.9, 453.2, 453.4, 453.8,

453.9, 671.3, and 671.4. Five-digit codes, such as 415.11 (included under the code 415.1), were not listed separately, as they are included under the corresponding 4-digit codes.

## CLINICAL SIGNIFICANCE

- Throughout the US, only 33.9% of patients with deep venous thrombosis are treated at home.
- Those most frequently treated at home, 62.9%, are relatively young (aged 18-50 years) with no comorbid conditions.
- Hospital charges for relatively young patients with deep venous thrombosis and no comorbid conditions are millions of dollars.
- Relatively young patients with deep venous thrombosis and no comorbid conditions may be a group to target for more frequent home treatment.

## Exclusions

Exclusions included patients aged <18 years and patients with pulmonary embolism in addition to deep venous thrombosis. The ICD-9-CM codes used for identification of patients with pulmonary embolism are 415.1, 634.6, 635.6, 636.6, 637.6, 638.6, and 673.2.

## Comorbid Conditions

Patients with one or more of the comorbid conditions listed in the Charlson Index were defined as having comorbidity.<sup>21</sup> Conditions listed in the Charlson Comorbidity Index and the ICD-9-CM codes used to identify these conditions are shown in [Table 1](#).

**Table 1** International Classification of Diseases, 9th Edition, Clinical Modification (ICD-9-CM) Comorbid Conditions Included in the Charlson Index<sup>21</sup>

	ICD-9-CM Codes Used
Comorbid conditions included in the Charlson Index	
Acute myocardial infarction	410
Heart failure	428
Peripheral vascular disease	440.2, 443.9
Cerebrovascular disease	430-438
Dementia	290
Chronic obstructive pulmonary disease	490-496
Rheumatologic disease	710.0, 710.1, 710.4, 714.0, 714.1, 714.2, 714.8
Ulcer disease	531-534
Acute or chronic liver disease	570, 571
Diabetes mellitus	250.0-250.3
Hemiplegia and hemiparesis	342.0-342.9
Paraplegia	344.1
Moderate or severe renal disease	580-586, 588
Diabetes with chronic complications	250.4-250.6
Any neoplasms, leukemia, lymphoma	140-195, 200-208
Metastatic cancer	196-199
HIV and AIDS	042

AIDS = acquired immune deficiency syndrome; HIV = human immunodeficiency virus.

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