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Race affects adverse outcomes of deep vein thrombosis, pulmonary embolism, and acute kidney injury in coronavirus disease 2019 hospitalized patients

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ABSTRACT
Objective: The purpose of the present study was to explore the racial disparities in the incidence of deep vein thrombosis (DVT), pulmonary embolism (PE), and acute kidney injury (AKI) in hospitalized patients with coronavirus disease 2019 (COVID-19).

Methods: A retrospective analysis was performed of prospectively collected data of consecutive COVID-19 patients hospitalized from March 11, 2020 to May 27, 2021. The primary outcome measures were the incidence of DVT/PE and mortality. The secondary outcome measures included differences in the length of hospitalization, need for intensive care unit care, readmission, and AKI. Multivariable regression models were used to assess for independent predictors of the primary and secondary outcome measures.

Results: The present study included 876 hospitalized patients with COVID-19. The mean age was 64.4 ± 16.2 years, and 355 were women (40.5%). Of the 876 patients, 694 (79.2%) had identified as White, 111 (12.7%) as Black/African American, 48 (5.5%) as Asian, and 23 (2.6%) as other. The overall incidence of DVT/PE was 8.7%. The DVT/PE incidence rates differed across the race groups and was highest for Black/African American patients (n = 18; 16.2%), followed by Asian patients (n = 5; 10.4%), White patients (n = 52; 7.5%), and other (n = 1; 4.4%; P = .03). All but one of the hospitalization outcomes examined demonstrated no differences according to race, including the hospitalization stay (P = .33), need for intensive care unit care (P = .20), readmission rates (P = .52), and hospital all-cause mortality (P = .29). The AKI incidence differed among races, affecting a higher proportion of Black/African American patients (P = .003). On multivariable regression analysis, Black/African American race (odds ratio [OR], 2.0; 95% confidence interval [CI], 1.0-4.0; P = .04) and higher D-dimer levels (OR, 1; 95% CI, 1.1-1.2; P < .0001) were predictors of DVT/PE. In addition, Black/African American race (OR, 2.3; 95% CI, 1.4-3.7; P = .001), lower hemoglobin levels (OR, 0.84; 95% CI, 0.8-0.9; P = .0001), male sex (OR, 1.7; 95% CI, 1.2-2.4; P = .005), hypertension (OR, 2.1; 95% CI, 1.4-3.1; P = .0005), and older age (OR, 1.02; 95% CI, 1.006-1.03; P = .003) were predictors of AKI.

Conclusions: In our single-center case series, we found a higher incidence of DVT/PE and AKI among Black/African American patients with COVID-19. Black/African American race and D-dimer levels were independent predictors of DVT/PE, and Black/African American race, hemoglobin, and D-dimer levels were independent predictors of AKI. (J Vasc Surg Venous Lymphat Disord 2023;11:19-24.)

Keywords: COVID-19; Deep vein thrombosis; Pulmonary embolism; Racial disparities; Venous thromboembolism

Coagulopathy is one of the most common complications in patients with coronavirus disease 2019 (COVID-19) infection.1–3 A paucity of data is available that has specifically examined racial disparities in terms of the incidence of venous thromboembolism (VTE) among hospitalized patients with COVID-19.4 However, a
correlation has been found between VTE, COVID-19 infection, and poorer clinical outcomes. We investigated whether racial disparities were present in the incidence of deep vein thrombosis (DVT) and pulmonary embolism (PE) in a cohort of hospitalized patients with COVID-19 infection. Our secondary outcomes included differences in hospitalization outcomes, including acute kidney injury (AKI). Analyzing the outcomes pertaining to AKI were of interest because evidence has suggested that AKI can predispose patients to VTE in the presence of both acute and chronic kidney disease.6,7

**METHODS**

**Patient selection.** The MC NEWS study [Mayo Clinic neurological, vascular and neurovascular events with severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) study; institutional review board No. 20-003457] was a retrospective analysis of prospectively collected data for all patients affected by the COVID-19 pandemic identified within our campus. We used our electronic medical record system (Epic, Verona, WI) to identify all patients from March 11, 2020 to May 27, 2021 with a positive result for SARS-CoV-2 through polymerase chain reaction testing. Our cohort included 57.8% White, 12.4% Black/African American, and 6% Asian patients, representative of the national racial ecosystem. We used self-reported race data entered at the time of patient registration for care. To ensure accuracy in the data collection and validity of the cohort, we checked the patients’ unique identifiers and their inpatient status after March 11, 2020 using a natural language processing method (Mayo Data Explorer) developed by the Mayo Clinic. Furthermore, each of our patient’s hospital medical records were manually accessed and reviewed by a physician investigator to ensure that the hospitalization had been linked to the SARS-CoV-2 infection. Race as reported by the patient and available in the patient’s medical records was validated at patient admission to the hospital by one of the admission officers. The institution’s institutional review board and the COVID-19 task force reviewed and approved the study protocol and waived the requirement for patient informed consent owing to the minimal risk to the patients.

**Calculation of incidence of DVT and PE.** We reviewed each patient’s hospitalization records, including documentation of venous duplex ultrasound of either the upper or lower extremities, obtained at the discretion of the treating physician. Data regarding the presence or absence of acute DVT was abstracted. Additionally, we reviewed the records for documentation of computed tomography angiography (CTA) of the chest and recorded the presence or absence of acute PE. The rate of DVT/PE per racial group was calculated using the total number of hospitalized COVID-19 patients in each racial category as self-reported by the patients at registration as the denominator. The potential bias in obtaining duplex ultrasound scans was assessed by comparing the percent use of duplex ultrasound and CTA according to race.

**Outcomes assessment among COVID-19 patients with DVT and PE.** We collected demographic data, including self-reported race, pertinent medical history, and vital signs at admission or registration, laboratory values at admission and when first measured during hospitalization, and the hospital course data, including the requirement for intensive care unit (ICU) care, length of hospitalization, all-cause mortality, AKI, and hospital readmission (up to the end of data collection, August 15, 2021). AKI was defined in accordance with KDIGO (kidney disease improving global outcomes) criteria in 2012 as an acute increase in serum creatinine of 0.3 mg/dL within 48 hours, an increase in serum creatinine of ≥1.5 times the baseline within the previous 7 days, or a urine volume of <0.5 mL/kg/h for 6 hours.

**Statistical analysis.** Tests of statistical significance for univariate comparisons of the demographics and baseline patient risk factors were conducted using the Pearson χ² test or Fisher exact test for categorical variables and the Kruskal-Wallis test for continuous variables. Descriptive statistics are presented as the median and interquartile range for continuous variables and frequencies and percentages for categorical variables. We used multivariable logistic regression analysis to examine the association of different factors (ie, race, age, sex, body mass index, hemoglobin, D-dimer level) with the outcomes, including DVT/PE and AKI. Differences were considered statistically significant at P < .05. All statistical analyses were performed using SAS statistical software, version 9.4 (SAS Institute, Cary, NC).
RESULTS
From March 11, 2020 to May 27, 2021, a total of 876 patients had required hospitalization at the Jacksonville campus of the Mayo Clinic because of COVID-19 infection. The mean age of this cohort was 64.4 ± 16.2 years, and 355 were women (40.5%). Of the 876 patients, 694 (79.2%) had self-identified as White, 111 (12.7%) as Black/African American, 48 (5.5%) as Asian, and 23 (2.6%) as other. The Black/African American patients had had a greater prevalence of hypertension (70.3%; \( P = .04 \), a

| Table I. Patient demographic and clinical characteristics stratified by race |
|---------------------------------------------------------------|
| Characteristic | All patients (n = 876) | White (n = 694) | Black/African American (n = 111) | Asian (n = 48) | Other (n = 23) | \( P \) value |
|----------------|----------------------|----------------|-------------------------------|---------------|---------------|--------------|
| Male sex | 521 (59.5) | 425 (61.2) | 49 (44.1) | 32 (66.7) | 15 (65.2) | .004 |
| Age, years | 65.0 (53.0-77.0) | 67.0 (56.0-78.0) | 55.0 (43.5-5.0) | 62.5 (45.8-70.5) | 57.0 (48.0-68.5) | <.001 |
| Hypertension | 552 (63.0) | 433 (62.4) | 78 (70.3) | 32 (66.7) | 9 (39.1) | .04 |
| Coronary artery disease | 217 (24.8) | 181 (26.1) | 20 (18.0) | 13 (27.1) | 3 (13.0) | .16 |
| Myocardial infarction | 79 (9.0) | 63 (9.1) | 10 (9.0) | 4 (8.3) | 2 (8.7) | 1.00 |
| Diabetes mellitus | 220 (24.8) | 167 (24.1) | 35 (31.5) | 9 (18.8) | 9 (39.1) | .10 |
| Peripheral vascular disease | 51 (5.8) | 45 (6.5) | 4 (3.6) | 0 (0) | 2 (8.7) | .14 |
| Ischemic stroke | 55 (6.3) | 42 (6.1) | 11 (9.9) | 1 (2.1) | 1 (4.4) | .28 |
| Transient ischemic attack | 49 (5.6) | 42 (6.1) | 5 (4.5) | 2 (4.1) | 0 (0) | .76 |
| Intracerebral hemorrhage | 13 (1.5) | 10 (1.4) | 2 (1.8) | 1 (2.1) | 0 (0) | .72 |
| Atrial fibrillation | 157 (17.9) | 139 (20.0) | 11 (9.9) | 5 (10.4) | 2 (8.7) | .02 |
| Hyperlipidemia | 445 (50.8) | 363 (52.3) | 51 (45.9) | 23 (47.9) | 8 (34.8) | .24 |
| Hypertensive medication | 471 (53.8) | 372 (53.7) | 69 (62.2) | 22 (45.8) | 8 (34.8) | .05 |
| Atrial fibrillation | 157 (17.9) | 139 (20.0) | 11 (9.9) | 5 (10.4) | 2 (8.7) | .02 |
| Lipid-lowering medication | 393 (44.9) | 319 (46.0) | 44 (41.1) | 19 (39.6) | 6 (26.1) | .24 |
| Anticoagulant medication | 322 (36.8) | 259 (37.3) | 39 (35.1) | 17 (35.4) | 7 (30.4) | .88 |
| Endotracheal mechanical ventilation | 59 (6.7) | 44 (6.3) | 6 (5.4) | 2 (4.1) | 0 (0) | .07 |
| History of DVT/PE | 99 (11.3) | 84 (12.7) | 10 (9.6) | 4 (8.3) | 1 (4.8) | .612 |
| Diagnosis of thrombophilia | 9 (1.0) | 8 (1.2) | 1 (0.9) | 0 (0) | 0 (0) | 1.00 |
| Active history of cancer | 110 (12.6) | 95 (13.7) | 12 (10.8) | 3 (6.3) | 0 (0) | .10 |
| Body mass index, kg/m² | 29.2 (24.9-34.3) | 29.3 (24.9-33.6) | 32.3 (26.3-38.3) | 26.6 (23.6-29.7) | 28.4 (25.8-32.2) | .002 |
| White blood cell count, \( 10^9/L \) | 6.4 (4.9-9.7) | 6.80 (4.90-9.80) | 6.30 (4.50-9.40) | 6.70 (5.05-8.00) | 9.20 (515.0-10.8) | .389 |
| Hemoglobin, g/dL | 13.0 (11.4-14.4) | 13.1 (11.5-14.5) | 12.3 (10.1-13.4) | 13.4 (12.0-14.9) | 12.6 (10.9-13.6) | <.001 |
| Hematocrit, % | 39.3 (34.9-43.2) | 39.4 (35.4-43.2) | 38.2 (32.3-41.9) | 41.0 (37.4-45.4) | 38.6 (32.8-41.4) | .007 |
| Albumin, g/dL | 3.6 (3.3-3.9) | 3.60 (3.30-3.90) | 3.60 (3.25-3.80) | 3.70 (3.40-3.90) | 3.60 (3.15-3.90) | .003 |
| Prothrombin time, seconds | 13.2 (12.1-14.5) | 13.3 (12.3-14.8) | 13.2 (12.1-13.4) | 12.9 (12.0-13.8) | 12.9 (12.1-14.2) | .15 |
| International normalized ratio | 1.2 (1.1-1.3) | 1.20 (1.10-1.30) | 1.20 (1.10-1.30) | 1.10 (1.10-1.20) | 1.15 (1.10-1.30) | .23 |
| D-dimer, ng/mL | 174 (34.9-102.0) | 174 (34.9-102.0) | 174 (34.9-102.0) | 174 (34.9-102.0) | 174 (34.9-102.0) | .03 |

DVT: Deep vein thrombosis; PE, pulmonary embolism.

Data presented as number (%), median (interquartile range), or mean ± standard deviation.

\* Normal range: 3.4-9.6 \( 10^9/L \).
\* Normal range: 135-317 \( 10^9/L \).
\* Normal range: \#500 mg/mL.
Table II. Hospitalization outcomes stratified by race

| Outcome                  | White (n = 694) | Black/African American (n = 111) | Asian (n = 48) | Other (n = 23) | P value |
|--------------------------|-----------------|---------------------------------|----------------|----------------|---------|
| Length of hospitalization, days | 5.0 (4.0-8.75)  | 6.0 (4.0-9.5)                   | 6.0 (4.0-10.0) | 5.0 (4.0-8.75) | .33     |
| Need for ICU care         | 98 (14.1)       | 18 (16.2)                       | 12 (25.0)      | 2 (8.7)        | .20     |
| Readmission              | 32 (4.6)        | 2 (1.8)                         | 1 (2.1)        | 1 (4.4)        | .52     |
| Mortality                | 41 (6.4)        | 3 (3.1)                         | 1 (2.2)        | 2 (11.1)       | .29     |
| AKI                      | 151 (21.8)      | 40 (36.0)                       | 7 (14.6)       | 7 (30.4)       | .003    |
| DVT/PE                   | 52 (7.5)        | 18 (16.2)                       | 5 (10.4)       | 1 (4.4)        | .03     |

AKI, Acute kidney injury; DVT, deep vein thrombosis; ICU, intensive care unit; PE, pulmonary embolism.
Data presented as median (interquartile range) or number (%).

higher body mass index (median, 32.3 kg/m²; P = .002), higher D-dimer levels (median, 1031 mg/mL; P = .03), and lower hemoglobin levels (median, 12.3 g/dL; P < .001). The D-dimer level for the patients without DVT/PE did not differ among the races. The prevalence of atrial fibrillation was higher for the Asian patients (20%; P = .02). The time from admission to diagnosis of DVT/PE was not different among the races. The average interval was 5.9 ± 10.2 days (Table I).

The overall incidence of DVT/PE was 8.7% and differed among the races (P = .03). The DVT/PE incidence was highest for the Black/African American patients (n = 18; 16.2%), followed by Asian patients (n = 5; 10.4%), White patients (n = 52; 7.5%), and other patients (n = 1; 4.4%). To ensure no bias was present for the tested patients, we also tabulated the number of duplex ultrasound and CTA imaging studies obtained, which demonstrated no significance among the racial groups (Supplementary Table I, online only).

The location of DVT and extent of PE was not different among the races (Supplementary Table II, online only). The hospitalization outcomes also did not differ according to race, including the length of hospitalization (P = .33), need for ICU care (P = .20), readmission rate (P = .52), and mortality (P = .29). The only statistically significant difference among the races was the incidence of AKI for Black/African American patients (P = .003; Table II). The typical risk factors resulting in a higher risk of DVT/PE were assessed and included a history of DVT/PE, thrombophilia, and an active diagnosis of cancer, and these were not different among the racial groups (Table I). On multivariable regression analysis, the odds of DVT/PE were higher for Black/African American patients (odds ratio [OR], 2.0; 95% confidence interval [CI], 1.0-3.8; P = .03), as were the odds of higher D-dimer levels (OR, 1.1; 95% CI, 1.1-1.2; P < .0001). Black/African American race (OR, 2.3; 95% CI, 1.4-3.7; P = .001), lower hemoglobin levels (OR, 0.84; 95% CI, 0.8-0.9; P < .0001), hypertension (OR, 2.1; 95% CI, 1.4-3.1; P = .0005), male sex (OR, 1.7; 95% CI, 1.2-2.4; P = .005), and older age (OR, 1.02; 95% CI, 1.006-1.03; P = .003) conferred higher odds for the development of AKI (Table III).

DISCUSSION

In the present analysis of 876 patients admitted to our healthcare system because of COVID-19 infection, we found that the incidence of DVT/PE was 8.7%. Our results showed racial differences in the incidence of DVT/PE, with Black/African American patients the most affected. Although our Black/African American patients had a higher risk of DVT/PE, most clinical outcomes, including mortality, the need for ICU care, and readmission to the hospital were not significantly different compared with the other races. However, our Black/African American patients had a significantly higher risk of AKI.

The rate of DVT/PE has remained consistent across our network of hospitals and locally. The higher rate of DVT/PE reported in the present study is in contrast to the findings from our recent systematic review and meta-analysis, in which no racial disparities in DVT/PE were found. The limitations of the studies included in the systematic review and meta-analyses could account for the differences in the findings. These limitations included a retrospective study design and a lack of standardization and uniformity in the reporting of racial demographics and the diagnosis of DVT/PE. These differences added significant heterogeneity to our meta-analysis, limiting its generalizability.

We believe that the patient pool in the present study resembles the national demographic of the United States, and, therefore, the findings are reflective of the true incidence of DVT/PE among racial groups. Before the COVID-19 pandemic, the incidence of DVT/PE had been reported to be higher for Black/African American patients, which had been attributed to the greater prevalence of comorbidities, a higher body mass index, poor educational level, and low socioeconomic status, among others. However, we also noted within our cohort that the D-dimer levels were higher in our Black/African American patients, a finding that had also been reported before the COVID-19 pandemic. Ongoing questions that our team are investigating are related to developing strategies to decrease the rate of DVT/PE in our COVID-19 hospitalized patients and understanding the procoagulant factors responsible for the hypercoagulability state.
that might predispose racially diverse patient groups to an increased risk of DVT/PE.

Differences in the metrics of the hospitalization outcomes overall were not statistically significant, except for the rate of patients developing AKI. This finding is in alignment with the current understanding of COVID-19 infection as a systemic endothelial microvascular thrombotic process. In several postmortem studies, extensive acute tubular necrosis, interstitial fibrosis, fibrin deposits, tubular–interstitial inflammation, and peritubular thrombi were recognized within the kidney biopsies.

Several limitations in our study are inherent to the retrospective nature of our review. Our electronic medical records do not include the socioeconomic status of each patient, which could have played a role in the incidence of DVT/PE, as reported in prepandemic studies. The testing for DVT and PE was not performed systematically for all patients hospitalized for COVID-19. Such testing was only performed for those patients with a clinical suspicion for DVT/PE, as determined by the treating clinician at hospitalization. The ultrasound studies for DVT were screening diagnostic studies, limiting the in-depth examination of each individual leg vein. Thus, only those with extensive DVT were captured owing to the symptomatic presentation of these patients. In addition, this limited the number of patients with only calf DVTs, because these patients might not have been clinically symptomatic and thus would not have undergone ultrasound of the extremities. Finally, we relied on the self-reported demographic data collected at admission to our hospital system. Therefore, more granular data regarding specific ethnic groups are lacking, such as individuals from Latin American countries, which represent a mixture of larger racial groups. Finally, a propensity matched analysis might have accounted for other possible confounders. However, at the data analysis, we did not have a large enough sample size for a propensity matched analysis. In addition, because our sample size was relatively small, we could not rule out that a type II error could have influenced the lack of a mortality difference among the races, although we would like to believe that this had resulted from the excellent patient care provided to our COVID-19 hospitalized patients.

CONCLUSIONS

In our single-center retrospective review of prospectively collected data, we found racial disparities in the incidence of DVT/PE and AKI in hospitalized patients with COVID-19 infection, with a higher incidence in Black/African American patients. Otherwise, the hospitalization outcomes were not significantly different among the races.

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AUTHOR CONTRIBUTIONS

Conception and design: YE, CM, MP, TG, DS, LH, ME, CR, PF, LP, JM

Analysis and interpretation: YL

Data collection: SF

Writing the article: YE, SF, JM

Critical revision of the article: YE, CM, MP, TG, DS, LH, YL, ME, CR, PF, LP, JM

Final approval of the article: YE, CM, MP, SF, TG, DS, LH, YL, ME, CR, PF, LP, JM

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Supplementary Table I (online only). Imaging studies for suspected deep vein thrombosis/pulmonary embolism (DVT/PE) stratified by race

| Imaging study             | White (n = 694) | Black/African American (n = 111) | Asian (n = 48) | Other (n = 23) | P value |
|---------------------------|-----------------|---------------------------------|----------------|----------------|---------|
| Duplex ultrasound scans   |                 |                                 |                |                |         |
| Upper extremity           | 276 (39.8)      | 39 (35.1)                       | 22 (45.8)      | 8 (34.8)       | .589    |
| Lower extremity           | 345 (49.7)      | 57 (51.4)                       | 25 (52.1)      | 13 (56.5)      | .905    |
| CTA of chest              | 269 (38.8)      | 45 (40.5)                       | 21 (43.8)      | 8 (34.8)       | .863    |

CTA, computed tomography angiography.
Data presented as number (%).
### Supplementary Table II (online only). Specific location of DVT and PE in all patients evaluated

| Pt. No. | Age, years | Gender | Race                  | D-dimer, ng/mL | Upper DVT | Lower DVT | DVT location     |
|---------|------------|--------|-----------------------|----------------|-----------|-----------|------------------|
| DVT     |            |        |                       |                |           |           |                  |
| 1       | 59         | Female | White                 | 1534           | Yes       | No        | Brachial vein    |
| 2       | 69         | Male   | Black/African American | 18,796         | No        | Yes       | Popliteal vein   |
| 3       | 64         | Male   | White                 | 787            | No        | Yes       | Femoral vein     |
| 4       | 70         | Male   | White                 | 42,000         | No        | Yes       | Peroneal vein    |
| 5       | 50         | Male   | Black/African American | 1250           | No        | Yes       | Femoral vein     |
| 6       | 44         | Male   | White                 | 14,052         | No        | Yes       | Peroneal vein    |
| 7       | 88         | Female | Black/African American | 5299           | Yes       | No        | Brachial vein    |
| 8       | 65         | Male   | Unknown               | 4340           | No        | Yes       | Popliteal vein   |
| 9       | 95         | Female | White                 | 1077           | No        | Yes       | Femoral vein     |
| 10      | 72         | Male   | White                 | 21,997         | No        | Yes       | Peroneal vein    |
| 11      | 75         | Female | White                 | 1561           | No        | Yes       | Popliteal vein   |
| 12      | 78         | Male   | White                 | 845            | Yes       | No        | Subclavian vein  |
| 13      | 38         | Female | White                 | 2121           | Yes       | No        | Jugular vein     |
| 14      | 34         | Male   | White                 | 20,749         | No        | Yes       | Femoral vein     |
| 15      | 73         | Male   | White                 | 2392           | Yes       | No        | Brachial vein    |
| 16      | 52         | Female | White                 | 2344           | Yes       | No        | Axillary vein    |
| 17      | 40         | Female | Black/African American | 7233           | No        | Yes       | Femoral vein     |
| 18      | 92         | Female | White                 | 11,937         | No        | Yes       | Popliteal vein   |
| 19      | 63         | Male   | White                 | 6758           | Yes       | No        | Jugular vein     |
| 20      | 62         | Male   | Black/African American | 42,000         | No        | Yes       | Femoral vein     |
| 21      | 59         | Male   | White                 | 1222           | No        | Yes       | Femoral vein     |
| 22      | 65         | Male   | White                 | 5533           | No        | Yes       | Femoral vein     |
| 23      | 92         | Female | White                 | 553            | No        | Yes       | Femoral vein     |
| 24      | 41         | Female | Black/African American | 2694           | No        | Yes       | Popliteal vein   |
| 25      | 83         | Male   | White                 | 349            | Yes       | No        | Jugular vein     |
| 26      | 66         | Male   | Black/African American | 3217           | Yes       | No        | Brachial vein    |
| 27      | 51         | Male   | White                 | 1767           | No        | Yes       | Popliteal vein   |
| 28      | 74         | Female | Black/African American | 1972           | Yes       | No        | Axillary vein    |
| 29      | 98         | Female | White                 | 4919           | No        | Yes       | Femoral vein     |
| 30      | 33         | Female | Black/African American | 3920           | Yes       | No        | Jugular vein     |
| PE      |            |        |                       |                |           |           |                  |
| 1       | 23         | Female | White                 | 523            | Right     | NA        | Segmental LL     |
| 2       | 50         | Male   | Black/African American | 15,022         | Right     | NA        | Segmental branches |
| 3       | 74         | Male   | Black/African American | 20,327         | Bilateral | NA        | Segmental to subsegmental |
| 4       | 44         | Male   | White                 | 1405           | Right     | NA        | Subsegmental LL  |
| 5       | 84         | Female | White                 | 1039           | Right     | NA        | ML segmental and LL subsegmental |
| 6       | 61         | Female | Black/African American | 5697           | Left      | NA        | Left main        |
| 7       | 73         | Male   | White                 | 24,133         | Right     | NA        | ML              |
| 8       | 67         | Male   | White                 | 5097           | Left      | NA        | Pulmonary artery |
| 9       | 72         | Male   | White                 | 21,997         | Left      | NA        | Segmental LL     |
| 10      | 79         | Male   | White                 | 9218           | Right     | NA        | Anterior basal segmental |
| 11      | 65         | Female | White                 | 390            | Bilateral | NA        | Segmental and subsegmental |
| 12      | 66         | Male   | White                 | 357            | Left      | NA        | Interlobar       |
| 13      | 59         | Male   | White                 | 600            | Bilateral | NA        | Multiple         |
| 14      | 84         | Female | White                 | 4064           | Right     | NA        | Subsegmental LL  |
| 15      | 70         | Female | Asian                 | 746            | Right     | NA        | Subsegmental LL  |
Supplementary Table II (online only). Continued.

| PE  | Laterality | NA    | PE location                      |
|-----|------------|-------|----------------------------------|
| 16  | 61         | Male  | Asian                            | 42,000 Bilateral Segmental to subsegmental |
| 17  | 62         | Male  | Black/African American           | 42,000 Right Segmental to subsegmental LL |
| 18  | 50         | Male  | White                            | 5120 Right Segmental LL                   |
| 19  | 52         | Female| White                            | 943 Right Subsegmental UL and LL         |
| 20  | 62         | Female| White                            | 6303 Right Segmental to subsegmental LL  |
| 21  | 87         | Male  | White                            | 2243 Bilateral Subsegmental              |
| 22  | 65         | Female| White                            | 6892 Right LL pulmonary branches         |
| 23  | 67         | Male  | White                            | 1541 Right Main pulmonary                |
| 24  | 87         | Female| White                            | 11,937 Right Segmental to subsegmental UL and LL |
| 25  | 78         | Male  | Asian                            | 886 Right LL                            |
| 26  | 75         | Male  | White                            | 943 Right Segmental to subsegmental LL   |
| 27  | 78         | Male  | White                            | 1388 Left UL and LL                     |
| 28  | 86         | Male  | White                            | 1222 Right Subsegmental LL              |
| 29  | 75         | Male  | White                            | 1222 Right Subsegmental LL              |
| 30  | 75         | Male  | White                            | 1222 Right Subsegmental LL              |
| 31  | 75         | Male  | White                            | 1222 Right Subsegmental LL              |
| 32  | 75         | Male  | White                            | 1222 Right Subsegmental LL              |
| 33  | 75         | Male  | White                            | 1222 Right Subsegmental LL              |
| 34  | 75         | Male  | White                            | 1222 Right Subsegmental LL              |
| 35  | 75         | Male  | White                            | 1222 Right Subsegmental LL              |
| 36  | 75         | Male  | White                            | 1222 Right Subsegmental LL              |
| 37  | 75         | Male  | White                            | 1222 Right Subsegmental LL              |
| 38  | 75         | Male  | White                            | 1222 Right Subsegmental LL              |
| 39  | 75         | Male  | White                            | 1222 Right Subsegmental LL              |
| 40  | 75         | Male  | White                            | 1222 Right Subsegmental LL              |
| 41  | 75         | Male  | White                            | 1222 Right Subsegmental LL              |
| 42  | 75         | Male  | White                            | 1222 Right Subsegmental LL              |
| 43  | 75         | Male  | White                            | 1222 Right Subsegmental LL              |
| 44  | 75         | Male  | White                            | 1222 Right Subsegmental LL              |
| 45  | 75         | Male  | White                            | 1222 Right Subsegmental LL              |
| 46  | 75         | Male  | White                            | 1222 Right Subsegmental LL              |
| 47  | 75         | Male  | White                            | 1222 Right Subsegmental LL              |
| 48  | 75         | Male  | White                            | 1222 Right Subsegmental LL              |
| 49  | 75         | Male  | White                            | 1222 Right Subsegmental LL              |
| 50  | 75         | Male  | White                            | 1222 Right Subsegmental LL              |
| 51  | 75         | Male  | White                            | 1222 Right Subsegmental LL              |
| 52  | 75         | Male  | White                            | 1222 Right Subsegmental LL              |
| 53  | 75         | Male  | White                            | 1222 Right Subsegmental LL              |
| 54  | 75         | Male  | White                            | 1222 Right Subsegmental LL              |

DVT: Deep vein thrombosis. ILA, interlobar artery. LL, lower lobe. ML, middle lobe. NA, not applicable. PE, pulmonary embolism. Pt. No., patient number. UL, upper lobe.

*Location of most proximal area affected with greatest DVT burden.