Outline of Hospitalization Due to Venous Thromboembolism in Brazil Between 2010 and 2020

Wagner Ramos Borges ✉ iD

Adjunct Professor, Bahiana School of Medicine and Public Health; Vascular Surgeon; Member of the SBACV; Doctor and Master in Medicine and Health/UFBA; Member of the Brazilian College of Surgeons; Preceptor of Vascular Surgery, Hospital Ana Neri/UFBa, Brazil

Raimundo Nonato de Souza Andrade iD

Professor, Bahiana School of Medicine and Public Health; Thoracic Surgeon, Member of the Brazilian Society of Thoracic Surgery, Brazil

Pedro Henrique Massi iD

Medical Student, Bahiana School of Medicine and Public Health, Brazil

Talita Cristina Cruz Paulino iD

Medical Student, Bahiana School of Medicine and Public Health, Brazil

Gustavo Novaes Lima iD

Medical Student, Bahiana School of Medicine and Public Health, Brazil

Isabela Pereira de Farias iD

Medical Student, Bahiana School of Medicine and Public Health, Brazil

Abstract:

An important pathology that affects the cardiovascular system is venous thromboembolism (VTE), a disease characterized by the formation of clots in veins. VTE is divided into two clinical presentations: pulmonary thromboembolism (PT) and deep vein thrombosis (DVT). The general objective of the present work is to describe the profile of patients hospitalized for venous thromboembolism and other venous diseases, in Brazil between the years 2010 and 2020. The specific objectives are the following: describe the demographic characteristics of hospitalized patients; describe the epidemiological trend of venous thromboembolism over the period. Based on data extracted from the SUS Hospital Information System (SIH/SUS), it was possible to analyze the following variables: annual frequency; race/color; sex; age range; brazilian demographic regions. Of the 446.328 hospitalizations for phlebitis, thrombophlebitis, embolism, and venous thrombosis in Brazil, between 2010 and 2020, it was noticed that 61,22% (273.254) are women, of which 42.94% (191.673) are self-declared as white and that 54,43% (242.969) are concentrated in the Southeast Region. The profile of patients admitted between 2010 and 2020 was identified as being composed of white women between 50 and 59 years old.

Keywords: *Venous Thromboembolism, Pulmonary Embolism, Deep Vein Thrombosis, Epidemiology, Involuntary Commitment.*

Introduction

Diseases of the cardiovascular system have been seen for many years as important factors in the population's illness. According to data from the Ministry of Health, in 1999, such comorbidities led to approximately 1,100,000 hospitalizations through the Unified Health System (Alves, Almeida, & Balhau, 2023). Within this scenario, Venous Thromboembolism (VTE) stands out as a pathological condition marked by the development of a clot in the veins, which leads to impairment of blood circulation.

The physiological changes that precede VTE are grouped by the Virchow's Triad, which encompasses endothelial lesions, stasis or turbulent blood flow, and blood hypercoagulability. The hypercoagulable state, which can have hereditary and genetic causes, promotes an imbalance between clotting factors by activating procoagulant substances and inhibiting anticoagulants (Kumar, Abbas, & Aster, 2016).

VTE has two distinct clinical presentations, which are closely related: Deep Vein Thrombosis (DVT) and Pulmonary Thromboembolism (PTE) (Nazario, Delorenzo, & Maguire, 2002). DVT consists of the formation of clots in the deep veins of the lower limbs, which have the potential to reach the pulmonary circulation (Nazario, Delorenzo, & Maguire, 2002). This mechanism results in PTE, a condition marked by the migration of an embolus to the pulmonary circulation, which compromises the irrigation of this organ and is generally associated with a more serious situation (Volpe, et al., 2010).

The diagnosis of venous thrombosis is complex, as no sign or clinical manifestation presented by the patient is predictive for confirmation or exclusion of the condition (Albuquerque, et al., 2017). The manifestations in Deep Vein Thrombosis are pain, heat, redness, swelling of the affected limb, cramps and, in some cases, greater predisposition to the formation of ulcers (Albuquerque, et al., 2017; Nazario, Delorenzo, & Maguire, 2002; Volpe, et al., 2010;

Albuquerque, et al., 2017; Goldman, & Schafer, 2022). However, certain patients may not have symptoms or only some of them [6]. Pulmonary embolism is characterized by different manifestations, namely: chest pain, usually pleuritic, tachypnea, dyspnea on exertion and, in some cases, cough (Goldman, & Schafer, 2022). Cases of infarction pulmonary complications are infrequent complications and, when they exist, they are associated with extensive events and previous diseases or comorbidities, such as pulmonary infections and heart failure (Silva, et al., 2021).

Treatment consists of three main categories (Rizzatti, & Franco, 2001): medication (use of anticoagulants, paying attention to the risk of hemorrhages) (Holbrook, et al., 2005), thrombolysis (through an injection of a substance into the patient's bloodstream) (Konstantinides, et al., 2014; Kearon, et al., 2016) and a filter in the vena cava (the insertion of devices in the inferior vena cava, being indicated for patients with DVT who cannot use anticoagulation) (Marques, 1998).

The presentation of signs and symptoms, often nonspecific and common to other pathologies, as well as clinical diagnoses with specificity lower than 50%, lead to underreporting of VTE (Heit, 2015). As a result, it is significantly difficult to know the real incidence of the disease. Due to this worldwide epidemiological problem, estimating the prevalence of VTE is a challenging task, and for this reason, the numbers are variable.

In Europe, estimated data on the annual incidence of DVT episodes are 684,000 (148 / 100,000) and 435,000 (95 / 100,000) for PTE. Rates are equally worrying in the United States (USA), for example, it is estimated that the prevalence of PTE is between 300,000 and 600,000 cases and it is responsible for 60,000 to 100,000 deaths annually. In the world, an estimated number of deaths from VTE is 543,000 every year (Isabel, & Costa, 2017). In Brazil, in turn, the numbers that characterize the epidemiology of VTE are also inaccurate, but alarming. According to certain references, the

incidence of the disease is 100 to 200 episodes per 100,000 inhabitants (Heit, 2015), while others describe it as 60 per 100,000 inhabitants (Diogo-Filho, et al., 2009).

VTE can still cause several long-term complications even in patients who comply with anticoagulant therapy, so about 1/3 (33%) of patients who had DVT/PE will have a new episode in 10 years, which, in most cases it takes a new hospitalization (Isabel, & Costa, 2017).

The analysis of the relationships between VTE and different health variables also allows understanding the impacts of this disease on the Brazilian population. From an epidemiological study carried out at the "Hospital das Clínicas" of the Federal University of Uberlândia, MG, between September and December 2005, it was concluded that the most frequent risk factors found for VTE were prolonged surgery (85.2%), anesthesia general (46.2%), age equal to or above 60 years (42.3%), prolonged restriction to bed (27.4%) and age between 40 and 59 years (24.9%) (Diogo-Filho, et al., 2009). Age and factors that promote immobility are crucial for the development of VTE. There are also the following variables intrinsically associated with the prevalence of VTE: obesity, increasing the risk by 2 to 3 times, in cases of BMI greater than $30Kg.m^2$ (Amaral, & Tavares, 2023), neoplasms, with an increase in risk of 5 to 7 times (Alves, Almeida, & Balhau, 2023), in addition to pregnancy (increased risk by 10 times) and the postpartum period (25 times) (Heit, Spencer, & White, 2016).

Venous thromboembolism is a disease predominantly affecting older people ($\geq$ 65 years). Thus, age is an important risk factor for the development and incidence of VTE. However, regarding the probability of recurrence, age cannot be classified as a consistent predictor. According to the HERDOO2 model, older ages are more associated with a higher risk of VTE resurgence in women. While, according to the DASH model, younger men and women are more susceptible to relapse. The Vienna model, in turn, does not classify age as a predictor of recurrence (Heit, 2015).

It is important to highlight that the occurrence of VTE on a global scale is higher in men, at a rate of 130/100,000, when compared to women, 110/100,000. However, during the fertile age, this rate is slightly elevated in females, but after 45 years it returns to the previous pattern. Added to this, even in relation to women, the occurrence of PTE is common in all trimesters of pregnancy (Isabel, & Costa, 2017).

Objectives

Primary objective: to describe the profile of patients hospitalized for VTE and other venous diseases in Brazil between 2010 and 2020.

Secondary objective: to describe the demographic characteristics of hospitalized patients and the epidemiological trend of VTE over the period.

Methods

The present work constitutes an observational, retrospective, aggregated, descriptive documental study of secondary data, extracted from the SUS Hospital Information System (SIH/SUS), available in the DataSUS database, referring to patients hospitalized in Brazil between the years of 2010 to 2020, by place of residence, second chapter of ICD-10: IX. Diseases of the circulatory system, in the category Phlebitis, thrombophlebitis, embolism and venous thrombosis.

The data obtained were then treated in the Microsoft Excel software, where tables and graphs referring to the collected data were constructed. This data can be verified through the TabNet portal, at the following access link: https://datasus.saude.gov.br/.

To describe the profile of VTE hospitalizations and associated conditions in Brazil, the variables used were annual frequency, race/color (white, black, brown, yellow, brown, indigenous and without information), biological sex (male or female), age group (15 to 19 years old, 20 to 29 years old, 30 to 39 years old, 40 to 49 years old, 50 to 59 years old, 60 to 69 years old, 70 to 79

years old and 80 years old and over) and the nature of the regime (public or private). The demographic regions of Brazil (North, Northeast, Midwest, Southeast, South) were also evaluated, excluding the Federative Unit.

Data regarding the population residing in each Brazilian region (South, Southeast, North, Northeast, Midwest) between 2010- 2020, the resident population by biological sex in the period 2010-2020 and the resident population by age group (15 to 19 years old, 20 to 29 years old, 30 to 39 years old, 40 to 49 years old, 50 to 59 years old, 60 to 69 years old years old, 70 to 79 years old and 80 years old and over) over 2010-2021, with the aim of carrying out the statistical treatment, in order to calculate the hospitalization coefficients, their downward or upward trends, as well as compare such data, according to the Brazilian region, sex and age group.

Information on the percentage of obesity by region and percentage of smokers by region in 2010 was obtained through the Surveillance system of risk and protective factors for chronic diseases by telephone survey - VIGITEL, on the DataSUS portal.

To calculate the hospital lethality rate due to phlebitis, thrombophlebitis, embolism and venous thrombosis, between the years 2010 and 2020, the ratio between the number of deaths and the number of hospitalized patients for these diseases was calculated, whose data were collected on the portal of the DataSUS, according to sex, age group and Brazilian region, in the same period.

Results

Between 2010 and 2020, 446,328 hospitalizations for Phlebitis, Thrombophlebitis, Embolism and Venous Thrombosis were recorded in Brazil. The total number of deaths from these pathologies in the same period was 10,986 cases, while the average hospital lethality rate represented 2.46%. When analyzing the general Brazilian panorama, during the ten years studied, it was noted that there was a slight central tendency towards an increase in lethality

rates, the coefficient of hospitalization and the numbers of hospitalizations, without significant fluctuations. As for deaths, no trend of increase or decrease was identified.

The Southeast region had the highest number of hospitalizations, totaling 242,969 (54.43%), followed by the South and Northeast regions, 102,601 (22.98%) and 64,514 (14.45%), respectively. However, when calculating the hospitalization rate per 100,000 inhabitants, between 2010 and 2020, the South Region leads the other regions, with an average of 32.13 cases of hospitalization, accompanied by the Southeast (25.79), Midwest (15.15), Northeast (10.49) and North (5.54).

The hospital fatality rate during the period referring to each calculated region revealed an oscillating pattern in the North and Northeast regions, which presented the highest values, followed by the Midwest, Southeast and South regions, respectively. Regarding the lethality averages in each region, the Northeast leads, with 3.86%, followed by the North (3.79%), Midwest (2.47%), Southeast (2.33%) and South (1.77%). Central trend values showed a slight increase in the fatality rate in the North and Northeast, as well as a significant increase in the Midwest. The Southeast, South and North regions showed a relative balance in this period.

According to the hospital fatality rate graph, drastic growth rates were revealed in the North Region, in 2014 (52.68%) and in 2020 (47.81%). Furthermore, a significant oscillation was evident in the Central-West Region, between the periods of 2018 and 2019, with a growth rate of 65.50% in 2018, and a reduction rate of 76.28% in 2019.

The general panorama of the period shows a significant number of women hospitalized for phlebitis, thrombophlebitis, embolism and venous thrombosis, so that of the 446,328 hospitalized patients, 61.22% (273,254) are women and 38.77% are men (173,074). When comparing the hospitalization coefficient for both sexes, it was noted that females (23.92 hospitalizations per 100 thousand inhabitants) continue to lead men (15.8 hospitalizations per 100 thousand inhabitants).

From the chart of admission coefficients between genders, it was observed that there were no significant data fluctuations. Thus, the central tendency line remained constant, in both sexes, during the analyzed period.

Between 2010 and 2020, the total number of deaths from phlebitis, thrombophlebitis, embolism and venous thrombosis recorded was 6,277 among women and 4,709 among men. However, an inversion was noted in terms of the lethality rate in the same period, in which males, whose average lethality rate was 2.72%, exceeded females (2.30%). The central trend line remained constant for data from male patients and revealed a slight increase for female patients.

When evaluating the data according to the race/color criterion, the white population stands out, with a total of 191,673 (42.94%), in the period studied, followed by the black population, totaling 128,991 (28.9%), of which 109,586 call themselves brown and 19,405 call themselves black. However, there is also a highlight for patients whose race/color criterion was ignored, totaling 120,097 (26.9%) between 2010 and 2020.

The analysis based on the regime revealed that the sum of hospitalizations for private services (130,947) significantly exceeds those for public services (101,005). The numbers of hospitalizations in which the type of regime was not registered were very expressive (214,376). From 2011 to 2014, there were no records of hospitalizations classified as ignored. However, between 2016 and 2020, the nature of the regime was not distinguished in any hospitalization.

The distribution by age group, in total absolute numbers during the period, revealed a greater number of cases among 40 to 49 years old (84,205), 50 to 59 years old (85,166), 60 to 69 years old (79,876). However, when the coefficient of hospitalizations per 100,000 inhabitants is calculated, a change in this scenario is verified, with the prevalence of the age group of 80 years or more over the others. It was noted that there was a trend of hospitalization with linear growth according to age, which can be evaluated through the hospitalization coefficients of the year 2020 with

3.04 cases in the range of 15 to 19 years, 20 to 29 years (7, 7), 30 to 39 years old (14.68), 40 to 49 years old (25.61), 50 to 59 years old (30.59), 60 to 69 years old (44.16), 70 to 79 years old (58, 07) and 80 years or older (72.64).

When observing the incidence of hospitalizations during the period 2010-2020, it can be noted that within the same age group, there was a pattern of decline over the years analyzed. In view of this, it can be seen that the reduction rate between 15 and 19 years old was 5%, 20 to 29 years old (11%), 30 to 39 years old (12%), 40 to 49 years old (11%), 50 to 59 years old (20%), 60 to 69 years old (17%), 70 to 79 years old (28%) and 80 years old or older (26%).

The lethality rate according to age group was markedly higher in individuals aged 80 years or more when compared to the other age groups. This can be seen by calculating the mean fatality rates for each year analyzed (2010-2020). Thus, the age group: 15 to 19 years, exhibited a value of 0.55%, 20 to 29 years (0.49%), 30 to 39 years (0.69%), 40 to 49 years (0.96 %), 50 to 59 years old (1.85%), 60 to 69 years old (2.78%), 70 to 79 years old (4.44%) and 80 years old or more (8.22%). In view of this, it can be seen that there is a tendency towards an increase in the mortality rate from the age of 20, with an increase of 40% in the range from 20-29 to 30-39 years, 39% from 30-39 to 40-49 years , 92% from 40-49 to 50-59 years old, 50% from 50-59 to 60-69 years old, 59% from 60-69 to 70-79 years old and 85% from 70-79 to 80 years old and over.

Discussion

The distribution of numbers of hospitalizations for Phlebitis, Thrombophlebitis, Embolism and Venous Thrombosis by Brazilian regions reflects the impacts of disparities in sociodemographic factors, such as differences in income, access to health services, as well as the number of inhabitants in each region. According to the data obtained, the Southeast region stood out, in relation to the others, in terms of the absolute number of hospitalizations, followed by the South, however, when the incidence rate is calculated, the South shoots first, reflecting the

lower population size when compared to the Southeast.

Another factor that influences the high incidence rate in the South is its particularity of low temperatures, since vasoconstriction, elevation of coagulation factors and reduction in the performance of physical activities induced by the climate are pro-coagulant factors, being correlated with thrombosis (Ohki, & van Bellen, 2017). Added to this, the South region, in 2010, stood out in first place regarding the percentage of obesity (16.4%) and smokers (18.1%). Thus, bearing in mind that both are important risk factors for the development of the aforementioned vascular pathologies, their leadership in terms of such risk factors helps to explain the high incidence rate of hospitalizations in this Region.

Regarding the fatality rate profile, the North and Northeast regions alternate during the years with the highest associated values, the Northeast with an average fatality rate of 3.86%, and the North with 3.79%. Thus, although the South and Southeast have higher incidence rates and absolute numbers of hospitalizations, respectively, they are classified with the lowest average lethality rates (1.77% in the South and 2.33% in the Southeast). This information corroborates the results shown in the literature, which state that the Brazilian regions with the highest proportion of cases of VTE hospitalization (South and Southeast) have the lowest mortality rate due to the disease, which can be explained by the interregional differences in relation to income and access to health services for rapid diagnosis and decision-making (Silva, et al., 2021).

The profile in relation to gender also corroborates the literature, since women correspond to most hospitalizations. Intrinsic factors may be favorable to this arrangement, such as the use of oral contraceptives, eventual pregnancy, puerperium or gynecological surgery, as well as a greater search for health services by the female population in relation to the male population (Isabel, & Costa, 2017; Heit, Spencer, & White, 2016). Regarding the use of oral contraceptives , although pills currently have a

lower concentration of estrogen, especially ethinyl estradiol, their use increases the risk of VTE by up to six times compared to those that do not use hormonally based contraceptives. The absolute risk, however, in women aged less than 35 years and without associated risk factors remains between low and moderate (Linnemann, et al., 2022).

When analyzing the occurrence of this condition in relation to age, it is noted that the probability of being affected by the disease grows according to the patient's age; some authors consider that this growth has a direct relationship with longevity (Silva, et al., 2021). The data referring to the hospitalization coefficient according to age groups corroborate the literature, since they presented a central tendency of significant growth, regarding the increase in age group. Therefore, it can be concluded that there was a dose-response relationship between the patients' ages and hospitalization rates.

On other studies, it is noted that, from the age of 40 (Silva, et al., 2021), the occurrence rate increases considerably, with a higher risk of VTE incidence, but other authors consider that this occurs from the age of 50 (Hansen, et al., 2001). A more expressive increase in hospitalization rates was observed from the transition between the 50-59 and 60-69 age groups.

From data collection, it was observed that hospital mortality rates increased significantly as age groups increased, with an exponential increase among patients aged 70-79 years and 80 years and over. This finding reflects the fragility resulting from the greater presentation of comorbidities typically presented by older age groups, making these patients more susceptible to less favorable outcomes, in addition to death (Heit, 2015).

The body of bibliographic evidence suggests that VTE is more frequent in the population of African ancestry (Vidal, 1996). Epigenetic factors help to justify this arrangement, such as obesity, which increases the risk two to three times, together with the greater activity of factor VIII in this ethnic group, which may favor thromboembolic events; 10% of healthy people have values above 228 IU/dl (de Paula Sabino,

et al., 2007; Heit, 2015). However, the genetic basis of this increase in the population of African origin is still unknown.

According to the data collected regarding the hospitalization coefficients, however, a significantly higher incidence of hospitalization was revealed in individuals who self-identify as white. However, the high number of patients whose race was not identified was an obstacle that made it impossible to determine the true pattern of incidence of hospitalizations due to VTE, according to the race/color criterion.

During data collection, it was noticed that the studied MORB ICD-10 list does not distinguish notifications of phlebitis and thrombophlebitis from those of embolism and venous thrombosis. This bias may have compromised the analysis of the data obtained, by including phlebitis and thrombophlebitis in the analyzed variables.

Conclusion

Venous Thromboembolism is a recurrent condition in the in-hospital setting, and its complications are pathologies of high risk to the patient's health, with the associated risk factors determining the patient's prognosis. The study indicates that the profile of hospitalization in the Brazilian population is composed mainly of white women, aged 50 to 59 years. In the Brazilian territory, the Southeast region led the total attendances in the period. The present study, whose database comes from DataSUS, has limitations, as the data were made available by grouping four different pathologies into a single category. This resulted in inaccurate information, negatively impacting the epidemiological design of Venous Thromboembolism in the Brazilian population.

References

Albuquerque, C., Costa, C., Martins, R., & Madureira, A. (2017). Preventive Measures Of Venous Thromboembolism In The Hospitalized Patient: An Integrative Literature Review. In Z. Bekirogullari, M. Y. Minas, & R. X. Thambusamy (Eds.), *Health and Health Psychology*

- *icH&Hpsy. European Proceedings of Social and Behavioural Sciences* (pp. 24-34). Future Academy. https://doi.org/10.15405/epsbs.2017.09.3

Alves, E., Almeida, C., & Pratas Balhau, A. (2015). Venous Thromboembolism Diagnosis and Treatment.

Amaral, C., & Tavares, J. (2023). Prophylaxis of venous thromboembolism In the surgical patient: The role of anesthesiology in a multidisciplinary responsibility. *SPA Magazine*, *22*.

de Paula Sabino, A., Guimarães, D. A., Ribeiro, D. D., Paiva, S. G., Sant'Ana Dusse, L. M., das Graças Carvalho, M., & Fernandes, A. P. (2007). Increased Factor V Leiden frequency is associated with venous thrombotic events among young Brazilian patients. *Journal of thrombosis and thrombolysis*, *24*(3), 261–266. https://doi.org/10.1007/s11239-007-0024-x

Diogo-Filho, A., Maia, C. P., Diogo, D. M., Fedrigo, L.dosS., Diogo, P. M., & Vasconcelos, P. M. (2009). Study of epidemiological surveillance of venous thromboembolism prophylaxis in surgical specialties of a school tertiary referral hospital. *Arquivos de gastroenterologia*, *46*(1), 9–14. https://doi.org/10.1590/s0004-28032009000100007

Goldman, L., & Schafer, A.I. (2022). *Goldman-Cecil Medicine*. (26th edition). Sao Paulo: GEN Group.

Hansen, K. E., Kong, D. F., Moore, K. D., & Ortel, T. L. (2001). Risk factors associated with thrombosis in patients with antiphospholipid antibodies. *The Journal of rheumatology*, *28*(9), 2018–2024.

Heit J. A. (2015). Epidemiology of venous thromboembolism. *Nature reviews. Cardiology*, *12*(8), 464–474. https://doi.org/10.1038/nrcardio.2015.83

Heit J. A. (2015). Epidemiology of venous thromboembolism. *Nature reviews. Cardiology*, *12*(8), 464–474. https://doi.org/10.1038/nrcardio.2015.83

Heit, J. A., Spencer, F. A., & White, R. H. (2016). The epidemiology of venous thromboembolism.

Journal of thrombosis and thrombolysis, 41(1), 3–14. https://doi.org/10.1007/s11239-015-1311-6

Holbrook, A. M., Pereira, J. A., Labiris, R., McDonald, H., Douketis, J. D., Crowther, M., & Wells, P. S. (2005). Systematic overview of warfarin and its drug and food interactions. *Archives of internal medicine, 165*(10), 1095–1106. https://doi.org/10.1001/archinte.165.10.1095

Isabel, C., & Costa, S. (2017). *Preventive measures for venous thromboembolism in hospitalized patients: an integrative literature review.* Polytechnic Institute of Viseu Viseu Higher School of Health.

Kearon, C., Akl, E. A., Ornelas, J., Blaivas, A., Jimenez, D., Bounameaux, H., Huisman, M., King, C. S., Morris, T. A., Sood, N., Stevens, S. M., Vintch, J. R. E., Wells, P., Woller, S. C., & Moores, L. (2016). Antithrombotic Therapy for VTE Disease: CHEST Guideline and Expert Panel Report. *Chest, 149*(2), 315–352. https://doi.org/10.1016/j.chest.2015.11.026

Konstantinides, S. V., Torbicki, A., Agnelli, G., Danchin, N., Fitzmaurice, D., Galiè, N., … & Task Force for the Diagnosis and Management of Acute Pulmonary Embolism of the European Society of Cardiology (ESC) (2014). 2014 ESC guidelines on the diagnosis and management of acute pulmonary embolism. *European heart journal, 35*(43), 3033–3069k. https://doi.org/10.1093/eurheartj/ehu283

Kumar, V., Abbas, A., & Aster, J.R. (2016). *Cotran Pathology - Pathological Basis of Disease.* (9th edition). Sao Paulo: GEN Group.

Linnemann, B., Rott, H., Zotz, R., & Hart, C. (2022). Venous Thromboembolism Issues in Women. *Hamostaseologie, 42*(5), 290–299. https://doi.org/10.1055/a-1919-9558

Marques, L.J. (1998). Pulmonary thromboembolism. *Medicine, Ribeirão Preto, 31*, 257-265.

Nazario, R., Delorenzo, L. J., & Maguire, A. G. (2002). Treatment of venous thromboembolism. *Cardiology in review, 10*(4), 249–259. https://doi.org/10.1097/00045415-200207000-00010

Ohki, A. V., & van Bellen, B. (2017). A incidência regional do tromboembolismo venoso no Brasil. *Jornal vascular brasileiro, 16*(3), 227–231. https://doi.org/10.1590/1677-5449.000517

Rizzatti, E.G. & Franco R.F. (2001). Treatment of venous thromboembolism. *Medicine, (Ribeirão Preto), 34*, 269-275.

Silva, J.P., Souza, R.B., Oliviera, L.C., Rocha, L.B., Spinelli, J.M., & Couto, M.H.S.H. (2021). Epidemiological profile of pulmonary thromboembolism in Brazil from 2015 to 2019. *BEPA, 18*(208).

Vidal, H. (1996). Deep vein thrombosis: review of current concepts. *Brazilian Journal of Orthopedics, 31*(10).

Volpe, G.J., Joaquim, L.F., Dias, L.B.A., de Menezes, M.B., & Moriguti, J.C. (2010). Pulmonary thromboembolism. *Medicine (Ribeirão Preto), 43*(3), 258-271.