



Pulmonary embolism: an underdiagnosed and underreported entity in Brazil

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TO THE EDITOR,

A recent investigation⁽¹⁾ published in this journal revealed a significant increase in hospitalizations due to pulmonary embolism (PE) over the past decade in Brazil, from 2.57/100,000 inhabitants in 2008 to 4.4/100,000 inhab. in 2019, with an average annual percentage change (AAPC) in the period of 5.6%; $p < 0.001$ (Figure 1A).

Several registries in different countries have also shown an increase in PE hospitalizations in recent decades.⁽²⁾ An American registry recorded a significant increase in hospitalizations due to PE after the introduction of computed tomographic pulmonary angiography (CTPA) for the diagnosis of this condition (62.1/100,000 inhab. vs. 112.3/100,000 inhab.; $p < 0.0001$) comparing the periods before and after 1998, when multi-detector computed tomography was introduced.⁽³⁾ A Spanish registry also showed an increase in PE hospitalizations, from 20.44/100,000 inhab. in 2002 to 32.69/100,000 inhab. in 2011; $p < 0.05$.⁽⁴⁾ Similar findings were observed in registries in Italy and Australia.^(5,6)

It is noteworthy that the PE hospitalization rates in Brazil have been much lower than those reported in developed countries worldwide (Figure 1B). According to Figure 1A, the highest annual PE hospitalization rate in Brazil was recorded in 2019, with 4.7 hospitalizations/100,000 inhab. Meanwhile, in Figure 1B, an American registry showed a PE hospitalization rate of 112.3/100,000 inhab. between 1998-2006;⁽³⁾ a Spanish registry recorded an annual PE hospitalization rate of 32.69/100,000 inhab. in 2011,⁽⁴⁾ and an Italian registry showed yearly PE hospitalization rates of 55.5 and 40.6/100,000 inhab. for women and men, respectively, from 2002 to 2012.⁽⁵⁾

Based on these data, it is possible that PE is underdiagnosed in Brazil; therefore, it is likely that many patients do not receive the correct diagnosis of this condition. Since the symptoms of PE are non-specific, its clinical presentation can be confused with several other diseases, such as pneumonia, heart failure, and chronic obstructive pulmonary disease, among others. The definitive diagnosis is only possible using imaging tests such as CTPA or planar ventilation/perfusion lung scintigraphy. These diagnostic tests are expensive, and their availability is still restricted to large centers in Brazil, especially in the public health system. Moreover, rational measures for diagnosis and treatment based on algorithms proposed by international guidelines that include, for example, pre-test probability, d-dimer, and direct oral anticoagulants (DOACs), need to be more widely adopted in the country.

On the other hand, this study also showed a significant reduction in PE fatality rates over the past decade, decreasing from 21.21% to 17.11% (AAPC: -1.9%; $p < 0.001$).⁽¹⁾ This finding corroborates those reported by other major international registries, which also showed a substantial reduction in PE fatality rates in recent years.⁽²⁾ In an American registry, for example, the PE fatality rates for the first episode were 5.9%, 4.2%, 3.8%, and 2.4%, respectively, in the 2001-2002, 2003-2004, 2005-2006, and 2007-2008 periods.⁽⁷⁾ Another American registry showed a decrease in PE fatality rates for males and females between 2003-2011.⁽⁸⁾ In a Chinese registry, a decrease in PE fatality rates was observed from 25.1% (95% confidence interval (CI) 16.2-36.9) in 1997 to 8.7% (95%CI 3.5-15.8) in 2008.⁽⁹⁾ In an Italian registry, the PE fatality rates decreased between 2002 and 2012 in women (15.6% to 10.2%) and men (17.6% to 10.1%) ($p < 0.0001$).⁽⁵⁾ In addition, a World Health Organization (WHO) database showed a decrease in age-adjusted PE fatality rates between the years 2000 and 2015 in European countries from 12.8% (95%CI 11.4-14.2) to 6.5% (95%CI 5.3-7.7).⁽¹⁰⁾

Despite the significant decline in PE fatality rates in the past decade in Brazil, the rates registered in the country are still higher than those documented in other countries around the world (Figure 1C). The higher fatality rates in Brazil could be directly related to PE underdiagnosis. In this scenario, only the diagnosis of more severe conditions, which account for the highest in-hospital mortality rates, is carried out, whereas PE with little clinical significance may remain undiagnosed in most cases in Brazil. On the other hand, we cannot rule out the possibility that the lower PE fatality rates in developed countries could be influenced by overdiagnosis, given that the number of PE diagnoses could have been inflated with clinically less significant cases that were only detectable through highly sensitive imaging tests and experienced radiologists.

PE underreporting in Brazil may also be another significant issue. According to Gomes et al. (2022),⁽¹⁾ hospitalization data extracted from the Hospital Information System (SIH) of the Brazilian Unified Health System (SUS) Information Technology Department comprises approximately 70% of public hospital admissions. Another possibility would be the high number of outpatient PE diagnoses. However, even though the home treatment of low-risk PE is feasible, we know this approach is still not widespread in Brazil; most physicians still hospitalize their patients for anticoagulant treatment initiation. Another problem could be the underreporting of in-hospital PE, since the diagnosis of PE may not be included within the primary

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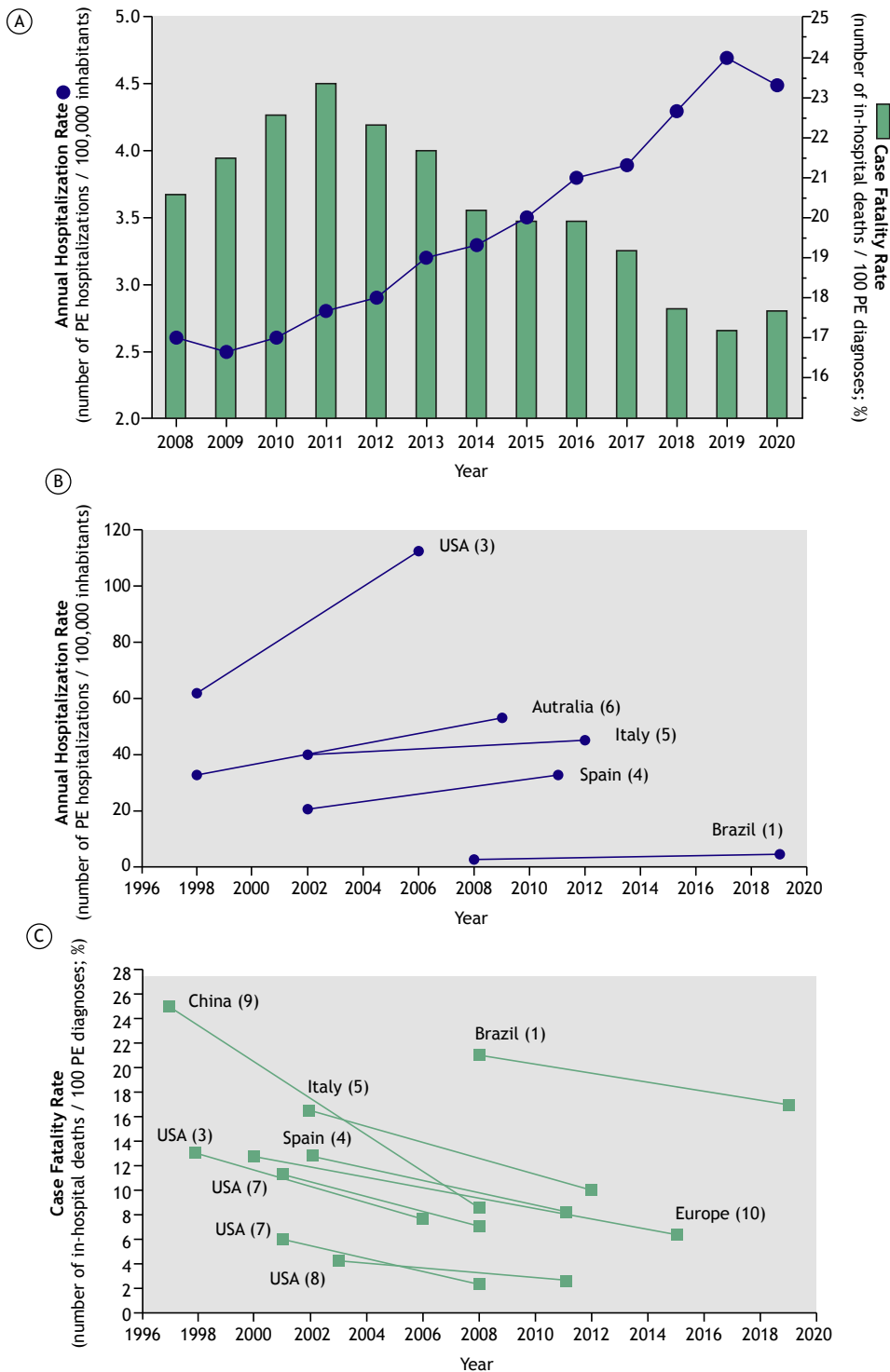


Figure 1. (A) Line graph showing the annual pulmonary embolism (PE) hospitalization rates per 100,000 inhabitants over time (left y-axis) and bar graph showing the change in the yearly PE fatality rates (right y-axis) in the period from January 2008 through December 2020 in Brazil. Source: Hospital Information System (SIH) of the Brazilian Unified Health System (SUS) Information Technology Department. (B) Comparison of Brazil's annual PE hospitalization rates with other countries in the world. (C) Comparison of Brazil's annual PE fatality rates with other countries in the world. PE: pulmonary embolism; USA: United States of America. Numbers in parentheses indicate the reference number from which the data was retrieved.

hospitalization diagnoses in patients hospitalized due to other medical conditions, such as femur fracture,

etc. Nevertheless, even underreporting alone would not explain these lower PE hospitalization rates in Brazil.

In conclusion, as in other countries around the globe, Brazil recorded increased PE hospitalization rates and decreased PE fatality rates over the past decade. However, it is essential to emphasize that the PE hospitalization rates are lower and the PE fatality rates are higher in Brazil than in any other developed country. A significant percentage of PE is probably not diagnosed in Brazil. In addition, this condition may be underreported. Undiagnosed and inadequately treated PE can have numerous future consequences for these patients, such as the development of chronic thromboembolic pulmonary hypertension.

PE is a neglected disease in Brazil. The Brazilian Unified Health System (SUS) needs to incorporate new strategies to improve the diagnosis and promote adequate treatment of this disease in the country. The use of clinical scores (Wells and modified Geneva), rational flowcharts for diagnosis, and risk stratification should be encouraged, allowing for more adequate management and better outcomes. In addition, when indicated, these patients should have access to DOACs since, aside from their more predictable effects, these drugs can be administered at home. In this way, we can increase the diagnosis rate, decrease the fatality rate, and cut down on hospital costs.

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