Early physicians’ mortality in Espírito Santo: a decade trend
Mortalidade precoce de médicos no Espírito Santo: tendência de uma década

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ABSTRACT | Introduction: Mortality data make it possible to develop indicators to guide the planning of health promotion and prevention actions in order to reduce mortality from preventable causes. However, there are no publications on physicians’ mortality in the state of Espírito Santo, Brazil. Objectives: To describe mortality distribution and potential years of life lost from 2006 to 2015 among physicians who lived in Espírito Santo. Methods: This is a descriptive study of secondary data from the Mortality Information System of the Brazilian Ministry of Health. The distribution of socio-demographic variables and of basic cause of death was studied by absolute and relative frequencies. Potential years of life lost in each death were considered the years remaining from age at death up to the age limit of 70 years. Results: There were 20 deaths of female physicians (14.5%) and 118 (85.5%) of male physicians, with predominance of whites (87.9%) and married (56%) individuals. The main causes of death were neoplasms (39.1%), diseases of the circulatory system (19.6%), and external causes (19.6%). The majority of female and male deaths occurred from 60 to 69 years, but average death was significantly lower among women compared to men (respectively 58.3 and 67.0 years). Potential years of life lost totaled 1,226 years, with a mean of 14.6, which was greater in women (20.4) compared to men (13.4). Conclusions: Mortality trends observed in the general population were also present among physicians in Espírito Santo. However, contrary to the general population pattern, average death age was lower in women. Early mortality caused many lost years of life, especially among women.

Keywords | mortality; potential years of life lost; occupational health; physicians.
INTRODUCTION

Mortality data make it possible to develop indicators that allow for establishing health care priorities, becoming highly valuable to help plan health promotion and prevention actions1 aimed at effectively reducing deaths from preventable causes.2

Mortality among physicians has been studied for more than a century.2 International evidence shows that physicians’ mortality is higher and earlier than that of the population of the same socioeconomic status.3 National studies highlight that average death age of female physicians is much lower than that of male physicians.4,5 However, no studies have yet been published on physicians’ mortality in the state of Espírito Santo, Brazil.

The aim of this research is to describe the distribution of deaths of physicians living in Espírito Santo from 2006 to 2015, to investigate differences between sexes, and to estimate the impact of early mortality by assessing average death age and potential years of life lost (PYLL).

METHODS

A descriptive study was conducted using a source of secondary data. Since this research collected information from a public domain database, the project was waived from ethical appreciation by the Research Ethics Committee of Escola Superior de Ciências da Santa Casa de Misericórdia de Vitória (EMESCAM) (CAAE 84837318.1.0000.5065).

Information was collected from the Mortality Information System (Sistema de Informações de Mortalidade, SIM), in the individualized databases on all death certificates (DC) from 2006 to 2015, made available online by the Department of Informatics of the Brazilian Unified Health System (DATASUS), linked to the Brazilian Ministry of Health. Databases obtained were converted into the .dbf format using the TabWin application, and aggregated in a single database, which was codified, processed, and analyzed with the Statistical Package for the Social Sciences (SPSS) application, version 23.

RESULTS

Of the 210,386 deaths of individuals living in Espírito Santo that occurred from 2006 to 2015, when categorized by occupation, there were 138 deaths of physicians, described in Table 1.

Subsequently, records of individuals whose occupation was listed as physician, according to the Brazilian Classification of Occupations (Classificação Brasileira de Ocupações 2002, CBO-2002), were selected. Absolute and relative frequencies were used to study death distribution according to sociodemographic variables and to basic cause of death, categorized according to the International Classification of Diseases, 10th revision (ICD-10). Differences in the distribution of sociodemographic variables according to sex were investigated using the Pearson chi-square test or the Fisher exact test for qualitative variables and the non-parametric Mann-Whitney test for the variable death age, considering a level of significance of 5%.

Average death age was also calculated in complete years. Calculation of PYLL for each death considered the years of life remaining from the age at death up to the age limit established at 70 years.5 Overall PYLL was obtained by adding PYLL by death, whereas mean PYLL by death was calculated by dividing overall PYLL by the number of deaths considered. Average death age and PYLL were analyzed according to sex and to basic cause of death.
Both female and male deaths were concentrated in the age group from 60 to 69 years. However, mortality at younger ages was higher among women, with 45% of deaths occurring at an age under 60 years versus 25.7% among men.

The age distribution of deaths according to sex is consistent with the finding that female physicians died,

Table 1. Sociodemographic data from physicians who lived in the state of Espírito Santo, Brazil, and died from 2006 to 2015, according to sex

| Variables                | Male          | Female         | Total          |
|--------------------------|---------------|----------------|----------------|
|                          | n  | %  | n  | %  | n  | %  |
| Race/skin color*†        |    |    |    |    |    |    |
| White                    | 90 | 86.5 | 19 | 95.0 | 109 | 87.9 |
| Black                    | 0  | 0.0 | 0  | 0.0 | 0  | 0.0 |
| Yellow                   | 0  | 0.0 | 0  | 0.0 | 0  | 0.0 |
| Brown                    | 14 | 13.5 | 1  | 5.0 | 15 | 12.1 |
| Indigenous               | 0  | 0.0 | 0  | 0.0 | 0  | 0.0 |
| Age*†                    |    |    |    |    |    |    |
| 20 to 29                 | 4  | 34  | 1  | 5.0 | 5  | 3.7 |
| 30 to 39                 | 7  | 60  | 3  | 15.0 | 10 | 7.3 |
| 40 to 49                 | 7  | 60  | 2  | 10.0 | 9  | 6.6 |
| 50 to 59                 | 12 | 103 | 3  | 15.0 | 15 | 10.9 |
| 60 to 69                 | 39 | 33.3 | 5 | 25.0 | 44 | 32.1 |
| 70 or older              | 48 | 41.0 | 6 | 30.0 | 54 | 39.4 |
| Marital status*†         |    |    |    |    |    |    |
| Single                   | 10 | 9.3 | 5  | 27.8 | 15 | 12.0 |
| Married                  | 68 | 63.6 | 7 | 38.9 | 75 | 60.0 |
| Widowed                  | 9  | 8.4 | 3  | 16.7 | 12 | 9.6 |
| Separated                | 17 | 15.9 | 2 | 11.1 | 19 | 15.2 |
| Other                    | 3  | 2.8 | 1  | 5.5 | 4  | 3.2 |
| Place of residence‡      |    |    |    |    |    |    |
| Cariacica                | 0  | 0.0 | 0  | 0.0 | 0  | 0.0 |
| Fundão                   | 0  | 0.0 | 0  | 0.0 | 0  | 0.0 |
| Guarapari                | 3  | 25  | 2  | 10.0 | 5  | 3.6 |
| Serra                    | 3  | 25  | 0  | 0.0 | 3  | 2.2 |
| Viana                    | 1  | 0.8 | 0  | 0.0 | 1  | 0.7 |
| Vila Velha               | 25 | 21.2 | 4 | 20.0 | 29 | 21.0 |
| Vitória                  | 47 | 39.9 | 8 | 40.0 | 55 | 39.9 |
| Other                    | 39 | 33.1 | 6 | 30.0 | 45 | 32.6 |
| Place of death‡*         |    |    |    |    |    |    |
| Cariacica                | 5  | 43  | 0  | 0.0 | 5  | 3.6 |
| Fundão                   | 1  | 0.8 | 0  | 0.0 | 1  | 0.7 |
| Guarapari                | 1  | 0.8 | 1  | 5.0 | 2  | 1.5 |
| Serra                    | 24 | 20.4 | 1 | 5.0 | 25 | 18.1 |
| Viana                    | 1  | 0.8 | 0  | 0.0 | 1  | 0.7 |
| Vila Velha               | 14 | 11.9 | 5 | 25.0 | 19 | 13.8 |
| Vitória                  | 26 | 22.0 | 8 | 40.0 | 34 | 24.6 |
| Other                    | 46 | 39.0 | 5 | 25.0 | 51 | 37.0 |
| Total                    | 118| 100.00 | 20 | 100.00 | 138| 100.00 |

*Fourteen records (10.1%) with missing information on ethnicity, one (0.7%) with missing information on age, and four (2.9%) with missing information on marital status.

† Without statistically significant difference, p > 0.05.
‡ Eleven deaths occurred in municipalities of other states.
on average, nearly 9 years earlier than male physicians, because average death age was, respectively, 58.3 and 67.0 years, with a statistically significant difference (Mann-Whitney U test, p = 0.040).

Table 2 shows the age distribution of causes of death classified into the three ICD-10 chapters that accounted for 77.3% of deaths (78.8% among men and 75% among women), namely neoplasms, diseases of the circulatory system, and external causes. In these chapters, mortality under 39 years was mainly from external causes in both sexes, whereas mortality above 60 years was mainly caused by neoplasms and diseases of the circulatory system, although external causes persisted, at lower percentages, only among men.

Data on the main specific causes of physicians’ death are described in Table 3, which accounts for 108 deaths in this study (78.3%).

Among male physicians, neoplasms represented the leading cause of death, the most frequent of which was malignant neoplasm of prostate, followed by malignant neoplasm of bronchus and lung. This chapter was also the predominant cause of death among women, especially malignant neoplasm of breast, followed by malignant neoplasm of bronchus and lung.

Of the diseases of the circulatory system, the most frequent cause of death was acute myocardial infarction (AMI), whose frequency was greater in women than in men (40%).

It bears noting the important role of deaths from external causes recorded among physicians. Car accidents, including running-over of pedestrians, represent the main cause of death, among external causes, in both sexes. The high percentage of deaths from assault among women was also noteworthy. Deaths from air and space transport accidents also stood out: 18.5% of deaths from external causes, being predominant in men.

The chapter of endocrine diseases, whose data for specific causes are not presented in this article, is the fourth leading cause of mortality in the study population, with 10 deaths (7.3% of total), all caused by diabetes mellitus, accounting for eight deaths (6.8%) among men and two (10%) among women.

With regard to PYLL, Table 4 shows a total of 1,226 PYLL. For the calculation of this indicator, only deaths under 70 years of age were computed, which totaled 84 of the 138 physicians’ deaths included in the study. Mean PYLL was 14.6 years, being 34.31% higher in women (20.4 years) than in men (13.4 years). Furthermore, it was found that the lower average death age and higher mean PYLL, respectively 42 and 28 years, were related to external causes, accounting for 23 deaths (27.4%). When these deaths were compared to those from the other causes, notably chronic diseases, a significant difference was observed in average death age and thus in PYLL, reflecting in

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**Table 2. Basic cause of death in the main chapter of the International Classification of Diseases, 10th revision among physicians in the state of Espírito Santo, Brazil, from 2006 to 2015, according to sex and age**

| Age    | Male | Female |
|--------|------|--------|
|        | Neoplasms (tumors) (C00-D48) | Diseases of the circulatory system (I00-I99) | External causes (V01-Y98) | Neoplasms (tumors) (C00-D48) | Diseases of the circulatory system (I00-I99) | External causes (V01-Y98) |
| 20 to 29 | 0   | 0      | 4   | 0   | 0      | 1   |
| 30 to 39 | 0   | 1      | 6   | 0   | 0      | 3   |
| 40 to 49 | 2   | 0      | 3   | 0   | 0      | 1   |
| 50 to 59 | 6   | 4      | 1   | 2   | 0      | 0   |
| 60 to 69 | 16  | 9      | 4   | 3   | 1      | 0   |
| 70 or more | 21 | 12     | 3   | 3   | 1      | 0   |
| Total    | 45  | 26     | 21  | 8   | 2      | 5   |

* One record (0.7% of total) with missing information on age.
overall values. Therefore, except for chapters with only one occurrence, neoplasms, diseases of the circulatory system, diseases of the digestive system, and endocrine diseases accounted for the highest average death age (above 60 years) and for the lowest PYLL mean (8 years).

Table 3. Specific causes of death by the most frequent chapters of the International Classification of Diseases, 10th revision among physicians from the state of Espírito Santo, Brazil, from 2006 to 2015, according to sex

| Basic cause of death | Male | | Female | | Total | |
|----------------------|------|---|---|---|---|---|
|                      | n    | % | n  | % | n   | % |
| Neoplasms            |      |   |    |   |     |   |
| Malignant neoplasm of prostate | 7    | 15.2 | 0 | 0 | 7 | 13.0 |
| Malignant neoplasm of bronchus and lung | 6 | 13.0 | 3 | 37.5 | 9 | 16.7 |
| Malignant neoplasm of colon | 4 | 8.7 | 0 | 0 | 4 | 7.4 |
| Malignant neoplasm of kidney, except renal pelvis | 4 | 8.7 | 0 | 0 | 4 | 7.4 |
| Malignant neoplasm of stomach | 3 | 6.5 | 0 | 0 | 3 | 5.6 |
| Malignant neoplasm of liver and intrahepatic bile ducts | 3 | 6.5 | 0 | 0 | 3 | 5.6 |
| Malignant neoplasm of pancreas | 3 | 6.5 | 0 | 0 | 3 | 5.6 |
| Malignant neoplasm of esophagus | 2 | 4.3 | 0 | 0 | 2 | 3.7 |
| Malignant neoplasm of brain | 2 | 4.3 | 0 | 0 | 2 | 3.7 |
| Multiple myeloma and malignant plasma cell neoplasms | 2 | 4.3 | 0 | 0 | 2 | 3.7 |
| Malignant neoplasm of breast | 0 | 0 | 2 | 25.0 | 2 | 7.4 |
| Other neoplasms*     | 10   | 21.7 | 3 | 37.5 | 13 | 24.1 |
| Diseases of the circulatory system | 25 | 100.0 | 2 | 100.0 | 27 | 100.0 |
| Hypertensive heart disease | 1 | 4.0 | 0 | 0 | 1 | 3.7 |
| Acute myocardial infarction | 10 | 40.0 | 1 | 50.0 | 11 | 40.7 |
| Chronic ischemic heart disease | 3 | 12.0 | 0 | 0 | 3 | 11.1 |
| Cardiomyopathy       | 1 | 4.0 | 0 | 0 | 1 | 3.7 |
| Intracerebral hemorrhage | 4 | 16.0 | 0 | 0 | 4 | 14.8 |
| Stroke, not specified as hemorrhage or infarction | 2 | 8.0 | 0 | 0 | 2 | 7.4 |
| Other cerebrovascular diseases | 0 | 0 | 1 | 50.0 | 1 | 3.7 |
| Sequelae of cerebrovascular disease | 2 | 8.0 | 0 | 0 | 2 | 7.4 |
| Aortic aneurism and dissection | 2 | 8.0 | 0 | 0 | 2 | 7.4 |
| External causes       | 22   | 100.0 | 5 | 100.0 | 27 | 100.0 |
| Air and space transport accidents | 5 | 22.7 | 0 | 0 | 5 | 18.5 |
| Car accidents         | 8 | 36.4 | 4 | 800 | 12 | 44.4 |
| Fall                 | 2 | 91.0 | 0 | 0 | 2 | 74 |
| Intentional self-harm | 2 | 91.0 | 0 | 0 | 2 | 74 |
| Assault              | 1 | 45.5 | 1 | 200 | 2 | 74 |
| Other†               | 4 | 18.2 | 0 | 0 | 4 | 14.8 |

*In male physicians, one case of each type of malignant neoplasm: small intestine; rectum; other and unspecified parts of biliary tract; thymus; bladder; other and ill-defined sites; follicular (nodular) non-Hodgkin lymphoma; diffuse non-Hodgkin lymphoma; myeloid leukemia; and other leukemias of specified cell type. In female physicians, one case of each type of malignant neoplasm: other and ill-defined digestive organs; malignant melanoma of skin; and ovary.
†Three cases of risks and exposure: one case of accidental poisoning by and exposure to noxious substances and others of unspecified event, undetermined intent.
DISCUSSION

The lower average death age among female physicians in the state of Espírito Santo is consistent with similar studies conducted in the states of São Paulo and Santa Catarina, in which average death age of women was, respectively, 59.2 years vs. 69.1 years among men, and 46.5 years vs. 59.8 years among men. Conversely, according to the Brazilian Institute of Geography and Statistics (Instituto Brasileiro de Geografia e Estatística, IBGE), in 2015, life expectancy among Brazilians was 71.6 years for men and 78.8 years for women.

With regard to causes of death, the predominance of neoplasms, of diseases of the circulatory system, and of external causes was similar to findings from the study in Santa Catarina and different, in the order of causes of death, to findings from the study of São Paulo, in which the main causes of mortality were, respectively, diseases of the circulatory system, neoplasms, diseases of the respiratory system, and external causes. This may indicate that physicians have different behaviors or lifestyle depending on the region or state where they live and/or practice their profession.

There were also differences in terms of specific causes of deaths among physicians from Espírito Santo and from São Paulo, in which malignant neoplasms of the lung stood out, followed by prostate cancer among male physicians and, among female physicians, breast neoplasms, followed by colon and rectum neoplasms.

In a comparison about the neoplasm chapter of the ICD-10, prostate cancer accounts for the second highest incidence rate of all cancers among Brazilians and, in 2010, was the second leading cause of cancer deaths among men in the country. However, it bears highlighting early detection as a strategy to find tumors at their earliest stage and thus improve the chances of treatment success. This indicates the importance for men to undergo periodic medical examination, in which screening may be a strategy to be implemented when the benefits outweigh the risks, such as anxiety, excessive tests, overdiagnosis, and overtreatment.

Breast neoplasms were the leading cause of cancer mortality among women in Brazil from 2013 to 2017, accounting for 15.9% of deaths, with the Southeast region exhibiting the highest percentage (16.7%), which may justify the high frequency of this type of cancer among female physicians living in Espírito Santo.

Bronchus and lung cancer was the second cause of cancer death among both sexes in Brazil in 2015 and showed a higher mortality in men than in women. However, from 1990 to 2015, there was a decrease in mortality from this neoplasm among men (-14.1%) and an increase among women (+20.7%) in the country.
This trend of inversion in sex ratio may have been materialized among physicians living in Espírito Santo.

Meanwhile, in Brazil and worldwide, ischemic heart diseases are the main cause of death in this group. In 2016, diseases of the circulatory system are the leading cause of mortality in the general population, both in Brazil and worldwide, and, in this chapter, ischemic diseases of heart were the main causes of mortality, followed by cerebrovascular accidents. These two causes stood out as the main causes of death globally from 2005 to 2016, but their rates have been decreasing throughout this period in both sexes.

With regard to external causes of mortality of physicians in Espírito Santo, especially to air and space transport accidents, it is worth mentioning an accident with a single-engine airplane resulting from medical work that occurred in 2007, killing five professionals from an organ transplantation team. This event had a high impact on data from this research, since it assesses a relatively small number of deaths.

In agreement with the literature, a study conducted in São Paulo observed, in relation to external causes, that car accidents, including run-over of pedestrians, accounted for almost 40% of deaths in both sexes, and, in Santa Catarina, it was found that these accidents accounted for 43.8% of deaths among men and 33.3% among women. It bears highlighting that, in the Brazilian population, in 2016, assaults represented the specific cause leading to the highest mortality rate among external causes, followed by traffic accidents, which accounted for nearly 30% of deaths in both sexes, with an upward trend from 2010 onwards.

Therefore, physicians’ mortality resulted both from chronic diseases that affect the general population, characterizing the current epidemiological pattern of demographic transition, and from accidents, preventable events with the highest burden of PYLL observed in this study. Importantly, ischemic heart diseases were those that most contributed to PYLL, both globally and in Brazil.

It is worth emphasizing the importance of the occupational risk to which medical workers are exposed, including conditions of health provision to the population relying on the public sector, which are greatly deficient, in addition to the fact that professional practice often takes place in places that lack indispensable technological resources, representing an environment that puts the health of these professionals at risk and has an influence on the PYLL of this professional category.

In the context of this profession, despite being inserted into a little advantageous structure, women are increasingly gaining space in the medical field. Since 2004, women have been outnumbered men in medical schools and, since 2009, have constitute the majority of registrations in Regional Councils of Medicine (CRMs), with a mean age of 47.6 years for men and 42.8 years for women. However, women’s entry into the labor market did not balance the roles attributed to each sex. On the contrary, it reinforced and perpetuated an unequal and unfavorable gender-based division of labor.

Occupational medicine has an important role to play in the search for adapting work to workers, in order to, as much as possible, turn work into a health promotion agent. It bears noting the importance of access to appropriate collective protective equipment (CPE) or personal protective equipment (PPE) and of monitoring immunization for preventable diseases and for preventing biological risk, in addition to ensuring rapid access to chemoprophylactic measures in cases of accidents with potentially contaminated sharp objects, which should be notified and dully registered. It is also important not neglecting the need of performing periodical examinations in this professional category, with monitoring of occupational risks to which they are exposed and the main causes of death.

In the scenario of chronic diseases, it is recommended to implement protocols to prevent early death, inserting strategies to control chronic diseases among medical professionals, such as limiting continuous work shifts and controlling excessive working hours among these professionals, as well as scheduling periodical visits with occupational physicians to monitor and follow up occupational health.

Although this is a pioneer study on the theme in the state of Espírito Santo, there are some limitations inherent to studies with databases. It bears highlighting the possible loss of cases due to the inappropriate filling of the “occupation” field, as well as incorrect
filling of DC. However, Espírito Santo has few deaths from ill-defined causes, an important indicator of quality of the SIM, with a mean proportional mortality from this chapter of ICD-10 of 1.71% from 2006 to 2015, the third lowest percentage in the country, based on secondary data from the SIM for the period. The present research found only 1.45% of physicians’ deaths from ill-defined causes. Another limitation is the non-use of appropriate indicators to better estimate the risk of physicians’ deaths, because it was not possible to accurately establish the number of physicians living in the state, due to peculiarities of the professional registration in the CRM systems.

CONCLUSIONS

The results presented here make it possible to understand that, although the mortality trends observed in the general population were also present among physicians living in the state of Espírito Santo, Brazil, from 2006 to 2015, there were early mortality and many potential years of physicians’ life lost, especially in terms of PYLL for female physicians compared to male physicians. This evidences the need to intervene on factors that interfere with the health-disease process in this professional category, especially in female physicians, who suffer the effects of a society that is still traditionally patriarchal, in addition to prophylactic measures, either for chronic diseases or related to the occupational risks of physicians and/or to the way how work is developed.

Finally, it is important to reinforce that additional studies are necessary to gain a better understanding on physicians’ mortality in Brazil.

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Author contributions

MGCS was responsible for formal analysis of data, writing – review & editing, project validation and administration. DOF was responsible for study conceptualization, formal analysis of data, writing – review & editing, project validation and management. FDNS, IPS and LFR were responsible for study design, resources acquisition, formal analysis of data, writing – original draft, project validation and administration.
Early physicians' mortality in Espírito Santo

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