Original Article

Causes of death in Brazil: analysis by geographic regions and in the highest populated cities of São Paulo

Matheus Ferreira Linares[1] (iD), Silvia Maria Paparotto Lopes[2] (iD), Adriana Eliza Brasil Moreira[3], Pablo Agustin Vargas[1] (iD), Alan Roger Santos-Silva[1] (iD), Márcio Ajudarte Lopes[1,*] (iD)

[1] Departament of Oral Diagnosis, Piracicaba Dental School, University of Campinas (UNICAMP), Piracicaba, São Paulo, Brazil.

[2] Private Office and Uniodonto, Piracicaba, São Paulo, Brazil.

[3] Ilumina Hospital, Piracicaba, São Paulo, Brazil.

Corresponding author:
Márcio Ajudarte Lopes
Av Limeira 901, Piracicaba,
São Paulo, Brazil, 13414-903
Email: marcioajudartelopes@gmail.com

Aim: In this study we described the causes of mortality in Brazil, its 5 geographic regions, and in the most populated cities of Sao Paulo State in order to contribute for development of prevention and intervention strategies. **Methods:** Data on causes of death and age distribution of the populations were collected from online public databases and then submitted to the 2001 World Health Organization age standardization of rates for better assessment. **Results:** Data showed that the main causes of death in Brazil and in all 5 geographic regions were diseases of the circulatory system. Neoplasms were the second most frequent cause of death in Brazil and in 3 regions (South, Southeast and Midwest). However, in the other 2 regions (North and Northeast) the second most common was associated to external causes, being neoplasms the third most often. Additionally, in the South and Southeast the third cause of deaths were from diseases of the respiratory system and from the external causes occupied the fourth position. Analyzing the most populated cities of Sao Paulo State it was observed that all of them have the same profile of the country. On the other hand, as speculated previously, in Piracicaba city, the most common cause of mortality was neoplasm. **Conclusions:** These findings showed that Brazil has a large spectrum of causes of death and methods to decrease the mortality rates should be implemented in a local scenario rather than a nation-wide approach, where each location has to focus on its most urging problem.

Keywords: Mortality. Cause of death. Neoplasms.

Introduction

Causes of mortality data is an important tool for developing guidelines and policies for prevention and treatment of diseases. These data in Brazil have been published by the Brazilian Health Ministry since the year of 1975 by using the Mortality Information System (SIM), which provides the possibility to assess all causes of death from each city, state, region and the whole country[1]. It has already been reported by Prestes et al.[2] (2018), that SIM is a viable and precise tool when analyzing causes of death in a local scenario.

According to Bray et al.[3] (2018), noncommunicable diseases is currently the major cause of death worldwide, but it is expected that cancer will become the most common death cause. Therefore, it is possible to observe that the trends of cancer in several countries are slowly changing, not just in mortality, but also in prevalence levels[4-6]. In some countries it is already the main cause of death[4-6]. This fact is occurring in part because of the aging and the population growth in association with habits and life style[3,7]. However, these levels in mortality could be reduced, if education, prevention methods, and strategies for precocious diagnosis were applied, since, successful outcome is achieved particularly when the tumor is treated at the early stages[4,8].

Thus, the aim of this study was to assess the mortality rates in Brazil, in its 5 geographic regions, and in the most populated cities of Sao Paulo State in order to identify the main causes of death, which could help for better understanding the scenario and consequently for developing strategies of prevention and intervention, particularly at the public primary care health centers.

Materials and Methods

To obtain the mortality data it was used the SIM, which is available by the Computing Department of the Unified Health System (DATASUS), and the International Classification of Diseases 10th Revision (ICD − 10), through www.datasus.saude.gov.br[1] and ONCOCENTRO Foundation Database system available at http://www.fosp.saude.sp.gov.br[9]. The data on the age distribution from the determined populations was acquired through the Brazilian Institute of Geography and Statistics (IBGE) available at www.ibge.gov.br[10] and Seade foundation, available at www.seade.gov.br[11].

In addition, the crude mortality rate was calculated according to whole nation, region, state and city level and then the data was submitted to numbers of death to the 2001 World Health Organization (WHO) age standardization of rates to age-adjust standardized mortality rates (ASMR), for better assessment, using Piracicaba city population as reference. To calculate the ASMR, initially is necessary to calculate the crude mortality rate for age group, for each disease that is going to be evaluated. This rate is obtained by dividing the number of deaths for that specific disease by the city's population in that age group, and then multiplying the results by 100,000. Then we multiply, individually, the crude mortality rate of each age group by the proportion of habitants of the assessed city of that same age group. After obtaining the result of each group, we add them to have the ASMR.

Results

Assessing Brazil as a whole, the main cause of death, according to the chapters of the ICD – 10, were the diseases of the circulatory system (DCS), with a total of 358.882 deaths (27.3%), followed by neoplasms, external causes of morbidity and mortality (ECMM), and diseases of the respiratory system (DRS) accounting for 221.821 (17%), 158.657 (12%) and 155.620 (11.9%) deaths, respectively. The external causes of morbidity and mortality is used to classify deaths caused by environmental events and circumstances that are not related to diseases, such as traffic accident, suicide and murder.

When the causes of death were observed by region, it was possible to find some differences among them. For instance, in the North and Northeast regions the second most common cause of death was of ECMM with, respectively, 15.789 (19%) and 52.983 (15%) deaths, instead of neoplasms. However, when ASMR was applied, the five geographic regions had similar ranking to Brazil, excluding North and Northeast regions, where ECMM were still high (Figure 1).
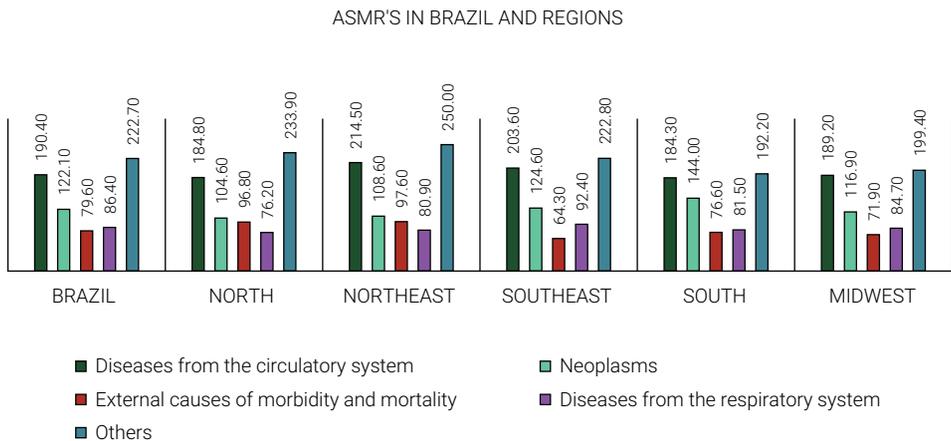

Figure 1. ASMR's in Brazil and its geographic regions according to ICD - 10 chapters.

Regarding Sao Paulo State, the number of ECMM was higher than most of the regions. However, when its ASMR was analyzed, it was the lowest of all. It was also observed the ASMR for deaths caused by DCS was higher than in any other region of the country, with a rate of 205.5 (Table 1).

Table 1. Causes of death in Sao Paulo State according to ICD - 10 chapters.

ICD – 10 chapters causes of death	Numbers	Crude rate	ASMR	%
Diseases of the circulatory system	87.725	194,3	205,5	29.8%
Neoplasms	55.256	122,4	129	18.7%

Continuação

Diseases of the respiratory system	40.676	90,1	95,3	13.8%
External causes of morbidity and mortality	22.194	49,1	50,5	7.5%
Others	88.902	196,9	205,6	30.2%
Total	294.753	652,8		100%

ICD – 10: International Classification of Diseases 10th Revision

Assessing the most populated cities of Sao Paulo State, it was observed that all of them had the same profile of the whole state (Table 2). However, as speculated previously, in the city of Piracicaba, the main cause of death was by neoplasms (Table 3). It was interesting that the top three causes of death had almost the same percentage. When the neoplasms were classified into the ICD – 10 groups, it was observed that the most frequent were malignant neoplasms of the digestive organs followed by malignant neoplasms of respiratory and intrathoracic organs, with 172 (34.1%) and 91 deaths (18%), respectively. Cause of deaths by malignant neoplasms of lip, oral cavity and pharynx, corresponded to 19 (3.8%), being the eighth most common (Table 4); the majority of them were diagnosed at stages III or IV (57.9%).

Table 2. ASMR's in the 17 most populous cities from Sao Paulo state according to ICD – 10 chapters. Cities with more than 380,000 habitants.

	Number of habitants	Diseases from The Circulatory System	Neoplasms	Diseases from The Respiratory System	External Causes of Morbidity and Mortality	Others
Sao Paulo	11.696.088	246,9	137,6	105,7	43,6	184
Campinas	1.150.753	193,3	127,1	101,1	54,9	167,4
Guarulhos	1.313.169	261,4	130,4	115,7	58,8	171,7
Sao Bernardo do Campo	799.645	200,7	131,6	99,2	41	154,7
Santo Andre	688.899	247,1	151,2	100,5	56,1	201,3
Sao Jose dos Campos	687.544	163,6	128,3	74,6	35,7	211,9
Osasco	676.149	275,2	145,3	103,8	62,7	180
Ribeirao Preto	661.997	198,3	137	104,6	62,5	199
Sorocaba	637.437	179	133,1	116,3	56,5	240,6
Mogi das Cruzes	491.486	265	141,5	87,8	55,2	197,1
Maua	447.911	237,2	107,6	89,3	39,5	149,4
Sao Jose do Rio Preto	437.273	195,5	135,3	117	70	192,3
Santos	425.621	248	160,6	92,7	36,2	220,2
Diadema	399.510	267	139,1	96,4	56,7	176,5
Jundiai	397.353	209	168,3	94,6	41,8	163,1
Carapicuiba	387.735	228,4	108,5	73,5	46,8	146,3
Piracicaba	382.817	124,1	126,8	82,8	47,8	163,1

ICD – 10: International Classification of Diseases 10th Revision, ASMR – age-adjust standardized mortality rates

Table 3. Causes of death in the city of Piracicaba according to ICD - 10 chapters.

ICD – 10 chapters causes of death	Numbers	Crude rate	ASMR	%
Neoplasms	504	126,8	126,8	18.9%
Symptoms, sings and abnormal clinical and laboratory findings, not elsewhere classified	496	124,8	124,8	18.7%
Diseases from the circulatory system	493	124,1	124,1	18.5%
Diseases from the respiratory system	329	82,8	82,8	12.4%
External causes of morbidity and mortality	190	47,8	47,8	7.1%
Others	648	163,1	163,1	24.4%
Total	2.660	669,4		100%

ICD – 10: International Classification of Diseases 10th Revision

Table 4. Causes of death in the city of Piracicaba according to ICD – 10 groups.

ICD – 10 groups causes of death	Numbers	ASMR	%
		126,8	100%
Malignant neoplasms of the digestive organs	172	43,3	34.1%
Malignant neoplasms of respiratory and intrathoracic organs	91	22,9	18%
Malignant neoplasm of breast	47	11,8	9.3%
Malignant neoplasms, stated or presumed to be primary of lymphoid, hematopoietic and related tissues	37	9,3	7.3%
Malignant neoplasms of male genital organs	31	7,8	6.2%
Malignant neoplasms of female genital organs	27	6,8	5.4%
Malignant neoplasms of urinary tract	25	6,3	5%
Malignant neoplasms of lip, oral cavity and pharynx	19	4,8	3.8%
Malignant neoplasms of eye, brain and other parts of central nervous system	17	4,3	3.4%
Malignant neoplasms of ill-defined, secondary and unspecified sites	14	3,5	2.8%
Melanoma and other malignant neoplasms of skin	13	3,3	2.5%
Malignant neoplasms of mesothelial and soft tissue	05	1,3	1%
Benign neoplasms	3	0,7	0.6%
Neoplasms of uncertain or unknown behavior	3	0,7	0.6%
Total	504	126,8	100

ICD – 10: International Classification of Diseases 10th Revision

Discussion

In overall analysis, it could be observed that the main cause of death in Brazil and in its all 5 geographic regions was DCS. This profile is similar to other developing countries where most of the people die because of DCS[4,6,12]. On the other hand, in some developed countries the main cause of death is related to neoplasms[5,12]. However, it seems that in developing countries the scenario is also changing with trends in mortality associated with DCS declining, while mortality caused by neoplasms are remaining

stable. In a near future it is possible that eventually neoplasms may become the leading cause of death also in developing countries[13-16].

Although in the entire Brazilian territory most of deaths were caused by DCS, there are important differences in mortality profile according to geographic regions. In the current study ASMR was used to standardize the mortality rates according to age for better assessment. It was observed that in the North and Northeast regions ECMM was the third most common cause of death, however it presented the highest ASMR in ECMM when compared to any other regions. In contrast, the South and Southeast regions had less number of deaths caused by ECMM and with a lower ASMR in ECMM. These data may be in part because the North and Northeast regions are less developed and are the more violent areas of Brazil. In addition, the mortality profile of the South and Southeast regions of Brazil was similar to developed countries, where the population is older with a very low ASMR in ECMM and higher ASMR in neoplasms and in DRS. Consequently, they are more likely to die from neoplasms and DRS than ECMM[17-19].

Analyzing Sao Paulo State, the most populated and developed state of Brazil, the mortality profile followed the same pattern of the Southeast, the region where it is inserted, with DCS being the first and neoplasms the second main causes of death. In addition, it was also analyzed the mortality profile of the most populated cities of Sao Paulo State and all of them had the same profile of mortality causes comparing to the State. However, in the city of Piracicaba, which is located in the interior of Sao Paulo State, with approximately 380,000 habitants and where the Dental School of University of Campinas is located, the main cause of death was by neoplasms. Interestingly, that this mortality profile was similar to developed countries, such as the United Kingdom, Spain, and Netherlands where the neoplasms are the main cause of death[4-6,12]. This can be related to degree of instructions of the population, access to health care system and the age distribution in Piracicaba. Therefore, in this city is more likely that people die of diseases, which are related to aging process, such as neoplasms and DCS.

When assessing the neoplasms by ICD-10 groups, it was noticed that malignant neoplasms of the digestive organs with an ASMR of 43.3, followed by malignant neoplasms of respiratory and intrathoracic organs with ASMR of 22.9 were the main sites. Despite being a city in Brazil where cancer is the main cause of death, it is interesting to know that these rates in mortality are quite low compared to studies performed by Bray et al.[3] (2018) and Ferlay et al.[20] (2015). The ASMR for the worldwide mortality in these types of cancers is almost the double compared to that observed in Piracicaba. Malignant neoplasms of lip, oral cavity and pharynx were the eighth in the city and with an ASMR of 4.8. When compared to the worldwide mortality for this type of cancer, in the studies by Bray et al.[3] (2018) and Ferlay et al.[20] (2015), it was possible to observe that the AMSR in Piracicaba was higher and this can be related to these group of neoplasms being diagnosed at late stage, as reported in this study.

It is well known that prevention, early diagnosis and adequate treatment are essential to decrease deaths. Screening for high risk patients is one of the methods that can

be effective in reducing mortality rates. Although some difficulty has been already reported, this strategy may allow to diagnose cancer at early stages[21-25].

Although to our knowledge the current study has valuable information, the data collection from online databases of public services could be considered a limitation since the authors did not have access to the original reports.

In conclusion, these data reinforced that Brazil is a huge country with a wide variation of mortality profiles. Therefore, having information of the main cause of deaths according to the specific geographic region, state or city is essential to establish appropriate public policy. In the city of Piracicaba, a project aiming to inform the population of how to prevent the main types of cancer and screening has been conducted in order to establish diagnosis at early stage and consequently decrease the mortality rate associate to malignant tumors.

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