

COLORECTAL CANCER IN THE BRAZILIAN POPULATION: MORTALITY RATE IN THE 2005-2015 PERIOD

Câncer colorretal na população brasileira: taxa de mortalidade no período de 2005-2015

Cáncer colorrectal de la población brasileña: tasa de mortalidad en el período 2005-2015

Original Article

ABSTRACT

Objective: To analyze the colorectal cancer mortality rate in Brazil. **Methods:** Descriptive and retrospective spatial time series study conducted from January 2005 to June 2015 using data from the Mortality Information System. The annual trend of deaths by region was assessed using the Mann-Kendall test and linear regressions to evaluate the direction of the growth. The significance level was set at 5% and the software R Core Team 2015 was used. **Results:** The mortality rate in Brazil was 7.98 deaths/100,000 inhabitants for the year 2014. Higher rates were observed in the South and Southeast regions. Regarding the number of deaths by sex, the female gender prevailed in all Brazilian regions, especially in the Southeast region. **Conclusion:** The study of colorectal cancer is epidemiologically important as it demonstrates a steady increase in mortality rates.

Descriptors: Colorectal Neoplasms; Mortality Registries; Mortality.

RESUMO

Objetivo: Analisar a taxa de mortalidade por câncer colorretal no Brasil. **Métodos:** Trata-se de um estudo descritivo, retrospectivo, de série temporal e espacial, realizado no período de janeiro de 2005 a junho de 2015, com base nos dados do Sistema de Informação sobre Mortalidade. Para avaliar a tendência anual de óbitos por região, foi utilizado o teste de Mann-Kendall, e regressões lineares para avaliar o sentido de crescimento. O nível de significância adotado foi de 5%, sendo empregado o software R Core Team 2015. **Resultados:** A taxa de mortalidade no Brasil foi 7,98 óbitos/100 mil habitantes para o ano de 2014. Maiores taxas foram observadas nas regiões Sul e Sudeste. Quanto ao número de óbitos por sexo, prevaleceu o feminino em todas as regiões brasileiras, destacando-se a região Sudeste. **Conclusão:** O estudo do câncer colorretal tem sua importância a nível epidemiológico por demonstrar um aumento crescente nos índices de mortalidade.

Descritores: Neoplasias Colorretais; Registros de Mortalidade; Mortalidade.

RESUMEN

Objetivo: Analizar la tasa de mortalidad por cáncer colorrectal en Brasil. **Métodos:** Se trata de un estudio descriptivo, retrospectivo, de serie temporal y espacial realizado entre enero de 2005 y junio de 2015 basado en datos del Sistema de Información sobre Mortalidad. Se utilizó la prueba de Mann-Kendall para valorar la tendencia anual de muertes por región y regresiones lineares para valorar el sentido de crecimiento. El nivel de significación adoptado fue del 5% a través del software R Core Team 2015. **Resultados:** La tasa de mortalidad en Brasil fue de 7,98 muertes/100 mil habitantes en 2014. Se observaron tasas más elevadas en las regiones del Sur y Sudeste del país. Hubo prevalencia del sexo femenino para el número de muertes por sexo en todas las regiones brasileñas principalmente en la región Sudeste. **Conclusión:** El estudio del cáncer colorrectal es importante a nivel epidemiológico porque presenta un creciente aumento de los índices de mortalidad.

Descriptores: Neoplasias Colorrectales; Registros de Mortalidad; Mortalidad.

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INTRODUCTION

Colorectal cancer (CRC) is a cancer that affects the segments of the large intestine (colon, rectum and anus)⁽¹⁾. Most epidemiological studies identify the CRC according to the International Classification of Diseases (ICD-10), which subdivides it into neoplasms of colon (C18), rectosigmoid junction (C19), rectum (C20) and anus (C21)⁽²⁾. Considered a global public health problem, colorectal cancer is identified as the third most common type of cancer worldwide after lung cancer and breast cancer^(2,3). It is the fourth leading cause of death from cancer in the world⁽²⁾ and the second most common cancer in Western countries^(2,3).

In the Southern and Southeastern regions of Brazil, the CRC is considered the third leading cause of death from cancer⁽³⁾. The highest incidence rates are observed in developed countries such as the United States of America (USA), Australia, New Zealand and Western Europe⁽²⁾ while the lowest incidence rates are found in Africa and intermediate rates are observed in Latin American countries⁽²⁾. According to data from the José Alencar Gomes da Silva National Cancer Institute (*Instituto Nacional do Câncer José Alencar Gomes da Silva – INCA*), there are 34,280 estimated new cases in 2016 in Brazil: 16,660 among men and 17,620 among women⁽⁴⁾.

Estimates for the year 2008 regarding the number of deaths from CRC pointed out 608,000 deaths worldwide^(5,6). However, there has been a decline in mortality rates in the countries of Western and Northern Europe and in the United States of America⁽⁶⁾. CRC mortality rates for 2008 in Eastern Europe were 20.3 deaths for every 100 thousand male inhabitants and 12.1 deaths per 100 thousand women⁽⁵⁾. Mortality rates in Africa and Asia were low compared to those in Europe, North America, New Zealand and Australia⁽⁵⁾. In Asia, the highest rates were observed in Japan and China⁵. In Brazil, the highest CRC mortality rates were observed in the Southern and Southeastern regions, ranging from 8.0 to 10.7 deaths per 100,000 inhabitants between 1980 and 1997⁽⁷⁾. For the year 2001, mortality rates among men ranged from 1.98 deaths per 100 thousand inhabitants in Manaus to 15.89 deaths per 100 thousand inhabitants in Porto Alegre⁽⁷⁾. Among women, the rates ranged from 3.21 deaths per 100 thousand inhabitants in Belém to 16.40 deaths per 100 thousand inhabitants in Porto Alegre⁽⁷⁾.

Risk factors for colorectal cancer include: family history of CRC; age; diet rich in animal fats; low intake of fruits, vegetables and whole grains; alcoholism and smoking; obesity and physical inactivity. The high consumption of fish, low consumption of processed red meats and physical activity are protective factors⁽⁸⁾. With regard to age, the CRC is more common among older people, especially after

age 60⁽³⁾, although it can occur at any age – the earlier the onset, the more aggressive it is, and it is usually related to hereditary transmission⁽⁹⁾. Inflammatory bowel diseases, particularly ulcerative colitis, are also related to CRC⁽³⁾. Sporadic adenomatous polyps, which account for 90% of all cases of colon and rectal cancer, are precancerous conditions in which there is a transformation of the normal colonic epithelium into an adenomatous polyp⁽⁹⁾. The adenocarcinoma progression is slow and lasts on average ten years, which makes this type of cancer an ideal target of prevention and screening programs for the population^(3,9).

The CRC is usually asymptomatic; however, special attention should be given to symptoms and warning signs such as: changes in bowel habits, abdominal pain and fecal occult blood and changes. Less common symptoms include the presence of mucus in stool, lower abdominal pain, anemia, poor general condition, palpable abdominal mass, acute intestinal obstruction, colonic fistula and peritonitis caused by intestinal perforation; however, they are part of the clinical picture of the disease^(3,10). It is considered one of the cancers that are most responsive to prevention measures (control of risk factors and early screening). The detection and removal of polyps through screening tests become an important prevention method and colonoscopy is the procedure of choice for the screening and treatment of these lesions⁽⁹⁾. In patients at low risk of developing CRC, screening should be performed through annual fecal occult blood tests, flexible sigmoidoscopy every five years or rigid sigmoidoscopy every two years in individuals aged 50 years and older. Patients at high risk of developing CRC should be screened through colonoscopy after 40 years of age⁽³⁾.

People's unawareness of the importance of CRC screening contributes to a reduced rate of adherence to diagnostic tests and an increase in its incidence. In the United States of America, the number of deaths from this cancer has declined in recent years due to the development of an effective screening system and educational campaigns on the subject^(9,11).

The diagnosis is made by biopsy during colonoscopy and the staging is measured based on physical examination, CT scans of the chest, abdomen and pelvis, and carcinoembryonic antigen levels⁽¹²⁾. The CRC treatment varies according to the stage and may include surgical procedure, chemotherapy or radiotherapy, or even a combination of two types of treatment⁽¹³⁾.

CRC prevention is based on the concept that the time interval between the lesion and the onset of the cancer is usually long, which allows the adoption of policies for population screening. Population actions to promote health through dietary reeducation and encouragement to engage in physical activity can have an impact on epidemiological

aspects of CRC. In addition, early detection and treatment of precursor lesions or cancer at an early stage lead to a reduction in its prevalence and mortality⁽²⁾.

Given that, the aim of the present study was to analyze the colorectal cancer mortality rate in Brazil.

METHODS

This is a descriptive and retrospective spatial time series study conducted from January 2005 to June 2015. It included the number of deaths per year, the number of deaths according to gender, the mortality rate by region and year, the number of deaths by each Brazilian region and percentage differences in deaths between years according to Brazilian regions. Death from colorectal cancer was considered when the disease was reported as the underlying cause of death on the death certificate (DC). ICD-10 (10th Revision) codes C18.0 through C21.0 were considered: malignant neoplasm of colon (C18.0), malignant neoplasm of rectosigmoid junction (C19.0), malignant neoplasm of rectum (C20.0) and malignant neoplasm of anus (C21.0).

Data on mortality were obtained from records of non-nominal death certificates from the Mortality Information System (*Sistema de Informação sobre Mortalidade – SIM*)⁽¹⁴⁾ powered by the Department of Informatics of Brazil's National Health System (*Departamento de Informática do Sistema Único de Saúde – DATASUS*) and from population data for the calculation of mortality indicators and annual estimates and projections of the Brazilian Institute of Geography and Statistics (*Instituto Brasileiro de Geografia e Estatística – IBGE*)⁽¹⁵⁾. For data analysis, it was calculated the mortality rate of colorectal cancer per every 100,000 inhabitants in Brazil and Brazilian regions per year. The proportional mortality was calculated until the year 2014 since the total number of deaths per year was only available on SIM until June 2015.

The area investigated was the Brazilian territory, which is divided into five regions (North, Northeast, Southeast, South and Midwest). Brazil has an area of 8,515,767.049 km² and had an estimated population of 184,184,264 inhabitants in 2005 and 202,768,562 inhabitants in 2014⁽¹⁵⁾. North: 14,698,878 inhabitants in 2005 and 17,231,027 inhabitants in 2014; Northeast: 51,019,091 inhabitants in 2005 and 56,186,190 inhabitants in 2014; Southeast: 78,472,017 inhabitants in 2005 and 85,115,623 inhabitants in 2014; South: 26,973,511 inhabitants in 2005 and 29,016,114 inhabitants in 2014; and Midwest: 13,020,767 inhabitants in 2005 and 15,219,608 inhabitants in 2014⁽¹⁵⁾.

Data were described using graphs such as line, sectors and vertical bars designed in MS Excel 2013. Mann-Kendall test was used to check for trends in the annual

sums of deaths from colon and/or rectosigmoid, rectum and anus cancers by region, and linear regressions were used to assess the direction of the growth. Significance level was set at 5%, and the software used was the R Core Team 2015.

The research project was not submitted to the Ethics Committee because it uses public secondary data.

RESULTS

There were 136,492 deaths from CRC reported to the Mortality Information System (*Sistema de Informação de Mortalidade – SIM*) of the Department of Informatics of Brazil's National Health System (*Departamento de Informática do Sistema Único de Saúde – DATASUS*) between January 2005 and June 2015 (Figure 1).

Regarding the number of deaths from CRC according to gender between January 2005 and June 2015, there were 71,197 (52%) deaths among women and 65,275 (48%) deaths among men – 20 deaths were not reported to the Mortality Information System (*Sistema de Informação sobre Mortalidade – SIM*).

The colorectal cancer mortality rate per 100 thousand inhabitants in Brazil and Brazilian regions, according to data provided by the Mortality Information System (*Sistema de Informação de Mortalidade - SIM*) of the Department of Informatics of Brazil's National Health System (*Departamento de Informática do Sistema Único de Saúde – DATASUS*) and estimates of population data from the Brazilian Institute of Geography and Statistics (*Instituto Brasileiro de Geografia e Estatística – IBGE*) (Figure 2) was 5.60 deaths per 100 thousand inhabitants in 2005 and 7.98 deaths per 100 thousand inhabitants in 2014. The Mann-Kendall test found a significant trend (1.000 (<0.001)). The linear regression (-534.1+0.27*YEAR) confirmed an increasing trend.

By analyzing the regions separately, it is also observed an increasing trend in the North through the Mann-Kendall test (0.867 (<0.001)) and linear regression (-278.9+0.14*YEAR). The mortality rate for the North was 1.60 deaths per 100 thousand inhabitants in 2005 and 2.87 deaths per 100 thousand inhabitants in 2014, representing the highest mortality rate in the region. The lowest mortality rate in the North was recorded in 2006, with 1.55 deaths per 100 thousand inhabitants.

In Brazil's Northeast, the mortality rate was 2.32 deaths per 100 thousand inhabitants in 2005, representing the lowest mortality rate in this region. In 2014, there were 4.12 deaths per 100 thousand inhabitants, representing the highest mortality rate. The Mann-Kendall test (1.000 (<0.001)) and linear regression (-412.0+0.21*YEAR) also found an increasing trend in the Northeast.

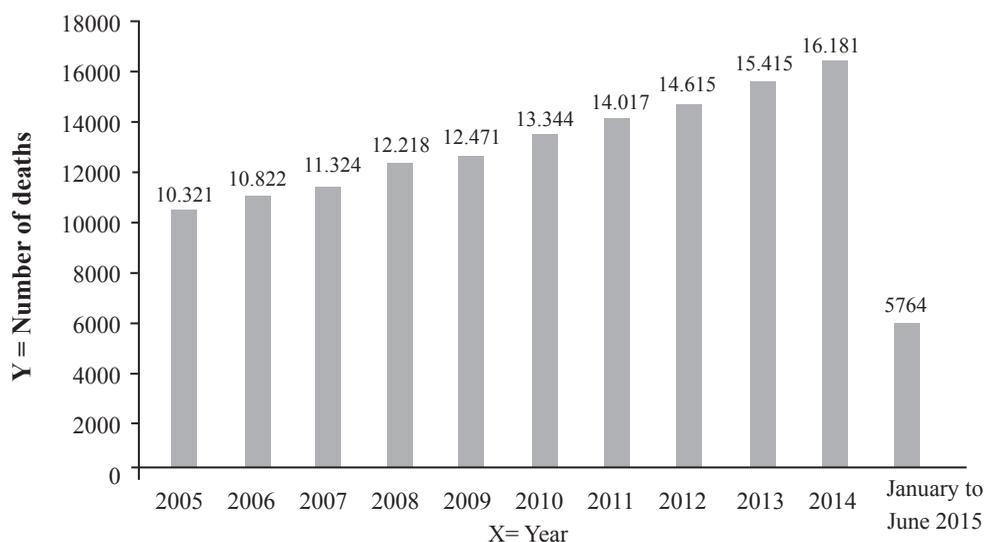


Figure 1 - Total number of deaths from colorectal cancer (CRC) by year. Brazil, 2005 to 2015.

Source: Mortality Information System (*Sistema de Informação de Mortalidade – SIM*). Informatics of Brazil's National Health System (*Informática do Sistema Único de Saúde – DATASUS*). Years 2005-2015.

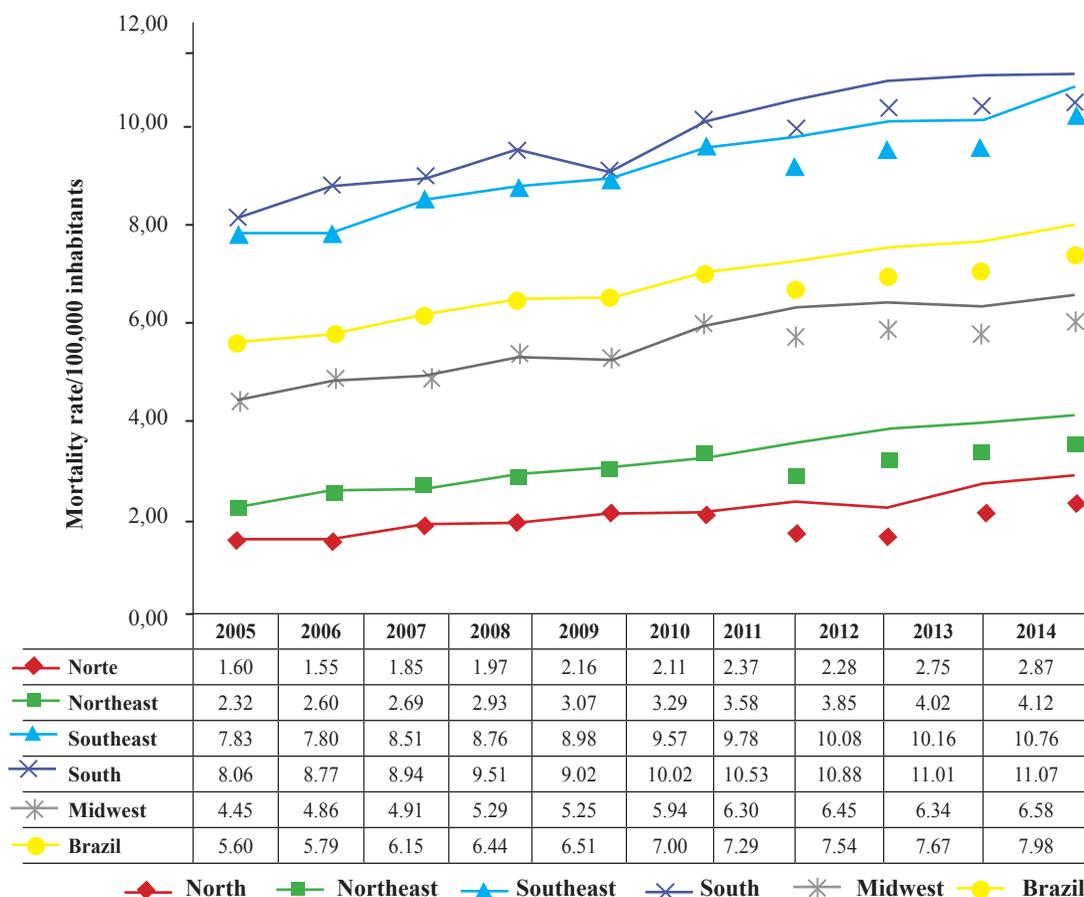


Figure 2 - Colorectal cancer (CRC) mortality rate by region and year. Brazil, 2005 to 2014.

Source: Mortality Information System (*Sistema de Informação de Mortalidade – SIM*). Informatics of Brazil's National Health System (*Informática do Sistema Único de Saúde – DATASUS*). Brazilian Institute of Geography and Statistics (*Instituto Brasileira de Geografia e Estatística – IBGE*). Years 2005-2014.

In the Southeast, the mortality rate was 7.83 deaths per 100 thousand inhabitants in 2005 and 10.76 deaths per 100,000 inhabitants in 2014, representing the highest mortality rate in the region. The lower mortality rate in the Southeast was recorded in 2006 (7.80 deaths per 100 thousand inhabitants). The Mann-Kendall test (0.956 (<0.001)) and linear regression (-652.5+0.33*YEAR) also observed an increasing trend in the Southeast.

In the South, the mortality rate was 8.06 deaths per 100 thousand inhabitants in 2005, representing the lowest mortality rate recorded for the region, and in 2014 there were 11.07 deaths per 100,000 inhabitants, representing the highest mortality rate recorded for the region. There was an increasing trend in this region according to the Mann-Kendall test (0.956 (<0.001)) and linear regression (-679.3+0.34*YEAR).

In the Midwest, the mortality rate was 4.45 deaths per 100 thousand inhabitants in 2005 – the lowest rate recorded – and 6.58 deaths per 100 thousand inhabitants in 2014 – the highest rate recorded. An increasing trend was also observed for the Midwest through the Mann-Kendall test (0.911 (<0.001)) and linear regression (-492.4+0.25*YEAR).

It is noteworthy that the South (11.07) was the region with the highest mortality rate, followed by the Southeast (10.76), Midwest (6.58), Northeast (4.12) and North (2.87).

The records of the number of deaths according to the Brazilian regions showed that the Southeast had the highest rates over the period analyzed, totaling 78,097 (57%) deaths, followed by the South – 28,236 (21%) deaths, Northeast – 18,260 (13%) deaths, and Midwest – 8,275 (6%) deaths. The North had the lowest absolute rates of mortality associated with colorectal cancer, with 3,624 (3%) deaths (Figure 2).

As for the relationship between mortality and gender (Figure 3) according to the regions, there was a higher number of deaths among women in all of them. In the North, there were 1,937 (53.46%) deaths among women and 1,686 (46.53%) deaths among men; in the Northeast: 10,146 (55.57%) deaths among women and 8,109 (44.42%) among men; in the Southeast: 40,610 (52%) deaths among women and 37,477 (47.99%) deaths among men; in the South: 14,247 (50.46%) deaths among women and 13,986 (49.53%) deaths among; and in the Midwest: 4,257 (51.45%) deaths among women and 4,017 (48.54%) deaths among men. The largest percentage difference between the genders occurred in the Northeast, and the lowest was in the South.

The data revealed different percentages of deaths from CRC between the years and regions of Brazil (Figure 4). It was observed that in the North there was an increase of 25% from one year to another (2012 to 2013), while the South had the highest percentage reduction in one-year mortality rates, that is, -4.4% from 2008 to 2009. Greater variations in the percentage of deaths over the years have been observed in the North, with values ranging from -2.36% between 2011 and 2012 and 25.54% between 2012 and 2013. By observing the line referring to the Southeast, it can be seen that it varied less than the others and was always increasing, that is, there was an increasing trend in the Southeast, but the rate never exceeded 6.8% per year. On the other hand, in the Northeast (13.25% between 2005 and 2006), South (10.17% between 2005 and 2006) and Midwest (14.25% between 2009 and 2010) there were greater variations at much higher rates.

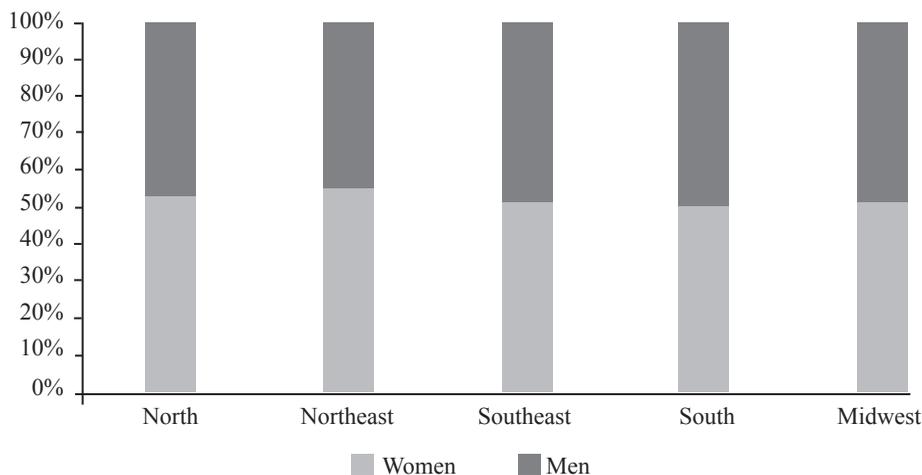


Figure 3 - Total number of deaths by region and gender. Brazil, 2005 to 2015.

Source: Mortality Information System (Sistema de Informação de Mortalidade – SIM). Informatics of Brazil’s National Health System (Informática do Sistema Único de Saúde – DATASUS). Years 2005-2015.

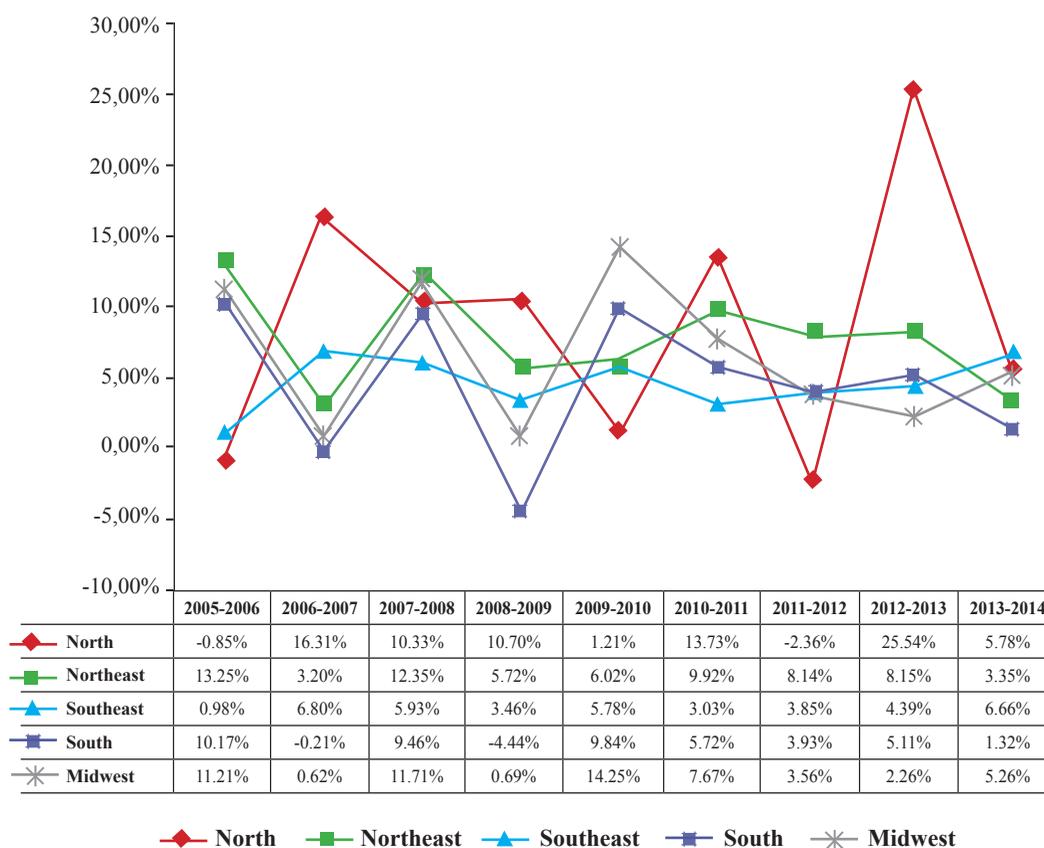


Figure 4 - Percentage differences in deaths between the years by region. Brazil, 2005 to 2014.

Source: Mortality Information System (*Sistema de Informação de Mortalidade – SIM*). Informatics of Brazil's National Health System (*Informática do Sistema Único de Saúde – DATASUS*). Years 2005-2014.

DISCUSSION

Colorectal cancer (CRC) is considered a public health problem worldwide and refers to malignant tumors affecting segments of the large intestine such as the colon, rectum and anus⁽¹⁾. Despite advances in medicine, especially in terms of diagnosis and treatment, mortality from this cancer is high and its global average survival – five years – has rates of 55% in developed countries and 40% in developing countries^(16,17).

In the present study, the analysis of the number of deaths from CRC per year showed that there is a steady increase over the years analyzed, with the lowest rate recorded in 2005 and the highest in 2014. Brazil is going through a period of epidemiological transition due to the reduction of deaths from infectious diseases and the increase in chronic and degenerative diseases, with cancer occupying a prominent place among them⁽¹⁸⁾. This is due to prevention factors and the changes in lifestyle habits, respectively.

Data from the American Cancer Society estimated that the USA had circa 140,000 diagnosed cases of the disease and about 50,000 deaths from CRC in 2011⁽¹⁹⁾. Compared to

these data, 14,017 deaths were recorded in Brazil in the same period; however, there are no records on SIM regarding the number of cases diagnosed in the same period, which prevents an analysis of the incidence of the disease and the number of deaths.

The analysis of SIM data on the number of deaths from CRC according to gender revealed a higher prevalence among women. According to IBGE (2014) and INCA (2014) data, the rate in the Brazilian population and the disease incidence were more prevalent among women over the years analyzed^(4,15). Therefore, it should be considered that both the incidence of the disease and the prevalence of the number of deaths in Brazil have been more significant among women.

In the present study, there was a steady increase in the CRC mortality rate in Brazil. In 2005, 5.6 deaths per every 100 thousand inhabitants were recorded and in 2014 there were 7.9 deaths per 100 thousand inhabitants, indicating a difference of 5,860 deaths in absolute numbers between 2005 and 2014. The highest CRC mortality rates were observed in the South and Southeast, and the lowest rates were in the North and Northeast. It is known that CRC

affects mainly the population in developed countries⁽⁹⁾, with a 5-6% risk for the development of this cancer throughout life in Western centers⁽²⁰⁾. Considering that the South and Southeast are the most developed and industrialized regions of Brazil, increases in mortality rates and in the number of deaths in these regions may be related to risk factors present in developed countries. These geographical differences may be a result of dietary habits and environmental factors that are imposed on a genetic susceptibility background^(21,22).

The increase in mortality rates may be related to the risk factors associated with this disease, such as age over 50 years, high-energy diet, red meat consumption, sedentary lifestyle, smoking and drinking^(9,12). Research conducted in the United States of America demonstrated that the control of preventable risk factors such as healthy diet and lifestyle reduced the incidence of CRC by 35% in that country⁽²³⁾. Estimates showed that 66-75% of cases could be prevented through the adoption of healthier lifestyles, balanced diet and regular physical activity⁽²⁴⁾.

Regarding age, CRC is more common after age 50 and affects less than 10% the population below this age⁽³⁾. The growth of the older population is a worldwide phenomenon. In Brazil, the proportion of older people increased from 9.1% in 1999⁽²⁵⁾ to 11.7% in 2015⁽²⁶⁾, and projections indicate that by 2020 Brazil will rank sixth in number of older people worldwide⁽²⁷⁾. Consequently, age-related diseases, such as CRC, now have more significant sociodemographic rates.

By analyzing the number of deaths according to the Brazilian regions the data revealed that the Southeast had the highest rates in absolute numbers of deaths over the years analyzed, followed by the South, Northeast, Midwest and North. When compared to the number of deaths according to gender by region, there was a higher absolute number of deaths among women in all of them, which was also predominantly in the Southeast. The fact that the Southeast stands out for having the highest number of deaths according to region and also the highest number of deaths among women may be explained by its larger population and the higher number of women in this region⁽¹⁵⁾.

The analysis of percentage differences in number of deaths from CRC over the years according to Brazilian regions revealed that there were several variations in the rates recorded. The highest percentage reduction in number of deaths was in the South and the highest increase in number of deaths was in the North. The region that has been more stable in relation to the increase in mortality rates was the Southeast.

In Brazil, the coverage of the Mortality Information System (*Sistema de Informação sobre Mortalidade – SIM*) and the quality of information from death certificates that feed the system vary according to the different Brazilian regions⁽²⁴⁾. These regional differences can overestimate

or underestimate mortality rates as they have quantitative limitations (underreporting of deaths and certificate flaws and qualitative limitations (misinformation and errors in the coding process of the underlying cause)^(24,28). However, in death certificates in which the underlying cause is a neoplasm, qualitative limitations should be minimized given the evolving nature of the disease, which requires prolonged hospital treatment and complementary tests to elucidate the problem⁽²⁸⁾.

CONCLUSION

The present study on colorectal cancer has an epidemiological importance as it shows a steady increase in mortality rates, especially in the female population and in the most developed regions of Brazil. The variations in the percentage differences in number of deaths from CRC require more accurate assessments of the quality of information from death certificates.

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