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The Epidemiology of Stomach Cancer

Luiz Claudio Santos Thuler

Divisão de Pesquisa Clínica do Instituto Nacional de Câncer (INCA) e Departamento de Medicina Especializada da Universidade Federal do Estado do Rio de Janeiro (UNIRIO), Rio de Janeiro, Brazil

Author for correspondence: Luiz C. S. Thuler, Divisão de Pesquisa Clínica, Instituto Nacional de Câncer, Rio de Janeiro, Brazil. E-mail: lthuler@gmail.com

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Abstract: The aim of this chapter is to examine stomach cancer incidence and mortality rates worldwide, focusing on numbers in Brazil. Data on new cases and deaths due to stomach cancer for 2020 and projections for 2040 were evaluated. A total of 1,089,103 new stomach cancer cases were estimated globally for 2020, with the highest incidence rates noted for Mongolia, Japan, and the Republic of Korea. Concerning mortality, a total of 768,793 deaths were reported for the same year, with the highest rates observed in Mongolia, Tajikistan, and China. In Brazil, a total of 13,360 new stomach cancer cases among men and 7,870 among women were estimated for 2020, with 13,850 deaths reported for both sexes. Although both incidence and mortality rates currently exhibit a downward trend in most countries, including Brazil, the number of new cases and deaths each year is not negligible, indicating the need for continued actions to reduce exposure to stomach cancer risk factors and the expansion of early diagnoses with timely treatment.

Keywords: Brazilian stomach cancer incidence; epidemiology of stomach cancer; stomach cancer mortality rates in Brazil; worldwide stomach cancer incidence rates; worldwide stomach cancer mortality rates

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INTRODUCTION

Stomach cancer remains one of the major health challenges worldwide, despite recent declines in incidence and mortality rates (1). According to the Global Cancer Observatory (2), stomach cancer was ranked as the 5th most frequent tumor and the 4th cancer with the highest mortality rates for both men and women in 2020. Incidence and mortality rates are twice as high in men compared to women (3) and about 75% of all cases and deaths occur in Asia (2). In Brazil, the country with the highest number of new cases and deaths due to stomach cancer in Latin America, this condition was ranked as the 5th most incident tumor and the 5th most deadly for both men and women in the same year (3). These variations can, at least in part, be explained by an uneven stomach cancer risk factor exposure distribution (4).

About 95% of all stomach cancers comprise adenocarcinomas, which, according to their topographical location, can be categorized into two main anatomical sites, namely cardia and distal (non-cardia) tumors. Most stomach cancers occur in distal regions and exhibit chronic *Helicobacter pylori* infection as their most notable cause. Cardia cancers have been associated with gastroesophageal reflux and obesity. Smoking, excessive alcohol consumption, salt intake, salt-preserved foods, smoked foods, pickled vegetables, coffee, low fruit and vegetable intakes and exposure to ionizing radiation (X-radiation, gamma-radiation), as well as being male and over 50 or 60 years old have been identified as risk factors for both anatomical sites, implying a predominant occurrence in low socioeconomic status areas (4–7).

In addition, other factors, such as occupational exposures to dust, coal, metals, talc, asbestos and rubber, heredity/genetic mutations, such as a history of stomach cancer in first-degree relatives, the presence of hereditary syndromes such as familial adenomatous polyposis (FAP), hereditary diffuse gastric cancer (HDGC) and Peutz-Jeghers syndrome, mutations in *GSTM1* or *CDH1* genes and interleukin IL-17 and IL-10 polymorphisms, previous gastric surgery, pernicious anemia, *Epstein-Barr virus* infection and being blood type A, as well as some races/ethnicities (Hispanics, Asians, Alaska natives, African Americans and American Indians) have also been associated with a high risk of developing this neoplasm (1, 4, 5, 8).

Primary and secondary prevention strategies should comprise the cornerstones of stomach cancer prevention (1). Primary prevention strategies include healthy behaviors such as ceasing smoking, reducing salt intake, limiting alcohol intake, and increasing fruit and vegetable consumption. On the other hand, inadequate evidence that Helicobacter pylori eradication may reduce the risk of stomach cancer is available, as barium-meal gastric photofluorography and serum pepsinogen or gastric endoscopy may also reduce stomach cancer mortality rates.

In this context, this chapter aims to assess the global numbers of new cases and deaths due to stomach cancer in 2020 and evaluate temporal incidence and mortality trends, focusing on data from Brazil.

WORLDWIDE STOMACH CANCER INCIDENCE RATES

World cancer incidence data for 2020 were estimated by the Global Cancer Observatory (2), an interactive web-based platform that offers global cancer statistics.

Projections were based on GLOBOCAN incidence estimates from 185 countries or territories for 36 types of cancer, categorized by sex and age group. National incidence rates and estimates derived from national mortality data employing the mortality-incidence ratio were obtained. In the absence of local data, rates derived from cancer registries in neighboring countries were used.

Stomach cancer was responsible for 6% of all cancer cases in 2020, excluding non-melanoma skin cancer cases. Estimates indicate a total of 1,089,103 new stomach cancer cases, 719,523 among men and 369,580 among women, corresponding to population-adjusted incidence rates of 15.5 and 7.0/100,000, respectively. The highest incidence rates for both sexes were observed in Mongolia (32.5/100,000), Japan (31.6/100,000) and the Republic of Korea (27.9/100,000), followed by some Central and South American countries, Russia, and China, while the lowest rates were noted in Mozambique (0.75/100,000), Indonesia (1.3/100,000) and Comoros (1.3/100,000) (2) (Figures 1A and 1B).

For the same year, stomach cancer ranked the 4th most common tumor in men and the 7th in women (2), excluding non-melanoma skin cancer (Figure 2). About ¾ of all stomach cancer cases were reported for Asia (74.5%), followed by Europe (12.9%), Latin America and the Caribbean (6.5%), Africa (3.0%), North America North (2.8%) and Oceania (0.3%) (2).

Brazilian stomach cancer incidence rates

In Brazil, cancer incidence data is based on data available in population-based cancer registries (PBCR). Currently, about 30 PBCR comprising at least 2 years of information are available, covering between 10 and 22% of the Brazilian population, depending on the year (9, 10). The National Cancer Institute (*Instituto Nacional de Câncer* - INCA) has computed annual estimates on the number of new cancer cases and their respective incidence rates since 1995 (11).

A total of 13,360 new stomach cancer cases were estimated for men and 7,870 for women for each year of the 2020–2022 triennium in Brazil, corresponding to incidence rates of 12.81 per 100,000 men and 7.34 per 100,000 women. Since the first national estimates in 1995 (12) the total number of new stomach cancer cases per year has increased among both men and women, from 11,100 to 21,230 in 2020, totaling a 91.3% increase. During the same period, the Brazilian population increased by 34.3% (13). Furthermore, excluding non-melanoma skin tumors, INCA data (11) indicates that stomach cancer among men ranks 2nd in frequency in Northern Brazil (11.75/100,000), and 3rd in the Northeast (10.63/100,000). Concerning other Brazilian regions, it is the 4th most frequent cancer (South 16.02/100,000, Southeast 13.99/100,000 and Midwest 9.38/100,000). Among women, stomach cancer is the 5th most frequent in Southern (9.15/100,000) and Northern (6.03/100,000) Brazil, occupying the 6th and 7th position in the other Brazilian regions (Central-West 6.71/100,000 and Northeast 7.03/100,000, Southeast 7.30/100,000, respectively). These rates place practically all Brazilian regions among the two highest global incidence stomach cancer rate quintiles according to the Global Cancer Observatory presented in Figure 1 (rates of over than 9.4 and 4.8/100,000 among men and women, respectively).

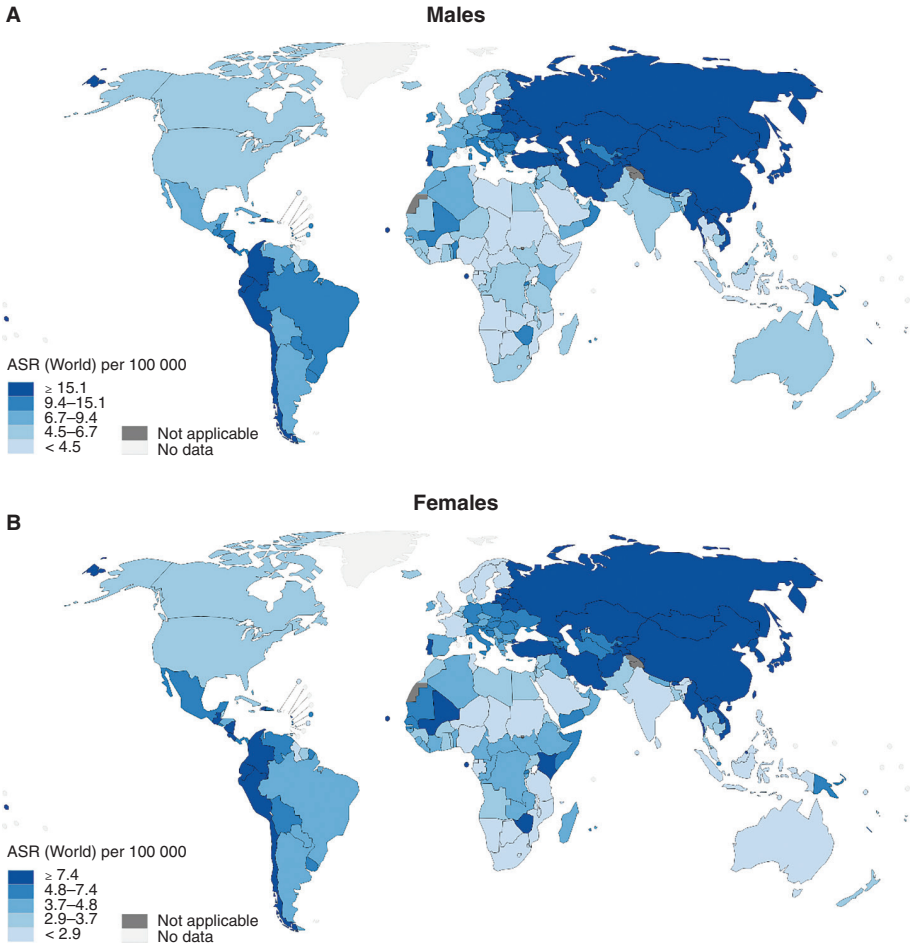

Figure 1. Estimated 2020 stomach cancer incidence rates per 100,000 men (A) and women (B), standardized by age (world population). Reproduced from the Global Cancer Observatory (2).

WORLDWIDE STOMACH CANCER MORTALITY RATES

Worldwide cancer mortality rates are also estimated by the Global Cancer Observatory (2). Mortality rates by sex and age groups for 2020 are based on national estimates from observed mortality rates and, when not available, on the incidence-mortality ratios reported in cancer registries from neighboring countries. Excluding non-melanoma skin cancer, a total of 768,793 deaths due to stomach cancer were reported worldwide in 2020, 502,788 among men and 266,005 among women. The estimated world population-adjusted mortality rates were of 11.0 and 4.9/100,000 for men and women, respectively. The highest mortality rates for both sexes were observed in Mongolia (24.6/100,000), Tajikistan (19.7/100,000) and China (15.9/100,000), while the lowest were

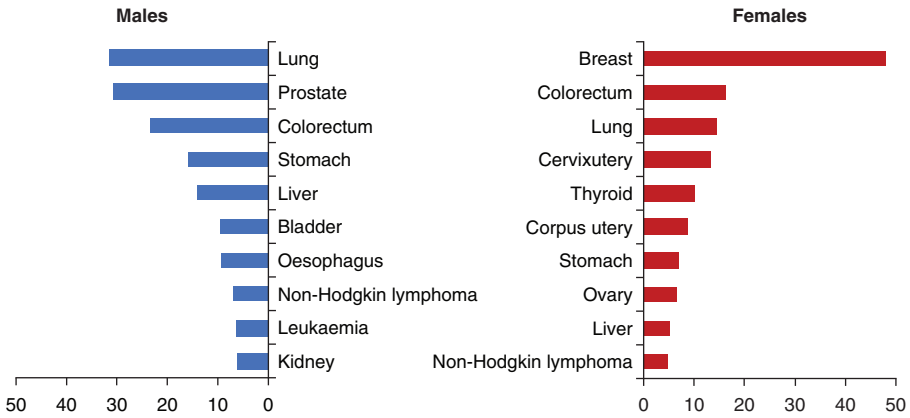

Figure 2. Estimated 2020 incidence rates per 100,000 men and women, standardized by age (world population). Reproduced from the Global Cancer Observatory (2).

observed in Mozambique. (0.69/100,000), Indonesia (1.1/100,000) and Comoros (1.2/100,000) (Figures 3A and 3B) (2). For the same year, stomach cancer ranked 3rd as the deadliest among men and the 5th among women excluding non-melanoma skin cancer cases (Figure 4) (2), appearing as the main cause of death by cancer in several South Central and Asian countries, including Iran, Afghanistan, Turkmenistan and Kyrgyzstan (3). A scenario very similar to that observed in terms of incidence is noted for mortality rates, with most cases reported for Asia (74.7%), followed by Europe (13.1%), Latin America and the Caribbean (6.6%). Africa (3.7%), North America (1.7%) and finally, Oceania (0.3%) (2).

Stomach cancer mortality rates in Brazil

In Brazil, cancer mortality data are made available by the Ministry of Health's Mortality Information System (*Sistema de Informação sobre Mortalidade* - SIM). The SIM was implemented in 1975 and consists of online data on deaths from all causes in the country, including cancer, from 1979 to 2020 (14). Brazilian indicators and cancer mortality rates can also be found at the Online Atlas of Mortality available on the INCA website in the form of tables, graphs, and maps (15). In 2020, the last year with complete data available, 8,772 deaths from stomach cancer were recorded in the country among men and 5,078 among women, totaling 13,850 deaths, with age-adjusted mortality rates for the world population of 8.47/100,000 for men and 4.69/100,000 for women (15).

TEMPORAL TRENDS IN STOMACH CANCER INCIDENCE AND MORTALITY IN BRAZIL AND WORLDWIDE

A drop in incidence and mortality rates due to stomach cancer has been noted in most countries over the last few decades, mainly attributed to the consumption of

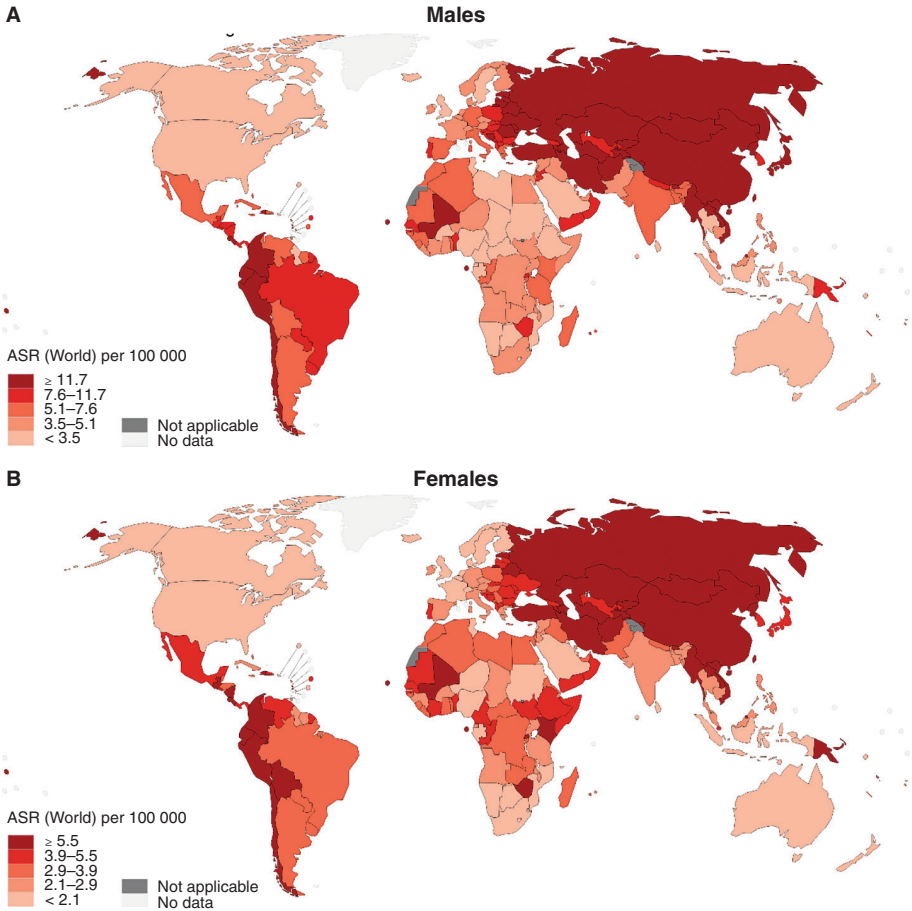

Figure 3. Estimated 2020 stomach cancer mortality rates per 100,000 men (A) and women (B), standardized by age (world population). Reproduced from the Global Cancer Observatory (2).

fresh food made possible by refrigeration technology and economic development (7, 16).

One study covering data from 1980 to 2018 from 48 countries indicates incidence rate decreases in 29 countries (60.4%) and mortality rate reductions in 41 countries (85.4%). The authors note that these declines were noted mainly in patients aged 40 and over (in 30 of 48 countries = 62.5%), although some rates in certain countries were also noted as increasing in populations under 40 years old (4).

In Brazil, age-adjusted mortality rates due to stomach cancer by the world population per 100,000 men or women between 1980 and 2020 significantly declined (–23.6% per year among men and –10.0% per year among women) (Table 1) (15).

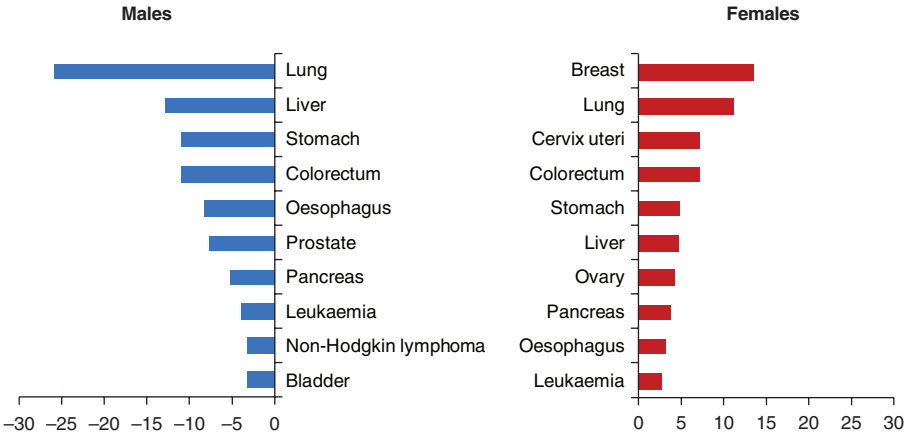

Figure 4. Estimated 2020 mortality rates per 100,000 men and women, standardized by age (world population). Reproduced from the Global Cancer Observatory (2).

TABLE 1 Crude and population-adjusted stomach cancer incidence rates per 100,000 for men and women

	Males		Females	
Year	Crude rate	Adjusted rate	Crude rate	Adjusted rate
1980	9.89	16.98	4.87	7.71
1981	10.11	17.02	4.84	7.46
1982	9.88	16.38	4.87	7.33
1983	9.92	16.27	4.77	7.01
1984	9.72	15.68	4.67	6.74
1985	9.52	15.22	4.38	6.20
1986	9.30	14.65	4.49	6.26
1987	9.51	14.85	4.62	6.33
1988	9.28	14.35	4.56	6.16
1989	9.10	13.95	4.45	5.93
1990	9.04	13.71	4.32	5.68
1991	8.95	13.43	4.47	5.78
1992	9.32	13.58	4.56	5.71
1993	8.88	13.43	4.42	5.75
1994	8.65	13.06	4.35	5.65
1995	8.77	13.27	4.32	5.63

Table continued on following page

TABLE 1 **Crude and population-adjusted stomach cancer incidence rates per 100,000 for men and women *(Continued)***

	Males		Females	
Year	Crude rate	Adjusted rate	Crude rate	Adjusted rate
1996	8.94	12.40	4.50	5.30
1997	8.86	12.29	4.53	5.34
1998	8.94	12.44	4.35	5.13
1999	8.72	12.16	4.41	5.18
2000	8.59	11.07	4.37	4.65
2001	8.38	10.78	4.24	4.54
2002	8.63	10.85	4.25	4.41
2003	8.68	10.70	4.38	4.43
2004	8.85	10.63	4.44	4.38
2005	8.94	10.48	4.58	4.41
2006	8.86	10.14	4.73	4.42
2007	9.08	10.15	4.80	4.37
2008	8.86	9.68	4.65	4.14
2009	8.95	9.49	4.39	3.80
2010	9.24	9.44	4.90	4.11
2011	8.94	9.02	4.71	3.89
2012	8.98	8.83	4.93	3.98
2013	9.34	8.98	4.94	3.88
2014	9.14	8.59	4.86	3.73
2015	9.17	8.43	4.94	3.72
2016	9.39	8.43	4.99	3.70
2017	9.10	7.95	4.83	3.49
2018	9.21	7.84	5.04	3.56
2019	9.38	7.80	5.10	3.51
2020	8.47	6.88	4.69	3.16

Reproduced from Instituto Nacional de Câncer (15)

Time trends in long-term stomach cancer incidence rates have been scarcely studied under a global perspective. Recently, an analysis on data from 108 cancer registries from 43 countries located on five continents pointed towards a downward incidence rate trend until 2030 in 41 of the 43 analyzed countries (6). Other authors have warned of increased new stomach cancer cases in adults under 50 living in developed countries, mainly associated with *Helicobacter pylori* infection (17, 18).

The Global Cancer Observatory's projections regarding cancer incidence and mortality rates for 2040 assume that the rates estimated for 2020 will remain constant, incorporating only demographic changes. Thus, a 62.8% increase in the number of new cases is estimated for the next 20 years compared to the 1,089,103 estimated cases for 2020, totaling 1,773,179 cases worldwide. Regarding mortality rates, estimates indicate that, in the same period, the total number of deaths due to stomach cancer will increase from 768,793 to 1,274,582, representing a 65.8% increase (19).

Concerning Brazil, the same projections indicate a 78.8% increase for new cases, from 20,139 in 2020 to 36,017 in 2040, higher among men (81.8%; from 12,961 to 23,558 cases) compared to women (73.6%; from 7,178 to 12,459 cases). The proportional mortality increases are expected to be higher than incidence rates for both men and women, increasing from 15,783 to 28,830 deaths per year, comprising an 82.7 % increase (19). It should be noted that these projections only consider the demographic changes expected to occur in the country.

CONCLUSION

Although incidence and mortality rates due to stomach cancer have declined in most countries, including Brazil, the number of new cases and deaths is not negligible. Under this scenario, efforts are required to reduce exposure to stomach cancer risk factors and obtain early diagnoses with timely treatment.

Conflict of Interest: The author declares no potential conflict of interest with respect to research, authorship, and/or publication of this manuscript.

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