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Socio-demographic disparities in colorectal cancer in Brazil, 1990-2019

Disparidades sociodemográficas no câncer colorretal no Brasil, 1990-2019

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ABSTRACT In the world, colorectal cancer presents high rates of incidence and mortality, with differences according to the level of sociodemographic development. The objective of this study was to analyze the sociodemographic disparities of colorectal cancer in the Brazilian population aged 30 and older. This is a time series study of incidence, mortality, disability-adjusted life years (DALY), and prevalence, by sex, in Brazil and its Federal Units (FU) states from 1990 to 2019. The trend was estimated using Joinpoint regression analysis, and the Socio-Demographic Index (SDI) was used in the correlation analysis. The data analyzed were estimated by the Global Burden of Diseases Study 19. In Brazil and its states, the highest rates of these indicators were observed in males, with an increasing trend in both sexes. There was a positive association between SDI and all the analyzed indicators except for DALY in men. The differences in rates and trends between the states reflect the country's development processes, such as urbanization and industrialization. More developed states have high rates with stable trends, while less developed states exhibit the opposite behavior, suggesting improved access to healthcare services and diagnosis.

KEYWORDS Colorectal neoplasms. Analytical epidemiology. Socioeconomic factors. Ecological studies. Global burden of disease.

RESUMO *No mundo, o câncer colorretal apresenta altas taxas de incidência e mortalidade, com diferenças segundo nível de desenvolvimento sociodemográfico. O objetivo foi analisar as disparidades sociodemográficas do câncer colorretal na população brasileira com 30 anos ou mais. Trata-se de estudo de série temporal da incidência, mortalidade, Anos de Vida Ajustados por Incapacidade (Disability Adjusted Life Years – DALY) e prevalência, segundo sexo, no Brasil e nas Unidades da Federação (UF) de 1990 a 2019. A tendência foi estimada pela regressão de Joinpoint, e o índice sociodemográfico (SDI – Socio-Demographic Index) foi utilizado na análise de correlação. Os dados analisados foram estimados pelo Global Burden of Diseases Study 19. No Brasil e nas UF, as maiores taxas dos indicadores foram observadas no sexo masculino, com tendência de aumento em ambos os sexos. Houve associação positiva entre o SDI e todos os indicadores analisados, exceto para DALY em homens. As diferenças nas taxas e tendências entre as UF parecem refletir os processos de desenvolvimento do País, tais como urbanização e industrialização, em que as UF mais desenvolvidas possuem taxas elevadas com tendências de estabilidade, e as UF em desenvolvimento, com comportamento inverso, sugerindo melhorias de acesso aos serviços de saúde e diagnósticos.*

PALAVRAS-CHAVE *Neoplasias colorretais. Epidemiologia analítica. Fatores socioeconômicos. Estudos ecológicos. Carga global da doença.*

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Introduction

Colorectal cancer (CRC) refers to any malignant cellular change that affects the colon, the rectum and the anal canal. It is considered a global public health problem[1], is the third most common cancer and the second leading cause of cancer death in the world, with 935,000 deaths estimated for 2020[2]. In Brazil, around 45,500 new cases of colon cancer are estimated for the three-year period from 2023 to 2025, and CRC is already the second most common cancer and the third leading cause of cancer death in the country[3,4]. There were 9,438 deaths from colon and rectal cancer in men (mortality rate of 10.3/100,000) and 9,767 in women (mortality rate of 7.9/100,000) in Brazil during 2020[5].

Most cases of CRC (60-65%) occur sporadically, i.e. they affect individuals with no family history[6,7]. The risk factors are age, male sex[8], westernised diet – including nitrates and nitrites consumption – physical inactivity, obesity, alcohol and tobacco consumption[9,10]. In addition to environmental factors[6], human papillomavirus (HPV) and human immunodeficiency virus (HIV) infection, together with sexual practices, are also risk factors for anal cancer[11,12].

Socio-economically disadvantaged areas have a worse prognosis, lower survival rates and a higher risk of death from cancer in general, as well as having the worst outcomes in relation to potentially curable cancers[13,14], including CRC. These situations could be avoided through strategic actions aimed at reducing social inequalities regarding access to healthcare services [15] and the control of risk factors[13,16,17]. Therefore, health promotion actions are aimed at halting or slowing down the course of the carcinogenic process[18] with the goal of cancer screening in its early stages, thereby increasing therapeutic efficacy and survival rates[13,19]. Socioeconomic inequalities have an important role in predicting morbidity and mortality of a disease among different populations. In people under the age of 30, CRC is a neoplasm associated with a genetic or hereditary mutation[20]. However, the prevalence of risk factors is higher from this age on, especially the modifiable ones[21,22], according to Federation Unit (FU)[23]. The aim of this study is to analyse the sociodemographic disparities present in the lives of Brazilians who are 30 years old or more, and who are affected with colorectal cancer, from 1990 to 2019.

Material and methods

This is a time series analysis of the incidence, prevalence, mortality and Disability Adjusted Life Years (DALYs) of CRC in individuals aged 30 years and over[21,22].

We used estimated and available data from the Global Burden of Disease Study 19 (GBD19) (available at https://vizhub.healthdata.org/gbd-results)[24], broken down by Federation Unit (FU) and sex, for Brazil, from 1990 to 2019.

The GBD study uses national data collected from the Ministry of Health's Mortality Information System (SIM)[25] and, to improve the quality of the information, the GBD applies algorithms to correct the underreporting of deaths and to reallocate them according to rubbish codes among the deaths classified as underlying causes[26,27]. The data was also analysed according to the Socio-Demographic Index (SDI), a tool that measures indices such as per capita income, fertility and education[24]. The SDI ranges from 0 (least developed) to 1 (most developed) enabling comparisons among Brazil's different geographical realities according to their development. The SDI quintiles were calculated for each year from 1990 to 2019, considering the Federative Units, allowing them to be classified into five groups: Low (0.0–0.45), Medium Low (0.45–0.60), Medium (0.60–0.68), Medium High (0.68–0.80) and High (0.80–1.0). Standardization of all the indicators obtained was carried out by the direct method, using the GBD standard population per 100,000 inhabitants[28].

The Average Annual Percent Change (AAPC) and the respective 95% confidence intervals (95% CI) were calculated to identify trends in the mortality indicators studied. The AAPC is the weighted average of the angular coefficients of the regression line, given equal weight for each segment's length over the entire interval. A significant increase or reduction in the trend occurs when it is different from zero ($p<0.05$). Joinpoint regression model was used to analyse the trend using Joinpoint software (version 4.9.1.0)[29].

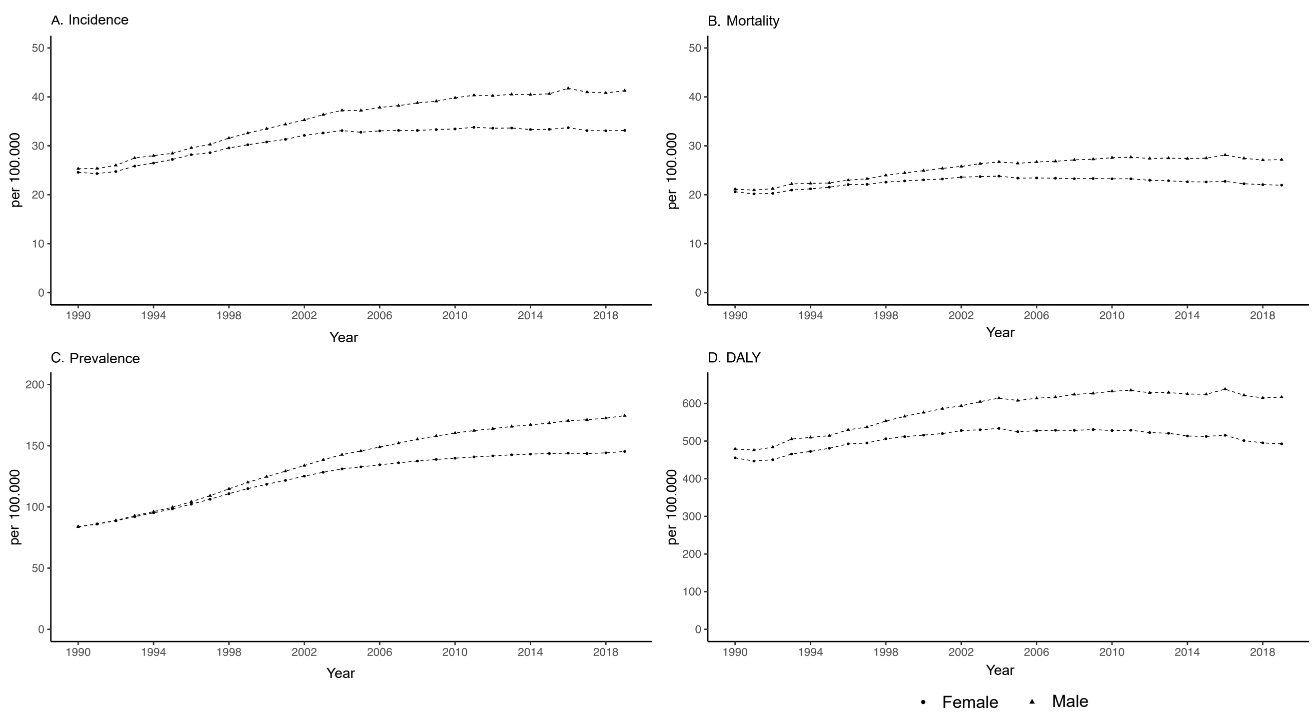
Regarding the correlation between the SDI measures and AAPC, it was analysed from 1990 to 2019 using Pearson's Correlation Test in the R software (version 4.2.2). In statistical analyses, correlation is a method used to assess a possible linear association between two continuous variables. In terms of the strength of relationship, the value of the correlation coefficient varies between +1 and -1. The closer to +1, the greater the strength of correlation and the closer to -1 the variables are inversely related, i.e., the higher one variable is, the lower the other is[30].

The research respected all ethical precepts[31,32] and was approved by the Research Ethics Committee of the Hospital das Clínicas of the Federal University of Goiás (UFG), under opinion no. 5.249.241.

Results

Analysing the entire period studied, men showed the highest incidence, prevalence, mortality and DALY rates in Brazil. There were significant annual increases in both sexes for all the parameters studied, although they were higher in men in the male group (*figure 1 and tables 1 and 2*).

Figure 1. Age- and sex-standardized incidence, prevalence, mortality and DALY rates for colorectal cancer in Brazilians aged 30 and over. Brazil, 1990 to 2019



Source: Author's own elaboration.

Incidence rates in the Brazilian Federative Units were higher in men and showed upward trends in both sexes. Among males, the biggest increases were in Bahia (2.8% p.a.), Pernambuco (2.8% p.a.) and Rio Grande do Norte (2.6% p.a.); among females, in Maranhão (2.8% p.a.), Ceará (2.1% p.a.), Amapá and Acre (1.9% p.a.). Notably, the FU in the North and Northeast regions registered the highest annual percentage increases. The FU with the highest annual increases in male prevalence are Pernambuco (3.5% p.a.), Bahia and Ceará (3.4% p.a.) and for females Maranhão (3.3% p.a.), Ceará (2.7% p.a.) and Acre (2.6% p.a.), with upward trends in the North and Northeast macro regions (*table 1*).

Table 1. Age standardised rate (1990 and 2019) and trend in colorectal cancer incidence and prevalence in Brazilians aged 30 and over, broken down by sex, by Federated Unit (FU) and Brazil, from 1990 to 2019

	Incidence - Female			Incidence - Male			Prevalence - Female			Prevalence - Male		
	Years		AAPC	Years		AAPC	Years		AAPC	Years		AAPC
FU	**1990**	**2019**	**95% CI**	**1990**	**2019**	**95% CI**	**1990**	**2019**	**95% CI**	**1990**	**2019**	**95% CI**
North												
Acre	12.25	21.2	1.9* (1.7;2.2)	14.85	27.07	2.0* (1.3;2.7)	40.05	84.89	2.6* (2.4;2.8)	44.52	104.09	2.9* (2.8;3.1)
Amapá	11.69	19.5	1.9* (1.6;2.2)	11.65	22.2	2.2* (1.7;2.8)	42.35	81.11	2.3* (2.2;2.4)	40.39	87.64	2.7* (2.5;2.9)
Amazonas	18.1	23.83	1.1* (0.7;1.5)	15.64	27.22	2.0* (1.5;2.4)	60.36	100.03	1.8* (1.5;2.0)	51.64	111.53	2.7* (2.5;2.9)
Pará	16.93	21.71	0.9* (0.8;1.0)	15.48	22.63	1.3* (1.1;1.6)	55.97	89.43	1.6* (1.5;1.7)	50.12	90.19	2.0* (1.9;2.2)
Rondônia	20.94	23.61	0.5* (0.3;0.8)	19.34	28.42	1.5* (1.1;1.9)	63.35	97.59	1.5* (1.3;1.7)	58.3	114.08	2.4* (2.2;2.6)
Roraima	14.92	20.84	1.2* (0.9;1.5)	19.78	26.46	1.0* (0.5;1.5)	49.36	84.57	1.9* (1.8;2.0)	61.65	104.95	1.8* (1.7;2.0)
Tocantins	13.66	20.04	1.3* (1.1;1.6)	14.49	29.91	2.5* (2.2;2.8)	44.89	85.08	2.2* (2.2;2.3)	46.32	120.26	3.3* (3.3;3.4)
Northeast												
Alagoas	16.16	23.41	1.3* (1.1;1.5)	14.86	26.41	2.0* (1.8;2.2)	50.94	93.83	2.1* (2.1;2.2)	46.8	104.13	2.8* (2.7;2.9)
Bahia	18.15	25.02	1.1* (1.0;1.2)	16.18	35.47	2.8* (2.6;2.9)	60.65	105.49	1.9* (1.8;2.0)	54.05	142.52	3.4* (3.4;3.4)
Ceará	14.79	26.49	2.1* (1.9;2.3)	14.51	31.54	1.8* (1.6;1.9)	53.38	116.37	2.7* (2.7;2.8)	51.36	134.96	3.4* (3.3;3.6)
Maranhão	8.9	19.76	2.8* (2.2;3.4)	15.96	26.26	1.7* (1.0;2.4)	30.97	79.92	3.3* (3.3;3.4)	49.28	99.92	2.5* (2.3;2.6)
Paraíba	16.34	22.36	1.1* (0.7;1.6)	13.85	26.98	2.3* (2.2;2.5)	57.28	96.39	1.8* (1.8;1.9)	48.69	113.43	3.0* (2.8;3.1)
Piauí	14.37	20.55	1.4* (0.8;2.1)	15.34	23.39	1.6* (0.6;2.5)	50.34	85.92	1.9* (1.8;2.0)	51.93	95.47	2.1* (1.9;2.3)
Pernambuco	17.33	26.04	1.5* (1.0;2.0)	13.9	30.74	2.8* (2.3;3.3)	55.83	104.61	2.2* (2.1;2.3)	45.02	120.5	3.5* (3.4;3.6)
Rio Grande do Norte	14.8	24.53	1.7* (1.5;2.0)	15	31.4	2.6* (2.2;3.0)	52.46	107.7	2.5* (2.4;2.6)	52.56	133.51	3.2* (3.1;3.4)
Sergipe	18.76	24.78	1.0* (0.5;1.5)	17.13	28.87	1.7* (0.9;2.6)	59.85	102.85	1.9* (1.8;2.0)	54.42	116.55	2.6* (2.5;2.8)
Southeast												
Espírito Santo	20.83	33.29	1.6* (1.4;1.9)	19.39	38.19	2.3* (2.1;2.5)	71.69	146.57	2.5* (2.4;2.6)	65.01	162.55	3.2* (3;3.4.0)
Minas Gerais	22.25	30.36	1.1* (0.8;1.4)	21.71	36.09	1.7* (1.4;2.0)	75.45	135.42	2.0* (2.0;2.1)	71.46	157.18	2.8* (2.7;2.8)
Rio de janeiro	30.26	40.3	1.1* (0.6;1.5)	33.58	52.23	1.6* (1.4;1.7)	99.53	171	1.9* (1.8;2.0)	104.15	211.64	2.5* (2.4;2.7)
São Paulo	31.61	40.23	0.8* (0.6;1.1)	35.3	51.12	1.3* (0.9;1.8)	109.18	182.4	1.8* (1.6;1.9)	115.92	221.66	2.3* (2.1;2.4)

Table 1. Age standardised rate (1990 and 2019) and trend in colorectal cancer incidence and prevalence in Brazilians aged 30 and over, broken down by sex, by Federated Unit (FU) and Brazil, from 1990 to 2019

	Incidence - Female			Incidence - Male			Prevalence - Female			Prevalence - Male		
	Years		AAPC	Years		AAPC	Years		AAPC	Years		AAPC
FU	1990	2019	95% CI	1990	2019	95% CI	1990	2019	95% CI	1990	2019	95% CI
South												
Paraná	25.12	35.57	1.2* (1.0;1.4)	27.47	46.16	1.8* (1.4;2.2)	82.15	153.79	2.2* (2.1;2.3)	88.34	193.08	2.8* (2.6;2.9)
Rio Grande do Sul	35.95	45.12	0.8* (0.6;1.0)	39.27	58.83	1.4* (1.1;1.6)	124.86	202.34	1.7* (1.6;1.9)	131.06	254.52	2.3* (2.2;2.5)
Santa Catarina	27.96	34.78	0.7* (0.5;1.0)	30.48	45.35	1.4* (1.2;1.5)	95.16	159.03	1.8* (1.8;1.9)	100.19	201.51	2.4* (2.4;2.5)
Midwest												
Distrito Federal	33.2	41.23	0.8* (0.6;1.1)	37.19	51.64	1.1* (0.7;1.5)	114.7	193.6	1.8* (1.7;1.9)	117.52	229.79	2.3* (2.2;2.5)
Goiás	25.77	31.56	0.7* (0.4;1.0)	25.12	37	1.4* (1.2;1.6)	89.41	139.59	1.5* (1.5;1.6)	85.48	159.45	2.2* (2.1;2.3)
Mato Grosso	17.15	25.53	1.3* (0.6;2.1)	17.49	27.42	1.5* (1.1;1.9)	58.97	109.02	2.1* (2.0;2.2)	58.22	114.47	2.3* (2.2;2.5)
Mato Grosso do Sul	21.28	28.97	1.1* (0.7;1.6)	20.62	34.16	1.9* (1.6;2.3)	73.1	120.67	1.7* (1.7;1.8)	68.89	137.89	2.4* (2.3;2.6)
Brazil	**24.58**	**33.14**	**1.1* (0.9;1.2)**	**25.32**	**41.27**	**1.8* (1.6;1.9)**	**83.91**	**145.34**	**1.9* (1.8;2)**	**83.79**	**174.64**	**2.6* (2.5;2.6)**

Source: Author's own elaboration.

AAPC: Average Annual Percent Change; CI: Confidence Interval; *: p-value<0.05.

Regarding men, mortality increased in 14 states, with higher percentiles in the North and Northeast regions; in the Federal District, there was a downward trend. Among the female population, mortality trends remained stable in 12 states and the only downward trend was observed in the Federal District (-0.3% p.a.). Comparatively, the Federal District's women are the ones who suffer the least from CRC, with a downward trend in the quality-adjusted life years lost due to CRC (-0.4 percent p.a.). Increasing trends were observed mainly in the North and Northeast, with Maranhão showing the highest AAPC (1.9% p.a.), while in the male group there is no downward trend; Distrito Federal and Roraima are the only FU with stability, and the highest annual percentages are in Pernambuco and Bahia (2.1% p.a.) (*table 2*).

Table 2. Age-standardised rate (1990 and 2019) and trend of colorectal cancer mortality and DALY in Brazilians aged 30 and over, broken down by sex, by Federated Unit (FU) and Brazil, from 1990 to 2019

	Mortality – Female			Mortality – Male			DALY – Female			DALY – Male		
FU	Years		AAPC	Years		AAPC	Years		AAPC	Years		AAPC
	1990	2019	95% CI	1990	2019	95% CI	1990	2019	95% CI	1990	2019	95% CI
North												
Acre	11.1	15.72	1.2* (0.9;1.5)	13.84	20.02	1.2* (0.7;1.8)	241.12	338.56	1.2* (0.8;1.5)	280.69	435.78	1.4* (0.8;2.0)
Amapá	9.76	13.96	1.3* (1.0;1.6)	9.93	16.03	1.7* (1.1;2.2)	212.1	311.86	1.4* (1.2;1.7)	208.57	350.69	1.8* (1.2;2.3)
Amazonas	15.77	16.76	0.4 (0.0;0.8)	13.6	19.03	1.2* (0.5;1.9)	344.02	371.76	0.4 (-0.3;1.0)	301.4	431.52	1.3* (0.8;1.8)

Table 2. Age-standardised rate (1990 and 2019) and trend of colorectal cancer mortality and DALY in Brazilians aged 30 and over, broken down by sex, by Federated Unit (FU) and Brazil, from 1990 to 2019

FU	Mortality – Female			Mortality – Male			DALY – Female			DALY – Male		
	Years		AAPC	Years		AAPC	Years		AAPC	Years		AAPC
	1990	2019	95% CI	1990	2019	95% CI	1990	2019	95% CI	1990	2019	95% CI
Pará	14.9	15.71	0.2 (-0.1;0.4)	13.65	16.34	0.7* (0.3;1.0)	328.4	352.55	0.2* (0.1;0.4)	301.55	375.6	0.8* (0.5;1.1)
Rondônia	18.96	16.74	-0.5 (-1.3;0.3)	17.31	20.02	0.7* (0.2;1.1)	384.59	363.96	-0.1 (-0.6;0.4)	372.04	442.09	0.7* (0.1;1.4)
Roraima	13.02	15.09	0.5* (0.2;0.8)	17.49	18.91	0.3 (-0.2;0.8)	282.03	319.58	0.5* (0.2;0.8)	370.48	415.27	0.4 (-0.1;0.9)
Tocantins	11.98	13.96	0.5* (0.3;0.8)	13.9	21.4	1.7* (1.4;2.1)	248.46	310.51	0.8* (0.6;0.9)	262.15	460.44	2.0* (1.7;2.2)
Northeast												
Alagoas	14.74	17.15	0.5* (0.3;0.8)	13.45	19.22	1.2* (1.1;1.4)	328.6	388.82	0.6* (0.3;0.8)	313.56	451.1	1.3* (1.1;1.5)
Bahia	15.9	17.68	0.4* (0.3;0.4)	14.03	25.1	2.0* (1.9;2.2)	354.38	411.12	0.5* (0.5;0.6)	324.2	586.32	2.1* (1.9;2.2)
Ceará	12.41	17.72	1.3* (1.1;1.6)	12.2	20.99	2.0* (1.4;2.5)	284.19	398.82	1.2* (1.0;1.4)	280.08	482.91	2.0* (1.6;2.3)
Maranhão	8.33	15.43	2.2* (1.7;2.6)	14.82	20.49	1.1* (0.5;1.7)	198.57	346.83	1.9* (1.5;2.4)	340.26	451.01	1.0* (0.3;1.6)
Paraíba	13.83	15.27	0.4 (-0.1;0.9)	11.69	18.25	1.6* (1.4;1.8)	309.32	341.91	0.4 (0.0;0.9)	266.86	419.33	1.6* (1.4;1.7)
Piauí	12.3	14.69	0.7 (-0.1;1.5)	13.12	16.56	0.9 (0.0;1.8)	268.78	323.02	0.8* (0.2;1.4)	288.13	373.87	1.0* (0.1;1.9)
Pernambuco	15.39	18.93	0.7* (0.2;1.2)	12.26	22.07	2.1* (1.6;2.6)	343.69	420.81	0.7* (0.2;1.2)	285.91	510.24	2.1* (1.6;2.5)
Rio Grande do Norte	12.53	16.49	1.0* (0.7;1.2)	12.65	20.95	1.8* (1.4;2.2)	272.74	369.52	1.0* (0.8;1.2)	281.93	482.21	1.9* (1.5;2.2)
Sergipe	16.91	17.66	0.2 (-0.4;0.7)	15.32	20.37	0.8* (0.5;1.1)	356.03	397.52	0.4 (-0.1;0.9)	332.28	476.84	1.2* (0.5;1.9)
Southeast												
Espírito Santo	17.49	22.04	0.8* (0.6;1.0)	15.9	25.26	1.6* (1.4;1.8)	390.73	498.61	0.9* (0.6;1.1)	359.67	573.69	1.5* (1.3;1.8)
Minas Gerais	18.85	19.77	0.1 (-0.1;0.3)	18.36	23.18	0.8* (0.5;1.0)	419.95	456.8	0.2 (-0.1;0.6)	416.48	550.68	0.9* (0.6;1.2)
Rio de janeiro	25.82	27.44	0.4* (0.2;0.6)	28.67	35.45	0.8* (0.6;1.0)	575.08	615.16	0.3* (0.0;0.6)	644.83	796.45	0.8* (0.6;0.9)
São Paulo	25.88	25.46	-0.1 (-0.4;0.2)	29.01	32.4	0.5* (0.3;0.8)	565.63	572.85	0.1 (-0.2;0.4)	642.23	721.88	0.6* (0.3;0.8)
South												
Paraná	21.48	23.82	0.4* (0.2;0.6)	23.24	30.68	1.0* (0.7;1.3)	461.03	534.3	0.5* (0.3;0.7)	519.03	700.34	1.2* (0.9;1.4)
Rio Grande do Sul	29.25	28.74	0.0 (-0.2;0.3)	31.67	36.92	0.5* (0.3;0.7)	619.55	632.84	0.1 (-0.1;0.3)	692.93	825.62	0.6* (0.4;0.8)
Santa Catarina	23.12	21.72	-0.2 (-0.4;0.0)	25.05	27.91	0.4* (0.1;0.7)	484.19	475.61	-0.1 (-0.3;0.2)	538.01	623.58	0.5* (0.4;0.6)
Midwest												
Distrito Federal	26.99	24.68	-0.3* (-0.5;-0.2)	31.22	30.95	0.0 (-0.5;0.4)	564.68	505.13	-0.4* (-0.6;-0.2)	620.57	622.88	0.0 (-0.4;0.5)
Goiás	21.1	20.78	0.0 (-0.4;0.5)	20.68	24.22	0.5* (0.4;0.6)	492.74	479.5	-0.1 (-0.3;0.1)	488.14	569.94	0.5* (0.3;0.7)
Mato Grosso	14.67	17.55	0.5 (-0.1;1.2)	15.04	18.72	0.7* (0.2;1.1)	325.65	393.7	0.6* (0.0;1.2)	336.97	429.65	0.8* (0.3;1.2)
Mato Grosso do Sul	17.83	20.37	0.5* (0.0;1.0)	17.28	23.86	1.3* (0.9;1.7)	400.48	454.17	0.5* (0.1;1.0)	392.86	538.61	1.3* (0.9;1.6)
Brazil	**20.61**	**21.96**	**0.2* (0.1;0.4)**	**21.13**	**27.18**	**0.9* (0.8;1.1)**	**455.31**	**492.55**	**0.3* (0.1;0.5)**	**479.05**	**616.81**	**0.9* (0.8;1.1)**

Source: Author's own elaboration.

AAPC: Average Annual Percent Change; CI: Confidence Interval; *: p-value<0.05.

When analysing the indicators according to the levels of sociodemographic development divided into quintiles, in terms of rates, the highest quintile (SDI >0.80) shows the highest values in all indicators regardless of gender; as for the annual increase, this same sociodemographic level shows the lowest AAPC in all indicators, with a significant trend, except for mortality and DALY in females. In contrast, the rates are lower in the less developed regions (SDI <0.68) and the trends show increasing tendencies, except for the Middle quintile, which remains stable regarding female mortality (*table 3*).

Table 3. Age-standardised rate (1990 and 2019) and trend of colorectal cancer incidence, prevalence, mortality and DALY in Brazilians aged 30 years and over, by sociodemographic index (SDI) level quintiles. Brazil, 1990 to 2019

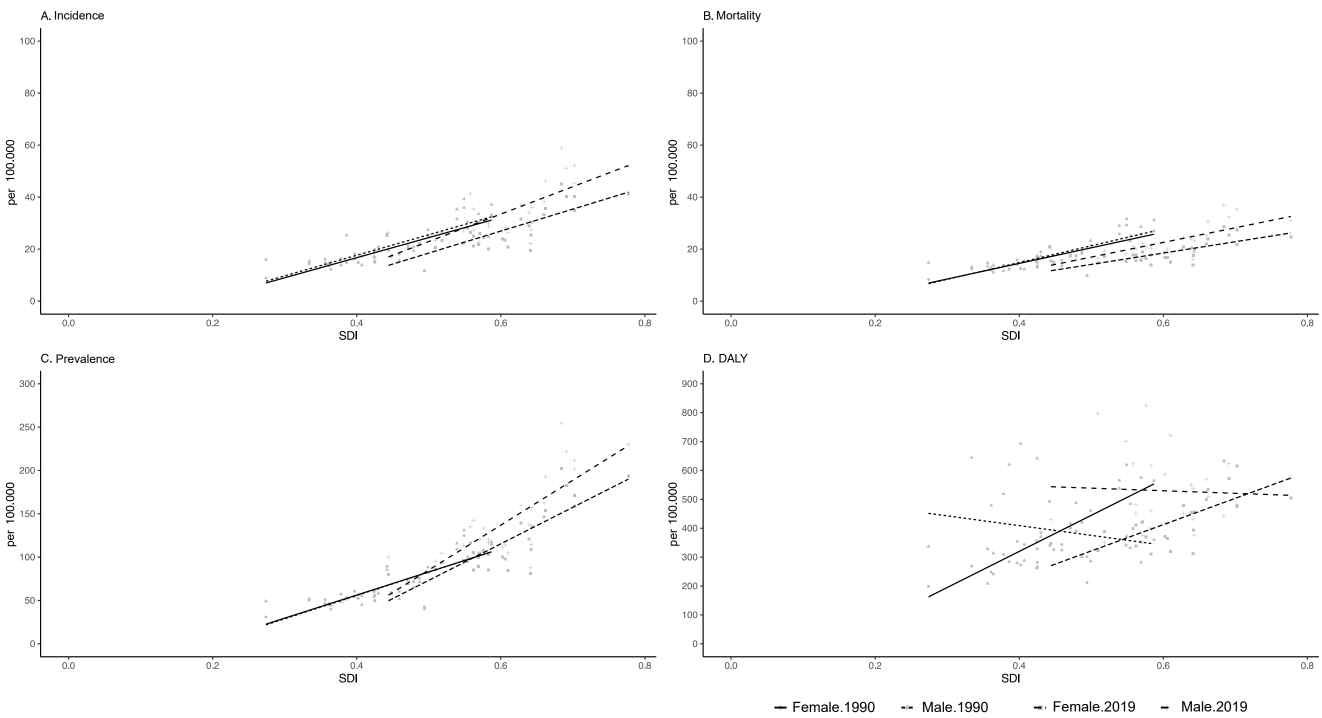
	Male			**Female**		
Quintile	**1990**	**2019**	**AAPC 95% CI**	**1990**	**2019**	**AAPC 95% CI**
Incidence						
Lower	14.73	27.84	2.3* (2.0;2.5)	13.31	23.11	2.0* (1.7;2.2)
Medium Low	15.11	31.11	2.5* (2.4;2.7)	16.85	24.56	1.3* (1.1;1.5)
Middle	19.7	32.2	1.7* (1.4;2.0)	20.46	27.03	1.0* (0.7;1.3)
Medium High	20.9	35.06	1.7* (1.5;2.0)	21.72	29.98	1.1* (0.9;1.3)
High	34.25	51.3	1.5* (1.3;1.7)	31.1	39.99	0.9* (0.7;1.2)
Prevalence						
Lower	48.48	114.3	3.1* (2.9;3.3)	45.57	98.04	2.8* (2.5;3.1)
Medium Low	50.98	124.6	3.1* (3.0;3.2)	56.93	102.1	2.0* (1.9;2.1)
Middle	65.38	134.4	2.5* (2.2;2.8)	69.46	116.4	1.8* (1.5;2.1)
Medium High	68.99	150.7	2.7* (2.2;3.3)	73.76	132.3	2.1* (1.9;2.2)
High	111.3	219.2	2.4* (2.3;2.5)	105.79	178	1.8* (1.7;2.0)
Mortality						
Lower	13.03	19.59	1.4* (1.1;1.8)	11.73	16.31	1.2* (0.9;1.4)
Medium Low	13.04	22.06	1.8* (1.6;2.1)	14.66	17.05	0.6* (0.5;0.8)
Middle	16.76	21.85	1.0* (0.7;1.2)	17.34	18.42	0.2 (0.0;0.5)
Medium High	17.63	22.9	0.9* (0.6;1.1)	18.04	19.8	0.2* (0.1;0.4)
High	28.37	32.98	0.6* (0.4;0.8)	25.78	25.82	0.0 (-0.2;0.2)
DALY						
Lower	298	446.5	1.4* (1.2;1.7)	264.74	366.4	1.2* (0.9;1.4)
Medium Low	300.6	510.4	1.9* (1.6;2.1)	328.14	397	0.7* (0.5;0.8)
Middle	382.4	502	1.0* (0.7;1.2)	392.49	416.4	0.2* (0.0;0.4)
Medium High	399	536.1	1.0* (0.7;1.2)	409.48	452.9	0.3* (0.2;0.5)
High	627.9	736.5	0.6* (0.4;0.8)	559.9	575.5	0.1 (-0.1;0.4)

Source: Author's own elaboration.

AAPC: Average Annual Percent Change; CI: Confidence Interval; *: p-value<0.05.

The correlation between the incidence, prevalence and mortality rates with the Sociodemographic Indexes for colorectal cancer among men in 1990 was significant (p<0.05), with a 0.76, 0.8 and 0.78 coefficient, respectively. Significant correlations in 2019 (p<0.05) were 0.72 for incidence and 0.77 for prevalence. The patterns were similar for women in 1990; the correlation coefficients for incidence, prevalence and mortality were 0.85, 0.85 and 0.84, respectively, with p<0.05. In 2019, these scores were 0.79 for incidence, 0.81 for prevalence and 0.74 for mortality (p<0.05). The correlation between women and DALYs was significant, at 0.82 in 1990 and 0.79 in 2019 (p<0.05). Unlike men, for whom there was no difference. Finally, there was no statistically significant correlation between the differences in the SDIs in 2019 and 1990 and the indexes that were studied (*figure 2*).

Figure 2. Sociodemographic Index (SDI) correlation coefficient with colorectal cancer indicators in Brazilians ≥ 30 years of age and also broken down by sex, 1990 and 2019



Source: Author's own elaboration.

Discussion

From 1990 to 2019, the epidemiological profile of colorectal cancer in Brazil and its Federated Units (FU) showed that men had the highest rates. In general, when analysed according to SDI quintiles, the least developed FU, especially those located in Brazil's North and Northeast regions, showed the lowest rates of the indicators studied. Age is an important non-modifiable risk factor and may be associated with the annual increase in the incidence of CRC, primarily as observed in the North and Northeast regions, which have seen an increase in the ageing rate over the last 12 years when compared to Brazil's South and Southeast regions, which had already shown older structures[33]. The country has been experiencing a decline in mortality and fertility rates[34], resulting in a change of structure in the age pyramid, which in turn reflects in a population ageing similarly to the ones present in developed countries, and increases the burden of NCDs[34-36].

Even though it is the main modifiable risk factor for CRC, inadequate diet has become increasingly frequent in the eating routine of Brazilians[37,38]. This increases the chances of people developing NCDs, such as CRC. In Brazil, in natura or minimally processed foods have been intensely replaced by ultra-processed foods[37,39-42] along with physical inactivity and sedentary behaviour, which have been following increasing trends over time[41] and contributing to the rise in obesity[39]. Obesity, alcohol and tobacco consumption, as well as the intake of ultra-processed foods are more prevalent in men[44,45], supporting the findings in the male group of this study and the differences observed between the units of analysis.

Expanding the healthcare services allows access to diagnosis and treatment, as seen in the Northeast region, where Primary Care coverage was 60.65% in 2007 and rose to 81.74% in 2019[46,47], according to the quality of the data[48]. However, there was a high mortality rate among males, which suggests delayed access to healthcare services. Low demand for health promotion and prevention services was observed in this group, which can result in late diagnosis and untreated health problems, something that has already been identified in other research studies[49-51].

By analysing the indicators with the Sociodemographic Index, it can be seen that the more developed FU have the highest incidence and prevalence rates, which can be explained by the better socioeconomic conditions of these groups[52], Analysis of the indicators with the sociodemographic index shows that the more developed FU have the highest incidence and prevalence rates, which can be explained by the better socioeconomic conditions of these groups, such as easier access to industrialized foods due to higher local development and purchasing power, longer life expectancy which implies greater exposure to risk factors for NCDs, including CRC, and access to quality health services[44,45]. Despite improvements in these conditions, the challenge remains to adhere to sustainable diets by integrating nutritional, cultural, economic and environmental aspects to guarantee food security, which will also make it possible to reduce NCDs[53].

Observed correlations can also be attributed to the country's social and regional discrepancies. According to the Brazilian Institute of Geography and Statistics (IBGE), the lowest average household incomes per capita in the country's main regions in 2019 were in the North (R$955.00) and the Northeast (R$945.00)[52] as well as low incomes and low levels of education[54], which increase the vulnerability of this group to CRC.

In both the 1990s and 2019, there was a strong correlation between rates and SDI in women, and those with higher income and schooling, as well as low fertility rates, showed better indicators compared to men, since they did not show an association between SDI and DALYs and mortality. Research shows that white women with higher incomes and more schooling tend to lead healthier lifestyles (diet, less tobacco and alcohol consumption and physical activity)[44,45] have a greater perception of risk and, as a result, have a higher incidence of preventive medical consultations, which allows for the timely diagnosis and treatment of diseases[39] that influence the reduction of mortality and morbidity.

A comparison of trends between Brazilian localities showed a different behaviour in the Federal District (DF), with a decreasing trend in mortality and DALYs for females and a stable trend for males. It should be noted that household income in the Federal District is the highest in the whole of Brazil (average per capita income of R$2,765.00)[52], which suggests greater access to health services and less dependence on public services. These findings are in line with previous studies which show that income has a negative correlation with the number of deaths from the disease, i.e., the higher the income, the lower the risk of dying and the less time lost due to death or disability[55,56].

Brazil is one of the few countries that offers a universal public health service for the entire population, whereby the Basic Health Units (UBS) and Family Health Units (USF) are responsible for prevention and promotion actions[57]. There is currently no standardized, universal colorectal cancer (CRC) screening programme in the country. Screening approaches for CRC are selected based on criteria such as financial viability and patient suitability. So, access to CRC screening depends on the geographical region and the financial capacity of the local health system and the decision to carry out screening, as well as the patient's individual medical history (risk of developing the disease)[57]. There are initiatives to organize the healthcare network in terms of cancer prevention, diagnosis and timely treatment, with the aim of improving the cancer survival rate in the country, in line with the law that guarantees early treatment within 60 days after diagnosis[58].

As this is a study using secondary data, it has limited accuracy of the indicators used. The Global Burden of Disease (GBD) statistically treats the data from the systems to obtain better quality data, such as corrections for underreporting of deaths and redistribution of unspecified causes, such as mortality. The methodology for these corrections and estimates includes many modelling stages, which consider data from the National Civil Registration Systems and other sources of information, as well as the redistribution of ill-defined codes. These estimates provide an overview of the epidemiology of RCC by comparing indicators between different states.

Conclusions

According to gender and state, the differences observed in colorectal cancer rates and their temporal evolution may be related to the various risk factors, as well as the lack of equitable access to healthcare services for timely diagnosis and treatment. The findings may reflect socioeconomic inequalities in Brazil and show a predominant increase in these trends in regions considered underdeveloped, regardless of gender, whereas the more developed regions show indicators with more stable trends, especially in the female group.

It is therefore essential that health policymakers adopt preventive policies against colorectal cancer. This entails investing in and prioritizing intersectoral public policies and surveillance programmes, which have a direct impact on life expectancy and morbidity and mortality rates in this population. Therefore, it must be emphasized that early detection of cancer is crucial for the success of treatment and to improve the chances of a cure.

Collaborators

Schaedler AC (0009-0004-8477-1626)* contributed to the conception, data collection and analysis, interpretation of results, preparation of the original draft, and approval of the final version of the manuscript. Veloso GA (0000-0002-5348-3793)* contributed to data collection and analysis, interpretation of results, critical revision of the text, and approval of the final version of the manuscript. Iser BPM (0000-0001-6061-2541)*, Malta DC (0000-0002-8214-5734)*, and Curado MP (0000-0001-8172-2483)* contributed to the interpretation of results, critical revision of the text, and approval of the final version of the manuscript. Oliveira MM (0000-0002-0804-5145)* contributed to the conception, data collection and analysis, interpretation of results, guidance, preparation of the original draft, critical revision of the text, and approval of the final version of the manuscript. ■

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