SCIENTIFIC JOURNAL
CEREM-GO

DOI 10.37951/2675-5009.2026v7i19.186
ISSN 2675-5009
e26186
SCIENTIFIC ARTICLE - ORIGINAL

EPIDEMIOLOGICAL ANALYSIS OF CANCER MORTALITY IN THE STATE OF GOIÁS BETWEEN 2015 AND 2024

EDUARDO RIBEIRO SENE[1], ANA MARIA RAGAGNIN DALMASO[1], BRUNNA MACHADO MEDEIROS[1], LYANDRA YURI KATSUYAMA NOGUEIRA[1], ADEMAR CAETANO DE ASSIS FILHO[1]

1. Universidade Federal de Jataí - UFJ, Jataí/GO, Brasil.

ABSTRACT

Introduction: Cancer is characterized by uncontrolled cell growth resulting from the transformation of normal cells into malignant ones, constituting a relevant public health problem. **Objective:** To analyze the epidemiological profile of mortality due to neoplasms in the state of Goiás, Brazil, from 2015 to 2024. **Methods:** This is a cross-sectional, descriptive, and quantitative study conducted using secondary data from the Mortality Information System (SIM), made available by DATASUS. All deaths by place of residence in the state of Goiás with the underlying cause classified in Chapter II of the ICD-10 (Neoplasms), occurring between 2015 and 2024 and involving individuals of all age groups, were included. The variables analyzed were year of death, sex, age group, education level, marital status, race/color, place of occurrence, health macroregion, and neoplasm groups. Data were analyzed descriptively using tables and graphs. **Results:** During the analyzed period, 68,385 deaths due to neoplasms were recorded in Goiás, showing an increasing trend over the historical series. There was a predominance of males and a higher concentration of deaths among individuals aged 60 years or older. The main causes of death were neoplasms of the digestive organs and of the respiratory and intrathoracic system, followed by breast neoplasms and neoplasms of the genital organs. Deaths were more concentrated in the most populous macroregions of the state, with a predominance of hospital deaths and individuals with low educational attainment. **Conclusion:** Cancer mortality in Goiás showed progressive growth, associated with population aging, sociodemographic inequalities, and the organization of the health care network.

Keywords: miology, Mortality, Neoplasms, Goiás, Sociodemographic profile.

INTRODUCTION

Cancer is a disease characterized by uncontrolled cellular growth resulting from the transformation of normal cells into malignant ones. These cells acquire the capacity for sustained proliferation, adaptation, and survival, escaping physiological control mechanisms. From a modern biological perspective, cancer represents an evolutionary process in which

transformed cells are subjected to selective pressures similar to those of natural selection. This phenomenon contributes to tumor heterogeneity, treatment resistance, and disease progression, all of which are central factors underlying its high lethality.[1]

Global statistics for 2022 reported approximately 20 million new cancer cases and nearly 10 million cancer-related deaths. Demographic projections indicate that the annual number of new cancer cases will reach 35 million by 2050, representing a 77% increase compared with 2022.[2]

In Brazil, data regarding the most prevalent cancer types reveal a sex-specific pattern. Among men, the most frequent malignancies include prostate cancer, followed by cancers of the trachea, bronchi, and lungs, as well as colorectal cancer, highlighting the importance of neoplasms associated with smoking and aging. Among women, breast cancer is the most common, followed by colorectal and cervical cancers, reflecting both behavioral factors and gaps in early detection and access to healthcare services.[3]

Cancer represents a major public health problem and ranks among the leading causes of mortality in Brazil. The risk factors associated with its development are largely shared with other noncommunicable chronic diseases and include smoking, obesity, alcohol consumption, exposure to ionizing radiation and solar radiation, and dietary habits characterized by high consumption of processed and ultra-processed foods. In addition, intrinsic factors, particularly those of a genetic nature, also exert a significant influence on the occurrence of the disease.[4]

In countries with a high Human Development Index (HDI), reductions in cancer incidence and mortality rates have been observed, mainly due to the implementation of effective prevention, screening, and treatment strategies. In contrast, in countries undergoing socioeconomic transition, these rates remain stable or continue to rise, reflecting structural limitations and restricted access to healthcare services. In this context, the main challenge lies in optimizing the use of available resources and strengthening policies capable of improving cancer control.[5]

Against this background, an epidemiological analysis of cancer mortality in the state of Goiás is essential for understanding the disease profile and for supporting prevention strategies and the development of public health policies.

MATERIALS AND METHODS

This is a descriptive cross-sectional study with a quantitative approach, conducted using data obtained from the Mortality Information System (SIM), accessed through the Brazilian Unified Health System Information Technology Department (DATASUS). The study aimed to describe deaths due to neoplasms among residents of the state of Goiás between 2015 and 2024.

For the analysis, inclusion criteria comprised death records by place of residence registered in the state of Goiás, involving individuals aged from 0 years to 80 years or older, with a diagnosis of neoplasm during the study period.

Data were obtained from DATASUS considering deaths whose underlying cause was classified under Chapter II of the International Classification of Diseases, 10th Revision (ICD-10), entitled Neoplasms. This chapter comprises 14 categories, including malignant neoplasms of the lip, oral cavity and pharynx; digestive organs; respiratory and intrathoracic organs; bone and articular cartilage; and skin (melanoma and other malignant neoplasms). In addition, the following variables were collected for analysis: age group, sex, educational level, marital status, year of death, and place of occurrence (residence).

The data obtained were analyzed and presented descriptively through tables and graphs created using Microsoft Excel. The findings were subsequently discussed based on scientific literature published in Portuguese and English.

As this study used publicly available secondary data with free access, submission to a Research Ethics Committee was not required, in accordance with Resolution No. 466/2012 of the Brazilian National Health Council.

RESULTS

Between 2015 and 2024, a total of 68,385 deaths due to neoplasms (Chapter II of ICD-10) were recorded among residents of the state of Goiás, demonstrating an increasing trend throughout the study period. In 2015, 5,956 deaths were reported, with a progressive increase through 2019 (6,874 deaths). After a slight reduction in 2020 (6,768 deaths), growth resumed in 2021 (6,875 deaths) and intensified in subsequent years, reaching 7,241 deaths in 2022, 7,686 in 2023, and 7,755 in 2024.

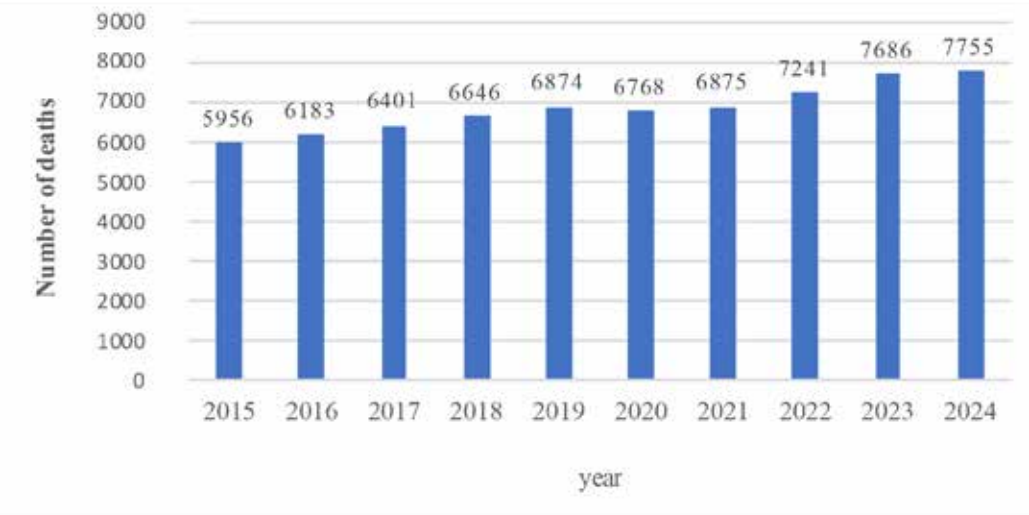

Figure 1: Distribution of deaths due to neoplasms according to year of death, Goiás, 2015–2024.
Fonte: MS/SVS/CGIAE – Mortality Information System (SIM). Prepared by the authors.

Regarding distribution by Health Macroregion, the highest concentration of deaths was observed in the Central-West Macroregion, followed by the Central-Southeast and Central-North Macroregions. The Northeast and Southeast Macroregions presented lower numbers of deaths, while the category "unknown" accounted for only a residual proportion. This pattern reflects the greater population density, higher degree of urbanization, and concentration of specialized healthcare services in the central regions of the state. Among the municipalities, the highest numbers of deaths were recorded in Goiânia (17,790 deaths), Aparecida de Goiânia (4,776), Anápolis (4,451), Rio Verde (1,620), and Luziânia (1,625).

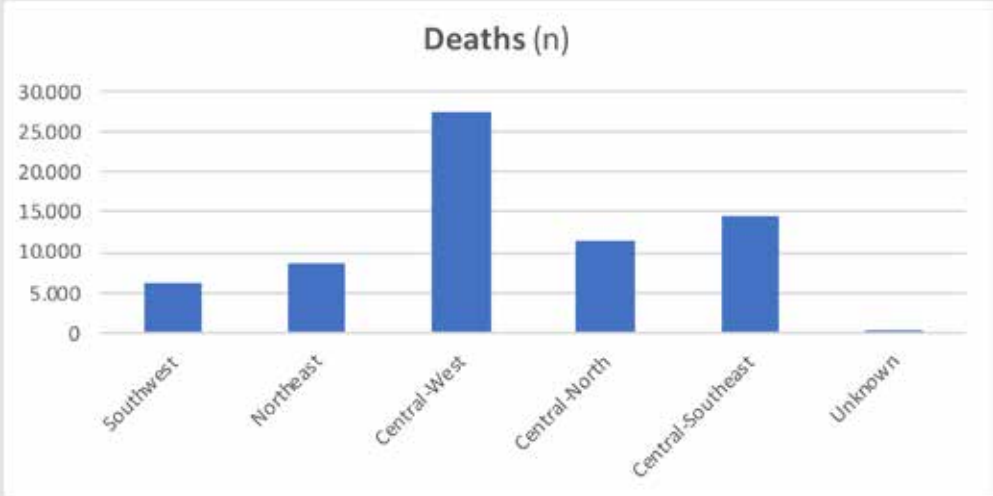

Figure 2: Distribution of cancer-related deaths in the state of Goiás according to Health Macroregion, 2015–2024.
Fonte: Mortality Information System (SIM/DATASUS). Prepared by the authors.

The most frequent neoplasm groups according to Chapter II of the ICD-10 (Neoplasms) were those involving the digestive organs (30.6%), respiratory and intrathoracic organs (16.0%), breast (7.9%), male genital organs (7.8%), female genital organs (7.1%), and the lymphatic and hematopoietic tissues (7.2%). This profile is consistent with the national pattern of cancer mortality, although percentage variations exist among the different anatomical groups.

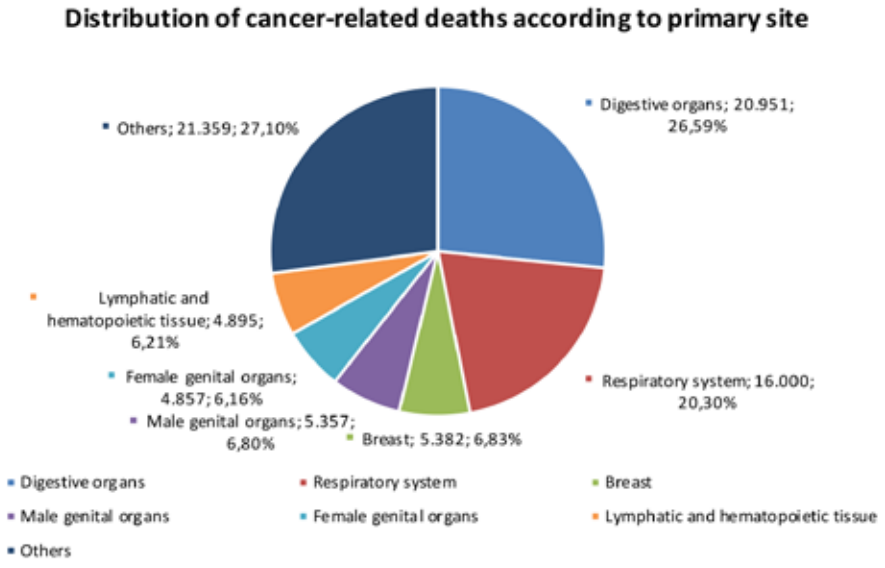

Figure 3: Proportional distribution of cancer-related deaths in the state of Goiás according to Chapter II groups of ICD-10 (Neoplasms), 2015–2024.
Fonte: Mortality Information System (SIM/DATASUS).

Note: Only groups accounting for ≥5% of total deaths were presented individually; the remaining groups were combined into the "Others" category (malignant neoplasms of the lip, oral cavity, and pharynx; respiratory and intrathoracic organs; bone and articular cartilage; skin [melanoma and other malignant neoplasms]; mesothelial and soft tissues; urinary tract; eye, brain, and central nervous system; thyroid and other endocrine glands; and neoplasms of ill-defined sites, multiple primary sites, in situ neoplasms, benign neoplasms, and neoplasms of uncertain or unknown behavior).

The distribution of deaths by age group demonstrated a strong association with aging, with a marked concentration beginning at 50 years of age. The highest proportions were observed among individuals aged 60–69 years (24.69%) and 70–79 years (24.44%), followed by those aged 80 years or older (18.88%), indicating that more than two-thirds of all deaths occurred in individuals aged 60 years and older.

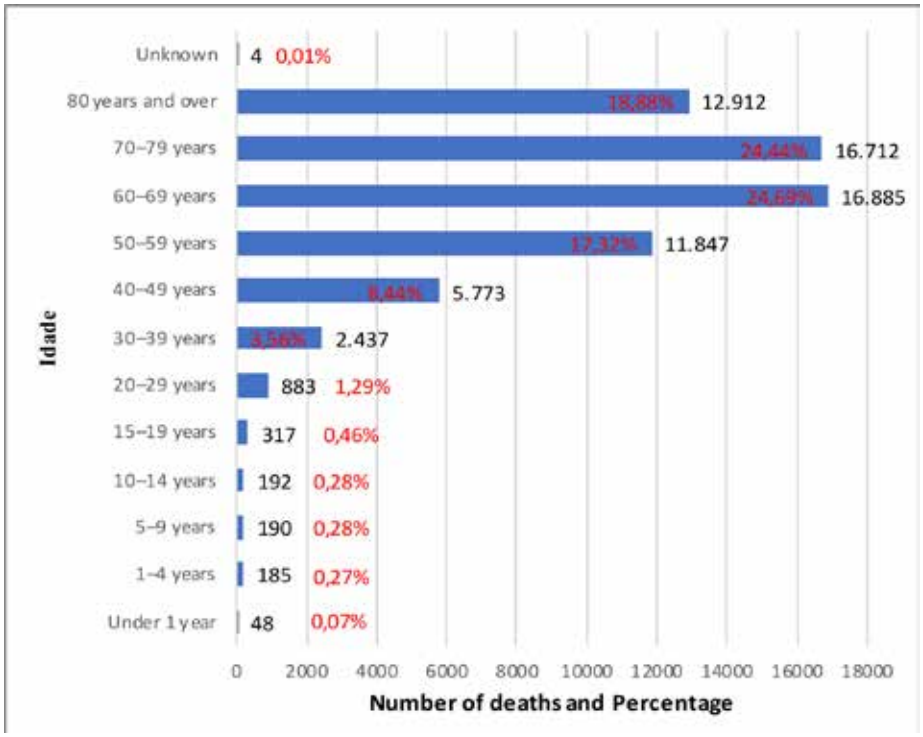

Figure 4: Distribution of cancer-related deaths in the state of Goiás according to age group, 2015–2024.
Fonte: Mortality Information System (SIM/DATASUS). Prepared by the authors.

Variation in the leading causes of death was observed according to age group. Among individuals aged 0 to 14 years, malignant neoplasms predominated, with a smaller contribution from thyroid neoplasms and neoplasms of uncertain behavior. In the 15–39-year age group, malignant neoplasms remained the most frequent cause, followed by cancers of the female genital organs and breast cancer. Among individuals aged 40–59 years, in addition to malignant neoplasms, cancers of the digestive organs and respiratory system were particularly prominent. In those aged 60 years and older, the greatest

burden of mortality was observed, mainly due to malignant neoplasms and cancers of the digestive and respiratory organs, highlighting the increasing complexity and disease burden associated with advancing age.

Table 1: Deaths by place of residence according to Chapter II groups of ICD-10 (Neoplasms) and grouped age categories, Goiás, 2015–2024.

ICD-10 Group	Male, n (%)	Female, n (%)	Unknow n, n	Total, n (%)
Total	36,283 (53.1)	32,087 (46.9)	15	68,385 (100.0)
Malignant neoplasms	35,816 (52.3)	31,628 (46.2)	15	67,459 (98.6)
Malignant neoplasms of specified sites	31,457 (46.0)	28,140 (41.1)	14	59,611 (87.2)
Malignant neoplasms of the lip, oral cavity, and pharynx	2,026 (3.0)	522 (0.8)	–	2,548 (3.7)
Malignant neoplasms of the digestive organs	12,029 (17.6)	8,916 (13.0)	6	20,951 (30.6)
Malignant neoplasms of the respiratory and intrathoracic organs	6,507 (9.5)	4,430 (6.5)	4	10,941 (16.0)
Malignant neoplasms of bone and articular cartilage	429 (0.6)	286 (0.4)	–	715 (1.0)

Melanoma and other malignant neoplasms of the skin	810 (1.2)	625 (0.9)	–	1,435 (2.1)
Malignant neoplasms of mesothelial and soft tissues	476 (0.7)	484 (0.7)	2	962 (1.4)
Malignant neoplasms of the breast	62 (0.1)	5,319 (7.8)	–	5,382 (7.9)
Malignant neoplasms of the female genital organs	–	4,857 (7.1)	–	4,857 (7.1)
Malignant neoplasms of the male genital organs	5,357 (7.8)	–	–	5,357 (7.8)
Malignant neoplasms of the urinary tract	1,703 (2.5)	886 (1.3)	–	2,589 (3.8)
Malignant neoplasms of the eye, brain, and other parts of the CNS	1,826 (2.7)	1,520 (2.2)	1	3,347 (4.9)
Malignant neoplasms of the thyroid and other endocrine glands	232 (0.3)	295 (0.4)	–	527 (0.8)
Ill-defined, secondary, and unspecified malignant neoplasms	1,581 (2.3)	1,354 (2.0)	–	2,935 (4.3)

Malignant neoplasms of lymphatic, hematopoietic, and related tissue	2,766 (4.0)	2,128 (3.1)	1	4,895 (7.2)
Multiple independent (primary) malignant neoplasms	12 (0.02)	6 (0.01)	–	18 (0.03)
In situ neoplasms	16 (0.02)	18 (0.03)	–	34 (0.05)
Benign neoplasms	103 (0.15)	153 (0.22)	–	256 (0.37)
Neoplasms of uncertain or unknown behavior	348 (0.5)	288 (0.4)	–	636 (0.9)

Source: Mortality Information System (SIM/DATASUS). Prepared by the authors.

Note: Percentages were calculated in relation to the total number of deaths due to neoplasms during the study period.

In the analysis by sex, a predominance of males was observed, accounting for 36,283 deaths (53.06%), compared with 32,087 deaths among females (46.92%). Among men, the leading causes of death were malignant neoplasms of the digestive organs (17.6%; n = 12,029), respiratory and intrathoracic organs (9.5%; n = 6,507), male genital organs (7.8%; n = 5,357), and lymphatic and hematopoietic tissue (4.0%; n = 2,766). Among women, the most prominent neoplasms were those of the breast (7.8%; n = 5,319), digestive organs (13.0%; n = 8,916), female genital organs (7.1%; n = 4,857), and respiratory and intrathoracic organs (6.5%; n = 4,430). In both sexes, relevant proportions of central nervous system neoplasms (4.9%), urinary tract neoplasms (3.8%), and ill-defined, secondary, or unspecified malignant neoplasms (4.3%) were also observed.

Table 2: Deaths by place of residence in the state of Goiás due to neoplasms, according to Chapter II groups of ICD-10 (Neoplasms) and sex, 2015–2024.

ICD-10 Group	Male, n (%)	Female, n (%)	Unknown, n	Total, n (%)
Total	36,283 (53.1)	32,087 (46.9)	15	68,385 (100.0)
Malignant neoplasms	35,816 (52.3)	31,628 (46.2)	15	67,459 (98.6)
Malignant neoplasms of specified sites	31,457 (46.0)	28,140 (41.1)	14	59,611 (87.2)
Malignant neoplasms of the lip, oral cavity, and pharynx	2,026 (3.0)	522 (0.8)	–	2,548 (3.7)
Malignant neoplasms of the digestive organs	12,029 (17.6)	8,916 (13.0)	6	20,951 (30.6)
Malignant neoplasms of the respiratory and intrathoracic organs	6,507 (9.5)	4,430 (6.5)	4	10,941 (16.0)
Malignant neoplasms of bone and articular cartilage	429 (0.6)	286 (0.4)	–	715 (1.0)
Melanoma and other malignant neoplasms of the skin	810 (1.2)	625 (0.9)	–	1,435 (2.1)
Malignant neoplasms of mesothelial and soft tissues	476 (0.7)	484 (0.7)	2	962 (1.4)

Malignant neoplasms of the breast	62 (0.1)	5,319 (7.8)	–	5,382 (7.9)
Malignant neoplasms of the female genital organs	–	4,857 (7.1)	–	4,857 (7.1)
Malignant neoplasms of the male genital organs	5,357 (7.8)	–	–	5,357 (7.8)
Malignant neoplasms of the urinary tract	1,703 (2.5)	886 (1.3)	–	2,589 (3.8)
Malignant neoplasms of the eye, brain, and other parts of the CNS	1,826 (2.7)	1,520 (2.2)	1	3,347 (4.9)
Malignant neoplasms of the thyroid and other endocrine glands	232 (0.3)	295 (0.4)	–	527 (0.8)
Ill-defined, secondary, and unspecified malignant neoplasms	1,581 (2.3)	1,354 (2.0)	–	2,935 (4.3)
Malignant neoplasms of lymphatic, hematopoietic, and related tissue	2,766 (4.0)	2,128 (3.1)	1	4,895 (7.2)
Multiple independent (primary) malignant neoplasms	12 (0.02)	6 (0.01)	–	18 (0.03)
In situ neoplasms	16 (0.02)	18 (0.03)	–	34 (0.05)
Benign neoplasms	103 (0.15)	153 (0.22)	–	256 (0.37)

Neoplasms of uncertain or unknown behavior	348 (0.5)	288 (0.4)	–	636 (0.9)

Mortality was associated with sociodemographic characteristics and place of occurrence. A higher proportion of deaths was observed among individuals with lower educational attainment, particularly those with 4–7 years of schooling (19.89%) and 1–3 years of schooling (18.92%), in addition to a high frequency of records with unknown educational level (21.62%). Regarding marital status, married individuals (39.32%) predominated, followed by single (19.05%) and widowed individuals (18.23%). Concerning race/ethnicity, White (45.46%) and Brown/Mixed-race individuals (43.15%) accounted for the majority of deaths. Most deaths occurred in hospital settings (77.89%), followed by home deaths (16.61%), highlighting the central role of the healthcare network in oncological care.

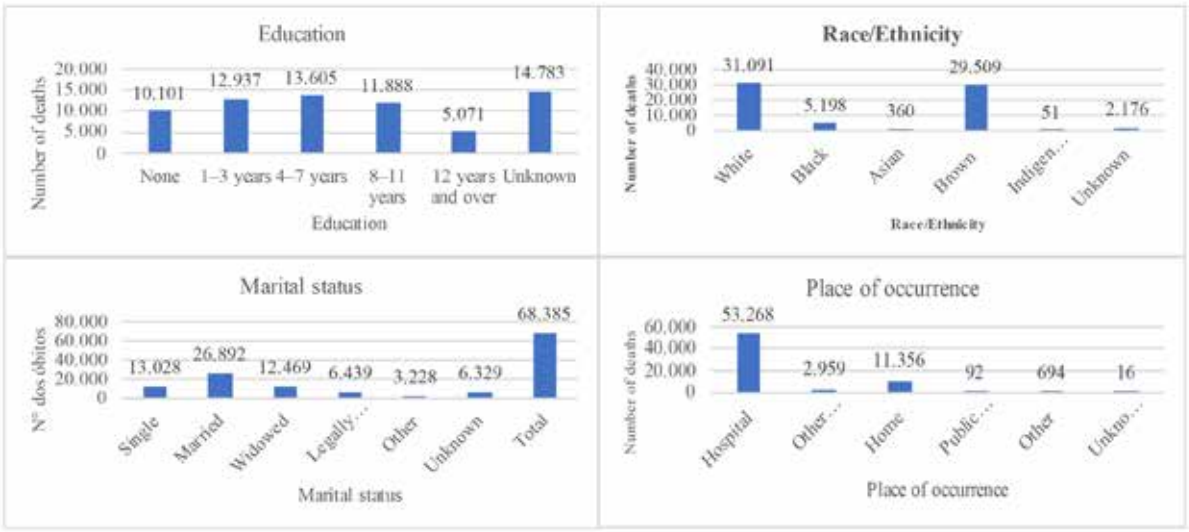

Figure 5: Distribution of cancer-related deaths according to sociodemographic characteristics and place of occurrence in the state of Goiás, 2015–2024.
Source: Mortality Information System (SIM/DATASUS). Prepared by the authors.

Note: Percentages were calculated in relation to the total number of deaths due to neoplasms during the study period.

DISCUSSION

In the present study, a substantial increase in the number of deaths due to neoplasms was observed over the analyzed period, rising from 5,956 records in 2015 to 7,755 in 2024,

corresponding to an approximate increase of 30%. This pattern reflects a sustained upward trend in cancer mortality, consistent with the growing global burden of the disease observed over recent decades. This local increase occurs within a broader context of epidemiological transition, in which, although countries with a high Human Development Index (HDI) account for the greatest absolute increase in cancer cases, low- and middle-HDI countries experience the largest proportional increases in incidence, estimated at 142% and 99%, respectively.[2]

The organization of the state of Goiás into health macroregions follows the principles of regionalization of the Brazilian Unified Health System (SUS), based on population, geographic, healthcare capacity, and patient-flow criteria. The greater concentration of cancer-related deaths in the Central-West, Central-Southeast, and Central-North macroregions, as well as in the most populous municipalities (Goiânia, Aparecida de Goiânia, and Anápolis), is consistent with the demographic distribution of the state, according to data from the Brazilian Institute of Geography and Statistics (IBGE). More populous and urbanized municipalities concentrate medium- and high-complexity healthcare services, which influences diagnosis, mortality reporting, and the centralization of deaths, reflecting both population dynamics and the organization of the healthcare network.[6,7,8,9]

In the Brazilian context, the literature points to regional heterogeneity in cancer mortality indicators. A study evaluating cancer mortality trends in Brazil between 1980 and 2006 identified higher mortality rates in inland regions compared with state capitals and did not observe a significant reduction in overall mortality during the study period.[10]

The distribution of cancer mortality according to the age group observed in this study is consistent with patterns reported in the literature. In the pediatric population, deaths due to malignant neoplasms predominated, in agreement with national studies indicating leukemia and central nervous system tumors as the leading causes of cancer-related death in children. However, due to the grouping structure of the data analyzed in this study, a specific comparative analysis of leukemia and central nervous system neoplasms was not possible.[11]

Among adolescents and young adults, the international literature describes a greater diversity of cancer types, with a progressive increase in incidence beginning in the third decade of life, particularly among women. Thyroid cancer, germ cell tumors, and melanoma are especially prominent, which is consistent with the greater contribution of gynecological and breast cancers observed in this study.[12]

From middle age onward, and particularly among older adults, the greatest burden of cancer mortality is concentrated in neoplasms of the digestive and respiratory systems, which are associated with cumulative exposure to risk factors and population aging. Despite the high incidence of cancer in this age group, mortality is influenced by competing causes of death, highlighting the complexity of the epidemiological profile of cancer throughout the life course.[13]

When comparing the data observed in Goiás with the national cancer mortality profile, a similar pattern was identified between sexes, although differences were noted in the relative frequency of neoplasm types. Among men, neoplasms of the digestive organs (17.6%) and respiratory and intrathoracic organs (9.5%) were important causes of death, consistent with the Brazilian scenario, in which prostate cancer (13.5%) and cancers of the trachea, bronchi, and lungs (13.2%) rank among the most prevalent. Among women, a closer resemblance to the national profile was observed, with breast cancer accounting

for 7.8% of deaths in Goiás, compared with 16.4% nationally, followed by cancers of the trachea, bronchi, and lungs (11.7%) and colorectal cancers (9.6%). The differences observed between state and national percentages may reflect regional disparities related to access to healthcare services, coverage of screening strategies, early diagnosis, and sociodemographic characteristics of the population, all of which are recognized determinants of cancer mortality patterns in Brazil.[14]

The higher proportion of deaths observed among individuals with lower educational attainment reflects a pattern widely described in the Brazilian literature, in which lower educational levels are associated with poorer socioeconomic conditions, greater exposure to risk factors, delayed diagnosis, and reduced timely access to healthcare services. Regarding marital status, the predominance of deaths among married individuals has also been reported in national investigations and is frequently interpreted as a reflection of the higher proportion of married individuals in older age groups, where the burden of cancer mortality is greatest. Concerning race/ethnicity, the predominance of White and Brown individuals mirrors the demographic composition of the state of Goiás. The high proportion of deaths occurring in hospital settings is similar to findings reported in other Brazilian studies and reinforces the central role of hospital-based care in oncology, particularly during advanced stages of disease. Recent investigations emphasize that although hospital deaths are associated with greater availability of specialized services, they may also indicate limitations in the expansion of palliative and home-based care in the country. Therefore, the findings of this study are consistent with the epidemiological profile of cancer mortality described in Brazil and highlight the influence of social determinants and healthcare network organization on oncological outcomes.[9,15,16]

REFERENCES

1. Brown JS, Amend SR, Austin RH, Gatenby RA, Hammarlund EU, Pienta KJ. Updating the definition of cancer. Mol Cancer Res. 2023 Nov 1;21(11):1142-7.

2. Bray F, Laversanne M, Sung H, Ferlay J, Siegel RL, Soerjomataram I, Jemal A. Global cancer statistics 2022: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. CA Cancer J Clin. 2024 May-Jun;74(3):229-263.

3. Brasil. Ministério da Saúde. Instituto Nacional de Câncer José Alencar Gomes da Silva. ABC do câncer: abordagens básicas para o controle do câncer. Rio de Janeiro: INCA; 2011.
4. Instituto Nacional de Câncer José Alencar Gomes da Silva. Causas e prevenção do câncer [Internet]. Rio de Janeiro: INCA; 2025 [citado 2025 dez 29]. Disponível em: gov.br/inca

5. Sung H, Ferlay J, Siegel RL, Laversanne M, Soerjomataram I, Jemal A, Bray F. Global Cancer Statistics 2020: GLOBOCAN Estimates of Incidence and Mortality Worldwide for 36 Cancers in 185 Countries. CA Cancer J Clin. 2021 May;71(3):209-249.

6. Goiás. Secretaria de Estado da Saúde. Plano Diretor de Regionalização da Saúde do Estado de Goiás. Goiânia: Secretaria de Estado da Saúde de Goiás; 2011.

7. Brasil. Ministério da Saúde. Região de Saúde e Redes de Atenção à Saúde. Brasília: Ministério da Saúde; 2010.

8. Instituto Brasileiro de Geografia e Estatística. Estimativas da população residente nos municípios brasileiros com data de referência em 1º de julho de 2024. Rio de Janeiro: IBGE; 2024.

9. Silva GA, Gamarra CJ, Girianelli VR, Valente JG. Tendência da mortalidade por câncer nas capitais e interior do Brasil entre 1980 e 2006. Rev Saude Publica. 2011 Dec;45(6):1009-18.

10. Spironello RA, Silva-Comar FM, Cardia GFE, Janeiro V, Pedroso RB, Cuman RJN. Mortalidade infantil por câncer no Brasil. Saude Pesqui. 2019 Nov;13(1):115-22.

11. Miller KD, Fidler-Benaoudia M, Keegan TH, Hipp HS, Jemal A, Siegel RL. Cancer statistics for adolescents and young adults, 2020. CA Cancer J Clin. 2020;70(1):1-17.

12. Evans CJ, Ho Y, Daveson BA, Hall S, Higginson IJ, Gao W. Place and cause of death in centenarians: a population-based observational study in England, 2001 to 2010. PLoS Med. 2014 Jun 3;11(6):e1001653.

13. Aguilar LB, Gomes CV, Lima Neto GS, Montenegro LHF, Oliveira JCS, Galvão ND, Melanda FN, Aves MR, Souza BSN. Tendência da mortalidade por câncer e principais tipos segundo macrorregiões do estado de Mato Grosso, 2000 a 2015. Rev Bras Epidemiol. 2022;25 Suppl 1:e220004. doi:10.1590/1980-549720220004.supl.1.1.

14. Instituto Nacional de Câncer José Alencar Gomes da Silva. Estatísticas de câncer: mortalidade conforme a localização primária do tumor e sexo. Rio de Janeiro: INCA, 2022. Disponível em: INCA – Estatísticas de Câncer. Acesso em: xx maio 2026.

15. Instituto Nacional de Câncer José Alencar Gomes da Silva. Atlas de Mortalidade por Câncer no Brasil. Rio de Janeiro: INCA; 2023.

16. Gomes B, Calanzani N, Curiale V, McCrone P, Higginson IJ. Effectiveness and cost-effectiveness of home palliative care services for adults with advanced illness and their caregivers. Cochrane Database Syst Rev. 2013;(6):CD007760. doi:10.1002/14651858.CD007760.pub2.

MAILING ADDRESS

EDUARDO RIBEIRO SENE
UFJ - Campus Jatobá (Cidade Universitária José Cruciano de Araújo)
BR 364 km 195 - Setor Parque Industrial, Jataí/GO
E-mail: edrsene@gmail.com

EDITORIAL AND REVIEW

Received: 06/04/26. Accepted: 16/04/26. Published in: 08/06/2026.