

Temporal and Geographical Overview of Cancer Mortality in Alagoas (2001-2022): The Urgency of Care Decentralization

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Panorama Temporal e Geográfico da Mortalidade por Câncer em Alagoas (2001-2022): A Urgência da Descentralização do Cuidado

Panorama Temporal y Geográfico de la Mortalidad por Cáncer en Alagoas (2001-2022): La Urgencia de la Descentralización de la Atención

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ABSTRACT

Introduction: Cancer is the second leading cause of death worldwide. Understanding its temporal and spatial distribution can support public policies and resource allocation. **Objective:** To describe the temporal trend and territorial distribution of cancer mortality in Alagoas between 2001 and 2022. **Method:** Epidemiological study using mortality data (ICD-10 C00–C97). Residents aged 19 to 99 years, with valid sex and municipality information, were included. Population data was obtained from DATASUS. Crude mortality rates (CMR) per 1,000 inhabitants were calculated. Trends were assessed by segmented log-linear regression, and spatial analyses and stratifications by Health Region were conducted in Python. **Results:** A total of 39,611 deaths were recorded (48.3% men). The CMR increased from 32,8 to 77,7/100,000 inhabitants, with an average annual change of +3.6%, between 2006 and 2022. Among men, prostate cancer was the leading cause (3,126 deaths; +5.8%/year), while among women breast cancer (2,989; +6.5%/year) and cervical cancer (2,031; +4.4%/year) predominated. The mean age at death was 63.9 years, with 25% occurring before the age of 54. 27.1% of the deaths occurred outside the municipality of residence, indicating centralized care. In 2020, there was a 0.7% decline, attributed to underreporting during the pandemic period, followed by recovery. **Conclusion:** Cancer mortality in Alagoas is increasing steadily, characterized by premature deaths, geographic concentration, and care displacement. Decentralizing the oncology network, expanding screening for preventable tumors, and strengthening home palliative care are priority actions to reduce mortality.

Key words: Neoplasms/mortality; Mortality; Spatial Analysis; Temporal Distribution.

RESUMO

Introdução: O câncer é a segunda principal causa de óbito global. Compreender a sua distribuição temporal e espacial pode subsidiar políticas públicas e alocação de recursos de maneira adequada. **Objetivo:** Descrever a tendência temporal e a distribuição territorial da mortalidade por câncer em Alagoas entre 2001 e 2022. **Método:** Estudo epidemiológico, realizado com dados de mortalidade (CID-10: C00–C97). Incluíram-se residentes de 19 a 99 anos, com sexo e município válidos. As populações foram obtidas no DATASUS. Calcularam-se taxas brutas de mortalidade por 100 mil habitantes. As tendências foram avaliadas por regressão segmentada log-linear, e as análises espaciais e estratificações por Região de Saúde foram conduzidas em Python. **Resultados:** Foram registrados 39.611 óbitos. A taxa de mortalidade aumentou de 32,8 para 77,7/100 mil habitantes, com variação anual média de +3,6% entre 2006 e 2022. Entre os homens, o câncer de próstata foi a principal causa (3.126 óbitos; +5,8%/ano), enquanto entre as mulheres predominaram mama (2.989; +6,5%/ano) e colo do útero (2.031; +4,4%/ano). A idade média ao óbito foi de 63,9 anos, sendo que 25% ocorreram antes dos 54 anos. Um total de 27,1% dos óbitos ocorreu fora do município de residência, revelando centralização assistencial. Em 2020, houve queda de 0,7%, atribuída à subnotificação durante o período pandêmico, seguida de retomada. **Conclusão:** A mortalidade por câncer em Alagoas cresce de forma sustentada, marcada por mortes prematuras, concentração geográfica e deslocamentos assistenciais. Descentralizar a rede oncológica, ampliar o rastreamento de tumores evitáveis e fortalecer os cuidados paliativos domiciliares são ações prioritárias para reduzir a mortalidade.

Palavras-chave: Neoplasias/mortalidade; Mortalidade; Análise Espacial; Distribuição Temporal.

RESUMEN

Introducción: El cáncer es la segunda causa principal de muerte a nivel mundial, y comprender su distribución temporal y espacial puede respaldar las políticas públicas y la asignación de recursos de manera adecuada. **Objetivo:** Describir la tendencia temporal y la distribución territorial de la mortalidad por cáncer en Alagoas entre 2001 y 2022. **Método:** Estudio epidemiológico, realizado con datos de mortalidad (CIE-10 C00–C97). Se incluyeron residentes de 19 a 99 años, con sexo y municipio válidos. Las poblaciones se obtuvieron del DATASUS. Se calcularon tasas brutas de mortalidad (TBM) por cada 100 000 habitantes. Las tendencias se evaluaron mediante regresión segmentada log-lineal, y los análisis espaciales y estratificaciones por Región de Salud se realizaron en Python. **Resultados:** Se registraron 39 611 defunciones (48,3% hombres). La TBM aumentó de 32,8 a 77,7 por cada 100 000 habitantes, con un cambio anual promedio de +3,6% desde 2009 a 2022. Entre los hombres, el cáncer de próstata fue la principal causa (3126 muertes; +5,8%/año), mientras que entre las mujeres predominaron mama (2989; +6,5%/año) y cuello uterino (2031; +4,4%/año). La edad media al fallecimiento fue de 63,9 años, y el 25% ocurrió antes de los 54 años. Casi la mitad de las muertes se concentraron en la 1ª Región de Salud (Maceió), y el 27,1% ocurrió fuera del municipio de residencia, lo que indica centralización asistencial. En 2020 hubo una disminución del 0,7%, atribuida al subregistro durante el período pandémico, seguida de recuperación. **Conclusión:** La mortalidad por cáncer en Alagoas aumenta de manera sostenida, caracterizada por muertes prematuras, concentración geográfica y desplazamientos asistenciales. Descentralizar la red oncológica, ampliar el tamizaje de tumores evitables y fortalecer los cuidados paliativos domiciliarios son acciones prioritarias para reducir la mortalidad.

Palabras clave: Neoplasias/mortalidad; Mortalidad; Análisis Espacial; Distribución Temporal.

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INTRODUCTION

Cancer constitutes the second leading cause of death worldwide. Projections indicate an expressive growth of the disease burden, mainly in low- and middle-income countries¹. In Brazil, according to the National Cancer Institute (INCA), 781 thousand new cases are estimated per year during the 2026-2028 triennium, revealing striking regional inequalities in both incidence and mortality^{2,3}.

Malignant lung, breast, prostate, colon, and rectum neoplasms figure among the main causes of death, reflecting the growing burden of chronic non-communicable diseases (NCDs) in the process of Brazilian epidemiological transition³. Despite advances in diagnosis and treatment, unequal access to oncological services remains a challenge, especially in regions such as the North and Northeast, where screening coverage and hospital infrastructure are scarce^{4,5}. Additionally, the interpretation of recent mortality time series requires caution, since the COVID-19 pandemic could have influenced the collection, recording, and consolidation of deaths in the health information systems.

Alagoas sits in that context. Understanding the temporal and spatial distribution of cancer mortality in the State is key to guiding equitable resource allocation, monitoring the impact of public policies, and identifying areas of greater vulnerability.

METHOD

Descriptive epidemiological study that analyzed mortality from malignant neoplasms according to the International Classification of Diseases and Related Health Problems (ICD-10)⁶ codes: C00-C97, of inhabitants of the State of Alagoas, from January 1st, 2001, to December 31st, 2022. The microdata from the Mortality Information System⁷ (SIM) were obtained in May 2024 through the *Plataforma de Ciência de Dados aplicada à Saúde* (PCDaS), a mirrored repository from SIM/Department of Informatics of the National Health System (DATASUS), and exported in CSV format. The annual reference populations were extracted from TABNET⁸/DATASUS and used in the crude mortality rates calculation (CMR).

Records of patients aged 19-99 years, with valid sex information (male or female), and an identified municipality of residence were included. Records with absent or inconsistent data in those categories were excluded. The analyzed variables included: sex, age at death, age group, municipality and Region of residence, location where the death occurred, and basic cause of

death. For the temporal analysis, the annual CMRs were calculated, and log-linear segmented regression was applied (Joinpoint model), estimating annual percentage changes (APC) and respective 95% confidence intervals (95% CI). Continuous data was presented as means and standard deviations (SD).

The spatial analysis was conducted by municipality of residence and aggregated to the ten Health Regions of Alagoas, enabling the team to assess the geographic concentration of deaths and identify assistance displacements, defined as when the municipality of occurrence is different from the municipality of residence. When interpreting the findings, data from the SIM referring to the pandemic period, especially 2020, were considered possibly influenced by delayed registration, under-notification, or fluctuations in information quality. All the steps of data cleaning, processing, and analysis were conducted in the Google Colab⁹ (Python 3.11) environment, using the Pandas, NumPy, Matplotlib, and Seaborn libraries.

This study did not require analysis by a Research Ethics Committee, since it is exclusively based on secondary data, with no identification of individuals in compliance with the National Health Council Resolution N. 466/12¹⁰ and N. 510/16¹¹.

RESULTS

During the analyzed period, 39,611 deaths from malignant neoplasms were registered among residents of the State of Alagoas, of which 20,492 (51.7%) were in women and 19,118 (48.3%) in men. Cancer CMR presented a sustained growth throughout the period, going from 0.33 deaths per thousand inhabitants in 2001 to 0.78 in 2022, which represents a relative increase of 137% (Figure 1). Trend analysis indicated two points of inflection: 2004/2005 and 2008/2009. Between 2001 and 2004, APC was +4.0% (95% CI: 1.2–7.0); between 2005 and 2008, it remained stable (+0.2%/year; 95% CI: –3.4–3.9); and, from 2009 to 2022, regained significant growth (+3.6%/year; 95% CI: 3.3–4.0). In 2020, there was a singular reduction of 0.7% in relation to 2019, followed by a resumption in the subsequent years.

Regarding distribution by sex and type of neoplasm, there was a predominance of digestive organ cancers for both sexes. Among men, prostate (3,126 deaths; +5.8%/year), lung (2,185; +4.4%/year), and stomach neoplasms (1,359; +4.6%/year) stood out. Among women, breast cancer (2,989; +6.5%/year), cervical cancer (2,031; +4.4%/year), and lung cancer (2,001; +6.5%/year) predominated. These numbers can be viewed in the heat maps (Figures 2 and 3).

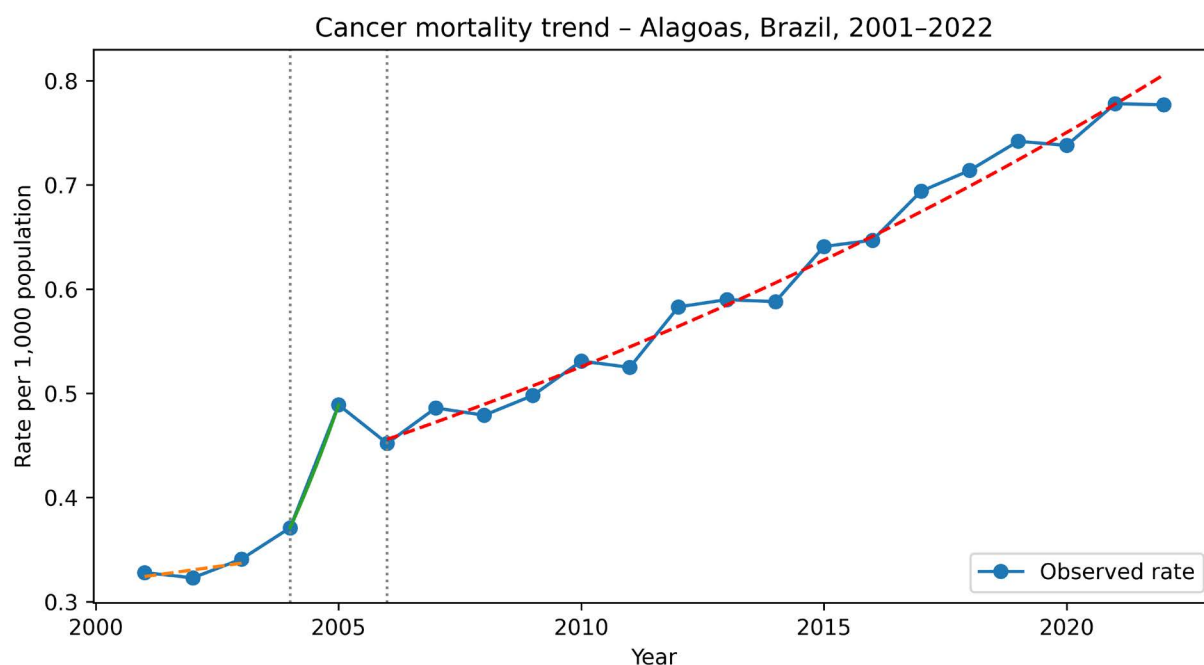


Figure 1. Cancer mortality trend (per 100 thousand inhabitants) in Alagoas between 2001 and 2022. Alagoas, 2025

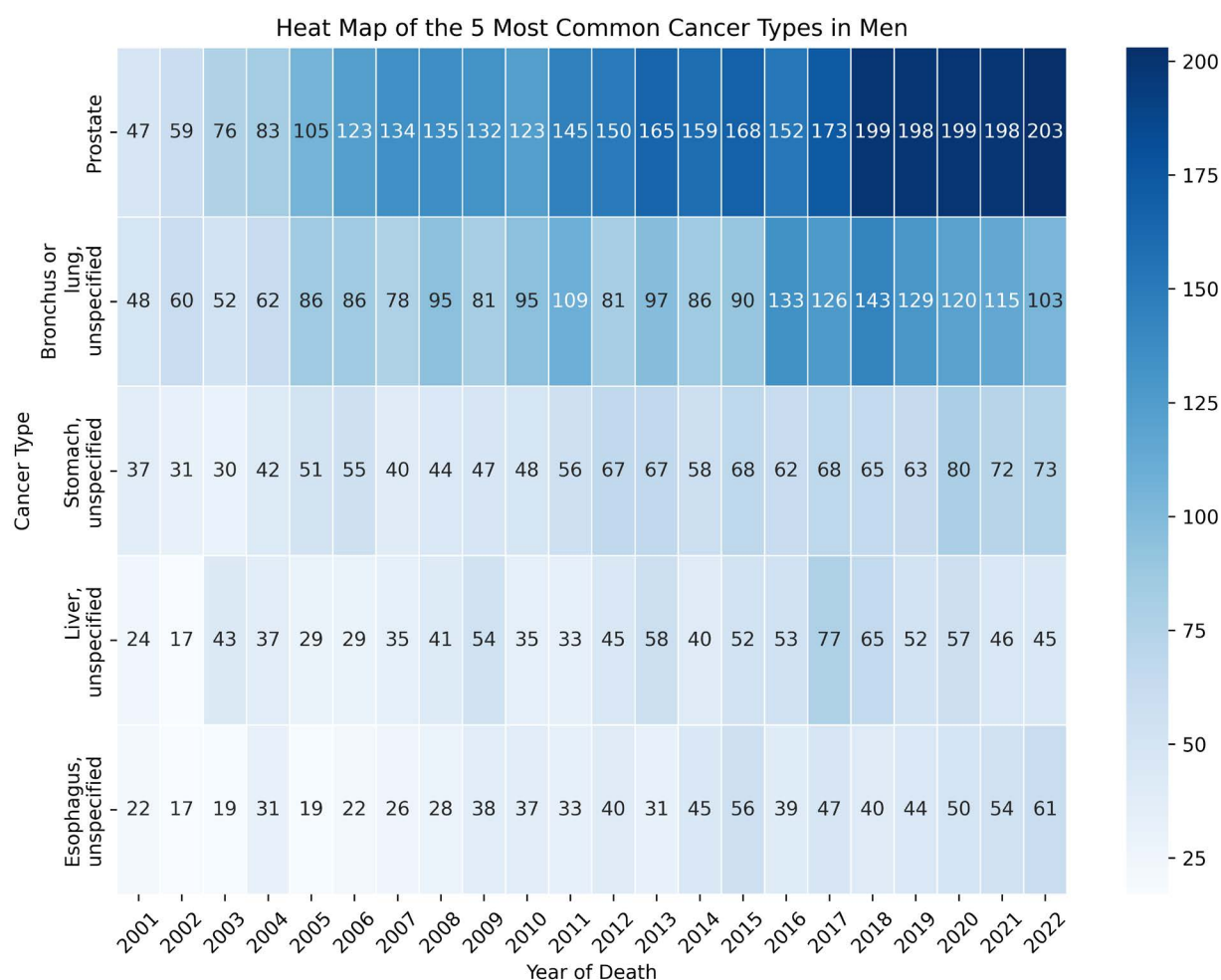


Figure 2. Heat map of cancer death distribution (five most common types) in males from 2001 to 2022. Alagoas, 2025



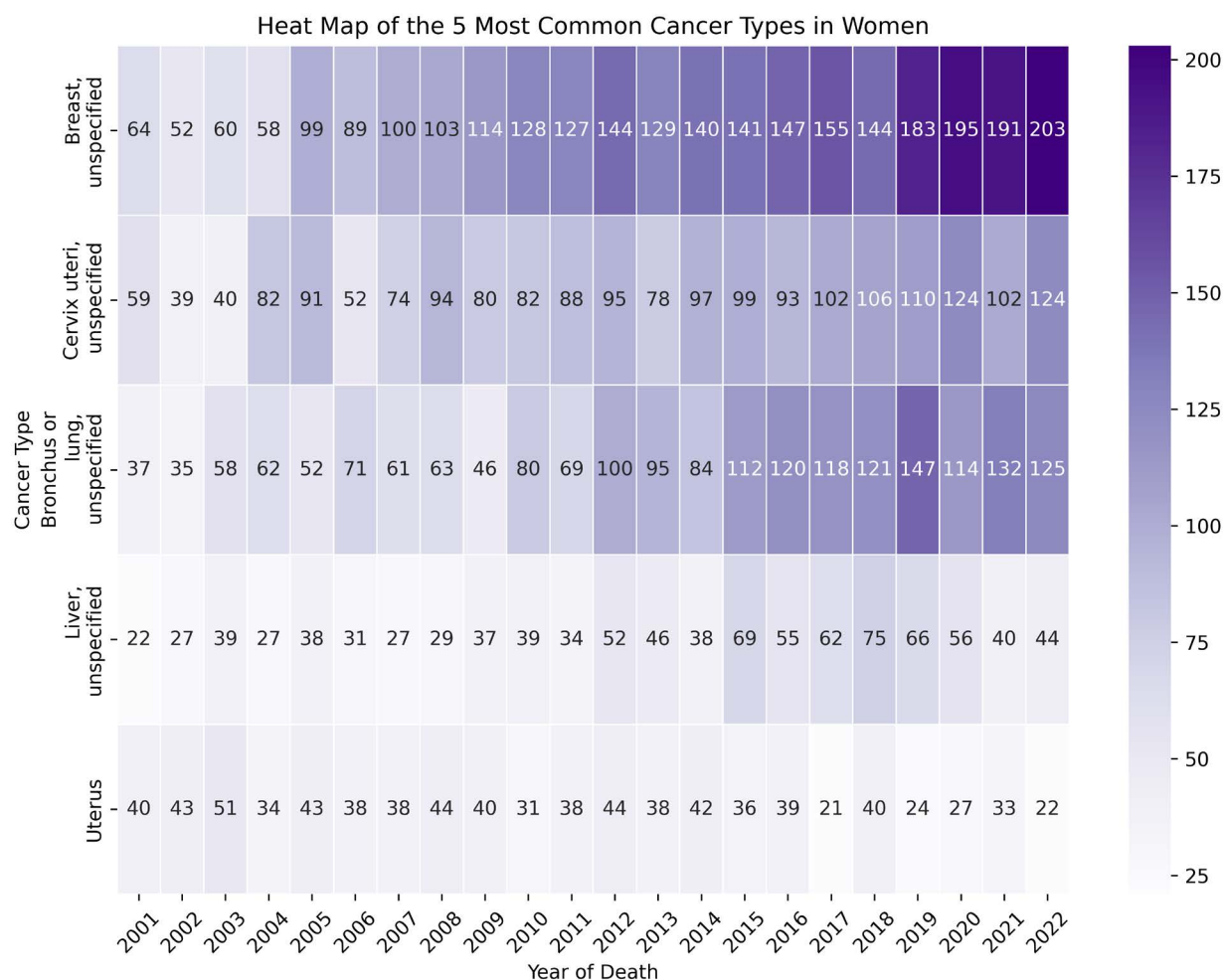


Figure 3. Heat map of cancer death distribution (five most common types) in females from 2001 to 2022. Alagoas, 2025

The mean age of death was 63.9 years (SD=15.7), with a median of 65 years. Approximately 25% of deaths occurred before 54 years and 75% up to 76 years, indicating a high mortality burden in productive age groups. Deaths from prostate cancer occurred at more advanced ages (76.3 years), while deaths related to liver malignant neoplasms represent the highest mean age among women (66.0 years). Early mortality was more evident in cervical and stomach cancer, with a considerable number of deaths occurring before age 50. The graph presented in Figure 4 details the age group distribution.

Spatial analysis showed a strong concentration of deaths in the 1st Health Region, which includes Maceió and adjacent municipalities, with 19,008 deaths per residence (48.0%) and 23,992 per incident (62.5%). The 7th Region (Arapiraca) ranked second, with 5,214 deaths per residence (13.2%). Regions with lower care density presented greater death percentages outside the municipality of residence, indicating displacement in search of oncological care, especially in the 2nd (59.7%), 3rd (49.4%), and 4th Regions (52.9%).

Additionally, the analysis of cancer deaths per Health Region highlighted relevant patterns. In the 1st Sanitary Region, there was a higher frequency of deaths from lung/bronchus cancer (C34.9), breast, unspecified (C50.9), and prostate (C61). In the 7th Sanitary Region, deaths from lung/bronchi cancer (C34.9), prostate cancer (C61), and breast cancer, unspecified (C50.9) also predominated. In the Regions with higher displacement percentages, especially the 2nd, 3rd, and 4th Sanitary Regions, deaths from lung/bronchus cancer and prostate cancer stood out, in addition to cervical cancer in the 3rd and 4th Regions.

In total, 10,749 deaths (27.1%) occurred outside their original municipality. Small municipalities, such as Satuba (73.9%), Paripueira (72.4%), and Novo Lino (71.4%), presented the greatest displacement proportions. In contrast, Maceió had the lowest rate (1.7%), confirming its leading role as the State's oncology care center. Most deaths were observed to have occurred in the hospital environment.

Finally, Figure 5 presents the most common deadly cancer types by municipality of residence in Alagoas.

There was a predominance of deaths related to prostate and lung cancer.

DISCUSSION

Cancer mortality in Alagoas between 2001 and 2022 followed an upward trend, with the crude mortality rate going from 0.33 to 0.78 per thousand inhabitants. This growth follows a global pattern, despite the State's particularities, following the epidemiological transition to an increased burden of chronic diseases, as presented in recent estimations by the Global Cancer Statistics (Globocan)^{1,2}. The data also reflects the strengthening of oncological surveillance after the implementation of the National Policy of Oncological Care (PNAO)¹² in 2005, later updated by the current National Cancer Prevention and Control Policy (PNPCC)¹³, instituted in 2013 and updated in 2023, in addition to the Action Plan for Cervix and Breast Cancers Control, in 2007¹⁴. However, challenges in primary investigation and early diagnosis persist.

In the profile by sex, mortality from digestive tract neoplasms was the most prevalent in both sexes, while prostate cancer, breast cancer, and cervical cancer remain the main causes of death in men and women, respectively. Tumors that can be screened or detected in early stages,

like prostate, breast, and especially cervix, showed a critical gap in screening and early diagnosis programs in the State, a challenge that has already been documented in other contexts of the Brazilian Northeast Region^{5,15}. The analysis highlights that liver cancer, probably associated with the high prevalence of chronic viral hepatitis in the population of Alagoas, is a well-established risk factor. This correlation is backed by global evidence, which attributes a major part of the global burden of liver cancer to viral infections by hepatitis B and C viruses¹⁶. This finding underscores the urgent need for integrating oncological control policies into viral hepatitis surveillance and treatment programs in the State.

An alarming finding of this study is that 25% of the deaths occurred before the age of 54, confirming the growing burden of cancer in young adults. These results are in line with the global trend, as described by Zhao et al.¹⁷, of a significant increase in cancer incidence and early mortality. The increase in cervical cancer and stomach cancer prevalence in young adults reinforces the need to broaden surveillance and incorporate new strategies that cater to other age groups. Additionally, improving the investigation of risk factors, such as inadequate eating habits, smoking, obesity, and occupational exposures, is essential to developing prevention strategies for young adults.

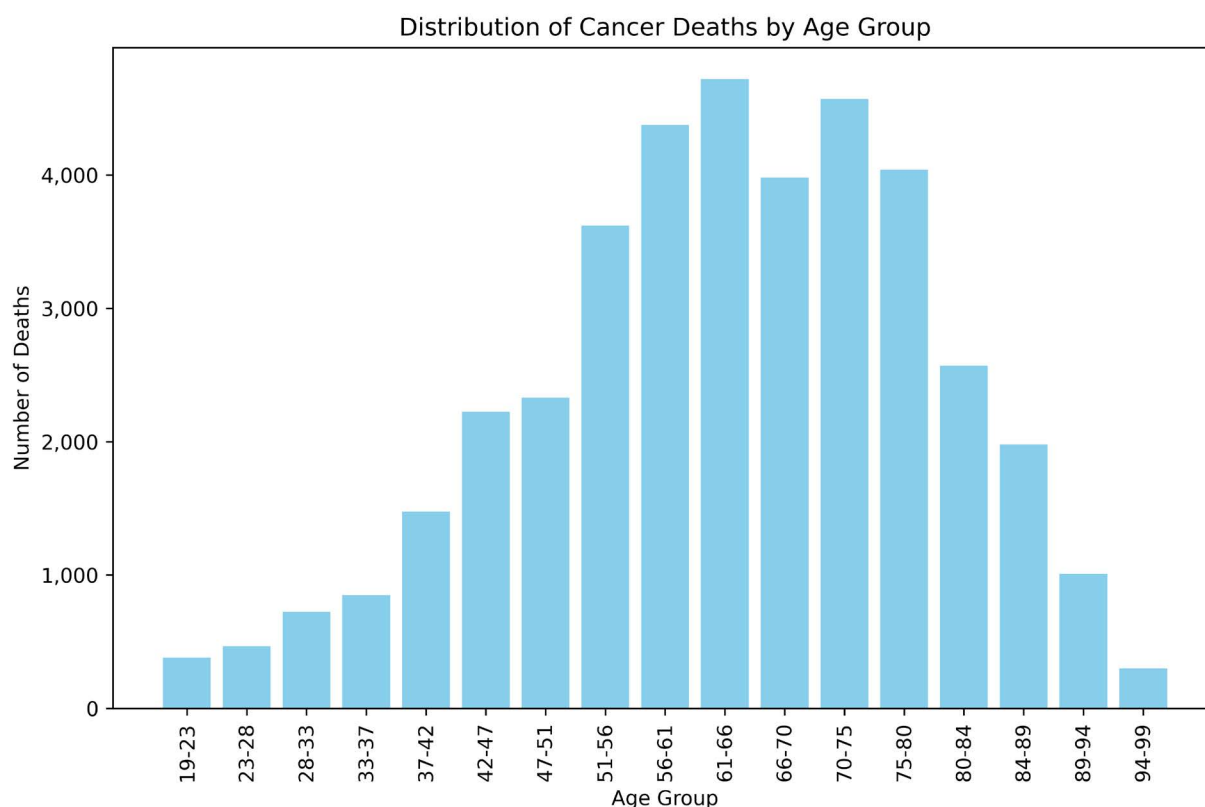


Figure 4. Distribution of cancer deaths by age group (2001-2022). Alagoas, 2025



Most Common Cancer Types by Municipality

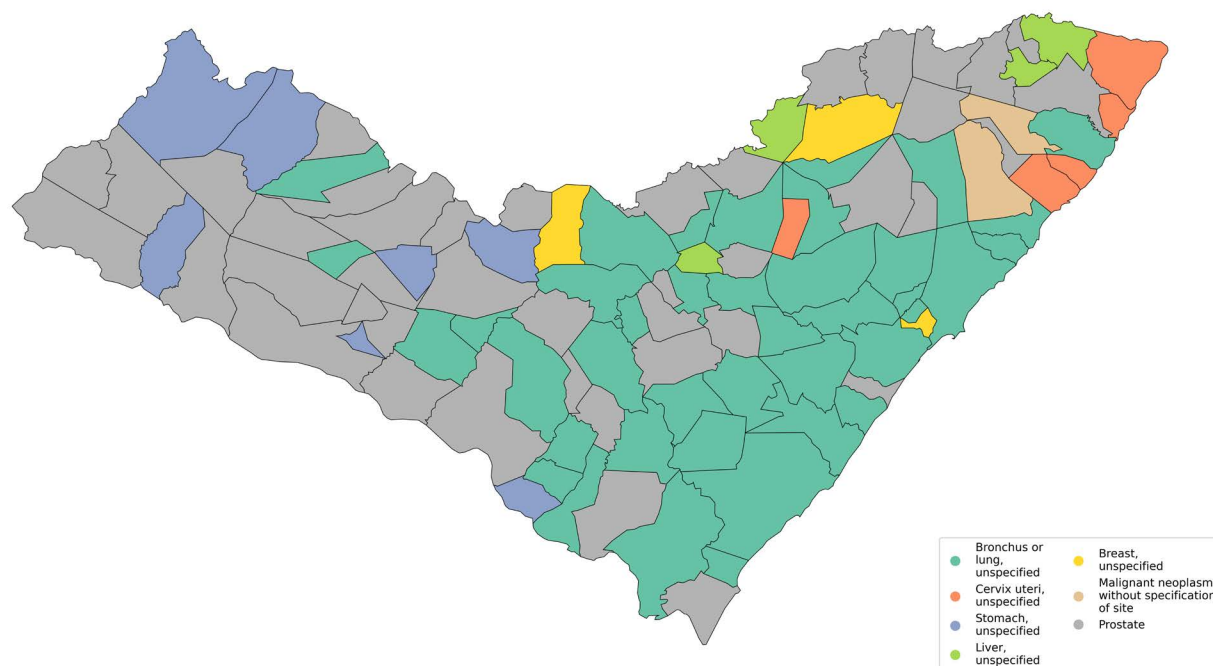


Figure 5. Geographic distribution of cancer type with most prevalent deaths in the municipality of residence (2001-2022). Alagoas, 2025

The discrete downward trend in data collection in 2020, followed by an immediate resumption, must be interpreted with caution: more than an actual reduction, it is a strong indication of under-recording and diagnosis retention during the COVID-19 pandemic, a consistently observed pattern in several epidemiological contexts during the period. In the study by Maringe et al.¹⁸, the results suggest that even brief interruptions in oncological services can lead to a significant increase in mortality in the following years. In the Northeast, there was a drop in exams and oncological hospitalizations, as reported by Monteiro et al.¹⁹. This transitory effect in the results from the present study suggests that delays in diagnosis and treatment during the pandemic period are still unfolding in the State's mortality data.

The spatial analysis revealed a striking centralization of deaths, aggravated by inequity in access to healthcare services. The concentration of records in the Metropolitan Region of Maceió, along with the prevalence of 27% of deaths outside the municipality of residence, indicates a migratory flow in search of specialized care and reinforces the social impacts already described in the national context⁴. The centralization of services is a common characteristic in low- and middle-income countries, where access to more specialized treatments is frequently limited to the capitals^{20,21}. Even intermediate hubs showed partial dependency on the capital, evidencing the need to strengthen oncological regionalization. These access barriers

not only delay diagnosis and treatment, aggravating prognosis, but also increase social disparities, making cancer a more adverse experience for people residing in the countryside.

The high frequency of deaths in the hospital environment, observed in the study, is a significant marker not only of service centralization but also of the scarcity of an active home palliative care network in the State. End-of-life hospitalization, often inevitable due to the lack of alternative support, creates a double overload for families: emotional, for depriving patients of a familiar comfort in their final moments, and financial, with additional costs for displacement and staying in another city. This reality is in line with evidence that shows how the integration of palliative care, preferably in the home environment, is associated with a better quality of life at the end-of-life and can reduce the burden on healthcare systems²². Therefore, the findings reinforce that, in parallel with the decentralization of curative oncological assistance, it is a priority to expand and strengthen home palliative care. This measure, integrated with the strengthening of screening and promotion of vaccination against preventable cancers, such as human papillomavirus (HPV) and hepatitis B, makes an essential and more human strategy to reduce early and avoidable deaths in the State.

Results point to an imperative need for targeted, evidence-based interventions. The high mortality rate from cervical cancer, a widely preventable

neoplasm, is a critical indicator of failure in screening. Systematic reviews in similar contexts demonstrate that implementing organized strategies with HPV testing in basic healthcare is crucial to reducing its impact²³. In parallel, to cope with the geographic barrier, a simple physical decentralization of services needs to be complemented with technological innovations. Telemedicine has emerged as a vital tool to expand access to specialists, enabling screening consultations, second opinions, and follow-up at a distance, as detailed in the review by Mostafaei et al.²⁴. However, we recommend a hybrid model that combines strengthening regional hubs with telehealth network integrations, focusing simultaneously on intensifying screening for preventable cancers and on the early diagnosis of tumors associated with the highest rates of premature mortality in the state.

Although this study provides an encompassing panorama of cancer mortality in Alagoas, some limitations must be considered. The descriptive and ecological nature of the analysis does not allow us to infer direct causal relations between the findings. Moreover, reliance on secondary SIM data is subject to variations in register quality and the accuracy of basic cause-of-death coding, including under-notification, especially in less structured municipalities. The option of using crude mortality rate, although valid to describe the burden of the disease in the population, does not include age adjustment or age standardization. Finally, the lack of detailed clinical data, such as tumoral staging at diagnosis and treatment modalities received, limits understanding of pathways that lead to investigative outcomes.

CONCLUSION

This study's findings draw a concerning scenario for oncology. Cancer mortality not only grows steadily, but unequally and prematurely, taking away lives at productive ages and disproportionately overloading countryside populations, forced to migrate in search of healthcare. The profile of deaths, dominated by neoplasms with a high potential for prevention or early detection, like cervical and breast cancers, signals critical failures in primary care and screening programs. Given this scenario, it is no longer postponable to transition from a centralized, curative model to an integrated, regionalized system of oncological care. Prioritizing investments in prevention, early diagnosis, home-based palliative care, and decentralization of the specialized care network represents the essential path to reversing this trajectory and mitigating the inequities that characterize the fight against cancer in the state.

CONTRIBUTIONS

All the authors have substantially contributed to the study design, data acquisition, analysis, and interpretation, wording, and critical review. They approved the final version for publication.

DECLARATION OF CONFLICT OF INTERESTS

There is no conflict of interest to declare.

DATA AVAILABILITY STATEMENT

Data available from SIM. The codes used in the analysis must be requested to the corresponding author.

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REFERENCES

1. Bray F, Laversanne M, Sung H, et al. Global cancer statistics 2022. *CA Cancer J Clin*. 2024;74(3): 229-63. doi: <https://doi.org/10.3322/caac.21834>
2. Ferlay J, Laversanne M, Ervik M, et al. Cancer incidence and mortality worldwide: GLOBOCAN 2022. *Int J Cancer*. 2024;154(4):586-99. doi: <https://doi.org/10.3322/caac.21834>
3. Instituto Nacional de Câncer. Estimativa 2026: incidência de câncer no Brasil [Internet]. Rio de Janeiro: INCA; 2026 [acesso em 28 jul. 2026]. Disponível em: <https://ninho.inca.gov.br/jspui/handle/123456789/17914>
4. Carlos CALV, Teixeira KM. Impactos do TFD em pacientes oncológicos: deslocamento, dinâmica familiar e redes de apoio. *Serv Soc Soc*. 2025;148(1):e-6628437. doi: <https://doi.org/10.1590/0101-6628.437>
5. Barros LO, Bezerra IC, Batista RFL, et al. Mortalidade por câncer de mama: tendência no Ceará, Nordeste e Brasil, 2005-2015. *Rev Bras Cancerol*. 2020;66(1):e-14740. <https://doi.org/10.32635/2176-9745.RBC.2020v66n1.740>
6. Organização Mundial da Saúde. CID-10: Classificação Estatística Internacional de Doenças e problemas relacionados à saúde. São Paulo: Edusp; 2008.
7. SIM: Sistema de Informação sobre Mortalidade [Internet]. Versão 3.2.1.2. Brasília (DF): DATASUS. [data desconhecida] - [acesso 2025 dez 14]. Disponível em: <http://sim.saude.gov.br/default.asp>



8. TABNET [Internet]. Brasília (DF): DATASUS. c2008 – [acesso 2020 maio 28]. Disponível em: <https://datasus.saude.gov.br/informacoes-de-saude-tabnet/>
9. Google. Google Colaboratory [Internet]. Mountain View (CA): Google LLC; 2025 [acesso 2026 jul 28]. Disponível em: <https://colab.research.google.com/>
10. Conselho Nacional de Saúde (BR). Resolução nº 466, de 12 de dezembro de 2012. Aprova diretrizes e normas regulamentadoras de pesquisas envolvendo seres humanos. Diário Oficial da União. Brasília, DF. 2013 jun 13; Edição 112; Seção 1:59.
11. Conselho Nacional de Saúde (BR). Resolução nº 510, de 7 de abril de 2016. Dispõe sobre as normas aplicáveis a pesquisas em Ciências Humanas e Sociais. Diário Oficial da União. Brasília, DF. 2016 maio 24; Edição 98; Seção 1:44-46.
12. Ministério da Saúde (BR). Portaria nº 2.439/GM, de 8 de dezembro de 2005. Institui a Política Nacional de Atenção Oncológica: Promoção, Prevenção, Diagnóstico, Tratamento, Reabilitação e Cuidados Paliativos, a ser implantada em todas as unidades federadas, respeitadas as competências das três esferas de gestão [Internet]. Diário Oficial da União, Brasília, DF. 2005 dez 9; Seção 1:80-1. [acesso 2026 ago 4]. Disponível em: https://bvsms.saude.gov.br/bvs/saudelegis/gm/2005/prt2439_08_12_2005.html
13. Ministério da Saúde (BR). Gabinete do Ministro. Portaria nº 874, de 16 de maio de 2013. Institui a Política Nacional para a Prevenção e Controle do Câncer na Rede de Atenção à Saúde das Pessoas com Doenças Crônicas no âmbito do Sistema Único de Saúde (SUS). Diário Oficial da União. Brasília, DF. 2013 maio 17; Edição 94; Seção 1:129-32.
14. Silva FA, Trindade ES, Santiago BG, et al. Políticas públicas de saúde para o enfrentamento do câncer no Brasil: análise dos planos estaduais de atenção oncológica. Rev Bras Cancerol. 2024;70(1):e144454. doi: <https://doi.org/10.32635/2176-9745.RBC.2024v70n1.4454>
15. Berlatto KC, Vogt ET, Peixer IM, et al. Mortalidade por neoplasias malignas dos órgãos digestivos no Brasil (2018-2023): análise epidemiológica e quantificação. Rev CPAQV. 2025;17(1):12. doi: <https://doi.org/10.36692/V17N1-05>
16. Sheena BS, Hiebert L, Han H, et al. Global, regional, and national burden of hepatitis B, 1990–2019: a systematic analysis for the Global Burden of Disease Study 2019. Lancet Gastroenterol Hepatol. 2022;7(9):796-829. doi: [https://doi.org/10.1016/S2468-1253\(22\)00124-8](https://doi.org/10.1016/S2468-1253(22)00124-8)
17. Zhao J, Xu L, Sun J, et al. Global trends in incidence, death, burden and risk factors of early-onset cancer from 1990 to 2019. BMJ Oncol. 2023;2:e000049. doi: <https://doi.org/10.1136/bmjonc-2023-000049>
18. Maringe C, Spicer J, Morris M, et al. The impact of the COVID-19 pandemic on cancer deaths due to delays in diagnosis in England, UK: a national, population-based, modelling study. Lancet Oncol. 2020;21(8):1023-34. doi: [https://doi.org/10.1016/S1470-2045\(20\)30388-0](https://doi.org/10.1016/S1470-2045(20)30388-0)
19. Monteiro MCC, Pantoja REL, Miranda ALA, et al. Impactos da pandemia de COVID-19 no diagnóstico, atendimento e mortalidade de pacientes oncológicos no Brasil: revisão de literatura. RSD. 2021;10(13):e350101321235. doi: <https://doi.org/10.33448/rsd-v10i13.21235>
20. Wawrzuta D, Klejdysz J, Pędzwiatr K, et al. Global access to radiotherapy: a geospatial analysis of current disparities and optimal facility placement. Radiother Oncol. 2025;211:111061. doi: <https://doi.org/10.1016/j.radonc.2025.111061>
21. Grover S, Xu MJ, Yeager A, et al. A systematic review of radiotherapy capacity in low- and middle-income countries. Front Oncol. 2015;4:380. doi: <https://doi.org/10.3389/fonc.2014.00380>
22. Bamodu OA, Tzeng DTW, Kuo KT, et al. Cancer care disparities: overcoming barriers to cancer control in low- and middle-income countries. JCO Glob Oncol. 2024;10:e2300439. doi: <https://doi.org/10.1200/GO.23.00439>
23. Casas CPR, Albuquerque RCR, Loureiro RB, et al. Cervical cancer screening in low- and middle-income countries: a systematic review of economic evaluation studies. Clinics (Sao Paulo). 2022;77:100080. doi: <https://doi.org/10.1016/j.clinsp.2022.100080>
24. Mostafaei A, Sadeghi-Ghyassi F, Kabiri N, et al. Experiences of patients and providers while using telemedicine in cancer care during COVID-19 pandemic: a systematic review and meta-synthesis of qualitative literature. Support Care Cancer. 2022;30(12):10483-94. <https://doi.org/10.1007/s00520-022-07415-6>

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