PUBLICAÇÃO OFICIAL DO NÚCLEO HOSPITALAR DE EPIDEMIOLOGIA DO HOSPITAL SANTA CRUZ E PROGRAMA DE PÓS GRADUAÇÃO EM PROMOÇÃO DA SAÚDE - DEPARTAMENTO DE BIOLOGIA E FARMÁCIA DA UNISC

ISSN 2238-3360

Revista de Epidemiologia e Controle de Infecção

Original Article

Sociodemographic profile of mortality from acute myeloid leukemia in the regions of Brazil: an ecological study

Perfil sociodemográfico da mortalidade por leucemia mieloide aguda nas regiões do Brasil: um estudo ecológico

Perfil sociodemográfico de la mortalidad por leucemia mieloide aguda en las regiones de Brasil: un estudio ecológico

Site doi: https://doi.org/10.17058/reci.v16i.20616

Submitted: 08/26/2025
Accepted: 01/04/2026
Available online: 03/13/2026

Corresponding author:
E-mail: caroline.carraro@hotmail.com
Address: Padre Luiz Gonzaga Jaeger Street, Cristo Rei, São Leopoldo, Rio Grande do Sul, Brazil.

Caroline Carraro[1]
Mariana Salmoria Ceron[2]
Raquel Aparecida Bertola Rodrigues Rêgo[3]
Daniely Sampaio Arruda Tavares[4]

[1]University of Vale do Rio dos Sinos (Unisinos), São Leopoldo, Rio Grande do Sul, Brazil.
[2]University of the Catarinense Plateau (Uniplac), Lages, Santa Catarina, Brazil.
[3]Federal University of Pelotas, Pelotas, Rio Grande do Sul, Brazil.
[4]Federal University of Ceará (UFC), Fortaleza, Ceará, Brazil.

ABSTRACT

Background and Objectives: Acute myeloid leukemia (AML), although a rare neoplasm, is the most common and aggressive type of the disease in adults. To date, no studies have analyzed the profile of acute myeloid leukemia in the general population across the entire Brazilian territory for the proposed period. This study aimed to analyze the epidemiological profile of AML in the five regions of Brazil between 2014 and 2023. **Methods:** This is an ecological study based on the Mortality Information System (SIM) available in DATASUS. Deaths for which the underlying cause was classified as acute myeloid leukemia were selected across the Brazilian regions for the period from 2014 to 2023. The variables included were age group, sex, race, year of death, and educational level. After data collection, the information was organized in an Excel spreadsheet, and descriptive statistics were performed. **Results:** A total of 33,596 deaths were recorded during the period, with a predominance in the Southeast Region (47.7%) and a progressive increase in deaths, peaking in 2023. Higher mortality was observed among men (52.5%), white individuals (61%), those aged 70 to 79 years (21.1%), and individuals with 8 to 11 years of schooling (23.9%). **Conclusion:** Thus, the importance of this research is highlighted in guiding effective public policies for the most affected populations and regions, with the aim of reducing mortality through early therapy and the optimization of healthcare resources.

Keywords: *Leukemia myeloid acute. Mortality. Health profile.*

RESUMO

Justificativa e Objetivos: A leucemia mieloide aguda (LMA), apesar de ser uma neoplasia rara, é o tipo mais comum e agressivo da doença em adultos. Até o momento, não há estudos que analisem o perfil da leucemia mieloide aguda na população geral em todo o território brasileiro no período proposto. Este estudo teve como objetivo analisar o perfil epidemiológico da LMA nas cinco regiões do Brasil entre 2014 e 2023. **Métodos:** Trata-se de um estudo ecológico, com base no Sistema de Informações sobre Mortalidade (SIM) disponível no DATASUS. Foi realizada a seleção dos óbitos cuja causa básica foi classificada como leucemia mieloide aguda entre as regiões brasileiras no período de 2014 a 2023. As variáveis incluídas foram: faixa etária, sexo, raça, ano do óbito e escolaridade. Após a coleta dos dados as informações foram organizadas em uma planilha Excel e realizada estatística descritiva. **Resultados:** Foram registrados 33.596 óbitos no período, com predomínio na Região Sudeste (47,7%) e aumento progressivo de mortes, atingindo o pico em 2023. Observou-se maior mortalidade entre homens (52,5%), indivíduos brancos (61%), com idade entre 70 e 79 anos (21,1%) e escolaridade de 8 a 11 anos (23,9%). **Conclusão:** Logo, evidencia-se a importância desta pesquisa para direcionar políticas públicas eficazes para as populações e regiões mais afetadas, com o intuito de reduzir a mortalidade por meio da terapia precoce e otimização dos recursos de saúde.

Descritores: *Leucemia mieloide aguda. Mortalidade. Perfil epidemiológico.*

RESUMEN

Justificación y Objetivos: La leucemia mieloide aguda (LMA), a pesar de ser una neoplasia rara, es el tipo más común y agresivo de la enfermedad en adultos. Hasta la fecha, no existen estudios que analicen el perfil de la leucemia mieloide aguda en la población general en todo Brasil durante el período propuesto. Este estudio tuvo como objetivo analizar el perfil epidemiológico de la LMA en las cinco regiones de Brasil entre 2014 y 2023. **Método:** Este es un estudio ecológico basado en el Sistema de Información de Mortalidad (SIM) disponible en DATASUS. Se seleccionaron las muertes cuya causa se clasificó como leucemia mieloide aguda entre las regiones brasileñas de 2014 a 2023. Las variables incluidas fueron: grupo de edad, sexo, raza, año de muerte y nivel de educación. Después de la recolección de datos, la información se organizó en una hoja de cálculo de Excel y se realizó estadística descriptiva. **Resultados:** Se registraron 33.596 fallecimientos durante el período, con predominio en la región Sudeste (47,7%) y un aumento progresivo de fallecimientos, con pico en 2023. Se observó mayor mortalidad en hombres (52,5%), personas de raza blanca (61%), con edades comprendidas entre 70 y 79 años (21,1%) y con 8 a 11 años de estudios (23,9%). **Conclusión:** Por lo tanto, la importancia de esta investigación es evidente para la formulación de políticas públicas eficaces para las poblaciones y regiones más afectadas, con el objetivo de reducir la mortalidad mediante la terapia temprana y la optimización de los recursos sanitarios.

Palabras Clave: *Leucemia mieloide aguda. Mortalidad. Perfil epidemiológico.*

INTRODUCTION

Cancer is one of the leading causes of global mortality, with incidence and death rates continuously rising, reflecting a serious public health problem on a worldwide scale.[1] Acute myeloid leukemia (AML) is a hematologic malignancy characterized by a disruption of myeloid differentiation and the malignant clonal expansion of immature myeloblasts. It is the most prevalent subtype of leukemia in adults, accounting for approximately 80% of cases worldwide. The disease has an aggressive clinical course and high lethality, being responsible for approximately 62% of deaths related to leukemia. The incidence is strongly associated with population aging, ranging from 1.3 cases per 100,000 individuals under 65 years of age to 12.2 cases per 100,000 among individuals above this age group.[2,3] The early identification of cytogenetic and molecular abnormalities constitutes a fundamental element for better tailoring of therapy for patients.[4]

The disease shows a steadily increasing annual incidence worldwide, with a predominance in males. Epidemiological studies show that gains in overall survival have been more consistent in women and in patients aged 50 to 75 years, whereas individuals over 75 years have experienced minimal or no improvement over the past decades. When left untreated, AML is invariably fatal. Although therapeutic advances have increased survival rates, complications associated with the disease, such as bone marrow failure and recurrent infections, still result in an unfavorable prognosis.[2,3]

According to the National Cancer Institute, approximately 11,540 new cases are estimated to occur in the country during the 2023 to 2025 triennium. Regarding mortality, leukemia deaths accounted for 3.1% of all cancer deaths in 2017, ranking it as the eighth most lethal type of malignant neoplasm.[5] Data from the Oncology Observatory indicate that, between 2008 and 2017, approximately 63,000 leukemia-related deaths were recorded in Brazil, of which around 36% were due to AML.[6]

To date, there are no studies analyzing the profile of AML in the general population across the entire Brazilian territory for the period from 2014 to 2023. Thus, the importance of more in-depth investigations into the factors associated with AML mortality in Brazil is emphasized, taking into account regional, structural, and healthcare-related aspects that may influence clinical outcomes through early diagnoses and appropriate treatments.

In light of this, the objective of this study is to analyze the epidemiological profile of AML in the five regions of Brazil between 2014 and 2023. Understanding these aspects allows for the identification of regional patterns and supports the development of oncology care strategies.

METHODS

This is an ecological study, utilizing secondary data from the Department of Informatics of the Unified Health System (DATASUS). The time frame covers the period from 2014 to 2023, encompassing the five geographic regions of Brazil.

Mortality information was obtained from the Mortality Information System (SIM) by selecting deaths for which the underlying cause was classified as AML, according to the International Classification of Diseases – 10th revision (ICD-10: C92.0), accessed in July 2025.

The inclusion criteria for the analysis of AML deaths in the five Brazilian regions were: age range from under 1 year to 80 years and older, sex (male and female), race (White, Mixed (Pardo), Black, Indigenous, and Yellow), year of death from 2014 to 2023, and education level (none, 1–3 years, 4–7 years, 8–11 years, and 12 years or more). Cases were excluded if the underlying cause of death was not acute myeloid leukemia, if the death occurred outside the national territory, or if duplicate records were identified.

The data were organized into spreadsheets and subjected to descriptive statistical analysis. Absolute and relative frequencies of deaths from acute myeloid leukemia were calculated according to sex, age group, race/ethnicity, education level, year of death, and geographic region. An analysis of the temporal distribution of deaths from 2014 to 2023 was conducted, as well as a spatial analysis according to the Brazilian regions. Additionally, stratified analyses were performed between the sociodemographic and temporal variables. The results were presented using tables and graphs. Inferential analyses were not performed due to the descriptive nature of the study.

As this research involved secondary, publicly available data without identification of subjects, the study was conducted in accordance with the required ethical standards, as established by Ministry of Health Resolutions 466/2012, 510/2016, and 580/2018.

RESULTS

Between 2014 and 2023, 33,596 deaths from AML were recorded in Brazil. The regional distribution showed a predominance in the Southeast Region, with 16,034 deaths (47.7% of the total). This was followed by the Northeast Region with 7,205 deaths (21.4%), the South Region with 6,061 deaths (18.0%), the Central-West Region with 2,513 deaths (7.5%), and the North Region with 1,783 deaths (5.3%).

The highest annual number of deaths was observed in 2023, with 3,834 cases, representing an increase of

6.4% compared to 2022. In the comparison between 2019 and 2021, a decrease in the number of deaths was observed from 2019 to 2020, followed by a subsequent increase in 2021. The lowest number of deaths during the period occurred in 2014, with 2,953 cases recorded. From that year onward, an increase in the number of deaths was observed in 2015 and 2016, followed by a decrease in 2017 and a subsequent rise in 2018 (Figure 1).

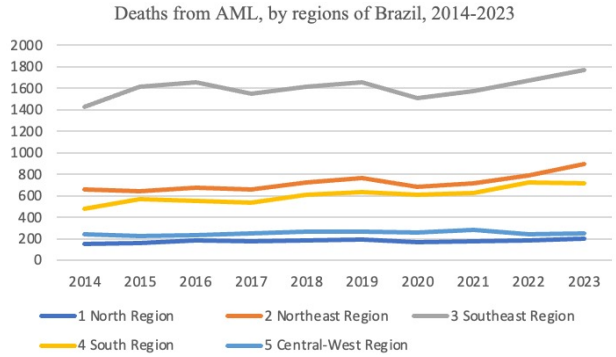

Figure 1. Time series and trend of AML deaths by Brazilian region, 2014–2023.

A predominance of deaths was observed in males compared to females. Regarding race/ethnicity, the highest proportion of deaths occurred among individuals classified as White, followed by Mixed (Pardo), while the Indigenous and Yellow categories accounted for a minimal share of the total records.

Regarding age group, deaths were concentrated primarily among older age groups, with the highest frequency in individuals aged 60 and above, especially in the 70–79 years group. In contrast, the lowest proportions were observed among children, particularly those under five years of age.

Regarding education level, a higher concentration of deaths was observed among individuals with intermediate education, particularly those with 8 to 11 years of schooling, while the lowest percentages occurred among people with 12 or more years of education and among those with no schooling (Table 1).

Table 1. Distribution of AML deaths according to sociodemographic characteristics and regions of Brazil, 2014–2023.

Variables	North N (%)	Northeast N (%)	Southeast N (%)	South N (%)	Central-West N (%)
Sex					
Male	977 (54.79)	3738 (51.88)	8379 (52.26)	3212 (52.99)	1335 (53.12)
Female	806 (45.20)	3466 (48.11)	7655 (47.74)	2849 (47.01)	1178 (46.88)
Ignored	0 (0.00)	1 (0.01)	0 (0.00)	0 (0.00)	0 (0.00)
Age Group					
<1ano	18 (1.0)	28 (0.39)	34 (0.21)	15 (0.25)	14 (0.56)
1-4	66 (3.70)	153 (2.12)	202 (1.26)	64 (1.06)	47 (1.87)
5-9	57 (3.19)	149 (2.07)	151 (0.94)	52 (0.86)	47 (1.87)
10-14	66 (3.70)	195 (2.71)	241 (1.50)	61 (1.01)	48 (1.91)
15-19	84 (4.71)	221 (3.07)	314 (1.96)	92 (1.52)	53 (2.11)
20-29	155 (8.69)	531 (7.37)	784 (4.89)	284 (4.69)	152 (6.05)
30-39	166 (9.31)	640 (8.88)	1079 (6.73)	380 (6.27)	214 (8.52)
40-49	212 (11.89)	690 (9.58)	1382 (8.62)	522 (8.61)	258 (10.27)
50-59	206 (11.55)	954 (13.24)	2060 (12.85)	796 (13.13)	334 (13.29)
60-69	315 (17.66)	1202 (16.68)	3231 (20.15)	1291 (21.30)	481 (19.14)
70-79	268 (15.03)	1337 (18.56)	3572 (22.28)	1430 (23.59)	490 (19.50)
80 and older	170 (953)	1104 (15.32)	2983 (18.60)	1074 (17.72)	375 (14.92)
Ignored	0 (0.00)	1 (0.01)	1 (0.01)	0 (0.00)	0 (0.00)
Race					
White	469 (26.30)	2345 (32.55)	11049(68.91)	5347 (88.22)	1286 (51.17)
Black	84 (4.71)	512 (7.11)	1031 (6.43)	162 (2.67)	127 (5.05)
Yellow	9 (0.50)	22 (0.31)	141 (0.88)	21 (0.35)	13 (0.52)
Mixed	1154 (64.72)	4036 (56.02)	3326 (20.74)	413 (6.81)	1016 (40.43)
Indigenous	19 (1.06)	9 (0.12)	11 (0.07)	6 (0.10)	11 (0.44)
Ignored	48 (2.69)	281 (3.90)	476 (2.97)	112 (1.85)	60 (2.39)
Schooling					
None	205 (11.49)	910 (12.63)	744 (4.64)	299 (4.93)	208 (8.28)
1-3 years	342 (19.18)	1340 (18.60)	2778 (17.33)	1022 (16.86)	359 (14.29)
4-7 years	365 (20.47)	1255 (17.42)	3025 (18.87)	1593 (26.28)	492 (19.58)
8-11 years	442 (24.78)	1489 (20.67)	3990 (24.88)	1484 (24.48)	624 (24.83)
12 years or more	194 (10.88)	782 (10.85)	2645 (16.50)	756 (12.47)	399 (15.88)
Ignored	235 (13.18)	1429 (19.83)	2852 (17.79)	907 (14.96)	431 (17.15)

DISCUSSION

The study revealed that 33,596 AML cases resulted in death, with the majority occurring in 2023 in the Southeast Region. Male sex, the 70–79 age group, White race, and 8 to 11 years of schooling were the variables most frequently observed in the identified epidemiological profile.

The increase in deaths from acute myeloid leukemia over the study period is consistent with trends described in the international literature, which indicate high mortality associated with AML, especially in elderly populations, despite recent therapeutic advances.[1-3,11] In Brazil, the higher concentration of deaths in the Southeast Region may be related to greater population density and higher diagnostic capacity, while the lower proportions observed in the North and Central-West Regions suggest inequalities in access to healthcare services and possible underreporting, as described in national studies.[5,6,8-10] The temporary reduction in records between 2019 and 2020 is consistent with evidence indicating the impact of the COVID-19 pandemic on cancer diagnosis and reporting, including hematologic malignancies, reinforcing the influence of structural and healthcare-related factors on the observed mortality patterns.[7]

In 2020, the National Cancer Institute (INCA) recommended postponing screening tests, which resulted in an 84.2% reduction in the performance of these exams in May of that year, with priority given only to diagnostic investigation and treatment of positive or symptomatic cases. O atraso nos diagnósticos e tratamentos durante o período pandêmico pode ainda estar repercutindo na incidência e na mortalidade por câncer, o que possivelmente contribui para o aumento gradual dos óbitos registrados entre 2021 e 2023, com 3.384, 3.602 e 3.834 casos, respectivamente.[7]

The male predominance in deaths related to AML observed in this study is corroborated by the research conducted by Mantovani et al., which reported a similar proportion of 52.33%, and also by the study by Salvaro et al., which found a higher prevalence of the disease among male patients (51.88%).[8,9] With regard to race, the predominance of white individuals found in this research was also observed in the study by Salvaro et al., corresponding to 32.03% of the diagnosed cases.[9] Therefore, white male individuals may present higher mortality from AML, probably due to a higher incidence of the disease related to genetic and environmental factors, as well as a poorer prognosis when compared to females.[10] In this context, it is worth highlighting that, in both sexes, the average lifetime risk of developing AML is estimated to be around 0.5%.[11]

The distribution of deaths from AML according to educational level revealed a higher prevalence among individuals with 8 to 11 years of schooling (23.90%), while lower proportions were observed among those with no formal education (8.28%) or with 12 years or more of schooling (14.22%). According to Nielsen et al., patients with AML and a lower educational level had significantly worse survival, even after adjustments for age, sex, comorbidities, and clinical characteristics.[12] This difference was more evident in the first two years after diagnosis, suggesting that socioeconomic factors associated with educational level may influence access to, adherence to, and response to treatment for the disease.

Regarding age group, mortality from AML was higher among individuals aged 70 to 79 years (21.12%) and 60 to 69 years (19.40%), which is consistent with the study by Salvaro et al., which demonstrated that the incidence of deaths from AML increases progressively with advancing age.[9] Corroborating this finding, according to the American Cancer Society, AML is predominantly diagnosed in individuals with a mean age of approximately 69 years. [11]

Therefore, AML constitutes a serious public health problem in Brazil, with a rising trend in mortality over the period from 2014 to 2023.[5,6] The findings of this study reveal that deaths are concentrated primarily in the Southeast Region, especially in the year 2023, suggesting not only a higher disease burden in this area but also possible improvements in reporting and diagnostic capacity.[5,8] Higher mortality was observed among male individuals, white individuals, those aged 70 to 79 years, and those with 8 to 11 years of schooling.[8,10,12] These data outline a sociodemographic profile of the most vulnerable population, which can serve as a basis for more targeted strategies in prevention, early diagnosis, and oncology care.

In addition to the significant concentration of cases in the Southeast Region, relevant regional inequalities were observed, with lower absolute numbers in the North and Central-West regions, which may reflect differences in access to specialized hematology services, as well as variations in the surveillance and death registration systems among the states.[5,6,8-10] However, such results should be interpreted with caution, since these regions have significantly smaller populations when compared to the Southeast. This geographic pattern is consistent with national findings that highlight regional inequalities in onco-hematological care and underscores the need for public policies aimed at promoting equity in the diagnosis and treatment of acute myeloid leukemia across the country, especially in historically more vulnerable areas.[5,12]

This study has limitations inherent to the use of secondary data from health information systems, which are subject to incompleteness, underreporting, and inconsistencies in variable entries, potentially affecting the interpretation of the sociodemographic findings.[13, 14]

Furthermore, regional inequalities in the organization of the healthcare network and in health surveillance may impact the quality and coverage of records, especially in areas with limited access to specialized services.[14] As this is a cross-sectional and descriptive study, it is not possible to establish causal relationships, limiting the analysis of determinants associated with deaths from acute myeloid leukemia.[13]

Therefore, this study contributes to the understanding of the mortality landscape of AML in Brazil, providing valuable insights for healthcare managers and professionals. New research with a longitudinal approach, including clinical and genetic variables, is recommended to expand knowledge on prognostic factors and to inform public policies that promote equity and improve outcomes for this hematologic condition.

REFERENCES

1. Sung H, Ferlay J, Siegel RL, et al. Global cancer statistics 2020: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. CA Cancer J Clin. 2021;71(3):209-49. https://doi.org/10.3322/caac.21660.

2. Palmieri R, Candoni A, Di Raimondo F, et al. Navigating acute myeloid leukemia towards better outcomes: Treatment pathways and challenges for patients ineligible for intensive chemotherapy. Blood Reviews. 2025 Apr;101288. https://doi.org/10.1016/j.blre.2025.101288.

3. Pelcovits A, Niroula R. Acute myeloid leukemia: a review [Internet]. R I Med J. 2020 Apr;103(4):38-40. Available from: http://rimed.org/rimedicaljournal/2020/04/2020-04-38-hem-onc-pelcovits.pdf.

4. Barry DL, Enjeti AK, Lincz LF, Skelding KA. Combination therapy in cancer: The potential of tetrandrine as a polytherapy for acute myeloid leukemia. Biochimica et Biophysica Acta (BBA) - Reviews on Cancer [Internet]. 2025 Jun 26;1880(4):189377. https://doi.org/10.1016/j.bbcan.2025.189377.

5. Simão F. Panorama da atenção de leucemia mieloide aguda no SUS [Internet]. Observatório de Oncologia; 2023. Available from: https://observatoriodeoncologia.com.br/estudos/panorama/2023/panorama-da-atencao-de-leucemia-mieloide-aguda-no-sus/.

6. Correa N. Tendências da mortalidade por leucemia no Brasil [Internet]. Observatório de Oncologia; 2020. Available from: https://observatoriodeoncologia.com.br/estudos/cancer-de-sangue/leucemias/2020/mortalidade_leucemias/.

7. Ribeiro CM, Atty ATM. Efeitos da Covid-19 na atenção ao câncer no Brasil: impactos do rastreamento ao tratamento. Rev Bras Cancerol [Internet]. 2025;71(1). https://doi.org/10.32635/2176-9745.RBC.2025v71n1.4848.

8. Mantovani M, Ynoue D, Guedes M, et al. Leucemias mieloides: avaliação epidemiológica no Brasil. Hematol Transfus Cell Ther. 2024;46(Suppl 3):S455-6. https://doi.org/10.1016/j.htct.2024.09.765.

9. Salvaro M, Frassetto M, Just M, et al. Leucemia mieloide aguda: perfil clínico-epidemiológico no Brasil entre 2009 e 2019. Hematol Transfus Cell Ther. 2021;43(Suppl 1):S505-6. https://doi.org/10.1016/j.htct.2021.10.871.

10. Fernandes M, Lucini C, Almeida I, Pinheiro L, Fernandes F. Perfil de óbito por leucemia mieloide aguda nos últimos 10 anos no Brasil. Hematol Transfus Cell Ther. 2024;46(Suppl 5):S1145. https://doi.org/10.1016/j.htct.2024.09.2002.

11. American Cancer Society. About acute myeloid leukemia (AML) [Internet]. Atlanta: American Cancer Society; 2019. Available from: https://www.cancer.org/content/dam/CRC/PDF/Public/8674.00.pdf.

12. Nielsen LH, Frederiksen H, Madanat-Harjuoja LM, et al. Socioeconomic status and overall survival among patients with hematological malignant neoplasms. JAMA Network Open [Internet]. 2024 Mar 4;7(3):e241112. https://doi.org/10.1001/jamanetworkopen.2024.1112.

13. Ribeiro CM, Atty ATM. Efeitos da Covid-19 na atenção ao câncer no Brasil: impactos do rastreamento ao tratamento. Rev Bras Cancerol. 2025;71(1). https://doi.org/10.32635/2176-9745.RBC.2025v71n1.4848.

14. Mantovani M, Ynoue D, Guedes M, et al. Leucemias mieloides: avaliação epidemiológica no Brasil. Hematol Transfus Cell Ther. 2024;46(Suppl 3):S455–6. https://doi.org/10.1016/j.htct.2024.09.765

AUTHORS' CONTRIBUTIONS

Caroline Carraro contributed to the bibliographic research, writing the abstract, introduction, methodology, discussion, interpretation and description of results, preparation of tables, conclusions, review and statistics. **Mariana Ceron** contributed to project management, bibliographic research, writing the abstract, introduction, methodology, discussion, interpretation and description of results, conclusions, review and statistics. **Raquel Aparecida Bertola Rodrigues Rêgo** contributed to project management, bibliographic research, writing the abstract, introduction, methodology, discussion, interpretation and description of results, conclusions, review and statistics. **Daniely Sampaio Arruda Tavares** contributed to writing the abstract, review and statistics.

All authors approved the final version to be published and are responsible for all aspects of the work, including ensuring its accuracy and integrity.

Please cite this article as: Carraro C, Ceron MS, Rêgo RABR, Tavares DSA. Sociodemographic profile of mortality from acute myeloid leukemia in the regions of Brazil: an ecological study. Rev Epidemiol Control Infect [Internet]. 2026 Mar. 13; 16. Available from: https://seer.unisc.br/index.php/epidemiologia/article/view/20616