

INCIDENCE AND MORTALITY OF MYELOID MALIGNANCIES IN CHILDREN, ADOLESCENTS AND YOUNG ADULTS IN BRAZIL: POPULATION BASED STUDY

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BACKGROUND

The myeloid neoplasms, including acute myeloid leukemia (AML) are heterogeneous disease with varied biology. It has incidence of approximately 7 cases per million in children under 15 years old, worldwide^{1,2}. Recently a study that analyzed some Brazilian Population-Based Cancer Registries (PBCR) demonstrated the differences in incidence rates of childhood leukemia in different geographical areas in Brazil³⁻⁷. The objective of this study was to describe incidence and mortality profile and evaluate trends in incidence and mortality rate of myeloid malignancies (MM) among children, adolescents and young adults (cAYA) in Brazil.

METHODS

Data on children, adolescents and young adults (aged 0-29 years) diagnosed with myeloid malignancies (MM). Incidence data are extracted from dataset of 16 Population-based cancer registries (PBCR) cities located in five geographical regions (1988 to 2014), and mortality from the databases of the Brazilian Health Mortality Information System (1979 to 2014) for the same Brazilian cities.

Case definition: Cases of myeloid malignancies were classified using the International Classification of Diseases for Oncology's third edition (ICD-O-3) morphology and topography code8, and each code was categorized in five group according the most recent classification suggested by the World Health Organization (WHO)9: AML, acute myeloid leukemia; MPN, myeloproliferative neoplasms; MDS, myelodysplastic syndrome; MDS/MPN, myelodysplastic and myeloproliferative neoplasms; NSL, Nonspecific leukemia. AML was further divided into two subgroups (Non-acute promyelocytic leukemia AML, Non-APL AML; and APL in consideration with APL have unique characteristics, treatment and clinical outcomes separated from Non-APL AML.

Statistical Methods: Age-specific incidence (ASIR) and mortality (ASMR) rates; age-adjusted incidence (AIR) and mortality (AMR) rates and crude incidence and mortality rates of all MM were calculated, according 16 PBCR cities and five age groups (< 1 year, 1-4 years, 5-9 years, 10-19 years and 20-29 years), based on the last 10 years of available information. Age-specific incidence rates of MM were calculated by five morphological group and two age group (00-19 years and 20-29 years). Incidence and mortality rates were adjusted by the world population of 196011. To identify changes in incidence and mortality rates over time the Joinpoint12 regression model analyses were performed, version 4.5.0.1 (<https://surveillance.cancer.gov/joinpoint>). To minimize the variability inherent in the small number of observations, the logarithm of the rates was used. The Annual Percent Change (APC) and Average Annual Percent Change (AAPC) were estimated. The best cut-point period for measuring the trends is describe elsewhere (<http://www.srab.cancer.gov/joinpoint>). Significance was determined with the Monte Carlo Permutation method.

Ethics: The study was approved by the Research Ethics Committee of the INCA, No. CAAE: 81841718.1.0000.5274.

RESULTS

Table 1. Distribution of all myeloid malignancies in children, adolescents and young adults by gender and age group according to PBCR, Brazil 1988-2014

PBCR by geographic region	< 1-year		1-4-years		5-9-years		10-19-years		20-29-years		00-29-years	
	M, N (%)	F, N (%)	M, N (%)	F, N (%)	M, N (%)	F, N (%)	M, N (%)	F, N (%)	M, N (%)	F, N (%)	M, N (%)	F, N (%)
North												
Belém (1996-2011)	1 (33.3)	2 (66.7)	3 (18.7)	7 (28.0)	25 (13.4)	14 (51.9)	27 (41.5)	32 (43.8)	73 (54.4)	34 (38.6)	88 (127.5)	89 (41.2)
Manaus (1999-2009)	5 (62.5)	3 (37.5)	8 (16.7)	8 (33.3)	24 (12.0)	12 (50.0)	24 (29.5)	24 (45.3)	53 (28.4)	38 (57.6)	66 (90.1)	85 (48.6)
Median	47.9	52.1	69.4	30.7	49.1	51.0	55.5	44.6	51.9	48.1	55.1	44.9
Midwest												
Aracaju (1996-2012)	1 (50.0)	1 (50.0)	2 (25.0)	2 (50.0)	4 (37.5)	1 (25.0)	4 (10.6)	5 (33.3)	15 (14.4)	16 (52.3)	29 (29.3)	25 (46.3)
Fortaleza (1990-2006)	10 (83.3)	2 (16.7)	12 (15.4)	19 (55.9)	34 (17.3)	15 (44.9)	32 (40.5)	33 (45.2)	73 (37.6)	79 (119.7)	111 (48.3)	230 (111.2)
João Pessoa (1999-2012)	1 (50.0)	1 (50.0)	2 (9.0)	9 (50.0)	18 (12.0)	8 (40.0)	20 (14.7)	5 (25.3)	17 (14.7)	21 (55.3)	38 (54.4)	44 (45.4)
Recife (1995-2012)	2 (40.0)	3 (60.0)	5 (18.2)	13 (41.9)	31 (17.0)	11 (39.3)	28 (28.4)	38 (57.6)	66 (45.5)	35 (44.9)	78 (108.9)	100 (48.1)
Salvador (1996-2005)	2 (33.3)	4 (66.7)	6 (31.6)	13 (68.4)	19 (63.3)	12 (66.7)	18 (33.6)	15 (31.2)	48 (34.7)	37 (52.1)	71 (81.0)	81 (50.0)
Median	50.0	50.0	61.0	50.0	60.0	40.0	66.7	33.3	46.8	53.2	51.9	44.1
Southeast												
Cuiabá (2000-2007)	3 (60.0)	2 (40.0)	5 (7.7)	1 (12.5)	8 (4.0)	2 (33.3)	6 (8.8)	1 (11.1)	9 (13.2)	5 (27.8)	18 (35.3)	11 (23.9)
Goiania (1988-2011)	3 (33.3)	6 (66.7)	9 (18.2)	8 (30.8)	26 (13.1)	8 (38.1)	21 (33.5)	26 (44.1)	59 (57.3)	50 (46.7)	107 (124.5)	98 (44.1)
Median	46.7	53.4	78.4	21.7	64.3	35.7	28.4	27.6	62.8	37.3	66.0	34.0
South												
Belo Horizonte (2000-2010)	3 (75.0)	1 (25.0)	4 (7.4)	9 (56.2)	16 (11.0)	11 (50.0)	22 (34.5)	27 (44.3)	61 (46.7)	22 (32.4)	68 (101.9)	70 (40.9)
Campinas (1991-2005)	2 (50.0)	2 (50.0)	4 (9.7)	3 (25.0)	12 (6.2)	9 (37.1)	14 (14.0)	21 (60.0)	35 (17.3)	32 (48.5)	49 (50.5)	97 (110.0)
Grande Vitória (1997-2012)	9 (62.5)	5 (37.5)	8 (14.7)	10 (52.6)	19 (9.9)	4 (20.0)	13 (15.4)	24 (43.6)	56 (25.2)	23 (57.9)	48 (79.5)	64 (44.8)
Jahú (1996-2014)	0 (0.0)	0 (0.0)	2 (10.0)	0 (0.0)	1 (3.3)	2 (6.7)	3 (5.0)	3 (5.0)	6 (6.7)	3 (3.3)	9 (12.0)	8 (10.0)
São Paulo (1997-2013)	27 (61.4)	17 (38.6)	44 (105.5)	83 (44.1)	188 (87.5)	100 (55.0)	222 (52.1)	204 (47.9)	426 (34.3)	302 (66.7)	646 (785.0)	669 (460.0)
Median	61.4	37.5	55.9	44.1	50.0	50.0	52.1	47.9	53.3	46.7	55.2	44.8
South												
Curitiba (1998-2012)	7 (87.5)	1 (12.5)	8 (15.7)	13 (43.3)	30 (19.6)	6 (24.0)	25 (28.0)	27 (49.1)	55 (48.3)	41 (46.1)	89 (119.5)	88 (42.5)
Porto Alegre (1993-2006)	3 (75.0)	1 (25.0)	4 (10.6)	6 (37.5)	16 (7.6)	4 (36.4)	11 (31.5)	26 (45.6)	57 (25.2)	21 (47.7)	44 (74.5)	58 (43.9)
Median	81.3	18.8	59.6	40.4	69.8	30.2	52.7	47.4	53.1	46.9	56.8	43.2
Brazil	50.0	38.6	56.7	41.9	58.0	40.0	54.7	44.3	53.1	46.7	54.6	44.8

Note. PBCR, Population-based Cancer Registries; N, total number of cases; M, male; F, female.

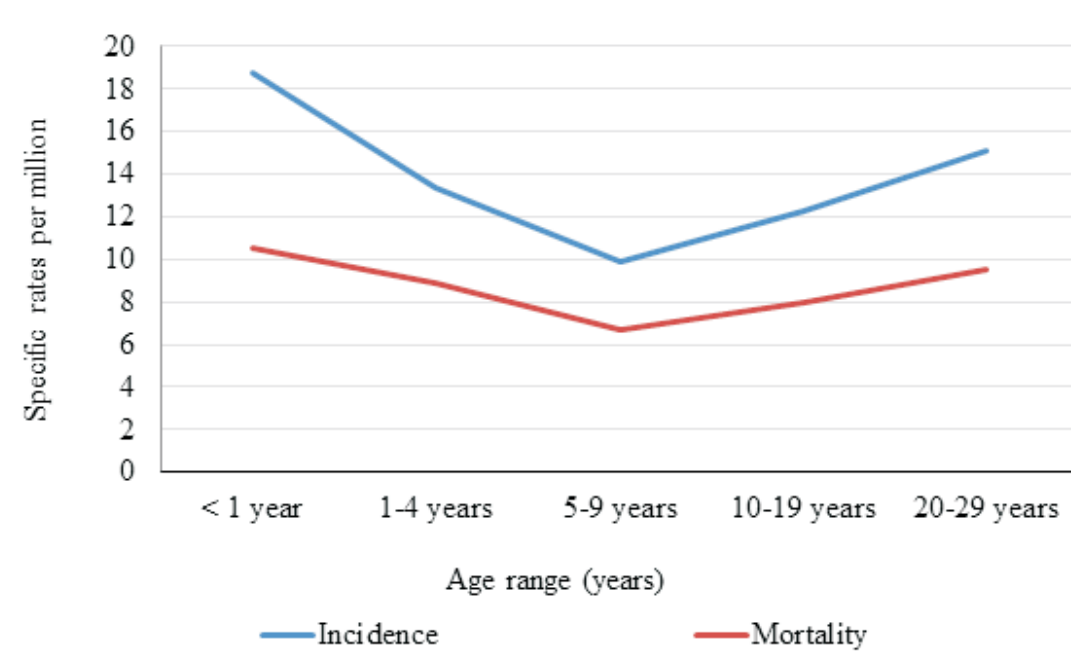


Figure 1. Median age-specific incidence and mortality rates per million of all myeloid malignancies in children, adolescents and young adults, Brazil 1996-2014.

Source: Population-Based Cancer Registries Fundação Instituto Brasileiro de Geografia e Estatística - IBGE/MP Divisão de Vigilância e Análise de Situação/CGPV/INCA/MS

Table 2. Distribution of all myeloid malignancies in children, adolescents and young adults by gender and age group according to PBCR, Brazil 1988-2014

PBCR by geographic region	AML						Total, N (%)
	Non-APL, N (%)	APL, N (%)	MPN, N (%)	MDS/MPN, N (%)	MDS, N (%)	NSL, N (%)	
North							
Belém (1996-2011)	89 (41.2)	2 (0.9)	53 (24.5)	0 (0.0)	3 (1.4)	69 (31.9)	216
Manaus (1999-2009)	98 (56.0)	2 (1.1)	30 (17.1)	0 (0.0)	0 (0.0)	45 (25.7)	175
Median	48.6	1.0	20.8	0.0	0.7	28.8	
Midwest							
Aracaju (1996-2012)	29 (53.7)	1 (1.9)	12 (22.2)	0 (0.0)	4 (7.4)	8 (14.8)	54
Fortaleza (1990-2006)	145 (63.9)	0 (0.0)	23 (10.0)	1 (0.4)	0 (0.0)	61 (26.5)	230
João Pessoa (1999-2012)	9 (62.5)	3 (37.5)	5 (5.2)	12 (12.4)	0 (0.0)	52 (53.6)	97
Recife (1995-2012)	99 (47.6)	5 (2.4)	37 (17.8)	2 (1.0)	2 (1.0)	63 (30.3)	208
Salvador (1996-2005)	77 (47.5)	2 (1.2)	35 (21.6)	0 (0.0)	0 (0.0)	48 (29.6)	162
Median	47.6	1.9	17.8	0.00	0.00	29.6	
Southeast							
Cuiabá (2000-2007)	16 (34.8)	1 (2.2)	9 (19.6)	0 (0.0)	0 (0.0)	20 (43.5)	46
Goiania (1988-2011)	112 (50.5)	5 (2.3)	35 (15.8)	0 (0.0)	17 (7.7)	53 (23.9)	222
Median	42.6	2.2	17.7	0.0	3.8	33.7	
South							
Belo Horizonte (2000-2010)	89 (52.0)	9 (5.3)	46 (26.9)	1 (0.6)	1 (0.6)	25 (14.6)	171
Campinas (1991-2005)	67 (69.1)	0 (0.0)	12 (12.4)	0 (0.0)	0 (0.0)	18 (18.6)	97
Grande Vitória (1997-2012)	86 (60.1)	9 (6.3)	15 (10.5)	0 (0.0)	2 (1.4)	31 (21.7)	143
Jahú (1996-2014)	12 (60.0)	1 (5.0)	1 (5.0)	0 (0.0)	4 (20.0)	2 (10.0)	20
São Paulo (1997-2013)	762 (52.4)	22 (1.5)	260 (17.9)	7 (0.5)	7 (0.5)	396 (27.2)	1454
Median	60.0	5.0	12.4	0.0	0.6	18.6	
South							
Curitiba (1998-2012)	125 (60.4)	13 (6.3)	37 (17.9)	5 (2.4)	0 (0.0)	27 (13.0)	207
Porto Alegre (1993-2006)	66 (50.0)	8 (6.1)	20 (15.2)	0 (0.0)	0 (0.0)	38 (28.8)	132
Median	55.2	6.2	16.5	1.2	0.0	20.9	
Brazil	52.2	2.2	17.5	0.0	0.2	26.1	

Note. PBCR, Population-Based Cancer Registries; N, total number of cases; AML, acute myeloid leukemia; APL, acute promyelocytic leukemia; MPN, myeloproliferative neoplasms; MDS, myelodysplastic syndrome; NSL, Nonspecific leukemia.

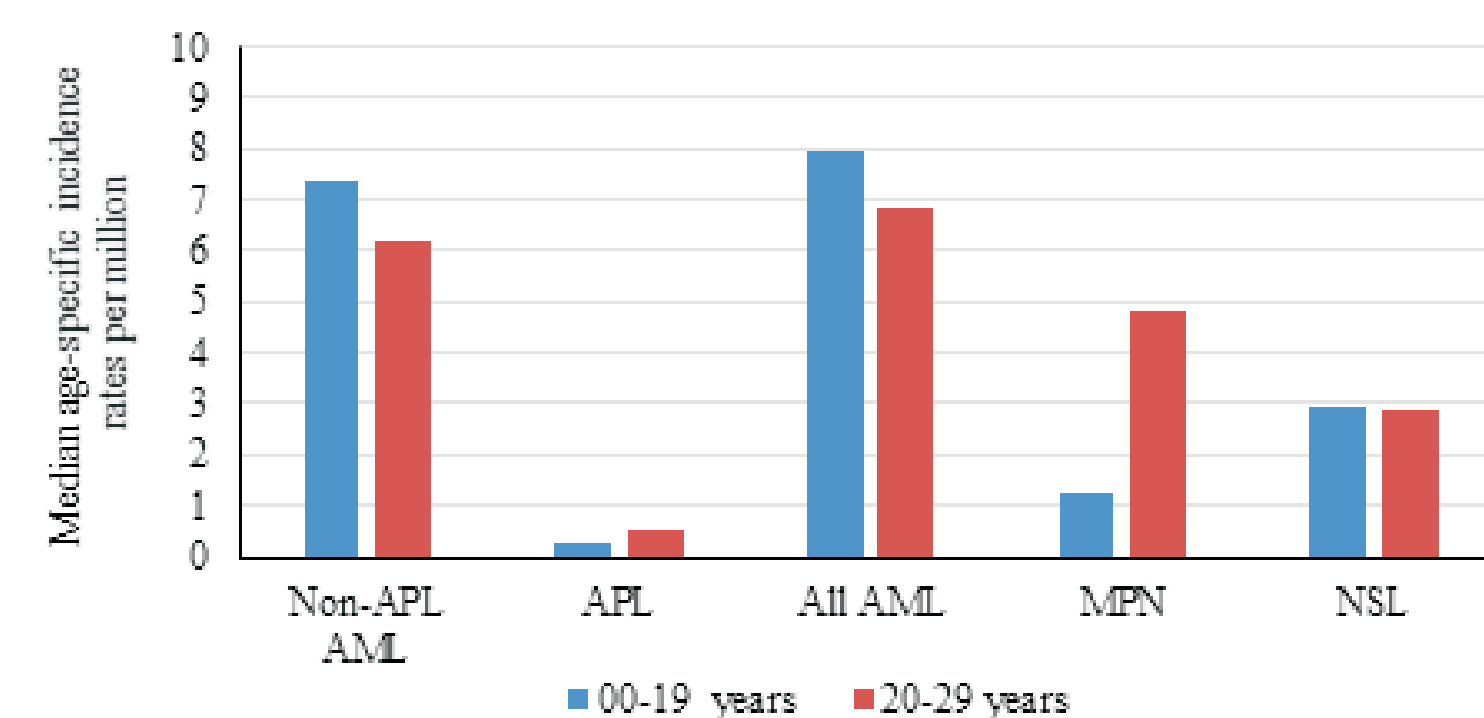


Figure 2. Median age-specific incidence rates per million of myeloid malignancies in children, adolescents and young adults, Brazil 1996-2014.

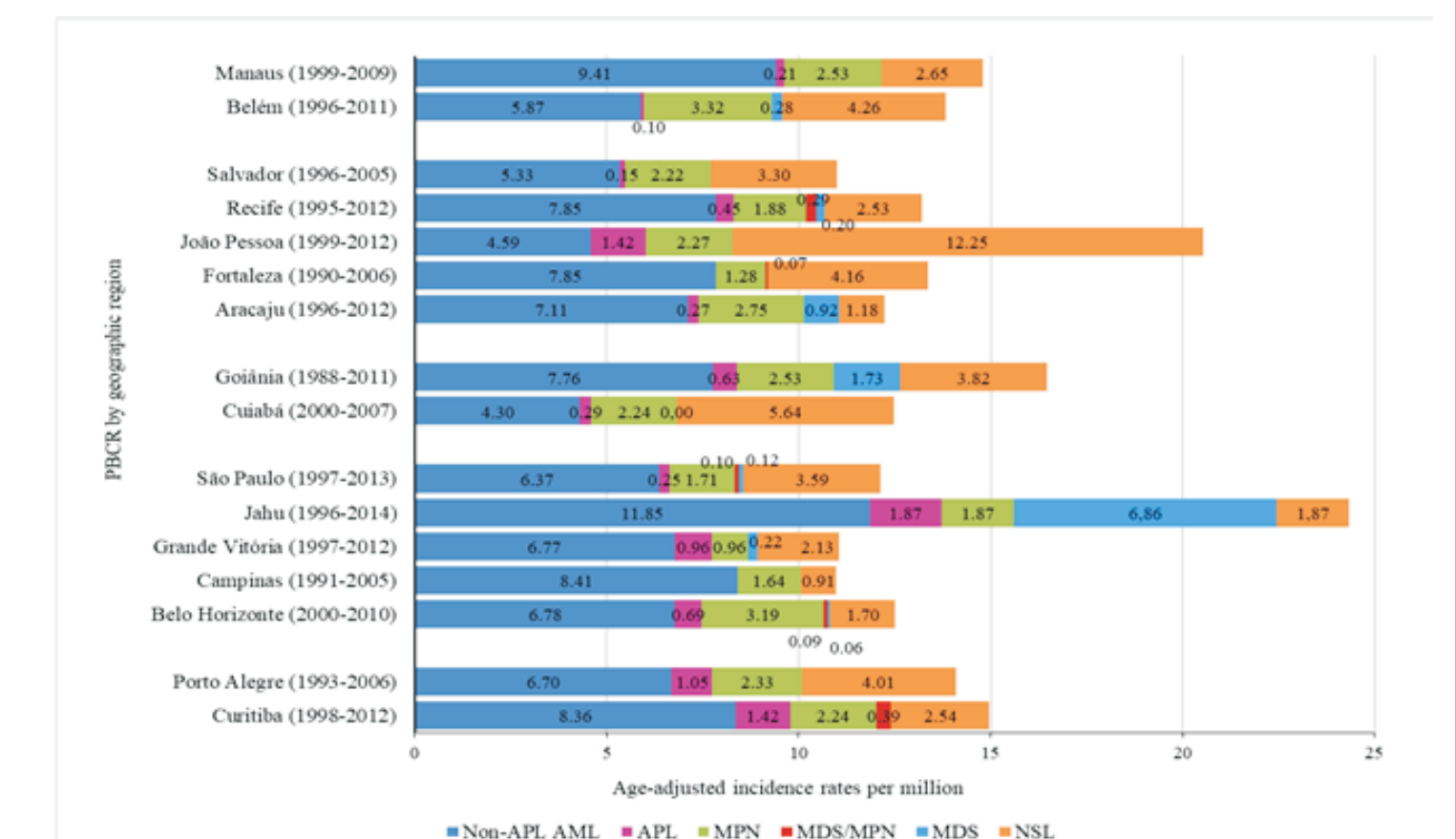


Figure 3. Age-adjusted incidence rates per million of myeloid malignancies in children, adolescents and young adults according to PBCR, Brazil 1996-2014.

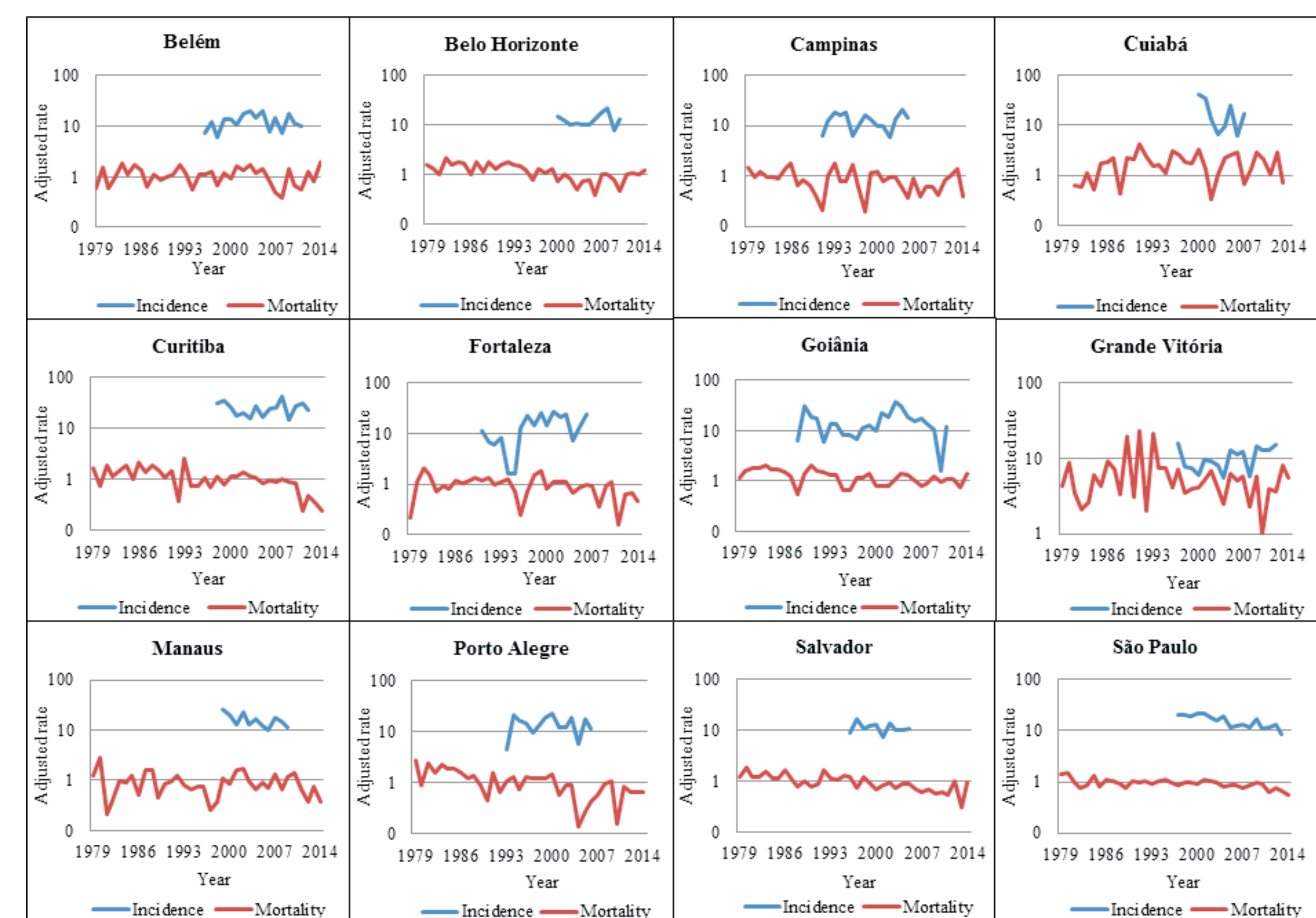


Figure 4. Historical series of distribution of the logarithm of rates incidence and mortality among all myeloid malignancies in Brazilian PBCR. Source: Population-Based Cancer Registries; Brazilian Health Mortality Information System (MIS)/DATASUS

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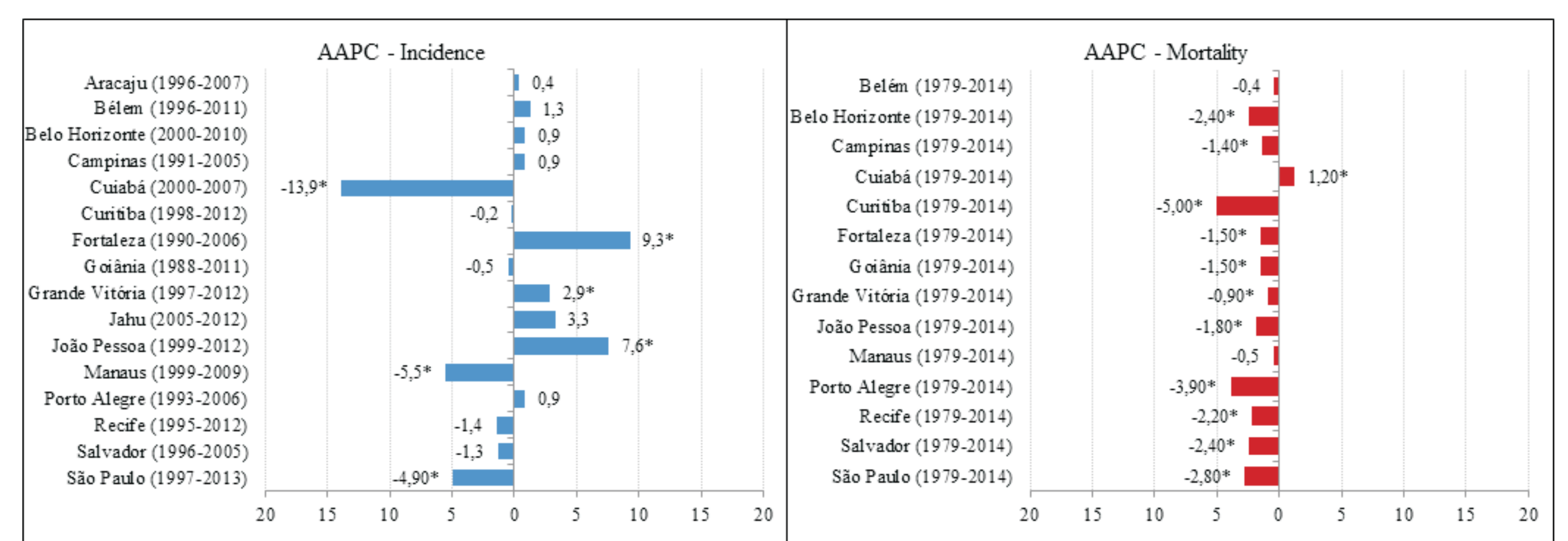


Figure 5. AAPC incidence and mortality rates of myeloid malignancies in children, adolescents and young adults according to Brazilian PBCR.

Note. AAPC, Average Annual Percent Change. *AAPC statistically significant (P-values <0.05).

Source: Sistema de Informação sobre Mortalidade - SIM/Datasus/MP; Fundação Instituto Brasileiro de Geografia e Estatística - IBGE/MP; Divisão de Vigilância e Análise de Situação/CGPV/INCA/MS

CONCLUSION

Our data analysis demonstrated a decline of incidence rates in some cities when compared with the historical series. A substantial decrease mortality rate observed, however, could be interpreted as a clear improvement in recognition, classification and therapeutically approach of myeloid malignancies. These observations are preliminary analysis and it still need to be further explored.

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