Child mortality and classification of its preventability by skin color or ethnicity in Mato Grosso do Sul, Brazil

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Abstract *The epidemiological study aimed to investigate the mortality of children under one year and the classification of preventability by skin color or ethnicity in Mato Grosso do Sul state in the period 2005-2013 retrieved from the Mortality and Live Births Information Systems. The annual child mortality coefficient and the description of deaths by components and by group of preventable, ill-defined and non-preventable causes for the three triennia were elaborated. The child mortality coefficient declined for all skin color or ethnicity categories, with a predominance of brown and black children. The early neonatal component had higher mortality rates for all categories, except for the indigenous population, which recorded predominance of the post-neonatal component. Deaths were mainly due to preventable causes, and they were not homogeneous among skin color or ethnicity categories. Deaths from ill-defined causes predominated among indigenous and brown children. The investigation of deaths pointed to differences in the components of mortality and preventable causes according to racial and ethnic contour, which could contribute to the direction of public policies that qualify the mother and child care network, especially for ethnic minorities.*

Key words *Child mortality, Race or ethnic group distribution, Information systems, Mother and child health*

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Introduction

The Child Mortality Coefficient (CMC) is an important indicator for the assessment of children's health and living conditions, since it shows the effectiveness of public health policies and the socioeconomic development of the country[1].

Child deaths causes are mostly classified as either totally or partially preventable or reducible by effective and accessible actions of the health services in a given place and period[2].

In view of its relevance, child mortality was one of the Millennium Development Goals (MDGs), with a commitment to reduce it by two thirds by 2015. This goal was achieved ahead of the deadline, falling from 47.1/1,000 live births (LB) to 15.3/1,000 LB in the period 1990-2011[3]. However, social and economic inequalities and uneven access to mother and child health services are still found and may influence child mortality[4,5].

In Chile, the reduction of child mortality rate in the last three decades has neared developed country rates, but there is still an increased risk of child deaths when analyzing the socioeconomic, ethnic-derived and unequal coverage of vital statistics[6] aspects.

In Brazil, studies on child mortality according to the ethnic-racial contour point to the complexity and challenges of expanding coverage of health services to different ethnic groups[5,7,8]. Thus, it is worth noting the improvement of the skin color/ethnicity variable in the live births and deaths certificates, reflected in the quality and coverage of the Health Information Systems, which allows greater reliability of health indicators for the planning of health actions and policies for the population[9].

In Brazil, in the period 1999-2002, comparative analyses showed that child mortality rates of brown children were close to white's. However, rates for black and indigenous children were substantially higher than white skin color or ethnicity[8].

Several studies[10,11] address the issue of child mortality, but there are still gaps with regard to investigations concerning the coefficient and its criteria of preventability for the category of skin color or ethnicity, especially for the State of Mato Grosso do Sul. Thus, this study aims to analyze deaths of children under one year and their criteria of preventability by skin color or ethnicity, in the State of Mato Grosso do Sul.

Methods

This is a descriptive epidemiological study on children's deaths according to skin color or ethnicity, for the period 2005-2013 (full years), in the State of Mato Grosso do Sul, located in the Midwest of Brazil, which has an area of 357,145,836 km^2, 79 municipalities and a population of 2,449,024 inhabitants[12].

The characterization of skin color or ethnicity follows the categories defined by the Brazilian Institute of Geography and Statistics (IBGE) – yellow, indigenous, white, black and brown, and the skin color or ethnicity referred to by a relative or person responsible for the information concerning the child who was born and died[9] is recorded in the Death Certificate (DC) and Live Birth Certificate (LBC). However, as of 2011, there was change in the recording of this variable in LBC, using mother's skin color or ethnicity and not of the child[13] anymore.

Children included in this study were selected from the database of the Mortality Information System (SIM) and the Live Births Information System (SINASC) during the study period, and skin color or ethnicity data category was ignored. Both systems showed adequate data quality (completeness and validity)[14,15].

To calculate the annual Child Mortality Coefficient (CMC), according to the different categories of skin color or ethnicity, death and live birth frequency was used to compose the numerators and denominators, respectively.

The related variables according to components and preventable causes were reviewed based on the 2005-2007, 2008-2010 and 2011-2013 triennia, with the purpose of analyzing possible temporal changes in the child mortality level, according to skin color or ethnicity.

Deaths of children under one year of age were considered, according to the early neonatal (0-6 days of life), late neonatal (7-27 days of life) and post-neonatal (28-364 days of life) components, as recommended by the Child and Fetal Death Surveillance Manual and the Committee for the Prevention of Child and Fetal Death[16].

Data on preventable death were retrieved from the classification of child death preventability, using the List of Preventable Causes of Death due to Interventions within the Brazilian Unified Health System[2].

Child deaths investigated (with and without informed summary record) were shown, as well as those not investigated in the last two triennia, since this activity started in 2006[17].

Data were entered and sorted in Microsoft Excel 2016 Electronic Spreadsheet and shown in tables, initially with statewide information, followed by skin color or ethnicity categories.

The Research Ethics Committee of the Anhanguera Uniderp University approved the study.

Results

There were 5,898 child deaths of mothers residing in the State during the period studied. The proportion of skin color or ethnicity deaths ignored was 2.1% (48/2,284) for the first triennium 2005-2007; 1.7% (35/2,049) for 2008-2010 and 1.0% (17/1,665) for 2011-2013. Regarding live births, 366,985 LBs were recorded for the period, with a proportion of ignored skin color or ethnicity field of 0.48% (575/119,560) for the triennium 2005-2007; 0.07% (90/121,635) for 2008-2010 and 0.9% (245/126,700) for 2011-2013.

CMC in Mato Grosso do Sul fluctuated in the first four years and declined in the following years. The coefficients for white children were less than 19/1,000 LB for each year. CMC for the indigenous skin color or ethnicity was around twice as high when compared to the State ratio for the study period. In the period 2006-2007, the yellow skin color or ethnicity did not report deaths and brown and black showed a marked fall for the last three years (Figure 1).

Most child deaths in the State and for most skin colors or ethnicities occurred in the early neonatal period, with a significant worsening for this component among brown children, 53.9%, 55.7% and 57.1%, respectively. It is worth noting that, unlike previous ones, the prevalence of deaths in the post-neonatal period for all three years was observed among indigenous children (Table 1).

The analysis of the triennia showed that most child deaths of residents in Mato Grosso do Sul were preventable, with a small reduction in their percentage. Deaths classified as not clearly preventable increased, recording 29% in the last triennium (Table 2).

The percentage of child deaths due to preventable causes was different in all triennia among the skin color or ethnicity categories. A decrease was noted for brown and indigenous children, while black children deaths increased in the second triennium, 90% (Table 2).

Regarding the criteria for avoidability of child deaths, a group of causes that were reducible by appropriate health promotion actions, linked to appropriate health care actions (42.9%, 31.2% and 38.5% respectively) prevailed for indigenous children when compared to the State and other categories (Table 2).

The highest proportions of deaths due to ill-defined causes were recorded among indigenous children, varying between 2.1% and 3.7%, and brown children, between 1.7% and 3.7%. Regarding the non-preventable causes, there were higher percentages in the triennia for white children, 27.5%, 32.2% and 32.7% (Table 2).

There was a significant improvement in the percentage of child deaths investigated by the State Committee for the Prevention of Mother and Child Mortality in Mato Grosso do Sul, recording 22.8% in the first triennium and 80% in the second (Table 3).

There was an increase in child deaths investigated with an informed summary sheet for all categories in the last triennium, with the lowest proportions recorded among indigenous (73.5%) and whites (80.2%) (Table 3).

Discussion

The study evidenced a decline of the CMC in the last three years for the State of Mato Grosso do Sul and for the skin color or black and brown ethnic group categories, with emphasis on the early neonatal period, except for the indigenous. As for preventable deaths, there was decrease for all skin color or ethnicity categories, except for blacks.

The reduced number of non-completion of the skin color or ethnicity field in both information systems used in this study showed adequate quality (completeness and validity) of vital data and, therefore, there was no need to apply the correction factor to estimate the CMC[18].

A study carried out in Cuiabá, State of Mato Grosso from 2006 to 2010 identified small fluctuations of its CMC, also for the State of Mato Grosso do Sul in the period 2005-2009 and decreasing trend in the last triennium[11]. However, this coefficient was significantly higher[10] when compared to the CMCs of a Cuban study.

When analyzing the CMC according to skin color or ethnicity, we can affirm that their relationship alone is not a risk factor, but when it interacts with other markers of social status (education, income and gender), ethnicity can expose the group to situations of vulnerability, with a view to their adverse social insertion[19].
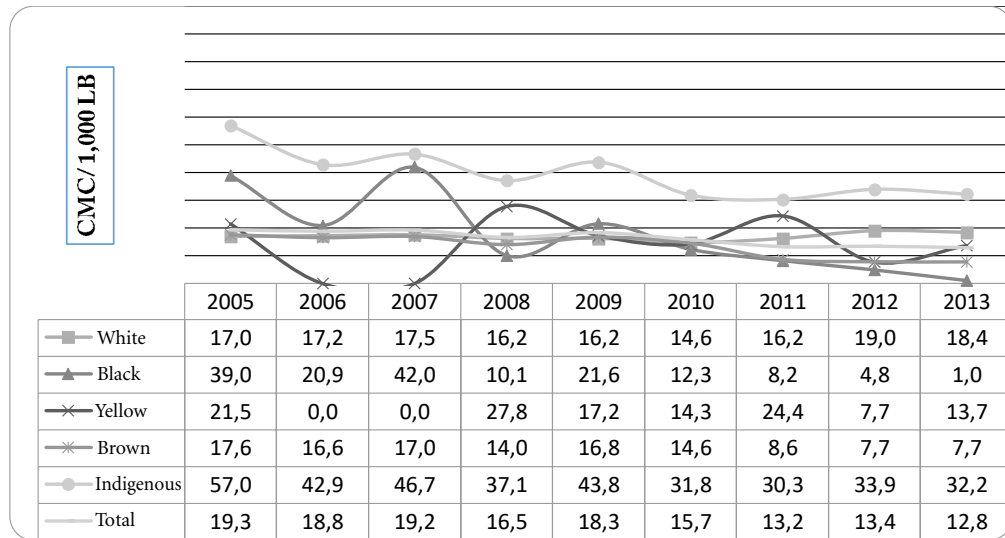
Figure 1. Distribution of Child Mortality Coefficient according to skin color or ethnicity. Mato Grosso do Sul, Brazil, from 2005 to 2013.

Source: Mortality Information System and Live Births Information System - Department of Informatics of the SUS, 2016.
CMC = Child Mortality Coefficient; LB = Live Births.

Table 1. Distribution of child mortality by components, by skin color or ethnicity. Mato Grosso Sul, 2005 to 2013.

Components	Yellow	Indigenous	White	Black	Brown	Total
	n(%)	n(%)	n(%)	n(%)	n(%)	n(%)
2005-2007						
Early neonatal	1 (50.0)	69 (24.6)	639 (51.6)	15 (46.9)	368 (53.9)	1.092 (48.8)
Late neonatal	0	29 (10.3)	235 (19.0)	8 (25.0)	96 (14.0)	368 (16.5)
Post-neonatal	1 (50.0)	182 (65.0)	365 (29.4)	9 (28.1)	219 (32.1)	776 (34.7)
Total	2 (100.0)	280(100.0)	1,239(100.0)	32(100.0)	683 (100.0)	2,236 (100.0)
2008-2010						
Early neonatal	1 (33.3)	70 (29.4)	506 (51.4)	8 (72.7)	433 (55.7)	1.018 (50.5)
Late neonatal	0	41 (17.2)	158 (16.0)	1 (9.1)	118 (15.2)	318 (15.8)
Post-neonatal	2 (66.7)	127 (53.4)	321 (32.6)	2 (18.2)	226 (29.1)	678 (33.7)
Total	3 (100.0)	238(100.0)	985(100.0)	11(100.0)	777(100.0)	2,014 (100.0)
2011-2013						
Early neonatal	2 (40.0)	64 (29.2)	448 (51.2)	5 (45.5)	307 (57.1)	826 (50.2)
Late neonatal	0	30 (13.7)	142 (16.2)	0	76 (14.1)	248 (15.0)
Post-neonatal	3(60.0)	125 (57.1)	285 (32.6)	6 (54.5)	155 (28.8)	574 (34.8)
Total	5(100.0)	219(100.0)	875(100.0)	11(100.0)	538 (100.0)	1,648 (100.0)

Source: Mortality Information System - Department of Informatics of the SUS, 2016.

In this study, CMC for white children allows us to understand that they have better socioeco- nomic conditions and access to health services. A study conducted in the city of Rio de Janeiro (RJ)

Table 2. Distribution of the classification of infant deaths according to avoidability criteria, according to skin color or ethnicity. Mato Grosso do Sul, from 2005 to 2013.

Avoidability causes	Yellow n(%)	Indigenous n (%)	White n(%)	Black n(%)	Brown n(%)	Total n(%)
2005-2007						
1.1. Reducible by vaccine prevention actions	0	0	0	0	1 (0.2)	1 (0.1)
1.2. Adequate care to women during gestation and birth and to the NB	1 (100.0)	77 (34.1)	685(78.3)	16(66.6)	401(75.3)	1.180(71.1)
1.3. Appropriate diagnostic and treatment actions	0	52(23.0)	89(10.2)	4 (16.7)	54(10.2)	199(12.0)
1.4. Appropriate health promotions and health care actions	0	97(42.9)	101(11.5)	4(16.7)	76(14.3)	278(16.8)
Sub-total (1.1 + 1.2 + 1.3+ 1.4)	1 (50.0)	226(80.7)	875 (70.6)	24(75.0)	532(77.9)	1,658(74.2)
2. Ill-defined causes[++]	0	6 (2.1)	23 (1.9)	0	15 (2.2)	44 (1.9)
3. Other causes (non-preventable	1 (50.0)	48 (17.2)	341 (27.5)	8 (25.0)	136(19.9)	534 (23.9)
Total (1 +2 + 3)	2 (100.0)	280(100.0)	1,239(100.0)	32(100.0)	683(100.0)	2,236(100.0)
2008-2010						
1.1. Reducible by vaccine prevention actions	0	0	1 (0.1)	0	0	1 (0.1)
1.2. Adequate care to women during gestation and birth and to the NB	0	83 (44.6)	496 (76.0)	10(100.0)	463(79.0)	1,052 (73.3)
1.3. Appropriate diagnostic and treatment actions	0	45 (24.2)	74 (11.3)	0	54 (9.2)	173 (12.0)
1.4. Appropriate health promotions and health care actions	1 (100.0)	58 (31.2)	82 (12.6)	0	69 (11.8)	210 (16.6)
Sub-total (1.1 + 1.2 + 1.3+ 1.4)	1 (33.3)	186 (78.2)	653 (66.3)	10 (90.0)	586(75.4)	1,436 (71.3)
2. Ill-defined causes	0	8 (3.4)	15 (1.5)	0	13 (1.7)	36 (1.8)
3. Other causes (non-preventable)	2 (66.7)	44 (18.4)	317 (32.2)	1 (10.0)	178(22.9)	542 (26.9)
Total (1 +2 + 3)	3 (100.0)	238(100.0)	985(100.0)	11(100.0)	777(100.0)	2,014(100.0)
2011-2013						
1.1. Reducible by vaccine prevention actions	1 (50.0)	0	4 (0.7)	0	3 (0.8)	8 (0.7)
1.2. Adequate care to women during gestation and birth and to the NB	1 (50.0)	57 (36.5)	438 (75.5)	5 (55.6)	298(77.2)	799 (70.6)
1.3. Appropriate diagnostic and treatment actions	0	39 (25.0)	54 (9.3)	1 (11.1)	32 (8.3)	126 (11.1)
1.4. Appropriate health promotions and health care actions	0	60 (38.5)	84 (14.5)	3 (23.3)	53 (13.7)	200 (17.6)
Sub-total (1.1 + 1.2 + 1.3+ 1.4)	2 (40.0)	156 (71.2)	580 (66.3)	9 (81.8)	386(71.8)	1,133 (68.8)
2. Ill-defined causes	0	8 (3.7)	9 (1.0)	0	20 (3.7)	37(2.2)
3. Other causes (non-preventable)	3 (60.0)	55 (25.1)	286 (32.7)	2 (18.2)	132(24.5)	478 (29.0)
Total (1 +2 + 3)	5(100.0)	219(100.0)	875(100.0)	11(100.0)	538(100.0)	1,648(100.0)

Source: Mortality Information System - Department of Informatics of the SUS, 2016.

Table 3. Distribution of child deaths from the investigation of the State Committee for the Prevention of Mother and Child Mortality, according to skin color or ethnicity. Mato Grosso do Sul, from 2008 to 2013.

Variable	Yellow n(%)	Indigenous n(%)	White n(%)	Black n(%)	Brown n(%)	Total n(%)
2008-2010						
Death investigated, with informed summary form	0	38 (16.0)	232 (23.6)	2 (18.2)	188 (24.2)	460(22.8)
Death investigated, summary form not informed	1 (33.3)	49 (20.6)	64 (6.5)	1 (9.1)	91 (11.7)	206 (10.3)
Death not investigated	2 (66.7)	151 (63.4)	689 (69.9)	8 (72.7)	498 (64.1)	1,348(66.9)
Total	3 (100.0)	238 (100.0)	985(100.0)	11(100.0)	777(100.0)	2,014(100.0)
2011-2013						
Death investigated, with informed summary form	5 (100.0)	161 (73.5)	702 (80.2)	10 (90.9)	443 (82.3)	1,321 (80.0)
Death investigated, summary form not informed	0	16 (7.3)	49 (5.6)	1 (9.1)	24 (4.5)	90 (5.5)
Death not investigated	0	42 (19.2)	124 (14.2)	0	71 (13.2)	237 (14.2)
Total	5 (100.0)	219 (100.0)	875(100.0)	11(100.0)	538(100.0)	1,648(100.0)

Source: Mortality Information System - Department of Informatics of the SUS, 2016.

has identified that white women are able to have greater access to hospital services for childbirth care, which contributes to reduced child deaths[20].

The indigenous population showed CMC higher than the other skin color or ethnicity categories. In Brazil, the CMC among indigenous children was higher and increasing when compared to the coefficients of white children, which showed lower and decreasing rates[8].

The death of indigenous children seems to show that historical, socio-cultural, environmental and sustainability conditions interact in the child's health process in its access to and the quality of health care, along with incipient death prevention strategies.

In this study, the lack of death records for yellow children may indicate a random variation of deaths for the years 2006 and 2007 or a underreporting that suggests weaknesses in the Mato Grosso do Sul SIM databases. The need to improve completion is evident and is associated to the adjustment of problems that include underreporting, since these measures are essential for a full knowledge of child deaths context[21]. The sharp fall in black and brown child deaths in the last three years indicates the need for studies that analyze this behavior and its possible correlations with social policies in the areas of health, education and fight against poverty.

Another contribution would be research in a timely manner, that is, closer to birth and de-ath events, which will ensure information quality and consistency[22]. This setting shows health inequities in the Brazilian population, which is reflected not only in the data for the calculation of infant mortality, but also in the variation of their coefficients[23].

This study evidenced that deaths occurred in the early neonatal period had a higher number of records and slight growth, which reflects weaknesses in the quality of health care of women in prenatal care and delivery and the newborn, unlike records found in Brazil and the Midwest in the period 2001-2011, which fell steadily[24].

Among the categories, indigenous children had high child mortality rates in the post-neonatal period, consistent with a study on child mortality by skin color and ethnicity in the state of Rondônia (RO)[5]. These values may be linked to the social and economic determinants that directly affect the child's health in the first years of life. These deaths are related to access to and quality of mother and child health care, as well as territorial, social and economic sustainability determinants that directly affect the health of the indigenous child in the first years of life and can lead to malnutrition and possible infections[24,25].

The analysis of child mortality according to preventable causes allows a more precise identification of the child's health situation in a given context, besides subsidizing actions more appropriate to the needs of the most vulnerable groups[26].

For the triennia analyzed, there was a decreasing trend of preventable child deaths and an opposite situation regarding non-preventable deaths. Different behavior was found in a study conducted in Belo Horizonte (MG) in the period 2006-2011, which identified stable rates of non-preventable deaths, 31.2% in the first triennium and 31.3% in the second[27].

Preventable infant deaths according to skin color or white and yellow race recorded smaller percentages when compared to the others that, despite showing a decreasing trend, still show high values. A study carried out by the Committee for the Prevention of Child Mortality in the State of Paraná found that white and yellow children had the lowest percentages (74.5%), while blacks, browns and indigenous had the highest (84.2%)[28].

The group of causes "reducible by adequate care to women in gestation and delivery and the newborn" had the worst results for the State and all categories of skin color or ethnicity, except for indigenous women. These deaths could be prevented with improved clinical resolubility, but also with regard to the organization of care in care networks, in order to ensure access to and the quality of services timely provided to pregnant woman and the newborn[29], in addition to the adequate use of scientifically proven procedures during childbirth, which may reduce the child's death risk[30].

However, when the preventability criteria were analyzed, deaths of indigenous children for the group of causes "reducible by adequate health promotion actions, linked to health care actions" evidenced the need to improve health care services for the indigenous child, with investments in training professionals to work in an interethnic context, in the articulation of the Indigenous Health Care Subsystem (SASI-SUS) with medium and high complexity levels, together with the importance of increasing coverage of water supply and sanitary sewage network adequate to the specificities of indigenous people.

In Brazil, in 2012, the two main causes of death for ethnicities / white, black, yellow skin colors were congenital malformations and prematurity, which are classified as causes that can be reduced by adequate care to women during pregnancy and delivery and to the newborn. On the other hand, the profile of the causes of child deaths was differentiated for the indigenous, in which child's infections continued to prevail over the other causes[9].

The percentage of not clearly preventable deaths showed an increase for all three years analyzed, with emphasis on skin color or white ethnicity. This behavior is to be expected, since preventable deaths are decreasing in the State and non-preventable deaths prove to be difficult to diagnose and prevent for the mother and child care network.

In this study, the proportion of deaths due to ill-defined causes among indigenous and brown children may indicate difficulties of access or poor care of these groups, besides indicating reduced information quality, unlike that identified among indigenous children of the State of Rondônia (RO), where high percentages (13.6%) of ill-defined causes are described[5].

The significant improvement in the rate of child deaths investigated in the State is due to the establishment of the Committees for the Prevention of Mother and Child Mortality (CPMMI), improving the information of the summary records and providing better training for professionals conducting the investigation in loco.

One of the strategies that can contribute to the improvement of the definition of the cause of death would be the active participation of the CPMMI, so that actions are more effective, in order to reduce deaths and contribute to quality records and official health statistics.

One of the limitations of this study is the fact that its findings are based on secondary data, due to the underreporting in the completion of the Death Certificate and the lack of clarity in the classification of the skin color or ethnicity category. However, the results clarify the situation of child deaths according to skin color or ethnicity in the State.

Finally, it was pointed out that the study facilitated the identification of color or race categories of the most vulnerable children population in relation to the analyzed variables, with the purpose of intensifying efforts to complete official documents with a view to improving data quality and qualifying professionals involved. The investigation of deaths from preventable causes according to racial ethnic contour can contribute to guide public policies that qualify the care network and improve living conditions, especially for ethnic minorities, in order to ensure differentiated care for each segment of the population of Southern region of Mato Grosso State.

Collaborations

RP Picoli: contributed substantially to the conception and planning, analysis and interpretation of data, as well as the final writing of the manuscript; LHO Cazola: contributed significantly to the analysis and interpretation of the data, as well as the critical review of the content and final writing of the manuscript; and DDG Nascimento: participated in the critical review and final writing of the manuscript.

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