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DEVELOPMENT AND PUBLIC HEALTH POLICIES: THE CASE OF FETAL MORTALITY

DESARROLLO Y POLÍTICAS DE SALUD PÚBLICA: EL CASO DE LA MORTALIDAD FETAL

DESENVOLVIMENTO E POLÍTICAS PÚBLICAS DE SAÚDE: O CASO DA MORTALIDADE FETAL

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Abstract

The fetal mortality rate is an excellent indicator for evaluating the quality of medical care in a region. This article identifies the incidence of the historical series of fetal mortality in the northern region of Rio de Janeiro State from the micro-regions of Campos dos Goytacazes and Macaé, between 2000 and 2019 so as to evaluate the medical assistance policy for pregnant women. This is a descriptive study of fetal deaths that occurred in the regions and micro-regions selected, broken down by duration of pregnancy, birth weight, and perinatal, early neonatal, and fetal mortality rates. The database used was from the Department of Informatics of the Unified Health System (DATASUS, acronym in Portuguese) and the International Classification of Diseases (ICD10). Historical series were constructed in the period by place of occurrence and residence and analyzed with the regression statistics method to assess trends. Despite the slight reduction in perinatal and early neonatal mortality rates in the municipality of Campos dos Goytacazes, the fetal mortality rate remains high and stagnant, while, in the municipality of Macaé, there was a tendency towards an increase in the fetal mortality rate over the long term. The findings indicate the need to implement

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new measures to improve the quality of prenatal care and restructure primary care in the northern region.

Keywords: Fetal and Perinatal Mortality. Pregnancy Complications. Public Health Policies. Northern of Rio de Janeiro State.

Resumen

La tasa de mortalidad fetal resulta ser un excelente indicador para evaluar la calidad de la asistencia sanitaria de una región. Este artículo tiene como objetivo identificar la tendencia de la serie histórica de la mortalidad fetal en la región Norte del estado de Río de Janeiro desde las microrregiones de Campos dos Goytacazes y Macaé, entre 2000 y 2019, para evaluar la política de asistencia médica a las mujeres embarazadas. En este estudio se describen las muertes fetales ocurridas en las regiones y microrregiones seleccionadas, desglosadas según la duración de la gestación, el peso al nacer y las tasas de mortalidad perinatal, neonatal temprana y fetal. La base de datos utilizada fue el Departamento de Informática del Sistema Único de Salud (DATASUS por su sigla en portugués) y la Clasificación Internacional de Enfermedades (CIE10). Se elaboraron series históricas en el periodo por lugar de ocurrencia y residencia y se analizaron con el método estadístico de regresión para la evaluación de las tendencias. A pesar de la discreta reducción de las tasas de mortalidad perinatal y neonatal precoz en el municipio de Campos dos Goytacazes, la tasa de mortalidad fetal permanece elevada y estancada, mientras que, en el municipio de Macaé, se observó una tendencia al incremento de esta tasa a lo largo de los años. Los hallazgos del estudio ponen de manifiesto la necesidad de aplicar nuevas medidas para mejorar la calidad de la atención prenatal y reestructurar la red de atención primaria.

Palabras clave: Mortalidad fetal y perinatal. Complicaciones en el embarazo. Políticas Públicas de Salud. Región Norte del estado de Río de Janeiro.

Resumo

A taxa de mortalidade fetal é um excelente indicador para avaliar a qualidade da assistência médica de uma região. O objetivo do artigo é identificar a tendência da série histórica da mortalidade fetal na Região Norte Fluminense a partir das microrregiões de Campos dos Goytacazes e Macaé, entre 2000 e 2019 para avaliar a política de assistência médica às gestantes. Trata-se de um estudo descritivo dos óbitos fetais ocorridos nas regiões e microrregiões selecionadas, discriminados por duração da gestação, peso ao nascer e taxas de mortalidade perinatal, neonatal precoce e fetal. A base de dados utilizada foi a do Departamento de Informática do Sistema Único de Saúde (DATASUS) e a Classificação Internacional de Doenças (CID10). Foram construídas séries históricas no período por local de ocorrência e de residência e analisadas com o método de estatística de regressão para avaliação das tendências. Apesar da discreta redução das taxas de mortalidade perinatal e neonatal precoce no município de Campos dos Goytacazes, a taxa de mortalidade fetal permanece elevada e estagnada, enquanto, no município de Macaé, observou-se uma tendência na elevação dessa taxa ao longo dos anos. Os achados do estudo evidenciam a necessidade da implantação de novas medidas para melhoria da qualidade do pré-natal e reestruturação da rede de atenção básica.

Palavras-chave: Mortalidade fetal e perinatal. Complicações na gravidez. Políticas Públicas de Saúde. Região Norte Fluminense.

Introduction

Approximately four million fetuses die worldwide each year, 98% of which are in developing countries. These are rough estimates, as fetal deaths are poorly understood or undocumented in these countries. Despite its seriousness, this public health problem has received little attention, and information related to it is limited (LANSKY, 2014).

According to Barbeiro (2015), in Brazil, the latest research has reported that the absolute number of fetal deaths dropped from 38,759 deaths in 2001 to 31,613 in 2011, and current data show the absolute number of fetal deaths has reduced—in 2019, it was 29,105. However, given the huge regional disparities in the Brazilian territory, this tendency of reduction is not equally verified in different regions and reflects the levels of development of these regions.

Conceptually, fetal mortality refers to the death of a conceptus (product of birth)—before being expelled from the mother or after being completely removed from the mother's body—and its birth weight is equal to or greater than 500 grams (g). If birth weight information is unavailable, a gestational age of 22 weeks (154 days) or more, or a body length of 25 centimeters or more, is considered (BRASIL, 2010).

Fetal mortality rate (FMR) can be defined as the proportion of fetal deaths divided by the sum of live births and fetal deaths at 22 weeks or more of gestation. As per Barbeiro (2015), the estimated FMR in 2001 was 12.3 per 1,000 births, dropping to 10.7 in 2011; in 2019, it stood at 9.82 per 1,000 births (RODRIGUES *et al.*, 2020).

This rate is considered a good health indicator, significant and useful for monitoring fetal mortality, but also a good indicator of the quality of medical care in a country or health care institution, which is the focus of this article (BARROS; AQUINO; SOUZA, 2019). Concern regarding perinatal causes of mortality, however, has been restricted to the survival of live births (BARBEIRO, 2015).

The early perinatal period was initially defined by the World Health Organization (WHO) in the eighth revision of the International Classification of Diseases—ICD-8, in 1967, as the period between the 28th week of gestation, or a newborn weighing over 1,000 g, and seven full days after birth. With the ICD-10, edited in 1993 and adopted in Brazil in 1996, this period was changed, now starting at the 22nd week of gestation and/or weighing over 500 g at birth and ending seven full days after birth.

Little attention has been paid to deaths that occur before birth, despite fetal mortality being influenced by the same circumstances and the same etiology as early neonatal mortality—the number of deaths between zero and six completed days of life, per thousand live births, in a geographic space, in the year considered. For this reason, as early as 1940, a combined analysis of the late fetal (fetus over 28 weeks of gestation) and early neonatal periods was recommended to identify the most appropriate health actions to reduce these deaths (ROUQUAYROL *et al.*, 1996).

To better understand this phenomenon—fetal mortality—, it should be understood the factors that lead to death. Risk factors for fetal death before birth include maternal status and obstetric and fetal complications. According to some studies, inadequate prenatal care, smoking, a high number of pregnancies, and low socioeconomic status may also increase this risk (SANTOS *et al.*, 2012).

Fetal death during delivery is usually caused by maternal conditions or obstetric complications and encompasses delivery and its improper management. Major causes include diabetes, infection, obstetric complications (hemorrhage during labor, hypertension, prolonged or blocked labor, poor fetal performance, multiple pregnancy, umbilical cord complications), asphyxia, birth, and economic factors (OLIVEIRA; COSTA, 2013). However, most fetal deaths occur in low-risk pregnancies, and their main causes are the fragmentation of care and management in Health Regions that do not treat the main causes that end up reflecting in obstetric complications.

This article addresses this problem in Brazil—a middle-income developing country—focusing on the northern meso-region and micro-regions of Rio de Janeiro State, that is, Campos dos Goytacazes and Macaé, and discusses whether there was also a reduction in FMR in this region as in Brazil, or if the results in the region and in its two micro-regions are different or are in line with this pattern. Its main contribution is to provide information to improve public policy on fetal health through the care and services offered to pregnant women and to reduce fetal mortality rates, which, as seen, is a significant indicator of medical care.

Its structure comprises four sections, besides this Introduction and the Conclusion. The first section describes how public policy on fetal health is organized in Brazil and in the northern part of Rio de Janeiro State to improve one of the main development indicators, infant mortality. In the second section, the methodology, the databases researched, and the methods of their analysis are explored. In the third section, the main results obtained from the research are presented. Finally, in the fourth section, the results are discussed in light of the literature on the subject.

Fetal health development and public policies

The fetal mortality rate is one of the main indicators of a country's development. In developed countries, quality public health care for pregnant women is one of the reasons why only 2% of fetal mortality occurs worldwide, while, in developing countries, as seen in the Introduction, the remaining 98% of fetal deaths are recorded. These differences may also be explained by discrepancies in the countries' socioeconomic indicators. Low socioeconomic indicators are a risk factor for infant mortality, especially in its late component. However, the influence of the quality of prenatal and perinatal care as contributing factors to early mortality, especially in the first hours and days of life, is questionable.

In Brazil, there have been recent public policy initiatives to minimize fetal deaths. Aiming to overcome the fragmentation of care and management in the Health Regions and to improve the political-institutional functioning of the Unified Health System (SUS, acronym in Portuguese) in 2010, the Ministry of Health (MH) established by means of the Ordinance 4,279, of December 30th of the same year, guidelines for the organization of the Health Care Network. In 2011, the organization of the four Thematic Health Care Networks (Thematic HCN) was proposed (BRASIL, 2013).

Launched in March 2011, there is the *Rede Cegonha*, established by the Ordinance of MH/GM n. 1.459/2011, aimed at pregnant women and children up to 24 months old. It is a strategy of the MH/ Secretariat Health Care Attention (SAS, acronym in Portuguese) to face maternal mortality, obstetric violence, and the low quality of the delivery and birth care network, developing actions to expand and qualify access to reproductive planning, prenatal, childbirth, and puerperium.

The great merit of *Rede Cegonha* is that it systematizes and institutionalizes a model of care for delivery and birth that has been discussed and built in the country since the 1990s, based on the pioneering spirit and experience of doctors, nurses, midwives, doulas, academics, anthropologists, sociologists, managers, public policy makers, pregnant women, activists, and health institutions, among many others (BRASIL, 2009).

The network is comprised by thirty-two hospitals in the State of Rio de Janeiro, the state where the northern part of Rio de Janeiro region, object of the study, is located. The project was implemented in six meso-regions, and Campos dos Goytacazes and Macaé were chosen in the northern part of Rio de Janeiro region, as they are the hub cities of this region. Campos and Macaé have high rates of maternal, fetal, and neonatal mortality, and are nodal centers for the region's health care flows. Campos receives patients from São Fidélis, São Francisco de Itabapoana, and São João da Barra and, to a lesser extent, from Carapebus and Conceição de Macabú, which direct their patients in greater numbers to Macaé (RIO DE JANEIRO, 2020).

Despite the reduction of the FMR with its implementation in 2015, these numbers remain high and stagnant, suggesting further studies of their causes and the implementation of new measures to face and reduce perinatal, early neonatal, and fetal mortality in the northern region of Rio de Janeiro (PREFEITURA MUNICIPAL DE CAMPOS DE GOYTACAZES, 2018).

Methodology and data analysis

The methodology adopted is a descriptive, retrospective study based on secondary data on fetal deaths recorded in the Department of Informatics of the Unified Health System (Datusus) in Mato Grosso do Sul (MS), in Brazil.

Information on live births and fetal deaths was collected in the Live Birth Information System (SINASC) and in the Mortality Information System (SIM) June 2021. Data for the years 2000 to 2019 were available.

Data on fetal deaths consulted at the electronic address <http://datusus.saude.gov.br/> refer to health regions and the northern part of Rio de Janeiro and deaths by place of occurrence and residence in the two main hub cities in the region—Campos dos Goytacazes and Macaé. The following

variables were considered: fetal death, early neonatal, perinatal, and live births, segmented by the northern region of Rio de Janeiro—Campos dos Goytacazes and Macaé—, and cause of death classified by the ICD-10.

Data tabulation was performed using the TabNet program. The Microsoft™ Excel program was used to organize the database and carry out the statistical and regression analyses.

As it is only an analysis of public data, the present study was not forwarded to the Ethics Committee in Research with Human Beings.

Data analysis was performed in three stages: first, two historical series were constructed for the absolute number of fetal deaths, one by place of occurrence and the other by place of residence, for the period between 2000 and 2019—the last year of available data. The goal of this comparison was to infer which of the two micro-regions had a higher number of occurrences concerning residents. The occurrences indicated where the patient was attended. By this, it was expected to find a greater difference between residence and occurrence in the micro-region of Campos de Goytacazes, which has been chosen as the headquarters of *Rede Cegonha* and nodal center of care flows.

Other historical series were constructed for perinatal, early neonatal, and fetal mortality rates in the northern region of Rio de Janeiro and Campos dos Goytacazes and Macaé micro-regions/centers. The goal of this series was to identify the main reason for perinatal mortality: is it due to the fetal or early neonatal period?

To calculate the fetal mortality rate (FMR), the number of fetal deaths (at 22 weeks of gestation or more) of mothers living in the northern region of Rio de Janeiro or cities studied $\times 1,000$ / total number of births of resident mothers (live births) plus fetal deaths at 22 weeks of gestation or more was used.

For the calculation of the early neonatal mortality rate (ENMR), it was utilized the number of resident deaths of mothers aged 0 to 6 days per thousand live births of resident mothers, and for the perinatal mortality rate (PMT), the number of resident deaths from 0 to 6 days of age and of fetal deaths at 22 weeks or more of gestation by the sum of live births and fetal deaths at 22 weeks or more of gestation.

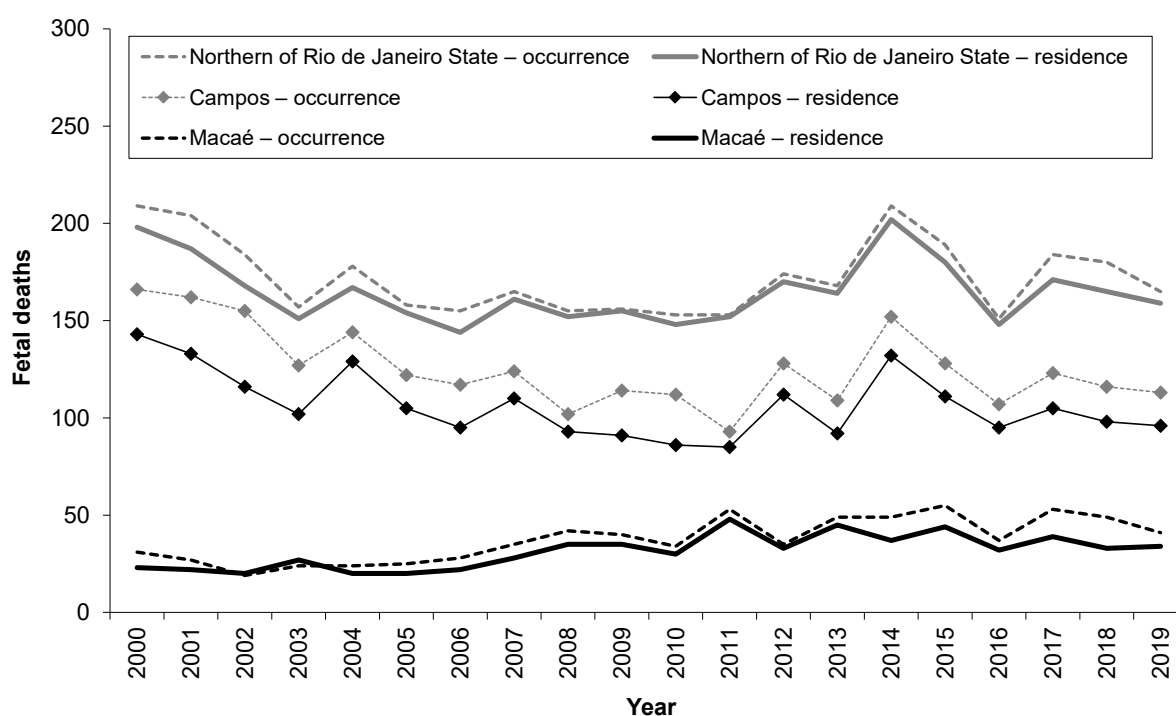
Finally, the analysis of trend of the historical series aforementioned was performed. For that, the statistical method of generalized linear regression was applied, allowing the comparison between the different time series of the northern region of Rio de Janeiro and the two micro-regions/central cities studied. The statistical significance adopted was $p \leq 0.05$. This analysis was discussed within the context of public policies on fetal health in the municipalities studied. The quantitative results were discussed with the literature on the subject.

Results

The northern region is one of the six meso-regions of the state of Rio de Janeiro. It is formed by the union of nine municipalities grouped in two micro-regions: Campos dos Goytacazes and Macaé.

Graph 1 shows the fetal deaths recorded in the region between 2000 and 2019, by residence and occurrence. Almost every year, both statistics are close, with the residence line being smaller than the occurrence line, which indicates flows of care between the municipalities in the Region, which is higher for Campos, as expected. However, from 2013 onwards, this phenomenon also appears in Macaé.

Graph 1: Fetal deaths recorded in the northern of Rio de Janeiro State, Campos dos Goytacazes and Macaé region, from 2000 to 2019



Source: Developed by the author, based on MS/SVS/CGIAE – SIM

It is possible to observe, in Graph 1, a period of decline in fetal mortality until 2003, with a subsequent increase, followed by a long period of stagnation until 2011. From 2012 onwards, there was a marked increase in the absolute number of deaths in the northern region of Rio de Janeiro, with a peak of deaths in 2014 and a subsequent fall, only from 2017 onwards. This trend has continued since then, but at levels lower than in 2003.

There is a difference in the trend of the absolute numbers of fetal deaths. In the Campos dos Goytacazes micro-region, both deaths by place of occurrence and residence maintained a downward trend between 2000 and 2011, with a downward trend again from 2017 onward. But the distance between deaths by occurrence and residence is greater than in the northern region, reflecting the characteristic of a relevant territorial space about the flows of care in the region.

For the Macaé micro-region, there is an inverse movement. Until 2011, there was a downward tendency in the absolute number of fetal deaths, but since then, there has been an increase with progressive mortality peaks in 2012, 2013, 2014, and 2017. As of 2017, mortality has fallen again, but at levels higher than in 2011.

Another relevant data verified in Macaé is that the numbers of deaths by occurrence and residence do not maintain a constant equidistance as in Campos dos Goytacazes, presenting between 2002 and 2004 an inversion in the lines, with more fetal deaths by place of residence than by occurrence. This result can be explained by the lower influence of Macaé regarding attracting flows for these types of service in the Region, as previously reported, but it seems that it has been changing since 2014 with increasing distance, although smaller than in Campos dos Goytacazes.

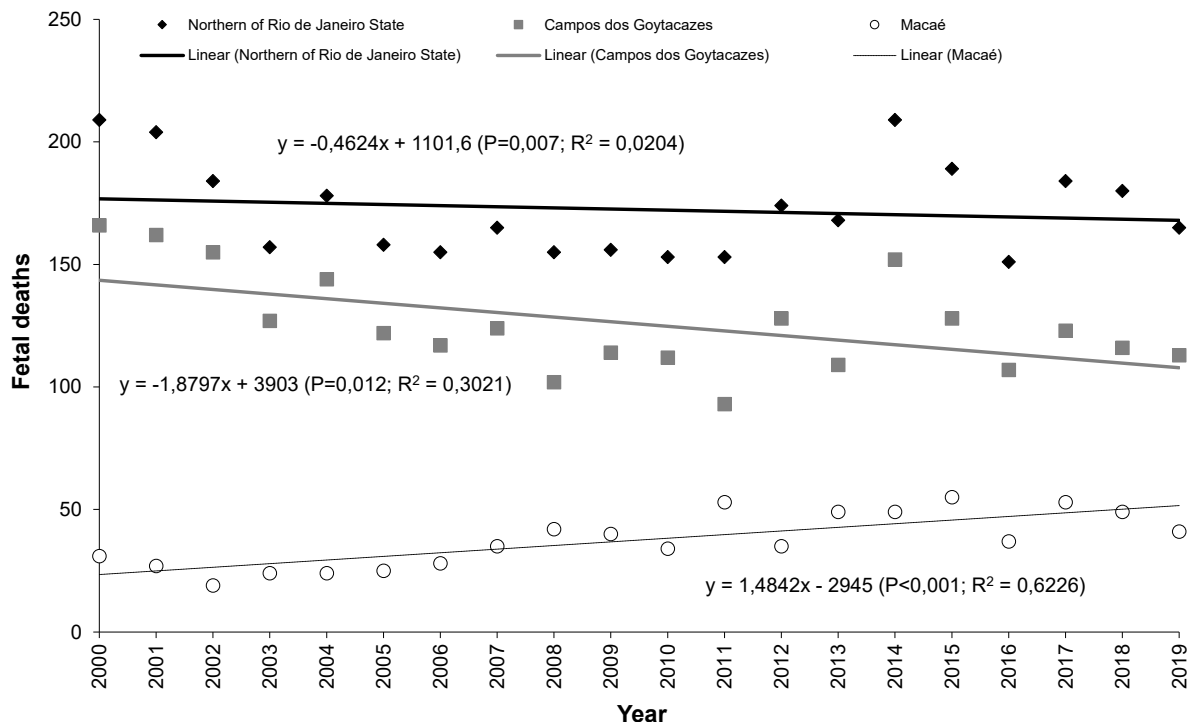
In other words, the differences between the place of occurrence and the place of residence (for the registration of fetal death) show that the two cities are regional centers for maternal and child health—high-risk pregnancies (women who have a pathology of and which has a higher risk of maternal and fetal death)—because they have a reference hospital unit: the *Hospital dos Plantadores de Cana*, in Campos dos Goytacazes, and the Public Hospital of Macaé, in the city of Macaé.

When evaluating the linear regression for fetal deaths by occurrence in the Norte Fluminense region in the period from 2000 to 2019 (Graph 2), a $p > 0.05$ (0.548) and absence of statistical significance ($R^2 = 0\%$), nothing can be said about the trend of the period. To verify if there would be statistical significance, it was tried to extend the period of the analysis, regressing it to 1996. The

result was a $p = 0.007 (< 0.05)$, indicating statistical significance with a 25.7% probability of a trend in fetal mortality reduction over time.

Despite being regional hubs and the distances between their headquarters being around 100 km, Campos dos Goytacazes and Macaé have differences in the absolute numbers of fetal deaths, as described above. The calculation of their respective linear regressions can be seen in Graph 2.

Graph 2: Linear regression of fetal deaths by occurrence in the northern of Rio de Janeiro region, Campos dos Goytacazes and Macaé from 2000 to 2019

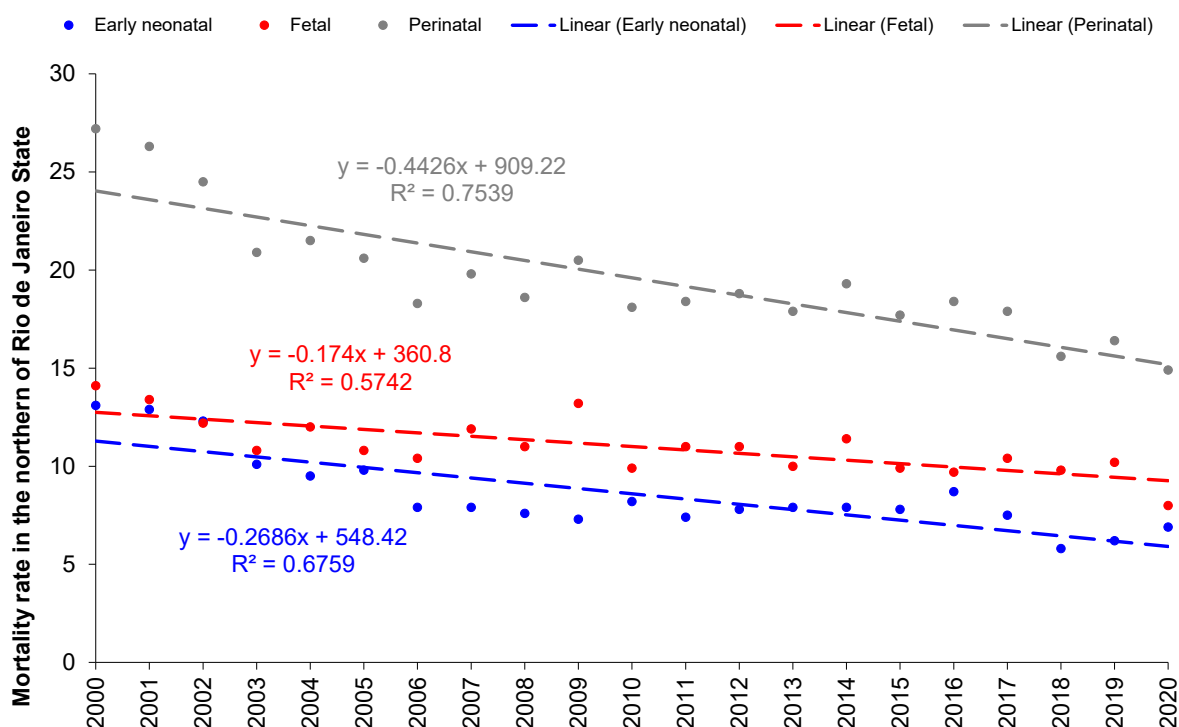


Source: Developed by the author, based on MS/SVS/CGIAE – SIM

As it is clear, the calculation of the regressions shows opposite tendencies: the micro-region of Campos dos Goytacazes with a probability of 26.3% on a downward and that of Macaé with a probability of 60.2% of an upward, suggesting that the fall is less relevant than the rise.

Another analysis carried out for a better diagnosis of the behavior of fetal mortality in the northern region of Rio de Janeiro was to calculate the regression of trends in perinatal mortality rates, separating them by the elements that compose it: fetal and early neonatal mortality rates (Graph 3).

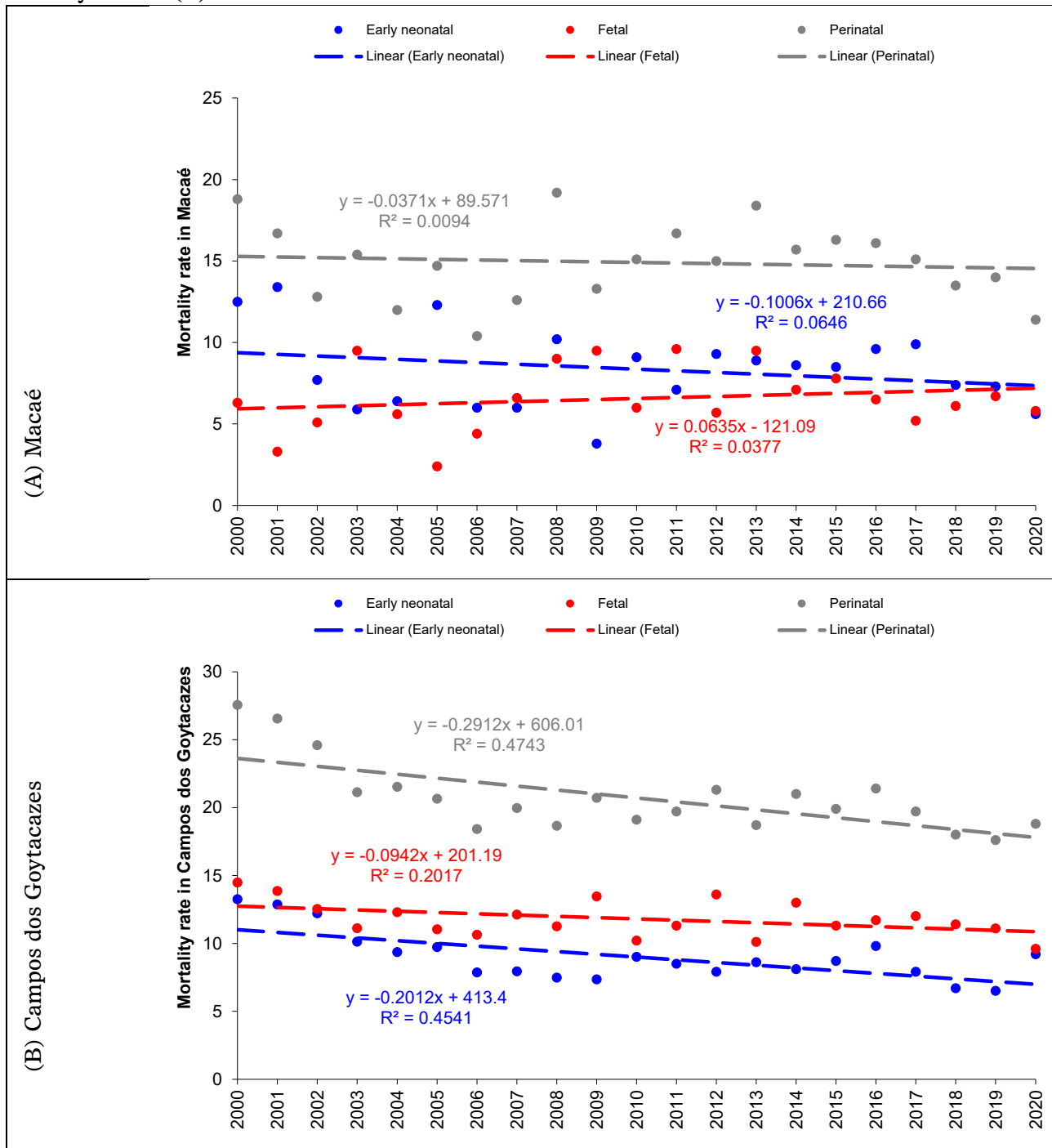
Graph 3: Early Neonatal, Fetal, and Perinatal Mortality Rate occurring in the northern of Rio de Janeiro State from 2000 to 2020



Source: Developed by the author based on SIM. State Health Department – SES/RJ. Status of the state base on 09/13/2021

However, when comparing data from Macaé with Campos dos Goytacazes (Graph 4), it is observed that there is a slight reduction in perinatal and early neonatal mortality rates—equation with negative factors (part B) and, in part A, there is an upward trend in fetal mortality in recent years—positive equation, with the year 2020, the rate of fetal and early neonatal mortality practically touching.

Graph 4: Early Neonatal, Fetal and Perinatal Mortality Rate occurring in Macaé (A) and Campos dos Goytacazes (B) from 2000 to 2020



Source: Developed by the author based on SIM. SES/RJ. Status of the state base on 09/13/2021

In summary, and from Graphs 3 and 4, it can be noted that the reduction in perinatal mortality was basically due to the decrease in the early neonatal mortality rate and that fetal mortality rates remain practically stagnant both in the northern region of Rio de Janeiro as in Campos dos Goytacazes.

Finally, fetal mortality, classified according to the ICD-10 category, was analyzed to assess the causes of death recorded. Some particularities were found in each micro-region. Table 1 shows the most common causes of fetal death, respectively, in Campos dos Goytacazes and Macaé.

Table 1: Fetal deaths by occurrence in the micro-region of Campos dos Goytacazes (A) and Macaé (B), by ICD-10 Category from 2000 to 2019

	Year	P20 Intrauterine hypoxia	P02 Fetus and newborn affected by complications of the placenta, umbilical cord, and fetal membranes	P00 Fetus and newborn affected by maternal conditions not necessarily related to the current pregnancy	P01 Fetus and newborn affected by maternal complications of pregnancy	P95 Fetal death from unspecified cause	A50 Congenital syphilis	Other
(A) Campos dos Goytacazes	2000 (n=166)	48.8%	18.7%	22.3%	1.8%	4.2%	0.0%	
	2001 (n=162)	42.0%	21.6%	22.8%	2.5%	5.6%	0.0%	
	2002 (n=155)	38.1%	24.5%	22.6%	3.9%	4.5%	0.0%	
	2003 (n=127)	44.9%	22.0%	21.3%	3.1%	0.0%	0.0%	
	2004 (n=144)	33.3%	28.5%	21.5%	3.5%	0.7%	0.0%	
	2005 (n=122)	43.4%	22.1%	24.6%	2.5%	0.0%	0.8%	
	2006 (n=117)	31.6%	23.9%	26.5%	0.9%	6.8%	0.0%	
	2007 (n=124)	43.5%	30.6%	14.5%	0.0%	2.4%	0.0%	
	2008 (n=102)	41.2%	27.5%	15.7%	3.9%	1.0%	0.0%	
	2009 (n=114)	39.5%	24.6%	20.2%	1.8%	3.5%	0.0%	
	2010 (n=112)	29.5%	25.0%	14.3%	6.3%	3.6%	0.9%	
	2011 (n=93)	44.1%	16.1%	16.1%	6.5%	3.2%	0.0%	
	2012 (n=128)	38.3%	21.1%	18.0%	4.7%	1.6%	0.0%	
	2013 (n=109)	50.5%	17.4%	17.4%	4.6%	1.8%	0.0%	
	2014 (n=152)	40.8%	23.0%	15.8%	7.9%	1.3%	0.0%	
	2015 (n=128)	49.2%	18.0%	10.9%	4.7%	3.9%	3.1%	
	2016 (n=107)	33.6%	32.7%	18.7%	4.7%	4.7%	0.0%	
	2017 (n=123)	34.1%	22.0%	19.5%	11.4%	4.1%	0.8%	
	2018 (n=116)	37.1%	25.9%	19.8%	5.2%	4.3%	1.7%	
2019 (n=113)	41.6%	14.2%	15.0%	6.2%	2.7%	6.2%		
(B) Macaé	Ano							
	2000 (n=31)	35.5%	16.1%	22.6%	19.4%	0.0%		
	2001 (n=27)	44.4%	37.0%	7.4%	3.7%	0.0%		
	2002 (n=19)	42.1%	36.8%	5.3%	10.5%	0.0%		
	2003 (n=24)	41.7%	45.8%	8.3%	0.0%	0.0%		
	2004 (n=24)	37.5%	25.0%	16.7%	4.2%	0.0%		
	2005 (n=25)	36.0%	48.0%	0.0%	8.0%	0.0%		
	2006 (n=28)	10.7%	39.3%	17.9%	17.9%	0.0%		
	2007 (n=35)	28.6%	34.3%	14.3%	11.4%	0.0%		
	2008 (n=42)	26.2%	28.6%	28.6%	2.4%	4.8%		
	2009 (n=40)	17.5%	27.5%	27.5%	7.5%	2.5%		
	2010 (n=34)	41.2%	32.4%	8.8%	0.0%	0.0%		
	2011 (n=53)	37.7%	24.5%	18.9%	9.4%	3.8%		
	2012 (n=35)	37.1%	34.3%	20.0%	0.0%	0.0%		
	2013 (n=49)	34.7%	24.5%	24.5%	4.1%	0.0%		
	2014 (n=49)	44.9%	18.4%	20.4%	2.0%	2.0%		
	2015 (n=55)	27.3%	21.8%	27.3%	5.5%	9.1%		
	2016 (n=37)	27.0%	13.5%	24.3%	2.7%	18.9%		
	2017 (n=53)	18.9%	15.1%	34.0%	5.7%	7.5%		
2018 (n=49)	44.9%	20.4%	10.2%	0.0%	10.2%			
2019 (n=41)	31.7%	24.4%	12.2%	4.9%	7.3%			

Source: Developed by the author based on MS/SVS/CGIAE SIM

In Campos dos Goytacazes (A), markedly, intrauterine hypoxia is the most frequent cause of fetal death in the micro-region of Campos dos Goytacazes. The second one is the P02 category, which are fetuses and newborns affected by complications of the placenta, umbilical cord, and fetal membranes, whose main representative is placental abruption and hemorrhage (P02.1). The third cause is represented by the P00 category—fetuses and newborns affected by maternal conditions not necessarily related to the current pregnancy. Among the pathologies that make up this group, maternal hypertension stands out (P.00.0).

The fourth cause of death is for fetuses and newborns affected by maternal complications of pregnancy, including maternal death (P01.6). There is still a high number of unspecified causes and an increase in deaths from congenital syphilis from 2015 onward.

In Macaé (B), intrauterine hypoxia is also the most frequent cause of fetal death but alternating in some years between the second (2005 to 2009) and the third cause (2017). The second most frequent cause is the P02 category, which are fetuses and newborns affected by complications of the placenta, umbilical cord and fetal membranes, whose main representative is placental abruption and hemorrhage (P02.1). The third cause is represented by the P00 category—fetuses and newborns affected by maternal conditions, not necessarily related to the current pregnancy. Among the pathologies that make up this group, maternal hypertension stands out (P.00.0).

The fourth cause is unspecified fetal deaths. From 2014 onwards, a significant increase in congenital syphilis has been observed in this micro-region, a year that coincides with the increase in the distance between the evolution of deaths by occurrence and residence (see Graph 2).

Discussion

The estimated resident population, agreed by the State Health Department, 2020 (SES/RJ), in the micro-region of Campos dos Goytacazes is 628,511 inhabitants and in the micro-region of Macaé is 326,611, so there is a greater number of women of childbearing age and, consequently, pregnant women in the micro-region of Campos dos Goytacazes in relation to the micro-region of Macaé. This also translates into higher numbers of fetal mortality in the Campos dos Goytacazes micro-region (RIO DE JANEIRO, 2020).

However, despite the population difference, Macaé shows a tendency towards an increase in fetal mortality in relation to Campos dos Goytacazes. This municipality has already had a referral hospital for high-risk pregnancy for a long time—Plantadores de Cana Hospital, where the Stork Network was implemented in 2015. The improvement in childbirth care, as well as a network of low-risk maternity hospitals, may have been one factor that reduced the fetal mortality rate over the years (RIO DE JANEIRO, 2017).

Despite Campos being a peculiar municipality, where, for many years, health has been supported by petrodollars, being one of the few municipalities that did not have the Family Health Program (PSF, acronym in Portuguese), today called the Family Health Strategy, with the drop in revenue royalties and special participations, they had to adapt. It was implemented the Family Health Program in 2013 simultaneously with the advent of the Federal Government's *Mais Médicos* Program (RIO DE JANEIRO, 2018).

Therefore, over the years, although the municipality has an established secondary and tertiary network, with low- and high-risk maternity hospitals, it has a fragmented primary care network that may have been aggravated by the covid-19 pandemic (SAGAN *et al.*, 2021). Initially, the worsening of the care network arrangement for pregnant women was caused by the change in the referral and counter-referral hospitals that receive high-risk pregnant women, the inclusion of a new pathology in the global disease panel, and initial empirical knowledge in the treatment of affected pregnant women and their changing epidemiological profile. More markedly, as of February 2021, these causes affected more pregnant women and this result can be seen translated into numbers an increase in premature births, maternal and fetal mortality rates (SAGAN *et al.*, 2021).

The Macaé micro-region opened its reference hospital in 2004—the Public Hospital of Macaé, and, according to official data, in 2004, 512 deliveries were performed and, in 2013, 2,063 deliveries, which may explain the difference in the death curves by occurrence and residence in this micro-region (MACAÉ, 2014).

Another thing that differentiates the micro-regions is that Macaé does not have maternity hospitals that cater only to low-risk pregnant women. The Macaé Public Hospital serves low and high risk, which may be one of the factors explaining the rise in fetal mortality rates over the years.

When the perinatal mortality rate is analyzed separately in the elements that compose it (fetal and early neonatal mortality rate - Graphs 3 and 4), it can be noted that the reduction in perinatal mortality was basically due to the reduction in mortality in the group neonatal mortality and that fetal mortality rates remain practically stagnant in the microregion of Campos dos Goytacazes and rise in the microregion of Macaé.

Finally, when analyzing fetal mortality according to the ICD-10 category in the Campos dos Goytacazes micro-region, fetal hypoxia has remained over the years, having as second and third

causes of fetal deaths, maternal pathologies related to hypertension, therefore preventable causes that demonstrate low quality prenatal care and childbirth care (OLIVEIRA; COSTA, 2013).

When compared with the Macaé micro-region, there is an alternation between the first causes of fetal deaths in some years: placental disorders or maternal pathologies, which are also a high number of deaths caused by maternal hypertension. However, in the fourth position, unspecified causes are observed, which are related to the investigation of fetal deaths, correcting the underlying cause of death. More markedly, there is a growing and significant number of fetal deaths from congenital syphilis, more evident from 2014 on, reaching 18.9% of fetal deaths in 2016 (RIO DE JANEIRO, 2020).

Another relevant point is the high number of fetal deaths from intrauterine hypoxia and unspecified causes in both micro-regions. This finding reflects the challenge that the maternal, infant, and fetal death surveillance team faces due to problems such as failures in health records from the Death and Live Birth Certificates, hospital and outpatient records, urgent care records, and Child and Pregnant Woman. Access to accurate information on the care of pregnant women and children impairs the reconstruction of the history of life and death for a better understanding of the problems that have occurred before and thus to proceed with the analysis of the preventability of death. Reliable correction of Mortality and Live Birth Information Systems is essential, as described by Barbeiro (2015) and Barros, Aquino and Souza (2019), so that medical diagnoses are more effective.

This information allows assessing the role of health care in the occurrence of these deaths and using it for reflection, planning, and the proposition of measures to prevent new occurrences and intervention for the reorganization of care.

Based on this information, the importance of prenatal care, the restructuring of primary health care (PHC) with the strengthening of referral and counter-referral networks, quality intrapartum care, continuing education of physicians and multidisciplinary teams, and investment in a fetal death investigation commission to reduce the incidence in Brazil (BARROS; AQUINO; SOUZA, 2019).

Conclusion

The northern region of Rio de Janeiro shows a gradual reduction in fetal mortality over the years, but when analyzing the data from its micro-regions—Campos dos Goytacazes and Macaé—, there are profound differences in the trend of fetal mortality.

Despite the slight reduction in mortality rates with the implementation of *Rede Cegonha* in 2015/16 in the municipality of Campos dos Goytacazes, it is observed that these numbers remain high and, thus, have remained stagnant since then, while in the municipality of Macaé this trend is of elevation, making evident the need to implement new measures to face and reduce fetal mortality.

Among the causes of fetal mortality, it is observed that maternal hypertension is still perpetuated as a significant direct and indirect factor of fetal mortality in the northern Rio de Janeiro region. This result reinforces that preventable causes of fetal death predominate in our country. However, the growing number of deaths from congenital syphilis, especially in the last five years, and with a higher proportion in the micro-region of Macaé, sheds light on the differences in fetal mortality trends between the micro-regions of Campos dos Goytacazes and Macaé, with an urgent need to confrontation and creation of a specific public policy to combat this also avoidable cause.

Another point to be noted is the strengthening and continuous training of the maternal-infant and fetal investigation committees in the northern region of Rio de Janeiro, most notably in the Macaé micro-region.

New studies should be carried out to determine the causes of the differences in fetal mortality trends in the two micro-regions of the northern of Rio de Janeiro.

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