● **Original article**

CHILD MORTALITY: ASSESSMENT OF THE REDE MÃE PARANAENSE PROGRAM AT A REGIONAL HEALTH DISTRICT IN THE STATE OF PARANÁ

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ABSTRACT: The objective was to analyze childhood mortality at a regional health department in the State of Paraná before and after the implementation of the Rede Mãe Paranaense program. The descriptive and retrospective method was used with secondary data from the Information System of the State Secretary of Health, using data from children younger than one year and causes of death, between 2009 and 2014. It was observed that, in the early neonatal period, the population size increased from 15,000 to 50,000, from 31% to 36% of deaths after the implementation. Despite the implementation of the program to improve women's health during pregnancy and birth and infant health, the avoidable deaths remained high, i.e. 63% before and 51% after the implementation. The results did not evidence a significant reduction in childhood mortality after the implementation of the program, but its implementation is still recent, demanding further time for the cities to adapt to the program and invest in the training of the professionals involved.
DESCRIPTORS: Infant mortality; Health evaluation; Health information systems; Cause of death.

MORTALIDADE INFANTIL: AVALIAÇÃO DO PROGRAMA REDE MÃE PARANAENSE EM REGIONAL DE SAÚDE DO PARANÁ

RESUMO: Objetivou-se analisar a mortalidade infantil em uma regional de saúde do estado do Paraná, antes e após a implantação do programa Rede Mãe Paranaense. Utilizou-se o método descritivo, retrospectivo com dados secundários dos Sistemas de Informação da Secretaria de Saúde do Estado, com dados de crianças menores de 1 ano e causas de óbitos, entre 2009 e 2014. Observou-se que no período neonatal precoce, houve aumento para o porte populacional entre 15.000 e 50.000 de 31% para 36% óbitos pós-implantação. Apesar da implantação do programa visando a melhoria da atenção à saúde da mulher na gestação, parto e ao recém-nascido, os óbitos evitáveis mantiveram-se elevados, 63% pré-implantação e 51% pós–implantação. Os resultados não evidenciaram redução significativa na mortalidade infantil após a implantação do programa, porém, sua implantação ainda é recente sendo necessário maior tempo para adequações dos municípios em relação ao programa e investimentos nas capacitações dos profissionais envolvidos.
DESCRITORES: Mortalidade infantil; Avaliação em saúde; Sistemas de informação em saúde; Causas de morte.

MORTALIDAD INFANTIL: EVALUACIÓN DEL PROGRAMA REDE MÃE PARANAENSE EN REGIONAL DE SALUD DE PARANÁ

RESUMEN: La finalidad fue analizar la mortalidad infantil en una regional de salud del estado de Paraná, antes y después de la implantación del programa Rede Mãe Paranaense. Fue utilizado el método descriptivo, retrospectivo con datos secundarios de los Sistemas de Información de la Secretaría de Salud del Estado, con datos de niños menores de 1 año y causas de óbitos, entre 2009 y 2014. Fue observado que, en el período neonatal precoz, aumentó el tamaño poblacional entre 15.000 y 50.000 del 31% al 36% de óbitos postimplantación. A pesar de la implantación del programa, visando mejorar la atención de salud de la mujer en el embarazo, parte y al recién-nacido, las muertes evitables siguieron altas, 63% pre-implantación y 51% post–implantación. Los resultados no evidenciaron reducción significativa en la mortalidad infantil después de la implantación del programa. Sin embargo, su implantación es reciente, demandando mayor tiempo para adecuaciones de los municipios con relación al programa e inversiones en las capacitaciones de los profesionales involucrados.
DESCRIPTORES: Mortalidad infantil; Evaluación en salud; Sistemas de información en salud; Causas de muerte.

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● INTRODUCTION

Despite the advances conquered in recent decades in terms of childhood mortality in Brazil, it remains a constant concern in public health. Epidemiological data reveal that more than 10 million children die each year around the world. This is an inadmissible situation as the deaths result from conditions that are considered preventable, which can be avoided by improving the living conditions and expanding the access to health[1].

In Brazil, demographic studies demonstrate that the childhood mortality rate has been dropping progressively. In 1997, the rate amounted to 35.20‰, reaching 24.32‰ [2] in 2007. In 2015, it corresponds to 16 deaths/1,000 Live Births (LB)[3]. The country ranks 120th among 187 countries on the ranking of the United Nations (UN), which assesses the childhood mortality rates, behind other Latin countries like Chile and Argentina[4].

The childhood mortality rates are lower in the economically more developed regions – Southeast and South (17.7‰ and 16.1‰, respectively), while the highest rates are found inthe North 25‰ and Northeast 35.6‰, with intermediary rates in the Central-West (18.9‰)[5]. Despite the range of prevalence rates of childhood mortality among the regions of Brazil, overall, many deaths can be avoided and are directly associated will malnutrition and infectious diseases[6].

In Paraná, in 2002, the childhood mortality rate corresponded to 16.4/1,000 LB; in 2007 to 13.2/1,000 LB; in 2010, the childhood was 12,12/1.000 LB; and in 2011, it reached 11,65/1,000 LB, demonstrating a drop by 3.6% in comparison with the year before[7]. On the other hand, what the evitability of the childhood deaths is concerned, according to the Childhood Mortality Information System (SIM) of the Paraná State Health Department (SESA), 68.2% of the deaths happened in 2007 were considered evitable. In 2010, this percentage had dropped to 61.5% of the investigated deaths[7]. Nevertheless, despite the reduction in the evitable deaths, this percentage is considered high in the state, as the rate for Brazil corresponds to 17.6%[8].

In that sense, in view of the stagnation in these indicators over the past years and, what is more, the high percentage of evitable maternal (81%) and childhood deaths (61%)[9], after analyzing deaths and risk factors for maternal and childhood mortality between 2006 and 2010, the state government of Paraná implemented the program Rede Mãe Paranaense (RMP) in 2012, based on a successful experience in the program Mãe Curitibana[10].

The main objective of the RMP is to organize maternal-infant care in all regions of the state, based on actions like the early capture of pregnant women at risk, their prenatal monitoring, risk stratification of pregnant women and children, care at a specialized outpatient clinic for pregnant women and children at risk up to the age of one year age, guaranteed delivery through a hospital affiliation system[7], based on the conceptual framework of the Health Care Networks proposed by Mendes (2010)[11], adopted in the state of Paraná as the care model to improve the access to and quality of health care, including maternal and infant care.

As the childhood mortality rate in Paraná needs to drop, mainly concerning deaths by avoidable causes, and as studies on RMP remain scarce due to its recent implementation, the effectiveness of the program to reduce the childhood mortality indicators needs to be verified. Therefore, the objective in this study is to analyze the childhood mortality in cities in the 9th Regional Health Department of Paraná State before and after the implementation of the RMP program.

● METHODS

Cross-sectional and retrospective study with a quantitative approach, using secondary data based on the Mortality Information System (SIM) and the Live Births Information System (SINASC), using data on childhood mortality < one year of age and its causes in cities in the 9th Regional Health Department (RHD) of Paraná between 2009 and 2014.

The 9th RHD is located in the West of Paraná State and consists of nine cities, four of which have <

15,000 inhabitants (Ramilândia, Serranópolis do Iguaçu, Itaipulândia and Missal), four between 15,000 and 50,000 habitants (Matelândia, Medianeira, Santa Terezinha de Itaipu and São Miguel do Iguaçu) and Foz do Iguaçu, which is the city that is home to the 9th RHD, with 256,088 inhabitants.

The region has an intermediate human development index (HDI), between 0.573 and 0.788, differently from the educational HDI, which is considered high, between 0.875 and 0.905, except for one city with an intermediate educational HDI (0.781)[12].

The city of Foz do Iguaçu, located in the triple frontier region, has an estimated population of 263.915 inhabitants (IBGE, 2016). Besides its inhabitants, the city attends to a floating population from neighboring countries (Paraguay and Argentina), hampering the health actions of the city with the largest population among the cities assessed[13].

To assess the deaths in children under one year of age, data for the period between 2009 and 2011 were used, before the implementation, and between 2012 and 2014, after the implementation of the RMP. The data were grouped in an Excel (2013) worksheet. The variables assessed were early neonatal mortality (0 to 7 days of life), late neonatal mortality (7 to 27 days of life) and post-neonatal mortality (28 to 364 days of life). The following categories: deaths reducible by appropriate care to women during pregnancy and birth and to infants; reducible by appropriate diagnostic and treatment actions; reducible by appropriate health promotion actions, linked to appropriate healthcare actions; badly defined causes of death; non-avoidable causes of death were analyzed by means of descriptive statistics with (relative and absolute) frequency distribution and presented and analyzed in the form of tables.

The information on the causes of death was coded according to the 10th Revision of the International Classification of Diseases ICD-10[14] and was analyzed in terms of evitability[15]. This is an excerpt from the research entitled: Analysis of Implementation and Development of the Rede Mãe Paranaense Program, Universal Call CNPq– 014/2013 Process: 474768/2013-9. Approval for this study was obtained from the Research Ethics Committee at Universidade Estadual do Oeste do Paraná, opinion 544.107/2014.

● **RESULTS**

Between 2009 and 2014, 450 deaths took place of children under one year of age, being 211 (46.9%) in the pre-implementation period and 239 (53.1%) after the implementation, in a total group of 37,467 thousand live births. Among these deaths, 329 were due to evitable causes, being 166 (78.7%) in the pre-implementation period of the RMP and 163 (68.2%) after the implementation.

In Table 1, the deaths were classified according to the population size of the cities. In the early neonatal period, an increase was found for the cities with less than 15 thousand inhabitants, from two (20%) deaths pre-implementation to three (37.5%) postimplementation. The same was true for the cities with between 15,000 and 50,000 inhabitants, from 10 (31%) deaths pre-implementation to 16 (36%) post-implementation, and a reduction for the city with more than 50,000 inhabitants, with 48 (38%) deaths pre-implementation and 45 (33%) post-implementation.

In the late neonatal period, a drop was only found in the city with more than 50,000 inhabitants, with 37 (30%) deaths pre-implementation and 35 (25%) post-implementation.

For the post-neonatal period, a drop was found in the cities with less than 15,000 inhabitants, with five (50%) deaths pre-implementation and two (25%) post-implementation. For the cities with 15,000 to 50,000 and > 50,000 inhabitants, the number of deaths increased, from 14 (44%) to 20 (45%) deaths for the cities with 15 to 50,000 inhabitants, and 40 (32%) to 58 (42%) deaths pre and post-implementation for the city with more than 50,000 inhabitants.

Like the post-neonatal deaths, the general mortality for the cities with more than 15 thousand inhabitants already increased. For the cities with 15 to 50,000 inhabitants, in the preimplementation period, 32 (19%) deaths occurred, increasing to 44 (23%) in the postimplementation period. In the city with more than 50,000 inhabitants, 125 (75%) deaths happened in the pre-implementation period and 138 (73%) deaths post-implementation.

Table 1 – Deaths in children under one year of age before and after the implementation of the Rede Mãe Paranaense program according to categories. 9th Regional Health Department. Foz do Iguaçu, PR, Brazil, 2009-2014

		Population size							
		< 15,000		15,000 -50,000		>50,000		TOTAL	
	Age Range	n	%	n	%	n	%	n	%
Pre	Early neonatal	2	20	10	31	48	38	60	36
	Late neonatal	3	30	8	25	37	30	48	29
	Post-neonatal	5	50	14	44	40	32	59	35
	General Mortality	10	6	32	19	125	75	167	100
Post	Early neonatal	3	37	16	36	45	33	64	34
	Late neonatal	3	37	8	18	35	25	46	24
	Post-neonatal	2	25	20	45	58	42	80	42
	General Mortality	8	4	44	23	138	73	190	100

Source: DATASUS

In Table 2, it is observed that the causes of deaths reducible by appropriate care to women during pregnancy and birth and to infants obtained the highest rates, as 132 (63%) could be avoided before the implementation of the program and 121 (51%) after the implementation.

Table 2 – Distribution of avoidable deaths in children under one year of age before and after the implementation of the Rede Mãe Paranaense program, according to the classification by Malta et al., 2007. 9th Regional Health Department. Foz do Iguaçu, PR, Brazil, 2009-2014

Evitable Deaths	Pre-implementation (n=211)					Post-Implementation (n=239)				
	2009	2010	2011	n	%	2012	2013	2014	n	%
1. Reducible by appropriate care to women during pregnancy and birth and to infants	49	37	46	132	63	27	44	50	121	51
2. Reducible by appropriate diagnostic and treatment actions	3	4	8	15	7	4	6	6	16	7
3. Reducible by appropriate health promotion actions linked to appropriate healthcare actions.	4	7	1	12	6	5	7	3	15	6
4. Badly defined causes of death	1	3	3	7	3	0	5	6	11	4
5. Inevitable causes of death	23	13	9	45	21.0	31	25	20	76	32.0
Total	80	64	67	211	100.0	67	87	85	239	100.0

Source: DATASUS

Next, the deaths reducible by appropriate diagnostic and treatment actions stand out, with 15 (7%) in the pre-implementation phase and 16 (7%) post-implementation of RPM. For the badly defined causes of death, the number increased from seven (3%) deaths preimplementation to 11 (4%) after the implementation of the program. The inevitable causes of the death in the post-implementation period significantly increased, from 45 (21%) to 76 (32%) childhood deaths.

● DISCUSSION

In a search for similar studies in the literature, no studies were found that analyze the childhood mortality and the causes of avoidable deaths before and after the implementation of the RMP in cities in the 9th RHD. Therefore, we consider that this study is the first analysis with this scope since the implementation of the program.

Neonatal mortality is considered an excellent maternal-infant indicator that reflects inadequate care actions for this population. The results demonstrate that the deaths in the early neonatal period did not drop significantly, remaining stable in the late neonatal period and considerably increasing in the post-neonatal period and in general terms after the implementation of the RMP in the city > 50,000 inhabitants. The deaths by avoidable causes, in the category of deaths reducible by appropriate care to women during pregnancy, birth and infants, ranked highest in the study period, despite a slight reduction after the implementation of the program.

In a study developed in Cuiabá, similar data were obtained. Out of 79 neonatal deaths, 57 happened in the early neonatal period, 29 in the first 24 hours after birth and 22 in the late neonatal period[6]. In a study developed in 2013 in the 15th RHD of Paraná, out of 74 deaths studied, 49% happened in the early neonatal period[16]. In another study developed in Piauí in 2008, out of 15 registered childhood deaths, 10 happened in the early neonatal period, representing 48%[17]. In another study developed in the Brazilian Northeast, however, between 2000 and 2009, a 44% drop in the neonatal component was found, from 15 to 8.4/1,000 LB in the years analyzed[18].

The reduction of neonatal mortality happens more slowly, as it involves situations that are harder to implement, such as the organization of neonatal services of excellence, as well as the preparation of specialized medical and nursing teams, from primary to tertiary health care[19].

Another factor related to the large number of neonatal deaths is the absence or insufficient number of prenatal care appointments[20], related to the quality of health care, with professionals prepared for cardiopulmonary resuscitation in the delivery room, aiming to prevent perinatal asphyxia and/or anoxia. This is an important mechanism to reduce neonatal mortality[21].

With a drop in the Childhood Mortality Coefficient (CMC) in the post-neonatal period, a study developed in the State of São Paulo revealed a rate different from this study, from 7.7% to 3.6% LB[22]. Similar data were obtained in a study developed in the 21st RHD of Paraná, in which 62% of the childhood deaths were concentrated in the post-neonatal period[23].

To achieve a reduction in the post-neonatal deaths, using the programs launched by the Federal Health Department is fundamental, such as the Family Health Program and the National Immunization Program, as well as public investments in the social area, education and infrastructure, with a view to improving the birth, morbidity and mortality indicators in the country[24].

In the analysis of evitable deaths in similar studies[16,25], high rates of childhood deaths reducible by appropriate care to women during pregnancy and birth and to infants were identified. This indicates that, when the diagnosis and treatment are done timely, many maternal problems during pregnancy, such as early membrane rupture or maternal renal and urinary tract conditions, part of the childhood deaths could be avoided[16]. These data appoint that inadequacies remain in the prenatal period and in birth and infant care.

In the category of deaths reducible by appropriate diagnostic and treatment actions, including respiratory diseases, such as lower and upper airway infections, pneumonias, among others, a study in the state of Minas Gerais obtained similar results[26]. In that sense, to reduce these deaths, health education actions are needed, mainly focused on women of reproductive age, as well as better access to the health services and better basic sanitation[27]. In other words, health promotion and prevention actions, as well as greater access to health and basic infrastructural services, which do not demand specialized care or access to the secondary or tertiary sector of the Health Care Networks (HCR).

The high rates of evitable childhood deaths indicate problems related to maternalinfant care, which may not be restricted to actions in the birth and postpartum periods. Preventive actions are needed, even before the women get pregnant, such as: reproductive planning and guaranteeing the access to the health services[28]. This fact suggests that, despite the implementation of the RMP in the 9th RHD, difficulties remain in health care for the maternal-infant population, demanding further investment

and training to put in practice the mission of the program and deliver excellent prenatal, birth and infant care.

The health services and professionals, especially the nurses, need to invest in specific actions to capture the pregnant women early, guarantee the access to the programs and enhance bonding, thus favoring the women's adherence to prenatal care. This easy access and bonding will contribute for the women to return to the service to take part in new programs after birth, such as family planning and childcare to monitor their children[29].

Being a newly implemented program in the state of Paraná, one of the limitations in the study was the lack of research to compare with the obtained results. Therefore, further studies are suggested to assess the effectiveness of the RMP, at the state level as well as in the other RHD. It is highlighted, however, that all management initiatives that prioritize the quality of prenatal and birth care are significant to reduce the childhood mortality.

● CONCLUSION

Despite all incentives and initiatives to reduce the childhood and maternal mortality, most deaths are still related to causes reducible by appropriate care delivery to women during pregnancy and birth and to infants. Many deaths happen in the early neonatal and postneonatal periods. In that sense, the health actions focused on pregnant women, prenatal care and infants still need improvements.

The results presented did not evidence a significant reduction in most childhood mortality classifications after the implementation of RPM. Nevertheless, the program is recent, demanding further time for the cities to adapt to the program and invest in the training of all professionals involved in prenatal and infant care. That is so mainly at the Primary Health Care Services (UBS), where the work starts during prenatal care for the pregnant woman, but continues after birth with childcare for children up to two years of age.

The health professionals, and mainly the nurses working in primary care, need to focus more attentively on care actions aimed at the health promotion and early detection of illnesses with a view to reducing the childhood mortality indicators and, hence, for the RMP to achieve better results.

● ACKNOWLEDGEMENTS

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