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Preventable deaths in childhood, according to actions of the Unified Health System, Brazil

Mortes evitáveis na infância, segundo ações do Sistema Único de Saúde, Brasil

Deborah Carvalho Malta[I], Rogério Ruscitto do Prado[I], Rafaela Magalhães Fernandes Saltarelli[II], Rosane Aparecida Monteiro[III], Maria de Fátima Marinho de Souza[IV], Márcia Furquim de Almeida[V]

ABSTRACT: ***Objective:*** To analyze the mortality trend of children under five years of age living in Brazil and regions, using the "Brazilian List of Preventable Causes of Death." ***Method:*** Ecological time-series study of mortality rate due to preventable and non-preventable causes, with corrections for ill-defined causes and underreporting of deaths from 2000 to 2013. ***Results:*** In Brazil, preventable death rates (5.1% per year) had a higher decrease compared with non-preventable ones (2.5% per year). Preventable causes associated with proper care during pregnancy had the highest concentration of deaths in 2013 (12,267) and the second lowest average percentage reduction in the year (2.1%) and for the period (24.4%). The South and Southeast regions had the lowest mortality rates in childhood. However, the Northeast region had the highest decrease in reducible child mortality (6.1% per year) and the Midwest, the lowest (3.5% per year). ***Conclusion:*** The decrease in childhood mortality rates was expected in the last decade, suggesting the progress in the response of health systems, in addition to improvements in health conditions and social determinants. Special attention should be given to pregnancy-related causes, i.e., expand the quality of prenatal care, in particular, due to fetal and newborn deaths resulted from maternal conditions, which increased significantly in the period (8,3% per year).

Keywords: Mortality, premature. Child mortality. Cause of death. Health services evaluation. Unified Health System. Epidemiology.

[I]School of Nursing, Universidade Federal de Minas Gerais – Belo Horizonte (MG), Brazil.

[II]Department of Medicine and Nursing, Universidade Federal de Viçosa – Viçosa (MG), Brazil.

[III]School of Medicine, Universidade de São Paulo – Ribeirão Preto (SP), Brazil.

[IV]Department of Surveillance of Non-communicable Diseases and Health Promotion, Health Surveillance Secretariat, Ministry of Health – Brasília (DF), Brazil.

[V]School of Public Health Faculty, Universidade de São Paulo – São Paulo (SP), Brazil.

Corresponding author: Deborah Carvalho Malta. Universidade Federal de Minas Gerais, Escola de Enfermagem. Avenida Prof. Alfredo Balena, 190, CEP: 30130-100, Belo Horizonte, MG, Brazil. E-mail:dcmalta@uol.com.br

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RESUMO: ***Objetivo:*** Analisar a tendência da mortalidade de crianças menores de cinco anos, residentes no Brasil e regiões, utilizando a "Lista Brasileira de Causas de Mortes Evitáveis". ***Método:*** Estudo ecológico de séries temporais da taxa de mortalidade por causas evitáveis e não evitáveis, com correções para as causas mal definidas e para o sub-registro de óbitos informados, no período de 2000 a 2013. ***Resultados:*** No Brasil, houve maior declínio da taxa de mortalidade por causas evitáveis (5,1% ao ano), comparadas com as causas não evitáveis (2,5% ao ano). As causas evitáveis por adequada atenção à gestação constituíram a maior concentração de óbitos em 2013 (12.267) e tiveram a segunda menor redução percentual média anual (2,1%) e do período (24,4%). As menores taxas de mortalidade na infância foram evidenciadas nas regiões Sul e Sudeste. Observa-se, no entanto, que a Região Nordeste apresentou o maior declínio da mortalidade infantil reduzível (6,1% ao ano) e o Centro-Oeste, o menor (3,5% ao ano). ***Conclusão:*** O declínio da taxa de mortalidade na infância já era esperado nessa última década, levando a acreditar na evolução da resposta dos sistemas de saúde, além de nas melhorias nas condições de saúde e determinantes sociais. Atenção especial deve ser oferecida às causas relacionadas à gestação, ou seja, avançar na qualidade do pré-natal, em particular, em razão da ocorrência de mortes no feto e no recém-nascido oriundas de afecções maternas que apresentaram importante acréscimo no período (8,3% ao ano).

Palavras-chave: Mortalidade prematura. Mortalidade na infância. Causas de morte. Avaliação de serviços de saúde. Sistema Único de Saúde. Epidemiologia.

INTRODUCTION

Different authors have used the concept of preventable death[1-4], with studies by Rutstein et al.[1] considered as precursors in the 1980s. These authors defined these deaths as those that could have been prevented, entirely or in part, by effective health care services and proposed a list with approximately 90 preventable conditions[1].

In the following years, several studies sought to implement this concept[1-3], aiming to construct indicators sensitive to the quality and diversity of health care, as they are a measure of result or impact of services useful to their surveillance and monitoring processes[4]. Charlton and Velez were the first to apply the concept in population studies in England and Wales[2]. We highlight the studies performed by Holland[3] on this theme in several countries and continents (Europe, Asia, and Oceania)[3].

In Brazil, the scientific production on preventability also increased, including review articles[4,5], service performance evaluations[6,7], and mortality trend studies in specific groups[7-10]. It is also worth mentioning the "Brazilian List of Preventable Causes of Death" for the under 5 and 5 to 74 age groups, from the perspective of the Brazilian Unified Health System (SUS)[11]. The construction of the list involved specialists from relevant areas and intense debate on the topic[11,12]. The theoretical framework adopted in the development of the Brazilian list in 2007 was based on lists available in Brazil and the world, in particular, the ones by Ortiz[13], and Tobias and Jackson[14].

Thus, the article applies the list and aims to analyze the trend of preventable and non-preventable causes of deaths in children aged 0 to 4 years in Brazil and regions.

METHOD

This is an ecological time-series study on child mortality trend according to preventable criteria in Brazil and regions from 2000 to 2013. The population consisted of children aged 0 to 4 years, who died in this period due to underlying causes according to the International Statistical Classification of Diseases and Related Health Problems, 10th Revision (ICD-10), whose death was reported to the Brazilian Mortality Information System (*Sistema de Informação sobre Mortalidade* – SIM) of the Ministry of Health.

The trend analysis of preventable deaths (2000-2013) used the "Brazilian List of Preventable Causes of Deaths"[11,12]. Deaths were classified as:

1. Preventable causes, with the following subgroups: 1.1 Reducible by vaccination actions; 1.2 Reducible by adequate pregnancy, delivery, fetus, and newborn care; 1.3 Reducible by adequate diagnostic and treatment actions; and 1.4 Reducible by adequate health promotion actions linked to health care actions; 2.
2. Non-preventable causes of death[12].

The original list anticipates the inclusion of ill-defined causes of death; however, the current work excluded this item, because it redistributed these causes.

We used the SIM databases and the Live Birth Information System (*Sistema de Informação sobre Nascidos Vivos* – SINASC) of the Health Surveillance Secretariat of the Ministry of Health (*Secretaria de Vigilância em Saúde/Ministério da Saúde* – SVS/MS). The SIM database was corrected using the redistribution of deaths classified as ill-defined causes (IDCDs) and the correction of underreported deaths. IDCDs have decreased significantly in the last decade due to the improvement and qualification of the SIM database, making it necessary to use methodologies to correct it, especially when analyzing time-series[15-18]. Therefore, we decided on the proportional redistribution of ill-defined deaths among all known causes, assuming that the distribution of ill-defined causes of death is similar to defined ones[15]. To that end, we adapted the methodology proposed by Duncan et al.[15] since we included external causes in the redistribution of IDCDs of the present study. The inclusion of external causes in the redistribution of deaths was based on studies that evidenced findings of violence and accidents among the investigated IDCDs[18]. Thus, we chose to add the total number of ill-defined deaths – including external causes – to the redistribution of deaths.

The correction of the number of reported deaths was estimated by means of SIM coverage in Brazilian cities, using data from the study developed by Szwarcwald et al.[19] entitled "Active Search for Deaths and Births in the Northeast and in the Legal Amazon: Estimation of SIM and SINASC coverage in Brazilian municipalities." Deaths were corrected according to year, gender, and federation units for underreporting and redistribution of IDCDs. We used the specific rate for this age group.

The trend of child mortality due to preventable causes and its subgroups and non-preventable causes were analyzed using the Simple Linear Regression method. The analysis of residuals evaluated the adequacy of the model, as well as the homoscedasticity of the

variables by states and causes. The SPSS Statistics 17.0 software was used. The level of acceptable statistical significance was $p < 0.05$.

This study complied with the recommendations of Resolution 466/12 of the National Health Council (NHC). We used secondary data, available on the official website of the Ministry of Health, which did not include confidential information, such as name and address. Thus, the study did not need the approval of a Research Ethics Committee.

RESULTS

In Brazil, 103,976 children under the age of 5 died –due to all causes – in 2000, this number dropped to 66,160 deaths in 2007, and 51,344 in 2013. In the same period, the number of deaths due to preventable causes decreased from 78,703 in 2000 to 35,318 in 2013, with a percentage reduction in mortality rate of 5.1% per year and 49.3% in the period (Table 1).

Reducible causes by vaccination actions remained stable in Brazil, with 181 deaths in 2000 and 128 in 2013 ($p = 0.193$), with an increase in deaths by pertussis ($p = 0.014$) (Table 1).

Reducible causes by adequate pregnancy care had the highest proportion of deaths among all subgroups in 2013 (12,267), approximately one-third of cases. There was a reduction of

Table 1. Absolute number of deaths, corrected mortality rate, percentage reduction in the period 2000-2013, and average percentage of annual reduction per thousand live births in children aged 0 to 4 years, according to preventable and non-preventable causes and the main specific underlying causes reducible by the Unified Health System. Brazil, 2000, 2007, and 2013.

Causes		2000	2007	2013	2000-2013 Percentage reduction	Annual Percentage reduction	p-value
1 Preventable causes	Cases	78,703	47,241	35,318	49.3	5.1	< 0.001
	Rate	22.8	15.5	11.6			
1.1 Vaccination actions	Cases	181	54	128	20.2	2.0	0.193
	Rate	0.05	0.02	0.04			
Pertussis		0.011	0.007	0.033	-193.2	-19.9	0.014
1.2 Adequate pregnancy care	Cases	18,320	14,707	12,267	24.4	2.1	< 0.001
	Rate	5.3	4.8	4.0			
Neonatal respiratory distress syndrome		2.6	1.5	1.0	62.1	7.1	< 0.001
Fetus and newborn affected by maternal conditions		0.3	0.6	0.8	-161.7	-8.3	< 0.001
Short-term pregnancy disorders and low birth weight		1.2	1.5	0.9	30.5	2.1	0.251

Continue...

Table 1. Continuation.

Causes		2000	2007	2013	2000-2013 Percentage reduction	Annual Percentage reduction	p-value
1.3 Adequate delivery care	Cases	9,550	6,537	4,645	45.1	4.4	< 0.001
	Rate	2.8	2.1	1.5			
Intrauterine hypoxia and perinatal asphyxia		1.6	1.2	0.7	54.9	5.8	< 0.001
Neonatal aspiration syndrome, except regurgitated milk and food		0.6	0.5	0.4	40.5	3.8	< 0.001
Fetus and newborn affected by placenta previa and other forms of placental abruption and hemorrhage		0.3	0.2	0.2	16.0	0.9	0.019
1.4 Adequate newborn care	Cases	22,605	11,524	8,278	58.7	6.5	< 0.001
	Rate	6.6	3.8	2.7			
Neonatal-specific infections, except congenital rubella and viral hepatitis		2.5	2.2	1.5	40.9	3.9	< 0.001
Neonatal-specific respiratory disorders		3.4	1.0	0.8	77.4	10.1	< 0.001
Other perinatal disorders		0.2	0.2	0.2	-6.0	-0.7	0.102
1.5 Adequate diagnostic and treatment actions	Cases	13,731	7,048	5,112	58.0	6.4	< 0.001
	Rate	4.0	2.3	1.7			
Pneumonia		1.9	1.1	0.8	56.5	6.0	< 0.001
Other bacterial diseases		1.2	0.6	0.4	65.5	7.7	< 0.001
Other acute lower airway infections		0.1	0.1	0.1	13.4	0.4	0.026
1.6 Health promotion actions linked to care actions	Cases	14,316	7,371	4,888	61.5	6.8	< 0.001
	Rate	4.2	2.4	1.6			
Intestinal infectious diseases		1.7	0.7	0,.3	80.5	11.3	< 0.001
Other accidental respiratory risks		0,.3	0.2	0,.3	-0.4	-0.2	0.866
Traffic accidents		0,.3	0,.3	0.2	33.5	2.6	< 0.001
2 Non-preventable causes	Cases	25,273	18,919	16,026	28.4	2.5	< 0.001
	Rate	7.3	6.2	5.2			
Total (Preventable + Non-preventable)	Cases	103,976	66,160	51,345	44.3	4.4	< 0.001
	Rate	30.1	21.6	16.8			

24.4% ($p < 0.001$) in the mortality rate for these causes between 2000 and 2013 and 2.1% per year. Among the main specific causes of death in this group, we highlight:

- neonatal respiratory distress syndrome decreased 7.1% per year and 62.1% in the period ($p < 0.001$);
- causes of deaths related to the fetus and newborn affected by maternal conditions increased 8.3% per year and 161.7% in the period ($p < 0.001$);
- disorders related to short-term pregnancy and low birth weight – not elsewhere classified – remained stable ($p = 0.251$). (Table 1).

Preventable deaths due to adequate delivery care revealed a decrease in the mortality rate of 45.1% ($p < 0.001$) between 2000 and 2013 and 4.4% per year. The specific causes of death that contributed most to this group were:

- intrauterine hypoxia and perinatal asphyxia, with a reduction of 5.8% per year and 54.9% in the period ($p < 0.001$);
- neonatal aspiration syndrome, with a decrease of 3.8% per year and 40.5% in the period ($p < 0.001$);
- fetus and newborn affected by placenta previa and others, with a reduction of 0.9% per year and 16% in the period ($p = 0.019$) (Table 1).

The group of reducible causes due to adequate neonatal care decreased from 22,605 deaths in 2000 to 8,278 in 2013, with a reduction in mortality rate of 6.5% per year and 58.7% in the period ($p < 0.001$), holding the second position in magnitude. The main causes of death in this group include:

- neonatal-specific infections decreased 3.9% per year and 40.9% in the period ($p < 0.001$);
- neonatal-specific respiratory disorders decreased 10.1% per year and 77.4% in the period ($p < 0.001$);
- other perinatal disorders were stable ($p = 0.102$) (Table 1).

Adequate diagnosis and treatment actions were responsible for 13,731 deaths in 2000 and 5,112 in 2013, with a reduction of 6.4% per year and 58% in the period ($p < 0.001$). The three main causes of death in this group were:

- pneumonia, with a mortality reduction of 6% per year and 56.5% in the period ($p < 0.001$);
- other bacterial diseases, with a decrease of 7.7% per year and 65.5% in the period ($p < 0.001$);
- other acute lower airway infections, which dropped 0.4% per year and 13.4% in the period ($p = 0.026$) (Table 1).

Reducible causes by adequate health promotion actions decreased from 14,316 deaths in 2000 to 4,888 in 2013, constituting a mean annual reduction of 6.8% and 61.5% ($p < 0.001$) in the period. The largest reductions were:

- infectious and intestinal diseases, which declined 11.3% per year and 80.5% in the period ($p < 0.001$);
- traffic accidents, with a reduction of 2.6% per year and 33.5% in the period ($p < 0.001$).

Other accidental respiratory risks showed stability ($p = 0.866$) (Table 1).

Non-preventable causes due to health service actions also dropped from 25,273 deaths in 2000 to 16,026 in 2013, with a decrease of 2.5% per year and 28.4% in the period (Table 1).

Figure 1 shows the decline in under-five mortality rate related to preventable and non-preventable causes in Brazil in the period. Preventable causes decreased 5.1% per year and 49.3% in the period ($p < 0.001$), while non-preventable causes halved, 2.5% per year and 28.4% in the period ($p < 0.001$).

Table 2 demonstrates similar results of the mortality rate from preventable and non-preventable causes according to Brazil and regions. The decrease in preventable causes was twice the non-preventable ones in all regions. The Northeast had the highest average annual reduction in the period (6.1% per year), followed by the North (4.7%), South (4.5%), and Southeast (4.4%), and the Midwest had the lowest (3.5%). The percentage of annual reduction in mortality rate from non-preventable causes was lower (2.5%), varying per region, with 1% in the Midwest and 3.9% in the Northeast (the highest) (Table 2).

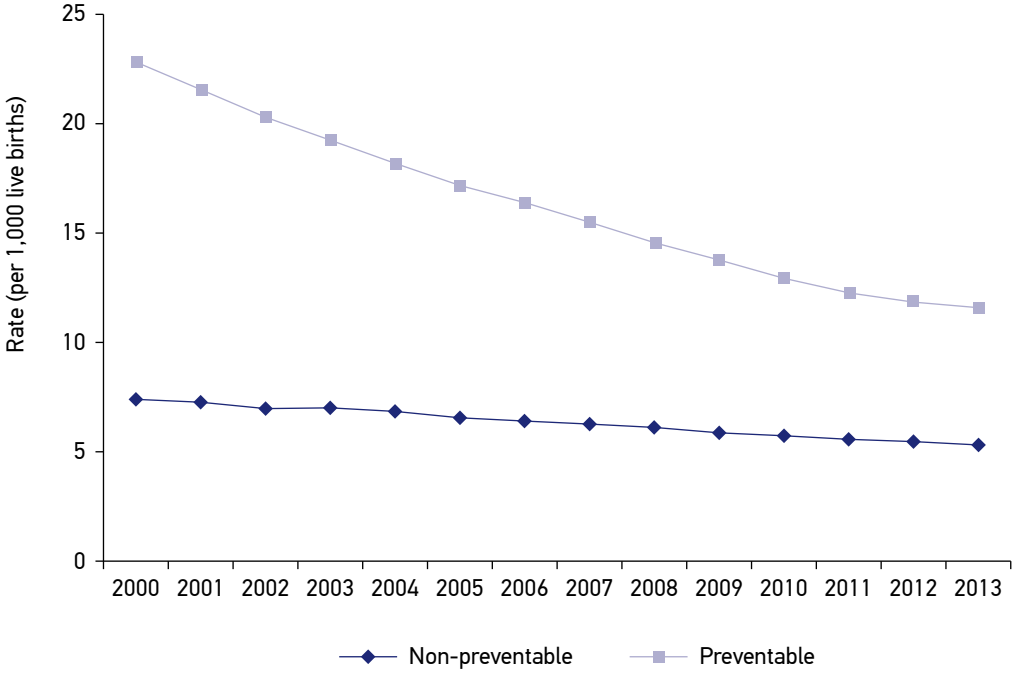

Figure 1. Corrected mortality rate per thousand live births in children aged 0 to 4 years, according to preventable and non-preventable causes. Brazil, 2000 to 2013.

Figure 2 shows the progress of preventable death according to subgroup and region in the period 2000-2013. The mortality rate in the period studied decreased in all groups, except for reducible causes by vaccination actions, which dropped until 2005-2007 and increased again in all regions until 2012, when it showed a reduction trend in all but the North and Midwest regions, where the rise persisted in 2013 (Figure 2A).

Other groups presented more homogeneous declines for other preventable causes (Figures 2B to 2F). Adequate diagnostic and treatment actions also decreased throughout the period, except in the North and Midwest regions, which increased between 2012 and 2013 (Figure 2E).

DISCUSSION

The results of the current study reveal improvements in child mortality rates. Deaths due to causes considered preventable had a more significant reduction, while non-preventable causes showed a smaller decline – half – in the period under study. The greatest reductions – 6.8% per year – resulted from health promotion actions linked to care actions (causes such

Table 2. Corrected mortality rate and average annual percentage reduction per thousand live births in children aged 0 to 4 years, according to preventable and non-preventable causes. Brazil and regions, 2000, 2007, and 2013.

	Region	2000	2007	2013	Average percentage reduction	p-value
Non-preventable	North	8.1	7.6	6.3	1.8	< 0.001
	Northeast	9.5	7.2	5.7	3.9	< 0.001
	Southeast	6.0	5.3	4.7	1.9	< 0.001
	South	5.5	5.0	4.5	1.6	< 0.001
	Midwest	7.0	6.5	6.1	1.0	< 0.001
	Brazil	7.3	6.2	5.2	2.5	< 0.001
Preventable	North	30.6	22.0	16.3	4.7	< 0.001
	Northeast	31.7	19.6	13.9	6.1	< 0.001
	Southeast	17.1	11.9	9.5	4.4	< 0.001
	South	14.3	10.3	7.9	4.5	< 0.001
	Midwest	18.9	14.2	11.9	3.5	< 0.001
	Brazil	22.8	15.5	11.6	5.1	< 0.001

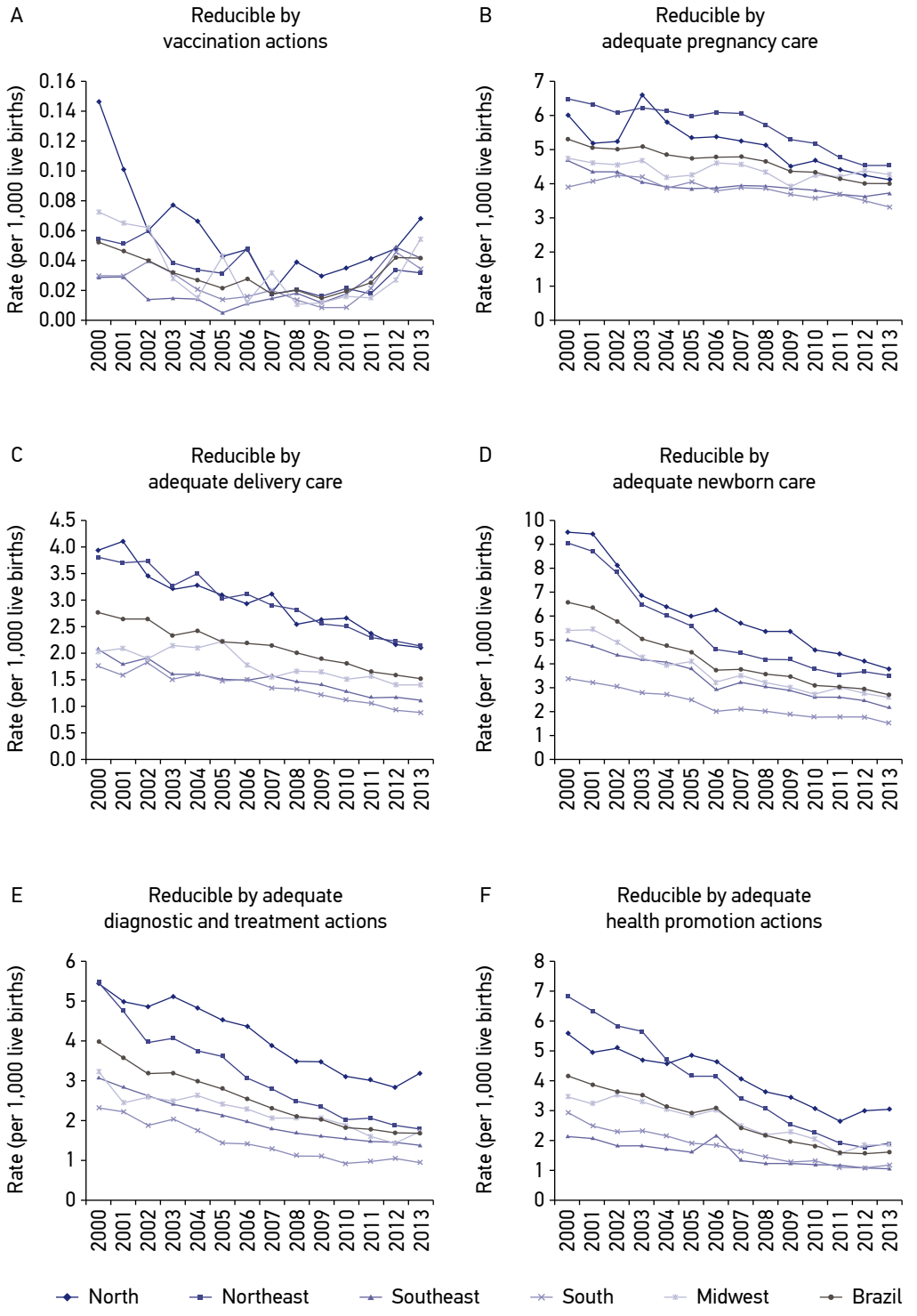

Figure 2. Corrected mortality rates according to preventable causes of death per thousand live births in children aged 0 to 4 years. Brazil and regions, 2000 to 2013.

as intestinal infectious diseases) and adequate newborn care (neonatal respiratory disorders), followed by adequate diagnostic and treatment actions (pneumonia, bacterial infections). Adequate delivery care (causes such as hypoxia, asphyxia) had a reduction of 4.4% per year, and the lowest decrease in rates resulted from vaccine-preventable diseases, which already presented very low rates due to advances in the past decades, with vaccines against poliomyelitis, measles, diphtheria, tetanus, and others. Causes associated with adequate pregnancy care accounted for a quarter of the causes of death and had the second lowest reduction in the period. The South and Southeast regions had the lowest mortality rates in childhood. However, the Northeast region had the highest decrease in reducible child mortality (6.1% per year) and the Midwest, the lowest (3.5% per year).

The literature has been presenting the use of indicators of preventable deaths as a useful tool for monitoring the impact of the Health sector on the risk of death of populations. According to Malta and Duarte[4], these methodologies are characterized by objectivity, timeliness, ease, and availability of indicators, enabling analysis of their temporal trends and comparisons between regions and cities. Preventable deaths become indicators sensitive to the quality of care provided by the health system and, therefore, allow the performance evaluation of its services[1,3,4,14].

The present study advances methodological aspects by including the redistribution of deaths not registered in the SIM, according to the methodology proposed by Szwarcwald et al.[19], in addition to incorporating the redistribution of IDCDs. The redistribution of IDCDs in defined causes represents a methodology to qualify death records. Statistical methods for this correction are used based on the behavior of the defined causes reported[15-18]. More commonly, proportional redistribution is used according to defined causes, registered by gender and age, excluding external causes[15]. França et al.[18] highlighted the importance of investigating death to support its redistribution. The authors found 9.3% of deaths by external causes among the ill-defined deaths investigated[18]. These findings indicate the importance of including external causes in the redistribution of deaths. The Global Burden Disease (GBD) study[16] has new parameters for redistribution of deaths, based on census estimates, death record systems, and other existing studies, and includes garbage codes, or non-specific codes, in the redistribution. The current study redistributed all causes of death, including external causes, according to findings by França et al.[18.] These methodological advances aim to establish estimates and incorporate rates closer to reality[18,19].

Progress in reducing child mortality worldwide has been described as one of the greatest global success stories in international health. Rates have halved in the last two decades, compared with the 1990 baseline of the Millennium Development Goals (MDGs). Between 1990 and 2013, under-five mortality rates dropped from 90 deaths per 1,000 live births (LB) to 46 deaths per 1,000 LB[20]. In absolute numbers, under-five deaths decreased from 9.9 million in 2000 to 6.3 million in 2013[20]. However, this indicator is still very relevant in the world and was included in the Sustainable Development Goals (SDGs) which indicate challenges to be faced[21].

The MDGs report revealed that complications in preterm birth are currently the leading global cause of under-five deaths, accounting for 17% of them, which go beyond the neonatal period (0-29 days)[22]. This finding demonstrates the transition in child health care, overcoming the predominant causes of the past, such as diarrhea, pneumonia, and infectious diseases[20,22].

Brazil was ahead of many countries, as it achieved the goal of reducing child mortality by 2/3, defined by the fourth MDG[22]. The country also decreased child mortality in both the post-neonatal (29 days to 1 year) and neonatal periods, the latter, however, was less expressive[7,9,10,22,23]. Post-neonatal mortality includes causes of death such as diarrhea, malnutrition, pneumonia, HIV/AIDS, and vaccine-preventable diseases – measles, tuberculosis, among others –, and its reduction reveals an improvement in sanitary conditions and progress in the supply of primary health care in the country[20,22,23].

The WHO report highlights the importance of perinatal causes and, in order to reduce them, it is necessary to focus on prenatal, delivery, and newborn care. Mortality rates due to adequate pregnancy care had the highest concentration of deaths in 2013 (23.8%) and the lowest reduction in the period (24.4%). Data from SINASC showed a rise in access to prenatal care in the country in recent years[23]. Also, data from the National Health Survey revealed that 97.4% of women reported having received prenatal care, with 83.6% starting within 13 weeks of pregnancy and 78.3% attending 6 or more appointments[24]. In other words, prenatal care increased in the country, which is consistent with the expansion of primary health care and the Family Health Program[25].

Studies report that inadequate prenatal care results from situations such as social inequality, access to health services, and acceptance of pregnancy[26,27]. Studies also claim that inadequate prenatal care is one of the most important risk factors in neonatal mortality[26-28]. Therefore, in addition to increasing access, it is necessary to invest in improving the quality of prenatal care through adequate management of pregnant women with risk factors and complications, such as hypertension, diabetes, genitourinary tract infections, among others.

Regarding prenatal-sensitive causes, deaths due to Neonatal Respiratory Distress Syndrome (NRDS) decreased, with emphasis on initiatives such as the use of pulmonary surfactants, included in the special procedures table of SUS under Directive No. 139 of November 10, 1997, allowing the improvement of the respiratory clinical status as well as the application of protocols that introduced drugs to induce lung maturity[29]. However, maternal conditions affecting the fetus and the newborn, e.g., diabetes, kidney diseases, increased in the period, which may reflect both a better diagnosis of these conditions during pregnancy and the growth in their prevalence[7]. Deaths from disorders related to short-term pregnancy and low birth weight were stable in the study period. Some studies have shown an increasing trend in preterm births in Brazilian cities[30]. SINASC also reported a rise in the registry of underweight newborns from 7.7% in 1997 to 12.5% in 2012[23].

The causes of death related to adequate delivery care presented a reduction in the period; causes such as intrauterine hypoxia, perinatal asphyxia, and neonatal aspiration syndrome decreased significantly, showing advances in delivery care. Perinatal asphyxia and intrauterine

hypoxia are syndromic manifestations, and their reduction could also be due to a more correct indication of other causes of death[7]. Deaths from placenta previa, placental abruption, and hemorrhage also decreased in the period.

Child mortality rate due to reducible causes regarding adequate newborn care presented the second highest reduction (58.7%), suggesting an improvement in the access to delivery and newborn care[20,23]. Deaths resulting from neonatal-specific respiratory disorders and neonatal-specific infections decreased, except congenital rubella and viral hepatitis. The set of preventable causes related to health promotion and care actions showed the most significant decline (61.5% per year) in the study period. In this group, we highlight the significant reduction in deaths by intestinal infectious diseases (80.5%), confirming results from previous global and national studies[23]. The expansion of basic sanitation, the growth of intersectoral actions, the improvement of oral rehydration therapy[7], and the impact of rotavirus vaccination[31] were initiatives that promoted the reduction in child mortality in the country. In addition, deaths resulting from traffic accidents decreased, which has been attributed to legal measures, such as the mandatory use of car seats and safety devices[32].

The group of reducible causes by adequate diagnostic and treatment actions, including pneumonia and other bacterial diseases, had the third largest reduction in this period (58%). In Brazil, this result can be accredited to the expansion of the primary health care system and the family health program strategy[7,25,33].

Vaccine-preventable diseases represent the group with the lowest number and rate of deaths – demonstrating the advances observed in the past – due to the incorporation of numerous vaccines in the schedule of the National Immunization Program (NIP)[7]. However, more recently, rates have been stable, with an increase in deaths due to causes such as pertussis, reinforcing the need to maintain surveillance, immunization, and health care actions, as these deaths are entirely preventable with the access to vaccines.

Upon analyzing the trend of reducible child mortality rates, the Northeast region had the highest decline and the Midwest, the lowest. This information shows that although regional inequalities have decreased, differences remain, with the lowest child mortality rates being reported in the South and Southeast regions.

Limitations of the study include the use of lists of preventable causes of death, which may vary according to advances in knowledge and use of new technologies, as well as the need to answer if effective health care can impact the proposed causes. In addition, external determinants of health care can affect the analyzed events and also alter the incidence and lethality of these causes of death regardless of the Health sector; for example, changing risk factors, as well as the identification of ecological associations of preventable deaths with the improvement of quality and coverage of health care must be interpreted with caution[7]. Lastly, another limitation is the use of SIM data, which, even if corrected, can be subjected to sub-enumeration, making the decline rates uncertain, despite the corrections.

International[1-3] and national[4,7,9,10,15] studies show the benefits of care factors in reducing preventable deaths. As a result, non-preventable causes due to external non-modifiable factors decrease more slowly than preventable ones, as they receive less intervention.

CONCLUSION

The current study introduced methodological changes in the application of the "List of Preventable Causes of Death" as it incorporated correction factors for underreporting and proposed the distribution of IDCDs.

Child mortality rates dropped globally, revealing advances in the delivery of health care. However, it still presents a challenge. In order for Brazil to meet the SDGs, the gaps from previous years must be identified and overcome.

Although the under-five mortality coefficients showed a declining behavior, they remain high when compared to other countries such as Sweden, Japan, Germany, Cuba, and the United States of America. It is important to pay special attention to pregnancy-related causes of death, that is, we need to improve the quality of prenatal care and the management of pregnant women, especially concerning fetal and newborn deaths resulting from maternal conditions, which increased significantly in the period of the study.

The list considers the advances in the field of public health care in Brazil and the potential for SUS intervention, according to its principles and technological incorporation. The use of the preventable death indicator is useful for monitoring trends, allowing the identification of gaps as well as supporting the proposition of suitable solutions.

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