Will Brazil comply with the SDG 3.1 of the 2030 Agenda? An analysis of maternal mortality, from 1996 to 2018

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Abstract *This article aims to analyze if it is possible for Brazil to meet the Sustainable Development Goals (SDG) 3.1, based on a diagnosis of the situation of maternal mortality in the Health Regions (HRs) of Brazil, in 2018, and the main characteristics of this mortality between 1996 and 2018 in the country. The study consists of two articulated phases: (i) bibliographical analysis of maternal mortality in Brazil; (ii) study in the Mortality Information System (SIM, in Portuguese). In 2018, from the 450 HRs, 159 showed a maternal mortality rate (MMR) of above 70 per 100,000 live births (LBs). Between 1996 and 2018, in Brazil, there was a reduction among women 30 to 49 years of age. However, in the age group of 10 to 29 years, there was no change during the time studied. The dissemination of the Maternal Mortality Committees, the PHPN, the PNAISM, and the "Stork Network" have all contributed to improvements in late pregnancies; however, they were inefficient at preventing deaths among young mothers. Compliance with SDG 3.1 requires: prioritization of CIR with MMR greater than 70.0/100,000 LB; qualification of prenatal services, focusing on care among women aged 10 to 29 years and hypertensive complications; and legalization of abortion.*

Key words *Maternal mortality, Policies, SDG*

Introduction

Reducing maternal mortality is a challenge for health systems around the world. This compromise has been included in the United Nations (UN) agenda, since the Millennium Development Goals (MDG), valid from 2000 to 2015.

Among the goals of the MDG, reduction of maternal mortality was one goal that was not met by many countries, including Brazil, and continues to be part of an unconcluded agenda.

In 2015, the new global agenda was ratified: Sustainable Development Goals (SDG). Among those objectives, the reduction of maternal mortality is redefined as Goal SDG 3.1: *By 2030, reduce the global rate of maternal mortality to less than 70 deaths by 100,00 live births*[1].

Aiming to make the SDG more in tune with local challenges, the Brazilian Federal Government, in a partnership with the Institute for Applied Economic Research (Ipea, in Portuguese), has adapted the Goals of the 2030 Agenda to the national reality, redefining SDG 3.1: *By 2030, reduce the ratio of maternal mortality to a maximum of 30 deaths per 100,000 live births*[2].

Although it is considered that Brazil has the conditions to go beyond the challenges proposed by the UN, maternal mortality is still present throughout the country, with great inequalities amongst different states.

Such inequalities become even more explicit when we examine the Brazilian reality from the standpoint of its 450 Health Regions (HRs), which are continuous geographic regions consisting of neighboring municipalities, grouped according to cultural, social, and economic affinities, which share networks of communication and infrastructure[3].

In 2018, out of the 450 HRs, 356 registered deaths by maternal causes (79.1%). 313 of these had ratios above *30 deaths per 100,000 live births (LBs)* (69.5%), and 159 had ratios above *70 deaths per 100,00 LBs* (35.3%)[4].

The comprehension of this mortality demands an approach which takes into consideration both regional inequalities and questions such as: the quality of available information; policies, programs, and actions aimed at dealing with maternal mortality; care provided during pregnancy and puerperium; the social profile and risk factors affecting those women; and illegal abortion.

With the purpose of contributing to this discussion, this study sought to analyze the possibilities of Brazil meeting SDG 3.1 targets. To achieve this, a diagnosis will be conducted concerning: (i) the situation of maternal mortality, focusing on the HRs in 2018, and (ii) the main characteristics of this mortality, from 1996 to 2018.

Methodological aspects

This study was conducted in two articulated phases. In the first phase, a bibliographical analysis was performed on maternal mortality in Brazil. In the second phase, a study was carried out on maternal mortality, using the Mortality Information System (SIM, in Portuguese). The purpose of the first phase is to provide the theoretical reference for the analysis of the data produced in the second phase.

The bibliographical analysis focused on the scientific production published in the SciElo.org database. The research, conducted on October 15th, 2019, used "maternal mortality" as a search word and the index "abstract" as the coverage of the research. In this search, 430 articles were found, and their abstracts were analyzed. From this analysis, 209 were discarded: 122 were duplicates; 36 had *infant mortality* as their aim; 17 referred to maternal mortality in other countries; 7 were about breastfeeding; 27 had as their object of study the *pregnancy of albino rats, births in the bovine population, and reproductive performance of sheep and swine.*

Thus, 221 references were related to the aim of this article and were within the scope to be explored in the bibliographical analysis.

As regards the study conducted in SIM, based on declared maternal deaths, the period between 1996 and 2018 was used as a time frame, which covers the period in which the SIM codifies its information from the ICD-10.

Moreover, the year of 2018, with more current data available, was analyzed separately, focusing on the HRs, to investigate the regional disparities in maternal mortality.

The characterization of maternal mortality[5] was performed based on the following ICD-10 codes:

▪ O00-O99 – referring to pregnancy, delivery, and puerperium (Chapter 15), except for codes O96 and O97;

▪ A34 – obstetric tetanus (*Chapter 1*);

▪ B20-B24 – Human immunodeficiency virus (*Chapter 1*);

▪ D39 – neoplasm of uncertain behavior of the female genital organs (*Chapter 2*);

▪ E23 – hypofunction and other disorders of the hypophysis (*Chapter 4*);

▪ F53 – mental disorders and behaviors associated with the puerperium, not classified anywhere else (*Chapter 5*); and

▪ M83 – adult osteomalacia (*Chapter 12*).

For the codes that are not listed in chapter 15, we used the search words "Death pregnancy/puerperium", selecting the categories: "During pregnancy, delivery, or abortion" and "During puerperium, up to 42 days".

Although SIM has adequate coverage, maternal deaths are, historically, not properly informed on Death Certificates in Brazil. The lack of confirmation of these deaths results in some of them being classified according to other definitions from the ICD-10, generating an underreported count.

Besides the weaknesses of the government databases, this study also has the following limitations: (i) the non-use of the correction factor for the underreporting of maternal death estimates and (ii) the non-use of statistical analysis of temporal series tendencies, focusing only on the descriptive analysis of the data.

The results of the research are presented with absolute and relative frequency and in maternal mortality rates (MMR) standardized by 100,000 LBs. The variables used to characterize maternal death were: *age group, place of occurrence, type of obstetric cause, ICD-10 groups, ICD-10 categories, education, skin color and race, marital status, Brazilian states, and HRs.*

Maternal mortality in Brazil, a bibliographical analysis

Of the 221 selected articles, 181 (81.9%) were published in journals from three specific areas: Public Health (104 articles, 45.1%), Gynecology and Obstetrics (42, 19.0%), and Nursing (35.15, 8%).

The remaining 40 articles (18.1%) are from Health History (3), Demographics (1), and other medical specialties (36).

Four journals stand out for their sheer volume of articles published on this topic: "Revista Brasileira de Ginecologia e Obstetrícia" (42, 190%); "Cadernos de Saúde Pública" (34, 15.4%); "Revista de Saúde Pública" (22, 9.9%); and "Revista Brasileira de Epidemiologia" (17, 7.7%). Combined, they total 115 of the articles selected in this analysis (52.0%).

The oldest article used here was published in 1972. However, it was only in the end of the 1990's that the scientific production on the topic intensified: 92.7% of the articles used for this analysis were published between 1998 and 2019. The triennium 2016-17-18 stands out, with 46 publications (20.8%).

Furthermore, the bibliographical analysis will discuss the definition and classification of the concept of "maternal death" and the reliability of the information; the public policies for dealing with maternal mortality, aimed at the embracement and medical care provided to the pregnancy-puerperium – pre-natal care cycle, hospitalization for delivery and Caesarian section, and social profile and risk factors associated with maternal death - prenatal care adaptation, hypertension, age group, education, race/skin color, marital status, pre-natal care, and unsafe abortion.

Bibliographical analysis

Maternal death is defined by the World Health Organization (WHO) as the death of a woman during gestation or during the period of 42 days after its end, due to any cause related to or aggravated by pregnancy or by measures related to it, not including accidental or incidental causes[6].

MMR is the health indicator used to verify[6,7] the risk of death during pregnancy, delivery, and puerperium; the health conditions of the female population; the adaptation of the health system to respond to the sanitary needs of women; and social inequalities.

Maternal deaths are classified as: *directly obstetric*, when related to complications during the pregnancy-puerperium cycle, due to inadequate practices or omissions; *indirectly obstetric*, when caused by pre-existing diseases or which developed/were aggravated due to the pregnancy; and *non-obstetric*, when they occur by accidental or incidental causes[7-9].

In Brazil, maternal deaths are, historically, poorly registered on death certificates[9]. The bad quality of information is related to errors: in the statement of the cause of death, by doctors; when filling out the Statement of Death; and when selecting the basic cause (under-notification) and in the absence of Statement of Death (under-reporting) by the responsible parties[10].

Regardless of such difficulties, several initiatives were taken, seeking to improve the quality of information: (1) the creation of the National System of Live Births (Sistema Nacional de Nascidos Vivos[6]), in 1990; (2) the introduction of mandatory entry variables in the Statement of Death, related to the presence of pregnancy at the time of death[6,10], in 1996; (3) regulation of the law of free cost for Statements of Death and

Birth[6,7], in 1998; and (4) the action of the Maternal Mortality Committees[7].

In addition to these measures to improve information quality, other policies have been implemented since the 1980's to address maternal deaths, making it an issue of both public health and female health.

In 1983, Brazil instituted the Program of Integral Assistance to Women's Health (PAISM, in Portuguese). PAISM is a historical reference, has defined the concept of "integral assistance to women's health", and has incorporated family planning as a health right[11,12].

In 1987, the Maternal Mortality Committee of the State of São Paulo was created, with strategic actions aimed at the promotion and prevention of maternal deaths[13]. There has been a wide dissemination of such initiatives around the country, and in 2005, Brazil already had *27 state, 172 regional, 748 municipal, and 206 hospital committees*[14].

In 2000, the Ministry of Health (MS) implemented the Prenatal Care and Birth Humanization Program (PHPN, in Portuguese), establishing adequate procedures for prenatal care, delivery, and birth.

Between 1990 and 2001, the MMR decreased from 141.0 to 80.0/100,000 LBs[11,15]; such policies may have contributed to that improvement.

During that period, the UN member states ratified the MDG, which proposed, among other aims, the reduction of maternal mortality by three fourths by 2015[11,15].

In 2004, the Ministry of Health implemented the National Policy for Integral Attention to Women's Health (PNAISM, in Portuguese), recognizing the diversity of the segments of the female population and of the cycles of life. The Stork Network, another policy implemented in 2011, aimed to guarantee the right to have reproductive planning, humane medical care, and safe care during the pregnancy-puerperium cycle[1,12].

Despite these initiatives, Brazil is still unable to meet the reduction projected by the MDG: a level of maternal mortality below 36.0/100,00 LBs[15]. In 2015, the MMR was 59,7/100,000 LBs, with a tendency of stagnation.

For Leal et al.[12], the stagnation of the MMR in the early 2000's was due to: abortion being illegal; problems in the quality of health care during pregnancy, delivery, and birth, with regional inequalities in providing qualified services; the wandering of expecting mothers from one facility to another; and the epidemic of Caesarian sections and premature births.

Such stagnation is explained, according to Rattner[16], by the inadequacy of the medical care provided for gestation, delivery, and post-delivery.

The combination of delivery in a health institution and adequate professional care is considered to be the most efficient intervention in terms of reducing maternal mortality: professional training, associated with adequate facilities, allow for the reduction by up to a third of all maternal deaths[17].

In 2015, 98.5% of women had children in health institutions; however, the connection of pregnant mothers to a hospital is still considered inadequate. In the North and Northeast regions, 16% of women had to seek medical care in more than one maternity in order to be attended to[12].

The hyper-medicalization of delivery in Brazil has been associated with an increase in maternal and infant morbidity: 56.9% of the births in Brazil, in 2015, were surgical[18]. It is important to highlight that the WHO does not recognize benefits to the mother and the baby in Cesarean section rates above 10.0%[12].

Prenatal care is considered a beneficial intervention in the prevention and treatment of *maternal anemia, gestational hypertension, severe pre-eclampsia and eclampsia, and several types of infections occurring during gestation and delivery.*[19] Studies[12] show that, in 2015, 98% of the mothers received some type of prenatal care. There was an increase from 49.0% to 67.0% in medical care with 7 or more appointments between 1995 and 2015. However, regional differences persist in the country: while the North region had a rate of 47.0%, the South region had a rate of 80.0% in 2015.

The poor quality of health services, the lack of integration of prenatal and delivery care, as well as the increase in unjustified C-sections[20] are possible explanations for this discrepancy in increased access to prenatal care and the persistence of high MMRs.

It is important to mention that the inadequacy of prenatal care is an important risk factor, as much for maternal death as for neonatal death[21,22-24]. Increasing the access to quality health care is fundamental in the prevention of both causes of death[23,24].

Inadequate prenatal care is more associated with precocious pregnancy. Teenage mothers tend to delay the beginning of prenatal care, which results in incomplete and inadequate care[25].

Among mothers aged 35 years or older, there is more awareness about the importance of pre-

natal care; however, late pregnancy is considered a risk factor, since it increases the probability of comorbidities during gestation, with effects for both the fetus and the newborn[25].

Although maternal death is more frequent in women of 20 to 34 years of age, because of the greater frequency of pregnancy, increase in age is associated with an increase in the incidence of chronic diseases and with the risk of maternal morbimortality[26-30].

Meanwhile, maternal mortality is avoidable in more than 90.0% of the cases.[31,32,33] Several studies[31,32,34,35] provide evidence that, in Brazil, there is predominance of maternal deaths by direct causes. Among these, the most present are hemorrhagic disorders, hypertensive syndromes, and postpartum infections[31,34-37].

Among medical complications which affect the pregnancy-puerperium period, hypertensive disorders are the most relevant[38,39]. It is estimated that hypertension affects 10.0% of the pregnant women, which is the primary cause of maternal death and accounts for up to 15.0% of all deaths.

Eclampsia is the most serious of the hypertensive disorders, its complications are related to the maternal-fetal pairing as well as to the quality of care provided, and it is responsible for approximately 50,000 global deaths/year[39].

The study conducted by Novo and Gianini[39] in the Hospital Complex of Sorocaba, between 1995 and 2005, shows that there was a significant decline in the proportion of eclamptic patients. That reduction was attributed to the implementation of the PHPN, with the promotion of prenatal assistance and safer interventions in primary and secondary care environments.

The effectiveness of prenatal care in primary care, complemented by secondary care provided to risk groups, is the main prevention measure for the majority of the gestational hypertensive complications[39].

However, in 2012, 60.0% of the pregnant women began prenatal care late, after the 12th week, and 25.0% did not attend the minimum six appointments[40]. Moreover, the large interval between the last appointment and delivery, and the poor investigation of gestational risk[33,35,37], aggravated the problem of the inadequacy of these services.

The low educational level of the mother is also considered a risk factor associated with pregnancy. One study conducted in Rio de Janeiro, between 1996 and 2004, identified an MMR of 28.0/100,000 LBs among women with a college education, as compared to 154.0/100,000

LBs among illiterate mothers[33]. Other studies indicate a higher frequency of maternal deaths among women with only an elementary education (52.0%)[31], with less than four years of education[38], or with five to eight years of education[28].

Race/color is another risk factor associated with maternal deaths. In 2001, in a study done in Brazilian state capitals, dark-skinned black women had MMR seven times higher than white or light-skinned black women, with ratios of 275.0/100,000 LBs among dark-skinned black women, 46.0/100,000 LBs among light-skinned black women, and 43.0/100,000 LBs among white women[33,41].

Studies also indicate the following risk factors: unsafe marital status and family neglect[31,34,37]; previous or current C-section delivery[27,29]; wandering from one health facility to another before delivery[27]: *with incidence four times higher for those who sought for three or more* facilities[29]; multiple gestation[29,30]; previous hypertension[27,28]; and history of abortion[27,28].

In Brazil, abortion is among the five main causes of maternal mortality[42,43]. According to Article 128 of the Brazilian Penal Code, ratified in 1940, abortion is characterized as a *crime against life*[12,42-44]. However, it is permitted in three situations: risk of life to the pregnant woman, pregnancy resulting from rape or incest, and in case of fetal anencephaly[12,43].

However, the law was not efficient in terms of inhibiting the practice of abortion, leaving many women at risk[12,43]. In most cases, the abortion is performed by unqualified people in unsanitary places and with no conditions to deal with eventual complications[42]. The illegal status of abortion makes it difficult to analyze its prevalence and magnitude, and there is an under-notification in official registries, especially in cases of provoked abortions[44].

A nationwide survey conducted in 2010 identified that 15.0% of all Brazilian women had had an abortion during their reproductive age, approximately 50% of whom required hospitalization[45]. The percentage of abortion reaches 22.0% among women between 35 and 39 years of age[12].

According to one survey[44] conducted in the state of Minas Gerais, between 2000 and 2011, there is a higher proportion of deaths caused by abortions within the historically more vulnerable groups: dark-skinned black women (70.5% of cases) and with less education (59.6% - up to seven years of education). Unsafe abortion is a practice which reinforces the health inequalities in Brazil.

Therefore, the articles discussed in this section constitute the theoretical referential which will be used to analyze the data on maternal mortality obtained from the SIM and presented as follows.

Maternal mortality in Brazil: 1996 to 2018

Graph 1 shows the MMR in Brazil between 1996 and 2018, contextualizing it with the overall rates of mortality, with the rates of female mortality and of women between 10 and 49 years of age. In the series, there was an increase of overall mortality rates from 2006 on; among women 10 to 49 years of age the rates showed a slight decline. However, the MMRs remained stagnant throughout the series.

Graph 2 shows the behavior of the MMRs in four age groups of females at the reproductive age. It is important to mention that the older the age group, the higher the risk of maternal death associated with it.

The mortality rate for the age group of 40-49 years reached a maximum of 379.2 in 1998, and had a minimum of 147.7 deaths per 100,000 LBs in 2014. Although there was a significant reduction, the rates are still too high for women

in this age group. On the other hand, in the age groups of 10-29 years and 20-29 years, the rates remained unchanged.

Next, Table 1 shows the main characteristics of maternal death for the four age groups selected, between 1995 and 2018.

What stands out, for all age groups, are: (i) the concentration of deaths in health facilities; (ii) the predominance of a direct obstetric cause, and (iii) the prevalence of the Cause Groups "Other obstetric Affections NCOP" and *"Proteinuria Edema and delivery puerperium pregnancy disorders"*.

Among women of 10 to 29 years of age, the *Complications related predominantly to Puerperium* are more important; for those of 30 to 49 years of age, the *complications during the pre-delivery and delivery* stand out.

The group of causes "Pregnancy ending in abortion" also stands out, reaching 8.8% and 9.1% for women 10 to 19 and 20 to 29 years of age, respectively, being the fifth most frequent cause of maternal death among those women during the period studied.

It should be emphasized that unsafe abortion, done illegally, is a serious public health problem, and the cases which occur in clandestine condi-
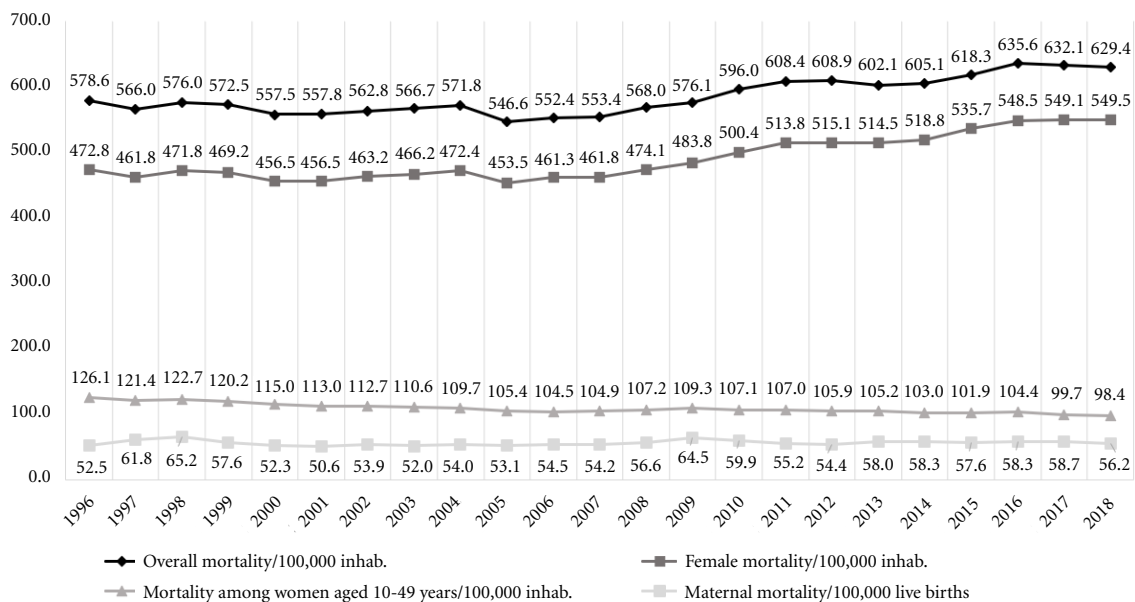
Figure 1. Brazil – overall mortality rate, female mortality, mortality among women of 10 to 49 years of age and maternal mortality rate, 1996 to 2018.

Source: Produced from data from the Mortality Information System (SIM) and the Live Birth Information System (SINASC).
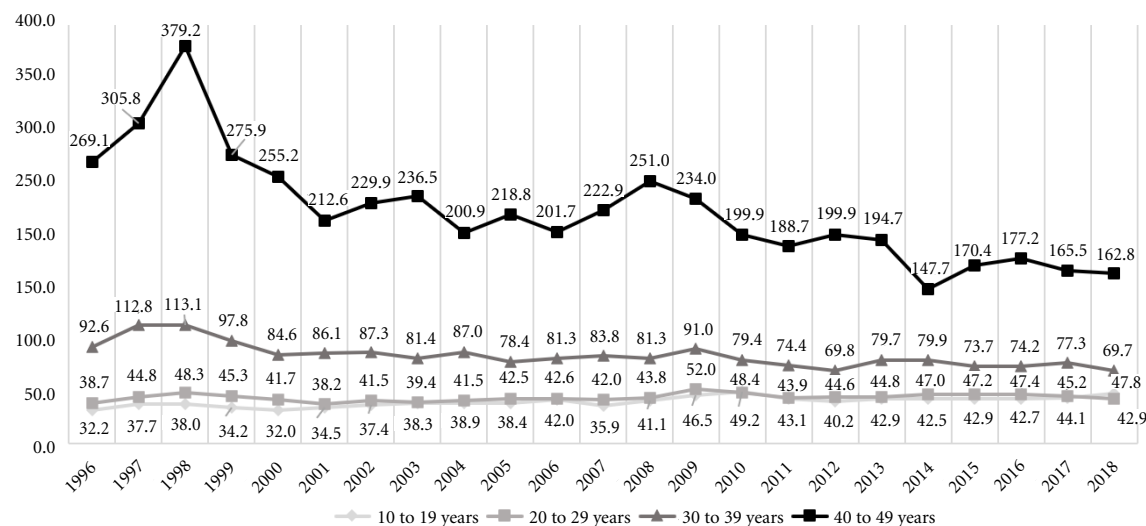
Figure 2. Brazil - Maternal mortality rate among women of 10 to 49 years of age, from 1996 to 2018.

Source: Produced from data from the System of Mortality Information System (SIM) and the Live Birth Information System (SINASC).

tions are not always informed as maternal deaths.

Table 2 shows a proposal which distributed the 450 HRs of Brazil in 3 selected segments of Maternal Mortality Rates: $MMR \leq 30.0$; $30.1 \leq MMR \leq 70.0$; and $MMR \geq 70.1$.

Therefore, in 2018, of the 450 HRs, 137 showed MMR ≤ 30.0/100,000 LBs, below the SDG 3.1 adapted by the Ipea to the national reality; on the other hand, 159 of them registered MMR ≥ 70.1/100,000 LBs, above the SDG 3.1 goal set by the United Nations.

As an explanation, we can mention that the establishment of those three segments of MMR was done based on two parameters: i) the SDG 3.1 goal from the United Nations, which seeks to reduce global maternal mortality to 70.0/100,000 LBs[1]; and ii) the re-adaptation of SDG 3.1 to the national reality done by the Ipea, which seeks to reduce the MMR to 30.0/100,000 LBs[2]. Therefore, the data presented in Table 2 seeks to organize the HRs according to these parameters.

Finally, Graph 3 organizes the 450 HRs by Brazilian states, distributed by the three selected groups of MMR. From the 27 states, nine had 50.0% or more of their respective HRs in the segment of MMR above 70.0%/100,000 LBs. Among these, four are from the North region: Amazonas (77.8% of the HRs), Amapá (66.7%), Pará

(53.8%), and Roraima (50.0%); three are from the Northeast region: Maranhão (57.9%), Ceará (54.5%), and Piauí (50.0%); and two are from the Midwest region: Mato Grosso do Sul (75.0%) and Goiás (55.5%).

Next, the data presented will be examined according to the bibliographical references discussed in this article, with the purpose of analyzing the possibility of Brazil meeting the SDG 3.1 goal.

Discussion

It should should be highlighted that Brazil did not meet the goal of reducing maternal mortality established in the MDG. The goal was a MMR of, at most, 36.0/100,000 LBs[15] by 2015. Graph 1 shows the stagnation of the MMR in Brazil in the early 2000's, making the attainment of the goal unviable.

Hence, the success in meeting the *SDG 3.1/2030 Agenda* requires understanding the factors which were responsible for that stagnation, thereby directing strategic action to deal with its causes.

In Graph 1, although the MMRs remained high, it could be noticed that, between 1998 and

Table 1. Brazil - characteristics of maternal mortality from the following variables: place of occurrence, kind of obstetric cause, main groups of individuals, main ICD categories, education, race/color, and marital status, according to age groups, 1996-2018.

| Variables	10 to 19 years		20 to 29 years		30 to 39 years		40 to 49 years	
	n	%	n	%	n	%	n	%
Place of Occurrence								
Hospital/ Health Facility	5,241	93.2	14,742	93.2	12,889	92.2	2,958	90.6
Other	380	6.8	1,079	6.8	1,084	7.8	307	9.4
Kind of Obstetric Cause								
Direct	4,123	73.3	11,005	69.6	9,682	69.3	2,123	65.1
Indirect	1,325	23.6	4,343	27.4	3,849	27.6	1,037	31.8
Non-Specific	173	3.1	473	3.0	439	3.1	103	3.1
Main ICD-10 Groups								
Other obstetric Affections NCOP	1,379	24.5	4,159	26.3	3,500	25.1	872	26.7
Protein, Edema and hyperat. disor. preg. deliv.puerp.	1,423	25.3	3,533	22.3	3,123	22.4	735	22.5
Complications related predom. to puerperium	721	12.8	2,321	14.7	2,537	18.2	603	18.5
Complications during pre-delivery and delivery	998	17.7	2,309	14.6	1,747	12.5	360	11.0
Pregnancy ending in abortion	496	8.8	1,434	9.1	1,039	7.4	194	5.9
Main CID-10 Categories								
O99 Other mat. dise. COP com. pregn. deliv. puerp.	1,037	18.6	3,309	21.5	2,810	20.8	726	23.0
O15 Eclampsia	885	15.9	1,801	11.7	1,396	10.3	283	9.0
O14 Gestational Hypertension with sign. proteinur.	326	5.9	1,055	6.9	876	6.5	175	5.5
O72 Postpartum hemorrhage	230	4.1	836	5.4	1,011	7.5	242	7.7
O85 Puerperal infection	453	8.1	818	5.3	528	3.9	112	3.5
O88 Obstetric origin embolia	180	3.2	602	3.9	598	4.4	129	4.1
O45 Premature placenta detachment	138	2.5	580	3.8	601	4.4	166	5.3
O62 Uterine contraction abnormalities	142	2.5	548	3.6	633	4.7	159	5.0
O95 Obstetric death from N.E. causes	173	3.1	473	3.1	439	3.2	103	3.3
O06 N.E. Abortion	205	3.7	531	3.4	339	2.5	57	1.8
Education								
0 to 3 years	745	13.3	2,160	13.6	2,465	17.6	861	26.4
4 to 11 years	2,799	49.8	7,036	44.5	5,373	38.5	974	29.8
12 or more	96	1.7	918	5.8	1,248	8.9	213	6.5
unknown	1,981	35.2	5,707	36.1	4,887	35.0	1,217	37.3
Color and Race								
White	1,565	27.8	4,941	31.2	4,903	35.1	1,031	31.6
Black, dark-skinned or light-skinned	3,082	54.8	8,291	52.4	6,851	49.0	1,628	49.9
Yellow/Indigenous	122	2.2	215	1.4	196	1.4	69	2,.1
Unknown	852	15.2	2,374	15.0	2,023	14.5	537	16.4
Marital Status								
Single	4,159	74.0	8,606	54.4	5,597	40.1	1,088	33.3
Married	653	11.6	4,640	29.3	5,790	41.4	1,506	46.1
Other	380	6.8	1,346	8.5	1,526	10.9	425	13.0
Unknown	429	7.6	1,229	7.8	1,060	7.6	246	7.5
Total deaths	5,621	100.0	15,821	100,0	13,973	100.0	3,265	100.0

Source: Produced from data from the Mortality Information System (SIM) and the Live Birth Information System (SINASC).

Table 2. Maternal mortality in Brazil in 2018: distribution by segments selected according to MMR, according to the number of HRs, the sum of maternal deaths and the MMR of each group.

Segments Selected by 100,000 live births	Number of HRs		∑ of number of deaths		MMR/100,000 LBs
	N	%	N	%	
MMR ≤ 30.0	137	30,4	63	3.8	13.0
30.1 ≤ MMR ≤ 70.0	154	34,2	811	49.0	49.6
MMR ≥ 70.1	159	35,3	782	47.2	94.7
Total	450	100,0	1.656	100.0	56.24

Source: Produced from data from the Mortality Information System (SIM) and the Live Birth Information System (SINASC).
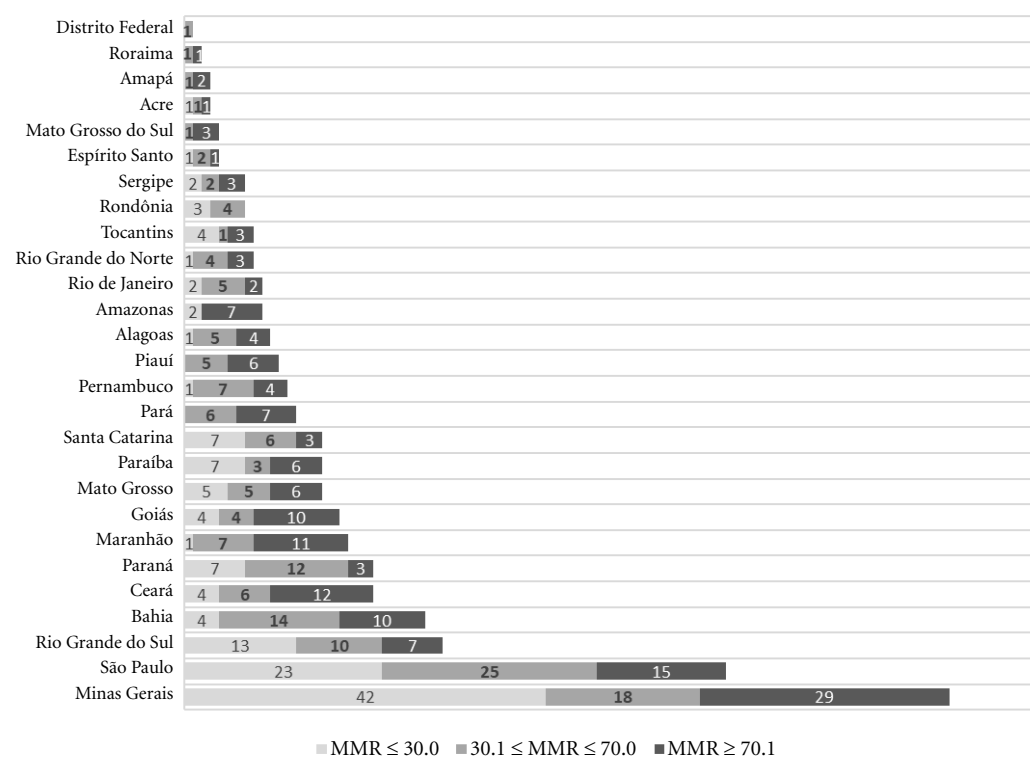
FIgure 3. Distribution of HRs by States of the Federation, according to the three segments of selected MMR: MMR ≤ 30.0; 30.1 ≤ MMR ≤ 70.0; and MMR ≥ 70.1. (n = 450).

Source: Produced from data from the Mortality Information System (SIM) and the Live Birth Information System (SINASC)

2001, there was a significant reduction in the rates, from 65.2% to 50.6%/100,000 LBs, a reduction of 22.4%.

Graph 2 attempts to improve the understanding about such a decline: the reduction in mortality was concentrated among women of 30 to 49 years of age, especially those who were 40 to 49 years of age. Among them, there was a reduction of 43.9% in the period (1998 - 2001).

However, Graph 2 corroborates the concept of risk associated with late pregnancy. The explanation for this fact is related to the association between increase in age and increase in incidence of chronic diseases[26-30].

Public policies aimed at meeting the *SDG 3.1/2030 Agenda* must take into consideration the dimension of the risk of maternal death associated with the increase in age, with a very high MMR for women of 30 to 49 years of age.

Throughout the early 2000's, a set of policies aimed at fighting maternal mortality was created by the Ministry of Health: The dissemination of Maternal Mortality Committees; the Program for Prenatal Care and Birth Humanization (PHPN) in 2000; the National Policy for Integrated Attention to Women's Health (PNAISM) in 2004; and the "Stork Network" in 2011.

These policies sought to promote prenatal care and safer intervention measures,[8,9,39] the recognition of the diversity of women and of life cycles, as well as the access to reproductive planning, humanized care, and safe care during the pregnancy-puerperium cycle[11,12].

Bearing this in mind, two situations, which disagree with Graph 2, should be mentioned: the aforementioned policies seemingly provoked important reductions among women aged 40 to 49 years and moderate reductions among women aged 30 to 39 years; whereas among women aged 10 to 49 years, such policies did not promote reductions in maternal mortality.

A possible explanation for this might be related to the adaptation of prenatal care among women over 35 years of age, who have a greater awareness of the importance of prenatal care, while the lack of concern about this care is more often associated with early pregnancies, teenage mothers take longer to initiate prenatal care[25].

Data from SINASC[46] exemplify this situation: in 2018, 62.8% of the pregnant women between 10 and 29 years of age had prenatal care that was considered to be *adequate/more than adequate,* while among women aged 30 to 49 years that percentage was 74.5%.

Therefore, it is essential to reinforce that women aged 10 to 29 years must reeive proper care during the entire pregnancy-puerperium cycle in order to reduce maternal deaths and, consequently, meet the SDG 3.1 goals.

Because of the poor quality of health services in Brazil, there is a predominance of maternal deaths by direct causes[31,32,34,35], meaning complications during the pregnancy-puerperium cycle resulting from inadequate practices or omissions[7-9]. This fact was demonstrated in Table 1.

Among the direct obstetric causes, the hypertensive disorders are considered the most relevant medical complications that affect the pregnancy-puerperium period[38,39]. Effective prenatal care is the main means through which to prevent these complications[19,39].

Despite the improvements in the adaptation of prenatal care (7 appointments or more) and of the near universalization of care, at least to some extent (98.0% in 2015)[12], it is important to mention that the prenatal care services in Brazil are inefficient to prevent hypertension disorders during gestation.

Based on Table 1, we can build a profile of maternal mortality in Brazil between 1996 and 2018: death in a health facility (92.6%) and for direct obstetric causes (69.6%), with hypertensive disorders during pregnancy, delivery, and puerperium being its main cause (22.8%) and eclampsia its main manifestation (9.0%). The social profile of these women is mostly black (dark-skinned and light-skinned) (51.3%), single (50.3%), with 4 to 11 years of education (41.8%).

These characteristics of maternal mortality are distributed in a heterogeneous manner throughout the country and produce severe regional inequalities. Table 2 shows these inequalities through three groups of HRs, determined by three selected levels of maternal mortality.

The HRs from the third group show MMRs above 70 per 100,000 LBs. Remaining at this level, Brazil certainly will not be able to meet the reduction projected by SDG 3.1 for the country. That group represents more than one third of the HRs in Brazil.

Such HRs, combined, show an MMR of 94.7/100,000 LBs. Comparatively, this level of mortality is similar to the rates registered in the following countries: Paraguay (84.0); Micronésia (88.0), Kiribati (92.0), Guatemala (95.0), and the Solomon Islands (104.0)[47]. It is important mention that these countries have a Human Development Index (HDI) considered *medium*, while Brazil has an HDI that is considered high[48].

Therefore, for Brazil to meet the SDG 3.1 from the 2030 Agenda, it will be necessary for those regional inequalities to be corrected, by implementing public policies focused on those HRs which have MMRs above 70.1/100,000 LBs, Such policies must take into consideration the specificities of those regions and the women's different sanitation needs.

Graph 3 allowed for the identification of strategic locations to address the problem of maternal mortality in Brazil, consisting of the states of Amazonas, Amapá, Pará, Roraima, Maranhão, Ceará, Piauí, Mato Grosso de Sul, and Goiás.

It should be emphasized that, from the 159 HRs with an MMR ≥ 70.1/100,000 LBs, 50.3%

are in the North and Northeast regions, whereas of the 137 HRs with an MMR ≤ 30.0/100,000 LBs, 70.4% are in the South and Southeast regions.

Therefore, meeting the SDG 3.1 requires prioritizing those locations, with the implementation of specific policies for each.

Final considerations

In 2018, Brazil's MMR was 56.2/100,000 LBs, which means that, in order to meet the reduction established by the SDG 3.1 of the 2030 Agenda (adapted to the national reality) - *30.0 per 100,000 LBs*, Brazil must reduce its MMR by 46.6% by 2030.

To achieve that, public policies must take into consideration: 1) prioritizing the HRs of Brazil, which present MMRs above 70.0/100,000 LBs; 2) the prevention of deaths by direct causes; 3) the development of a national survey to evaluate the quality of prenatal care provided to these women; 4) the qualification of prenatal care services, focusing on the prevention of hypertension complications; 5) a better adaptation of prenatal care for women between 10 and 29 years of age; 6) the implementation of policies to prevent deaths among young mothers; 7) legalization of abortion; 8) reduction of the rate of C-sections; 9) reduction of gestational risk associated with later age pregnancies; and 10) improvement in the quality of information on maternal deaths.

Approaching these ten recommendations in an articulated fashion will potentially provide conditions to put together a program which can guide public policies and help Brazil meet the SDG 3.1 of the 2030 Agenda.

Collaborations

CT Motta: Data collection, writing, analysis, and final revision; MR Moreira: analysis and final revision.

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