

Maternal health indicators in Brazil

A time series study

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Abstract

In addition to the maternal death indicator, Stork Network proposes the number of prenatal consultations, the gestational age of onset of prenatal care and the number of children breastfeeding.

The study aims to analyze maternal health indicators representative of the actions proposed by Stork Network in Brazil, after its implementation. Therefore, this is an ecological study of maternal health indicators in Brazil from 2012 to 2017.

Thus, it was found that the number of prenatal consultations per pregnant woman in Brazil from 2012 to 2017 increased >4 times between the first and the last year analyzed. The proportion of pregnant women who started prenatal care in the first trimester of pregnancy increased progressively each year in Brazil.

The breastfeeding coefficient also increased progressively between 2014 and 2017 in Brazil. It was found that maternal health indicators improved between 2012 and 2017 in the Brazilian territory.

Abbreviations: AB = basic care, MS = Ministry of Health, SUS = Public Health System, UF = Federation Unit.

Keywords: health status indicators, maternal health, maternal mortality, public health, public policy

1. Introduction

Maternal health is an area of high interest for public health, and the main indicator of the health situation of this public is the maternal mortality rate, which represents the outcome of greater negativity, as a result of the sum of poor quality of care provided in the pregnant-puperal cycle and social inequities, being

recognized worldwide as a guide for the management of public policies for the female population.^[1–4]

Nevertheless, other maternal health outcomes are considered indicators of health status, and other outcomes can be observed for health quality analysis in this area. The indicator showing prenatal coverage is representative of the number of prenatal visits each woman makes during pregnancy, and is an important indicator of both maternal health, reflecting the quality of care provided to women during pregnancy, and a determinant of newborn health.^[5,6]

Also in order to assess the quality of prenatal care, there is the indicator for the onset of prenatal care, the recommendation of which is that the first consultation should take place by the first 12 weeks of pregnancy.^[7] Thus, it is observed that prenatal care is among the actions of interest with impact on the quality of maternal health, being able to prevent maternal death, and is part of the list of responsibilities of Basic Care (AB), which in turn is the most accessible and close to the populations within the single health system.^[8]

In this sense, Brazil, with the objective of improving maternal and child health indicators, implemented in 2011 a care network called Stork Network, regulated by Decree No. 1459 of 2011, which is a strategic program of the Ministry of Health (MS), with the objective of to gradually systematize maternal and child health throughout the country, considering epidemiological criteria, such as the infant and maternal mortality rate, in addition to population density. For this, the program performs actions to encourage reproductive planning and humanization in pregnancy, childbirth, and the postpartum period, in addition to reserving the child's right to healthy birth, growth, and development.^[7]

In this context it is evident the importance of the adequate articulation and availability of the services that make up the maternal health network to provide attention and resolution to possible aggravations to maternal health. In the study by Bittencourt et al,^[9] it was observed that there is a greater quantity of Health Unic System (SUS) health services in the North

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and Northeast regions compared with the South and Southeast, which could be explained by the greater adherence to private services by their population.

Thinking about the articulation between maternal health services in Brazil, the Stork Network was instituted in 2011, which “aims to assure women the right to reproductive planning and humanized attention to pregnancy, childbirth and puerperium,” guaranteeing access, reception, and resolution. Its guidelines include ensuring risk-rating reception, increasing access and quality of prenatal care, linking the pregnant woman to the reference unit, good practices and safety in childbirth and childbirth care, and access to reproductive planning, organizing itself from four components: prenatal care; childbirth; puerperium and comprehensive child health care; and, logistics system.^[7]

This initiative reinforces the importance and the emergency that maternal health represents in the field of public health, so that all health services and professionals in this area should implement efforts to ensure quality and resolute assistance for women in the puerperal pregnant cycle, aiming above all at preventing maternal deaths and, consequently, contributing to the improvement in the quality of maternal health and other population groups as a result.

Nevertheless, there is a shortage of studies highlighting prenatal and breastfeeding indicators, among other maternal health indicators, in addition to the mortality indicator, for assessing the quality of health in this group. In this context, this study is justified by the importance of scientific research in the field of maternal health and analysis of the quality of the health situation in this area, as well as indicators of mortality. Thus, the objective of this work is to evaluate maternal health indicators after the implementation of the Stork Network in Brazil, in the time series from 2012 to 2017.

2. Materials and methods

This is an ecological study on maternal health indicators in Brazil after the implementation of the Stork Network. Ecological studies are studies in which the population is observed as a whole, that is, the unit of analysis is a group of individuals in a certain defined geographical area, and not the individuals separately.^[10,11]

The sample is of the census type, of which the 5565 municipalities of Brazil are part. In 2013 5 new municipalities (Balneário Rincão, Mojuí dos Campos, Paraíso das Águas, Pescaria Brava, and Pinto Bandeira) appeared in Brazil, making up 5570 since then; and in this study were included only the 5565 previously existing, in order to avoid the occurrence of missing data in the year before the inclusion of the 5 municipalities cited.

The Stork Network was established in June 2011, so it was decided to analyze the data from 2012 and, considering that the availability of data was limited until the year 2017, the study is composed of data from 2012 to 2017.

The study includes quantitative data on live births, children up to 2 years of age in breastfeeding, the number of prenatal consultations, and the number of women who began prenatal care in the first trimester of pregnancy, from which the variables were composed: breastfeeding coefficient, prenatal consultations, and the proportion of pregnant women who began prenatal care in the first trimester of pregnancy.

The data were obtained from 2 different sources: the quantitative of live births was obtained from the Live Birth Information System by accessing the SUS Department of

Informatics website (The Department of Informatics of the Unified Health System, <<http://datasus.saude.gov.br/>>); data on the number of breast-feeding children, the number of prenatal consultations, and the number of pregnant women who began prenatal care in the first trimester of pregnancy were obtained upon request to the MS through access to the Citizen Information Service's electronic system portal (e-SIC, <<https://esic.cgu.gov.br/>>).

Thus, all data were obtained by Brazilian municipality according to the year and grouped into other levels of analysis: Federation Unit (UF), Regions, and Brazil. To aggregate the data we calculated the averages for the quantitative variables, so that the data of the variables in the UF, Region, and Brazil represent the average per municipality.

It is worth noting that breastfeeding data are only available from the year 2014, since the primary source of this information is the new information system of e-SUS, which came into force in 2013.^[12] The data were collected in the period from January to September 2019, considering from the request to the receipt of data from the MS. They were stored and treated in Microsoft Office Excel and Statistical Package for the Social Science, version 10101141047, allowing the construction of tables containing the data that allowed the descriptive analysis of them by obtaining values of mean, median, standard deviation, amplitude, and confidence interval (95%), accompanied by the value of P (<.05).

The study follows the criteria of ethics on research with human beings, waiving the approval by the Ethics and Research Committee, since it makes use of data and information from secondary source and public domain, as listed in Resolution 510/2016 of the National Health Council.^[13]

3. Results

Data on health indicators of interest to the stork network were constructed: breastfeeding coefficient from 2014 to 2017, number of prenatal consultations from 2012 to 2017, and proportion of pregnant women who began prenatal care in the first quarter of pregnancy from 2012 to 2017 per municipality in Brazil, large regions, and UF.

Table 1 includes data on the number of prenatal consultations per pregnant woman in Brazil from 2012 to 2017. The inspection of the data shows that the average of this number increased each year during the period under analysis, being >4 times greater between the first and last year analyzed. The t test reveals the statistical significance of the data, obtaining for all years a value of P <.01.

Table 2 shows the proportion of pregnant women who began prenatal care in the first trimester of pregnancy, showing that this proportion increased progressively each year in Brazil, revealing that this percentage more than doubled between the first and last years. It was found that the data are statistically significant using the Student t test (P <.01).

From Table 3 it can be observed that the breastfeeding coefficient also increased progressively between the years 2014 and 2017 in Brazil, increasing >4 times between the first and last year studied. Thus, the comparison of means between years was statistically significant (P <.01) for all pairs.

Table 4 shows the 3 variables studied, according to the regions and units of the Brazilian federation in each year from 2012 to 2017. These data reveal that in all regions there was an increase in the number of consultations from the first year to the last studied, the lowest number was registered in the Southeast (0.81) and the

Table 1**Number of prenatal consultations per pregnant woman in Brazil from 2012 to 2017. Brazil, 2020.**

Year	n	Average	Mediana	Standard deviation	Maximum range	Confidence interval	P value
2012	5456	1.03	1.00	1.34	3.24	0.99–1.06	<.01
2013	5456	2.69	2.00	2.17	6.14	2.63–2.74	<.01
2014	5456	3.52	3.00	2.50	6.36	3.45–3.58	<.01
2015	5456	3.94	4.00	2.68	6.13	3.87–4.02	<.01
2016	5456	4.10	4.00	2.62	6.42	4.03–4.17	<.01
2017	5456	4.19	4.00	2.65	6.45	4.12–4.26	–

Source: DATASUS/ Brazilian Ministry of Health.

Table 2**Proportion of pregnant women who began prenatal care in the first quarter of pregnancy by municipalities in Brazil from 2012 to 2017. Brazil, 2020.**

Year	n	Average	Mediana	Standard deviation	Maximum range	Confidence interval	P value
2012	5456	0.34	0.00	0.47	0.88	0.32–0.35	<.01
2013	5456	0.64	1.00	0.48	1.0	0.62–0.65	<.01
2014	5456	0.73	1.00	0.44	1.0	0.72–0.74	<.01
2015	5456	0.79	1.00	0.40	1.0	0.78–0.80	<.01
2016	5456	0.81	1.00	0.39	1.0	0.80–0.82	<.01
2017	5456	0.82	1.00	0.38	0.83	0.81–0.83	–

Source: DATASUS/ Brazilian Ministry of Health.

largest in the South (1.34), and in the last studied year the lowest number was registered in the North (2.58) and the largest remained in the South (5.33). In 2012, the state with the lowest number of consultations was Amapá (0.06) and the highest number was Rondônia (2.80). While in the last year studied, the state with the lowest number of consultations was Maranhão (1.38) and with the highest number of consultations was Paraná (6.1).

As for the proportion of pregnant women who began prenatal care in the first quarter of pregnancy in the regions and Federal States of Brazil, it can be observed that also for this variable, in all regions there was an increase in the proportion of women who began prenatal care in the first quarter of pregnancy between the years 2012 and 2017, so that the largest increase was recorded in the Midwest region, from 0.33 in 2012 to 0.91 in 2017, and the smallest increase was in the North, increased from 0.27 in 2012 to 0.48 in 2017.

It should be noted that the biggest increase between the years was from 2012 to 2013 in all regions. Also, it is worth noting that only the Southeast region showed a small decrease in this proportion between 2016 and 2017. And the southern region maintained the same proportion in the last 2 years (0.90).

As for the Federal States, it can be seen that in 2012, the lowest proportion was recorded for the state of Amapá (0.06) while the highest was in the state of Mato Grosso do Sul (0.69). In the last

year studied, the lowest proportion remained in the state of Amapá (0.19), and the highest was in Paraná (0.99).

The data on the exclusive breastfeeding coefficient per municipality for the years 2014 to 2017 according to the regions and units of the federation show that in all regions this number has increased progressively over the years, with the southern region reaching the highest increases year by year and in 2017 the highest exclusive breastfeeding coefficient among the regions. While the northern region reached the last year studied with the lowest exclusive breastfeeding coefficient among the regions.

It is noted that among the states, Acre had the lowest coefficient in 2014 (4.66) and Paraíba had the highest that year (73.89), while in 2017, Rio de Janeiro had the lowest coefficient (44.88), and again Paraíba had the highest (275.22).

4. Discussion

Maternal mortality is the main indicator of the quality of maternal and women's health; however, outcomes other than death can be considered for health evaluation in the maternal group, from this perspective, the indicator of the quality of care is the number of prenatal consultations. In Brazil, it is recommended that at least 6 prenatal consultations be performed.^[14] The present study found a significant increase in the number of prenatal consultations per pregnant woman in Brazil, reaching an

Table 3**Exclusive breastfeeding coefficient per Brazilian municipality per year, from 2014 to 2017. Brazil, 2020.**

Year	n	Average	Mediana	Standard deviation	Confidence interval	P value
2014	916	35.01	55.99	129.00	31.38–38.64	<.01
2015	2675	76.15	118.61	110.00	71.66–80.65	<.01
2016	3514	123.13	176.84	100.14	117.28–128.98	<.01
2017	4032	160.35	209.00	134.83	153.90–166.80	–

Source: DATASUS/ Brazilian Ministry of Health.

Table 4**Maternal health care indicators in Brazil, second regions, and states, from 2012 to 2017. Brazil, 2020.**

Territory/Year	Number of prenatal consultations per pregnant woman						Proportion of pregnant women who began prenatal care in the 1st trimester of pregnancy						Exclusive breastfeeding coefficient/1000 NV			
	2012	2013	2014	2015	2016	2017	2012	2013	2014	2015	2016	2017	2014	2015	2016	2017
North	0.96	1.92	2.14	2.45	2.62	2.58	0.27	0.35	0.35	0.42	0.46	0.48	20.05	44.72	71.27	92.45
Acre	0.86	1.91	2.27	2.14	2.50	2.68	0.23	0.05	0.09	0.23	0.32	0.36	4.66	42.38	81.08	79
Amapá	0.06	1.00	1.13	1.25	1.88	1.88	0.06	0.19	0.13	0.19	0.13	0.19	5.03	26.35	37.31	54.05
Amazonas	0.51	0.85	1.00	1.58	1.69	1.69	0.17	0.15	0.15	0.22	0.29	0.29	5.45	32.69	53.92	60.79
Pará	0.61	1.69	2.10	2.62	2.88	2.87	0.20	0.30	0.34	0.44	0.52	0.53	12.92	39.79	58.01	58.32
Rorondônia	2.80	3.73	3.51	3.63	2.78	3.08	0.65	0.84	0.78	0.76	0.61	0.71	52.8	77.73	114.47	201.94
Roraima	0.33	1.13	1.33	1.87	2.07	2.07	0.13	0.27	0.27	0.33	0.53	0.53	-	28.89	49.66	28.03
Tocantins	1.57	3.13	3.65	4.05	4.51	3.80	0.43	0.68	0.72	0.79	0.82	0.77	39.44	65.2	104.42	164.99
Northeast	0.94	2.25	2.64	2.85	2.99	3.01	0.30	0.55	0.63	0.69	0.71	0.74	32.67	84.68	124.31	152.71
Alagoas	0.50	1.69	2.07	2.16	2.02	2.18	0.21	0.43	0.52	0.56	0.64	0.65	12.16	51.9	99.72	133.72
Bahia	0.84	2.25	2.94	3.33	3.48	3.40	0.20	0.48	0.57	0.69	0.69	0.67	32.34	70.93	108.24	141.23
Ceará	0.23	2.97	4.62	4.96	5.10	4.97	0.15	0.85	0.91	0.90	0.93	0.94	10.33	39.88	74.71	106.94
Maranhão	0.72	1.31	1.26	1.18	1.39	1.38	0.18	0.20	0.27	0.33	0.38	0.37	13.41	31.89	42.92	51.01
Paraíba	1.40	2.96	3.27	3.43	3.70	3.96	0.54	0.79	0.80	0.83	0.88	0.93	73.89	174.59	224.28	275.22
Pernambuco	1.51	2.53	2.96	3.14	3.45	3.15	0.40	0.68	0.77	0.82	0.82	0.82	41.9	59.86	103.76	129.32
Piauí	1.14	2.44	2.84	3.04	3.07	3.15	0.34	0.55	0.61	0.68	0.68	0.70	34.03	94.72	163.65	204.53
Rio Grande do Norte	1.05	2.72	2.58	2.83	3.04	3.28	0.45	0.63	0.70	0.82	0.82	0.84	64.24	173.02	235.94	252.81
Sergipe	1.08	1.34	1.20	1.54	1.63	1.62	0.20	0.32	0.48	0.56	0.56	0.70	11.69	65.35	65.61	79.58
Midwest	1.02	2.49	3.27	3.71	3.74	3.79	0.33	0.67	0.80	0.89	0.89	0.91	22.54	53.32	116.53	164.61
Mato Grosso	0.52	2.68	3.38	3.85	4.13	4.18	0.26	0.78	0.78	0.86	0.88	0.88	23.07	52.76	93.77	157.83
Mato Grosso do Sul	2.44	4.04	4.53	4.69	4.28	4.40	0.69	0.87	0.90	0.92	0.91	0.95	20.46	50.38	161.42	202.71
Goiás	0.10	0.76	1.89	2.60	2.80	2.79	0.05	0.36	0.73	0.89	0.88	0.90	24.1	56.81	94.4	133.29
Southeast	0.81	2.58	3.63	4.13	4.36	4.41	0.29	0.71	0.77	0.84	0.85	0.84	17.04	50.06	86.18	98.86
Espírito Santo	0.11	1.93	2.92	3.32	3.88	3.59	0.11	0.72	0.76	0.84	0.84	0.82	6.92	41.52	50.58	62.86
Minas Gerais	1.58	3.63	4.13	4.28	4.33	4.36	0.56	0.76	0.82	0.87	0.87	0.88	26.8	80.3	150.16	167.88
Rio de Janeiro	1.18	2.26	3.08	3.74	3.56	3.59	0.34	0.67	0.69	0.75	0.74	0.70	7.12	17.32	32.53	44.88
São Paulo	0.35	2.50	4.37	5.17	5.67	6.09	0.15	0.70	0.80	0.89	0.94	0.95	27.31	61.1	111.46	119.83
South	1.34	3.31	4.45	5.08	5.15	5.33	0.42	0.75	0.85	0.89	0.90	0.90	28.68	74.13	139.23	223.97
Paraná	1.26	4.23	5.28	5.83	5.94	6.1	0.51	0.89	0.93	0.97	0.98	0.99	47.94	91.56	119.68	175.46
Rio Grande do Sul	0.93	2.07	3.83	4.84	4.89	5.16	0.20	0.54	0.75	0.80	0.83	0.83	29.17	72.41	133.06	204.27
Santa Catarina	1.84	3.62	4.24	4.58	4.62	4.73	0.56	0.81	0.87	0.90	0.90	0.88	8.94	58.41	164.95	292.17
Distrito Federal	1.00	2.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	-	-	-	15.03

Source: DATASUS/ Brazilian Ministry of Health.

average of 4 consultations per pregnant woman in 2017 (Table 1), showing an increase in the coverage of this follow-up, but, as found by Zanette, Parpinelli, Surita, Costa, Haddad, Sousa, et al,^[15] this number remains below that recommended by health agencies, and ensuring the quality of this follow-up is a challenge beyond the quantitative indicator.

The increase in the number of prenatal consultations also occurred in North Africa, where the proportion of pregnant women with 4 or more consultations increased from 50% to 89% between 1990 and 2014.^[16] In a study published in 2015, 75.4% of women who performed prenatal care in public services performed >6 consultations.^[16] A study published in 2018 on data from the municipality of São Paulo showed that only 1.9% of women did not have prenatal consultations.^[17] Also in the study by Assis et al (2019), the proportion of pregnant women who had >6 prenatal consultations increased over the years studied.^[18]

A study that analyzed the factors associated with near maternal miss—a situation of great risk for mortality—in women who had experienced this situation, found that only 4.9% of the participants in the study did not have prenatal care; however, 49.2% performed <6 prenatal care visits, that is, almost half of those studied did not have qualified prenatal care considering the low number of visits.^[19] Another study published in 2015 showed that of pregnant women who died from maternal causes, less than half performed prenatal consultations.^[3]

The growing number of prenatal visits in Brazil detected through this study represents an improvement in access and quality of prenatal care, highlighting, however, the need to increase this number until it reaches that recommended by the responsible agencies,^[20] since a reduced number of prenatal visits impairs the quality of the actions scheduled for each gestational period and reduces the opportunities for detection of risk factors and necessary interventions.^[21]

About the timeline of the Stork Network, it appears that it is important to carry out about at least 6 prenatal consultations, so that the fetus and the pregnant woman have a more effective monitoring throughout the gestational period and, thus, increase the possibility diagnosis and early treatment in order to reduce the rate of maternal, fetal, and infant mortality. However, even with a minimum of 6 appointments indicated, this is not the reality of many pregnant women around the world, so it is necessary to implement strategies aimed at expanding the care network, as well as encouraging pregnant women to seek care.

In the study by Gasparin et al,^[22] it was found that in the northern, middle valley, and western regions of the state of Santa Catarina, prenatal coverage ranged from 61% to 100%, while in the highland, northern, and southern plateau regions, this coverage ranged from 30% to 60%, so that these coverage varies according to the economic reality of the different regions.^[22]

In this study, considering the data from the individual regions, the North presented the lowest numbers of prenatal consultations from 2013 to 2017, reaching 2.5 prenatal consultations per pregnant woman in the last year, while the South presented the highest numbers of consultations in all the years studied, 5.3 in 2017 (Table 4).

The main reasons for low prenatal care by pregnant women living in the north and northeast of Brazil were difficulties in access to health services and low schooling.^[15,22] In the study on prenatal quality in the territories of the legal Amazon and northeastern Brazil, results were obtained in which prenatal evaluation predominated as partially adequate, with a low

proportion of classification as adequate, and low social status was related to prenatal classification as inadequate.^[16]

According to Zanette et al, one of the parameters of prenatal quality is the gestational age at which this follow-up was initiated.^[15] In the present study, the proportion of pregnant women who began prenatal care in the first trimester of pregnancy increased over the years in Brazil and in each region separately, with the lowest percentages occurring in the North and the highest, occurring between the South and Midwest (Table 4).

In the present study, it was found that breastfeeding increased progressively over the years analyzed in Brazil (Table 3) as well as in the regions of Brazil separately (Table 4), with the north and southeast presenting the lowest coefficients, while the northeast and south presented the highest.

The analysis of determinants for breastfeeding among low birth weight infants, exclusive breastfeeding was more prevalent among infants whose mothers did not work outside the home or who were on maternity leave. In addition, the prevalence of exclusive breastfeeding increased progressively as the schooling of mothers increased and the human development index of the municipality increased.^[23]

Some factors may condition knowledge about breastfeeding, so that older women, more children, and those with higher education have more knowledge about breastfeeding. This knowledge influences the practice of breastfeeding, because the greater this knowledge, the greater the practice of breastfeeding.^[24]

In the study by Bauer et al,^[25] the breastfeeding guidelines made available in child care consultations were considered more effective in promoting exclusive breastfeeding up to 6 months of a child's life than the same guidelines when made available at another time of health care.^[25] In the study by Pevena et al,^[26] it was found that early receipt of breastfeeding stimuli was associated with early initiation of breastfeeding.

With the advances in medicine and technology, several improvements are verified in the public health sphere, including maternal health, highlighting specific actions for health, and others of a social nature, which contributed substantially to improvements in the indicators, such as the institution of the Community Health and Family Health Programs, greater access to education for women, access to drinking water and basic sanitation, and cash transfer programs.^[27]

5. Conclusion

Extrapolating the representation of maternal health beyond the mortality indicator, this study carried out the analysis of the situation of maternal health in Brazil from the indicators of quantity of prenatal consultations, beginning of prenatal in the first quarter of pregnancy, proposed by the strategy of attention to maternal health, Stork Network, for 6 years after its implementation.

Thus, it was observed that the practice of breastfeeding, the number of prenatal consultations, and the proportion of women who began prenatal care in the first quarter of pregnancy increased progressively in Brazil, revealing that maternal health has improved year by year, with some differences being noticeable between the Brazilian regions, so that the north and northeast have the worst indicators compared with the other regions, which is possibly linked to the socioeconomic characteristics of these regions, in addition to the initiatives in the field of health directly.

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