

Temporal trend of congenital malformations of the nervous system in the last four years in Brazil

Tendência temporal das malformações congênitas do sistema nervoso nos últimos quatro anos no Brasil

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RESUMO | INTRODUÇÃO: As malformações congênitas são representadas por anomalias funcionais ou estruturais do desenvolvimento fetal. Destaca-se a Encefalocele, Microcefalia, Hidrocefalia Congênita, Espinha Bífida, outras Malformações do cérebro, outras Malformações da medula espinhal e outras Malformações do sistema nervoso. **OBJETIVO:** Descrever a tendência temporal das malformações congênitas do sistema nervoso no período de 2010 a 2014 no Brasil. **MÉTODOS:** Estudo ecológico descritivo de tendência temporal englobando os anos de 2010 a 2014, cujos dados foram coletados do Departamento de Informática do Sistema Único de Saúde DATASUS, no sistema de informação sobre nascidos vivos (SINASC) sendo que estes respectivos dados estão de acordo com as estimativas populacionais do IBGE. A seleção da amostra foi realizada a partir da plataforma Informações de Saúde (TABNET). Foram incluídos recém-nascidos com malformações congênitas do sistema nervoso registrados nos anos de 2010 a 2014 no Brasil, sendo identificadas pelo CID-10: Q00 a Q007. As variáveis desse estudo foram: Região (Norte, Nordeste, Sul, Sudeste e Centro Oeste), sexo (masculino e feminino), tipo de parto (vaginal, cesáreo e fórceps), idade da mãe, idade gestacional e peso ao nascer. **RESULTADOS:** Os maiores números de ocorrência das malformações através do DATASUS, no período de 2010 a 2014 foi na região do Sudeste, seguido do Nordeste. **CONCLUSÃO:** O presente estudo demonstrou um panorama epidemiológico dos casos de malformações congênitas do sistema nervoso. Esses resultados servem como ferramenta para planejamento e intervenções em saúde, assim como, para um melhor entendimento dos gestores públicos, a fim de atender essa população e direcionar investimento nessa área.

PALAVRAS-CHAVE: Anomalias. Malformações congênitas do sistema nervoso. Sistema Único de Saúde.

ABSTRACT | INTRODUCTION: Congenital malformations are represented by functional or structural anomalies of fetal development. Of note is Encephalocele, Microcephaly, Congenital Hydrocephalus, Spina Bifida, other Malformations of the brain, other malformations of the spinal cord and other malformations of the nervous system. **OBJECTIVE:** To describe the temporal tendency of the congenital malformations of the nervous system in the period from 2010 to 2014 in Brazil. **METHODS:** A descriptive ecological study of the temporal trend encompassing the years 2010 to 2014, whose data were collected from the Department of Informatics of the DATASUS Single Health System, in the information system on live births (SINASC), and these data are in agreement with The IBGE population estimates. The sample selection was performed using the Health Information platform (TABNET). Newborns with congenital malformations of the nervous system were enrolled in the years 2010 to 2014 in Brazil, being identified by ICD-10: Q00 to Q007. The variables of this study were: Region (North, Northeast, South, Southeast and Center West), sex (male and female), type of delivery (vaginal, cesarean and forceps), maternal age, gestational age and birth weight. **RESULTS:** The highest number of occurrences of malformations through DATASUS in the period from 2010 to 2014 was in the Southeast region, followed by the Northeast. **CONCLUSION:** The present study demonstrated an epidemiological panorama of the cases of congenital malformations of the nervous system. These results serve as a tool for health planning and interventions, as well as for a better understanding of public managers, in order to serve this population and direct investment in this area.

KEYWORDS: Anomalies. Congenital malformations of the nervous system. Health Unic System.

Introduction

Congenital malformations (CM) are represented by functional or structural anomalies of fetal development. The term congenital refers that the problem is present, and may be internal or functional and even develop as age passes. The etiology of CM of the nervous system is multifactorial, and may occur due to genetic, environmental or unknown causes¹.

The etiological factors are usually related to the defect in neural tube closure, being the Mendelian inheritance, among the genetic causes, the one with the highest incidence². Maternal endocrinopathies, in addition to the drugs and chemicals ingested by the mother, also have an important teratogenic effect³. Some infectious agents are notably deleterious to fetal organogenesis, such as rubella virus, human immunodeficiency virus (HIV) and cytomegalovirus (CMV); the *Treponema pallidum* and the *Toxoplasma gondii*⁴ and now more recent the relation of CM with zika virus⁵. However, up to 70% of the congenital malformations remain with unknown etiology².

The CM have been growing significantly with regard to numbers of live births, occurring from 2% to 5% in Brazil and in the world, respectively⁶. Obtaining a high prevalence of 1 to 10: 1000 of the newborns, which encourages further investigation of related causes⁷. Within this group are encephalocele, microcephaly, congenital hydrocephalus, spina bifida, other congenital malformations of the brain, spinal cord and nervous system⁸. Such anomalies usually occur until the 29th day of embryonic life⁷.

In view of this health problem, the objective of this study is to describe the temporal trend of CM in the period between 2010 and 2014 in Brazil and to verify if there is a difference in the number of related cases and compared to the region, age of the mother, gestational age, type of birth, gender and birth weight, in order to enable a data collection on malformations in Brazil. This way, we can have a global vision of this public health problem that

affects several children and compromises their growth and development.

Material and method

It is a descriptive study of the ecological type of time series, based on secondary data in the period between 2010 and 2014 in Brazil. Data were collected from the Unified Health System Department of Informatics (DATASUS) in the period between August 2016 and May 2017 in the Live Births Information System (SINASC), which provides data on birth rates based on IBGE population estimates. The study presents as a target population the newborns with congenital malformations of the nervous system, being identified by ICD-10: Q00 to Q07.

The sample selection was performed using the Health Information platform (TABNET). The variables of this study were Region (North, Northeast, South, Southeast and Midwest), gender (male and female), type of delivery (vaginal, cesarean and forceps), maternal age, gestational age and birth weight. The study has no ethical or moral implications for using public domain secondary data from the government in which there is no information that can identify individuals.

Results

The occurrence of CM of the Nervous System in DATASUS, from 2010 to 2014, shows a highlight for the Southeast region with 3,916 cases, followed by the Northeast with 2,702. In relation to the years with the highest occurrence of cases, in 2011 it was 2,054 and in the year of 2012 there were 1,946 cases. (Table 1).

Table 1. Occurrence of congenital malformation of the Nervous System by DATASUS, related to the region, in Brazil, 2010-2014.

Regions	2010	2011	2012	2013	2014	Total
North Region	210	213	189	191	205	1.008
Northeast Region	510	626	534	494	538	2.702
Southeast Region	769	802	821	795	729	3.916
South Region	265	279	278	249	265	1.336
Midwest Region	132	134	124	126	126	642

Source: MS / SVS / DASIS-Live Birth Information System - SINASC

In relation to this anomaly, there was a prevalence in the female gender (4,757 cases) in relation to male, however in the period of 2011 and 2012 it was observed a greater occurrence in the male gender. (Table 2).

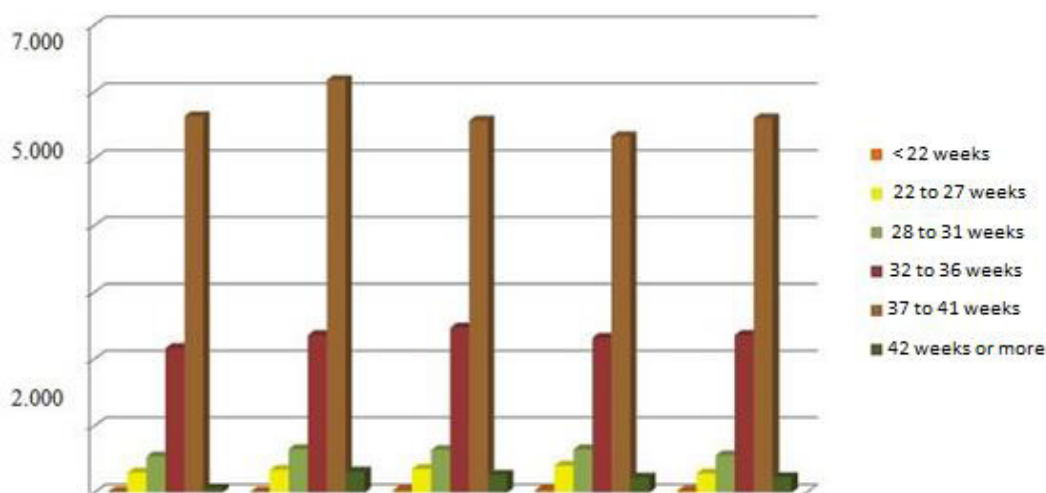
Table 2. Prevalence of congenital malformation of the Nervous System by DATASUS, related to gender, in Brazil, 2010-2014.

Gender	2010	2011	2012	2013	2014	Total
Female	940	993	950	932	936	4.757
Male	918	1.032	966	887	903	4.706

Source: MS / SVS / DASIS-Live Birth Information System - SINASC

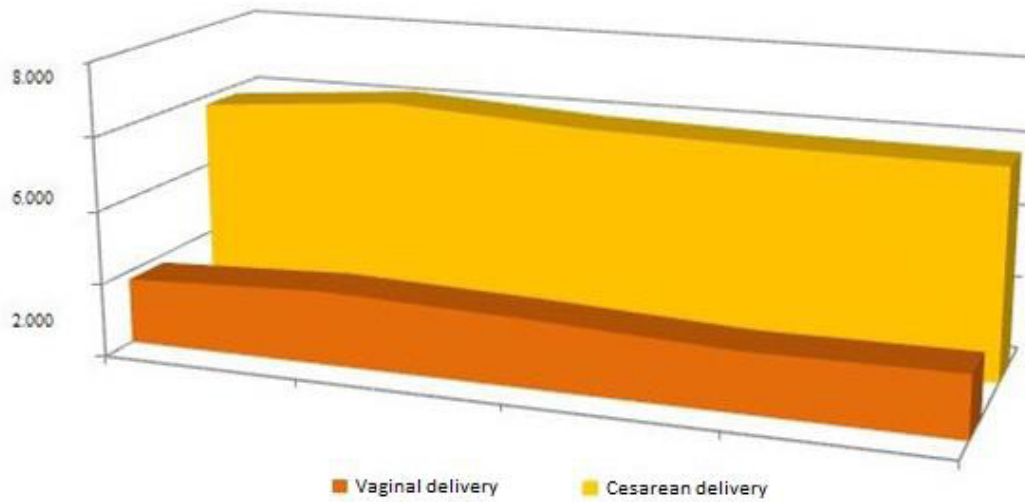
With regard to gestational age (GA), it was observed that the duration between 37 and 41 weeks obtained a greater number of cases 5,664, followed by a GA of 32 to 36 weeks with 2,335 cases. (Graphic 1).

Graphic 1. Occurrence of congenital malformation of the Nervous System by DATASUS, related to gestational age, in Brazil, 2010-2014.



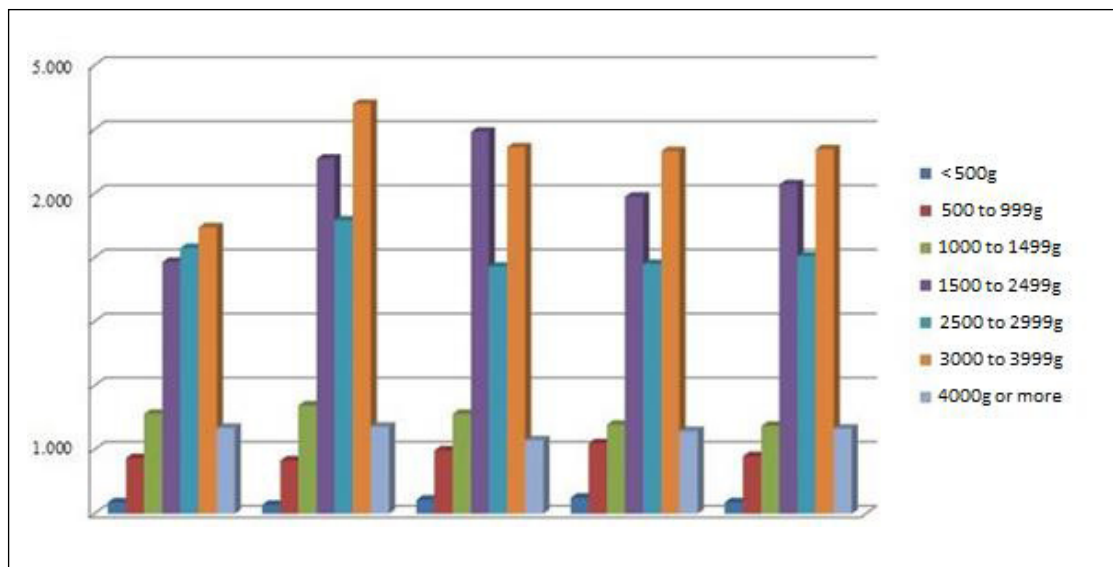
In the correlation between type of delivery and congenital malformation of the nervous system, it was observed that the cesarean deliveries presented a greater number of cases 7,228, in relation to the vaginal deliveries 2,209 cases. (Figure 2).

Graphic 2. Occurrence of congenital malformation of the Nervous System by DATASUS, related to type of delivery in Brazil, 2010-2014.



It was observed in Graphic 3 that the largest number of cases of children with CM had a birth weight of 3000 to 3999 kg, followed by children with birth weight of 1500 to 2499kg with 2,552 cases.

Graphic 3. Occurrence of congenital malformation of the Nervous System by DATASUS, related to birth weight in Brazil, 2010-2014.



It was observed that the largest number of cases of 2,394 occurred with mothers aged between 20 and 24 years old, followed by maternal age between 25 and 29 years old, 2,133 cases, 15 to 19 years old, 1,775 cases, 30 to 34 years old, 1,561 cases, 35 - 39 years old with 902 cases, mothers aged between 40 to 44 years old with 289 cases, 10 to 14 years old 102 cases, 45 to 49 years old with 17

cases, 50 to 54 years old with 2 cases and 55 to 59 years old, with 1 case.

Regarding the association of deaths in children with congenital malformation of the nervous system, the Southeast region had the highest number of cases 857, followed by the Northeast region 761. The type of vaginal delivery had the highest number

of deaths 1,248. Regarding gender, the female got 1,026 deaths. Those that were born with birth weight between 1500 and 2499 kilograms had a total of 389 deaths. When observed the maternal age, those who had children between 20 and 24 years old, the occurrence was of 388 deaths of these neonates. Regarding the gestational age, 413 deaths were found in those mothers with gestational period between 32 and 36 weeks.

Discussion

In the present study, the congenital malformations of the nervous system presented in the DATASUS, from 2010 to 2014, obtained a greater number of cases in the Southeast region, in women between the ages of 20 and 24 years, presenting the gestational period between 37 and 41 weeks and with cesarean delivery. With regard to children who were born with these abnormalities, the prevalence was in the female gender and weighing from 3,000 to 3,999 kg at birth. Deaths among these children were higher in the Southeast region, in women aged between 20 and 24 years old, presenting a gestational period between 32 and 36 weeks and who had vaginal delivery. Among the children who died the highest prevalence was in females weighing between 1,500 and 2,499 kg at birth. The greater number of occurrences in the Southeast region can be justified by the fact that the hospital units are easily accessible to the population of the county, thus, it implies in greater notifications about the malformations in these hospitals.

A similar finding was found in the study by Reis LLAS et al., who identified the highest number of cases in the county of Caceres, Mato Grosso, in 2014, with a congenital malformation of 74.70%, demonstrating that in these regions increased attention in medical care in the prenatal period is necessary in order to reduce these rates⁹. It is notorious to think about the inefficiency of preventive measures and assistance during prenatal care in these localities and, especially in those regions where the deficiency is also in the notifications of the cases. This aspect is corroborated by two other studies that have argued that researches performed in public hospitals and agreed to the SUS of the state of Rio de Janeiro have shown that the

rates of congenital malformations are higher and may be related to low socio-demographic indexes, deficiencies in the implementation of preventive measures and assistance during prenatal care^{10,11}. This leads us to think that underreporting can occur in the Northeast region, so the Southeast presents with the largest number of cases.

Regarding the gender, results indicated by Maciel ELN et al, identified that of newborns affected by microcephaly, the prevalence was in the male sex¹². Corroborating with Ramos AP et al, which aimed to estimate the prevalence of congenital malformations in newborns of a public hospital in the state of Bahia, it was observed that of the newborns with malformations, 51.9% were boys, 41.8% girls and 5.1% had ambiguous genitalia¹³. However, in the Fancini study, there was a prevalence of female sex, as in the present study¹⁴. According to Janerich DT, the presence of a greater number of these malformations in the female gender is related to the need for a greater amount of the human chorionic gonadotropin hormone in this population for an adequate closure of the neural tube. This increase may avoid the risk for this type of malformation¹⁵.

In a public hospital located in Bahia, the majority of children born with these anomalies were cesarean delivery, corroborating with the present sample and with the national literature¹³. This type of delivery is related to an increase in the concern for secondary prevention through prenatal care, which aims, among other things, to identify cases of congenital malformations through early diagnosis. Prenatal care has as one of the objectives to recognize risk factors for the occurrence of malformations, and to program the most appropriate type of delivery, thus preventing extrinsic factors from causing harm to the fetus^{11,14}. According to Pante et al, cesarean delivery became the route of choice for the termination of pregnancies due to the low number of prenatal consultations¹⁶. This increased index seems to be related to the attempt to avoid distortions and to preserve the life of pregnant women and newborns, since newborns with malformation are considered at risk, making the choice of cesarean delivery safer¹⁶.

A 2008 study reported that 30% of the neonates had low birth weight and 70% adequate weight, so there was no significant relevance between congenital malformation and low birth weight¹³.

Another study showed that neonates weighing 2,500 g or greater have a higher rate, corresponding to 76.1%¹⁷. Therefore, in the present sample we observed a higher prevalence of children with CM with adequate weight and gestational age, showing that children do not need to be at GA and birth weight extremes to have such anomalies.

In the case of the impact of the mother's age on the perinatal outcomes, the literature shows that women in the extremes of age generally have less favorable results than the so-called young adults (20-35 years old). Women with late gestation present a similar risk to adolescents in some aspects, and higher in other situations such as spontaneous abortion, ectopic pregnancy, chromosomal abnormalities and congenital malformations¹⁸. Among women aged between 15 to 19, the chance of death due to problems due to pregnancy or childbirth is twice as high as among those over 20 years old¹⁹.

Although the socioeconomic part of their study was not investigated, Restrepo Mendez MC et al, found the association between low weight with low income and mother's age between 16 and 19 years old. However, they reported that this increase in risk among adolescent mothers would be more explained by their socioeconomic conditions than by biological characteristics²⁰. Other authors discuss the relationship between maternal age and congenital malformations in adolescent mothers and concluded that the odds of one adolescent with multiple pregnancies generating a child with malformation is 6.14 times higher compared to adolescents with single gestation²¹. In the late mothers, 35 years old or older, the odds are 11.4, when compared to mothers aged 20 to 34 years²². However, regarding the maternal age Reis LLAS et al, found in their study that 44.8% of CM are in children born to mothers aged between 21 and 30 years old, which corroborates with the findings of this study⁹. However, due to the cultural changes or even the greater insertion of women in the labor market, this trend should continue in the coming years and health professionals should be prepared to provide assistance in any age group, making possible the desire of a safe motherhood.

The results of perinatal deaths in the national literature corroborate with the current study. Regarding death related to mother's age, Oliveira et al's study demonstrated that young adult women are generally more likely to give birth to newborns with abnormalities that die at birth (57.6%), with females predominating in these fetuses, with 51.9%²³. The predominant type of delivery, with regard to death at birth is the vaginal 55.6 to 57.5%. Being that, more than 70.0% of the newborns who died in the delivery room presented low weight²⁴. However, the risk of neonatal death is 44 to 50 times higher among neonates who presented low birth weight <2,500 kg, and prematurity <37 weeks of GA, which leads us to infer that most CM do not allow that fetuses develop properly, it is as if the mother's own body expels that fetus before it gains weight and concludes its gestational weeks²⁵.

Conclusion

The present study demonstrated an epidemiological panorama of the cases of nervous system congenital malformations. It was identified a greater prominence of these anomalies in the southeastern region, in the female babies, with birth weight of 3000 to 3999kg, born of mothers aged 20 to 24 years old, with GA between 37 and 41 weeks from cesarean delivery. These results serve as health intervention and planning tool, as well as for a better understanding of public managers, in order to serve this population and direct investment in this area.

It is believed that a multidisciplinary team can plan a better way to meet the needs of these children with anomalies, a reality that poses challenges related to the health sector. However, a concern has been raised about CM, so knowing epidemiology is important to target rehabilitation actions.

Contributions of authors

Pereira ALA performed data collection, design, interpretation of the results and the writing of the scientific article. Souza MAB participated in the design and guided the construction of the article. Santos JC participated in the design and guided the construction of the article.

Conflicts of interest

No financial, legal or political conflict involving third parties (government, business and private foundations, etc.) was declared for any aspect of the work submitted (including but not limited to grants and funding, advisory council, study design, manuscript preparation, statistical analysis, etc.).

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