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ANALYSIS OF THE QUALITY OF THE INFORMATION SYSTEM ON LIVE BIRTHS[1]

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ABSTRACT
This study aimed to analyze the quality of the Information System on Live Births (SINASC in Portuguese) in Mato Grosso, state located in the Midwest region of Brazil, by means of the percentage and trend of incompleteness of the system variables in the period from 2000 to 2012, according to maternal, gestational, labor and newborn infants variables. This is an ecological time series study. The incompleteness of the variables was verified by percentage of ignored and unfilled data. Percentages lower than 1% were considered excellent; good, between 1% and 2.99%; regular, between 3% and 6.99%; and poor values, higher than 7%. For the trend analysis, polynomial regression was used. The results showed that the quality of SINASC is excellent, since the percentage of incompleteness of the majority of analyzed variables was less than 1%. However, there was an increasing tendency of incompleteness for race/color and gestational age, indicating a need for continuous quality monitoring and control.

Keywords: Vital statistics. Information systems. Live births. Birth Certificate..

INTRODUCTION

The Information System on Live Births (SINASC) was created in 1990. The Live Birth Declaration (LBD) is an standardized instrument for collecting data from the system, which includes sociodemographic and epidemiological variables that refer to the identification of the newborn, the mother and the father; the place of birth; conditions of gestation and delivery; identification of possible congenital anomalies; the professional responsible for completing the LBD and to the registry office responsible for issuing the birth certificate[1].

Since the implementation of SINASC the LBD has been reformulated in order to improve this data collection instrument and the quality of information. The current model was implemented in 2010, and the main modifications regarding the way data are collected in this version were related to the variables: **age**, which also started to include the year of birth and age in years; **schooling**, which began to be collected based on the education cycle and grade, and no longer on studied years; **marital status**, in which the option stable union was included; **race/color**, which now refers to the mother instead of the newborn; **number of live children and number of dead children**, which were included in the data block on the gestational history; **gestational age and number of prenatal consultations**, which started to be collected in exact numbers and no longer at predefined intervals[2].

The quality of SINASC information has been studied by researchers from different regions of the country, and the incompleteness of information, which refers to the degree to which the information records have null values (ignored or unfilled), has been the object of these studies[3-7].

Research indicates that the quality of the SINASC variables shows a tendency to improvement in relation to the filling, however, some variables still need to be improved in relation to this aspect[2,3,7]. This can occur, among other factors, due to the difficulty of measuring and identifying some information and to the lack of clarity of the instruction material to filling out the LBD. It should be emphasized that the non-definition of a professional category responsible for its completion leads to a heterogeneity of professionals involved in the data collection process, including nursing staff professionals, which makes it difficult to target training[4,8].

Considering the scarcity of recent analyzes on the subject in the state of Mato Grosso (MT) and the fact that LBD was reformulated in 2010 and the need for comparisons over time to detect

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inconsistencies and difficulties in collecting and typing data in the system SINASC, this study aimed to analyze the quality of the Information System on Live Births in Mato Grosso, by means of the percentage and trend of incompleteness of the system variables, in the period from 2000 to 2012, according to maternal, gestation, labor and the newborn variables.

METHODOLOGY

This is an ecological time series study, carried out in Mato Grosso, state located at the Midwest region of Brazil. The analysis comprised the historical series from 2000 to 2012 using SINASC databases provided by the State Department of Health of MT.

The LBD model currently in force in the country consists of eight blocks: Block I - Identification of the newborn; Block II - Location of occurrence; Block III - Mother; Block IV - Father; Block V - Pregnancy and childbirth; Block VI - Congenital anomaly; Block VII - Filling; Block VIII - Registry Office; totaling 52 variables distributed among them. For the present study, 05 **maternal** variables were selected from the total of 14 compose the Block III - Mother: age, schooling, marital status, occupation and race/color. It should be noted that the variable race/color introduced in the LBD from 1996 to 2010 referred to the newborn. With the new version of LBD in 2010, however, it started to refer to the mother.

For purposes of analysis, this study considered the sum of records on race/color collected with the old model (race/color of the newborn) and the new one (race/color of the mother), which were presented here in the set of maternal variables, since, according to the Technical Advisory Committee of SINASC, in 2011 and 2012, both models were still in circulation in the country. We also included 06 variables of the 11 that make up Block V – **Pregnancy and childbirth**: gestational age, type of pregnancy, number of prenatal consultations, type of delivery, number of live births and number of fetal losses/abortions; and 04 variables related to the **newborn**, of the 06 that compose Block I - Identification of the newborn: sex, Apgar score at the 1st and 5th minutes, birth weight and congenital anomaly.

The quality of SINASC was analyzed by means of the incompleteness of the selected variables that were calculated by the sum of ignored (filled as code "9") and of blank fields. The criterion adopted to classify the incompleteness was the one proposed in a survey that evaluated SINASC in the state of Paraná, from 2000 to 2005 [4], in which quality was considered **excellent** when the percentage of incompleteness was less than 1%; **good,** between 1% and 2.99%; **regular** from 3% to 6.99%; and **poor,** equal to or greater than 7%.

The trend analysis of the percentages of incompleteness was performed in the Statistical Package for Social Sciences (SPSS) software version 18, through the test of polynomial regression models: Linear: $y = \beta_0 + \beta_1 x$, Quadratic: $y = \beta_0 + \beta_1 x + \beta_2 x^2$, Cubic: $y = \beta_0 + \beta_1 x + \beta_2 x^2 + \beta_3 x^3$ And Exponential: $y = \beta_0 * \exp(\beta_1 * x) \Leftrightarrow \ln(y) = \ln(\beta_0) + (\beta_1 x)$.

Sixteen polynomial regression models were used, in which the values of Y (percentage of incompleteness of the series) and of X (years in the study) represented, respectively, the dependent and independent variables and β0, β1, β2 and β3 are the coefficients of regression. The choice of the model that best described the relationship between the dependent and independent variables was among those with a *p* value <0.05, and when this was coincident, the simpler model was chosen. For the variables that did not present statistically significant *p* values, it was considered non-existent model able to describe its behavior during the study period.

The project was submitted to the Research Ethics Committee of the Júlio Muller University Hospital and approved under opinion no. 749406 on August 13, 2014.

RESULTS

The variables of the newborn, gender and birth weight were classified as excellent quality in all years of the historical series, with a percentage of incompleteness less than 1%. The variables Apgar at the 1st and 5th minutes presented poor quality in the initial years of this study, with approximately 11% of incompleteness, declining to 3% in 2005 and to less than 1% as of 2006. However, between 2010 and 2012, there was a significant increase in the percentages of incompleteness of the Apgar variables at the 1st and 5th minute. The variable congenital anomaly presented good quality until 2003 and excellent as of 2004 (Table 1).

Table 1. Percentage of incompleteness of the variables of the newborn in the SINASC of Mato Grosso, from 2000 to 2012, according to the year and total of LBD completed. Cuiabá, MT, 2015.

Year	Total of LBD completed	Incompleteness (%)				
		Gender	Apgar at the 1st min	Apgar at the 5th min	Birth weight	Congenital anomaly
2000	49387	0.05	11.79	11.38	0.75	2.18
2001	47621	0.00	9.40	9.14	0.45	1.47
2002	47772	0.01	8.01	8.07	0.13	2.37
2003	48616	0.01	3.95	3.94	0.13	1.47
2004	51186	0.00	0.62	0.62	0.12	0.31
2005	52347	0.02	2.39	2.38	0.08	0.20
2006	49525	0.00	0.72	0.72	0.04	0.11
2007	47738	0.00	0.25	0.52	0.04	0.43
2008	49824	0.00	0.58	0.60	0.09	0.07
2009	48829	0.00	0.50	0.49	0.02	0.15
2010	49219	0.01	0.55	0.54	0.03	0.19
2011	51425	0.01	0.93	0.93	0.11	0.49
2012	51312	0.00	1.01	1.03	0.11	0.40

Among the maternal variables, those classified as excellent were age, race/color and schooling, all of them with less than 1% of incompleteness in the analyzed period. Although the variable marital status has been classified as excellent in practically the entire study period, this variable presented several oscillations, and since 2008 the incompleteness was increasing. Maternal occupation was classified as regular in 2000 (5.96% of incompleteness) and 2001 (3.54% of incompleteness), being the variable that presented the highest percentage of incompleteness in all years analyzed (Table 2).

Table 2. Percentage of incompleteness of maternal variables in the SINASC of Mato Grosso, 2000 - 2012, according to the year and total of LBD completed. Cuiabá, MT, 2015.

Year	Total of LBD completed	Incompleteness (%)				
		Age	Marital status	Schooling	Occupation	Race/color
2000	49387	0.16	0.64	0.88	5.96	0.53
2001	47621	0.14	0.38	0.66	3.54	0.42
2002	47772	0.07	0.36	0.52	2.15	0.46
2003	48616	0.02	1.66	0.69	2.85	0.06
2004	51186	0.05	0.35	0.33	2.40	0.05
2005	52347	0.06	0.57	0.44	2.02	0.12
2006	49525	0.06	0.19	0.25	1.40	0.09
2007	47738	0.00	0.21	0.41	0.90	0.14
2008	49824	0.00	0.18	0.43	0.47	0.19
2009	48829	0.00	0.24	0.57	0.74	0.44
2010	49219	0.00	0.34	0.29	2.22	0.15
2011	51425	0.00	0.57	0.56	1.99	0.67
2012	51312	0.00	0.60	0.58	2.84	0.63

In the block pregnancy and delivery, the variables type of pregnancy, type of delivery and number of prenatal consultations stood out with an excellent quality throughout the study period. In turn, the incompleteness of gestational age increased from 2007 onwards, reaching a level of regular quality in 2011, with 2.69% of non-completion. The variables with the highest percentage of incompleteness were the number of live births (with regular quality in most of the analyzed years) and the number of fetal losses/abortions (with poor quality at the beginning and end of the period) (Table 3).

Table 3. Percentage of incompleteness of the variables of pregnancy and childbirth in SINASC of Mato Grosso, 2000 - 2012, according to the year and total of LBD completed. Cuiabá, MT, 2015.

		Incompleteness (%)					
Year	Total of LBD completed	Gestational age	Type of pregnancy	Type of delivery	No. of prenatal consultations	No. of live births	No. of fetal losses/abortions
2000	49387	0.02	0.03	0.06	0.68	5.45	9.36
2001	47621	0.50	0.05	0.04	0.68	5.80	11.29
2002	47772	0.41	0.03	0.02	0.51	5.91	10.68
2003	48616	0.22	0.01	0.01	0.36	4.64	9.64
2004	51186	0.19	0.04	0.02	0.14	4.17	9.32
2005	52347	0.17	0.02	0.02	0.16	5.77	12.50
2006	49525	0.17	0.01	0.01	0.33	3.11	6.17
2007	47738	0.19	0.01	0.01	0.39	2.15	4.34
2008	49824	0.32	0.01	0.01	0.25	1.18	2.56
2009	48829	0.43	0.01	0.01	0.12	1.71	3.63
2010	49219	0.62	0.04	0.03	0.44	4.34	7.86
2011	51425	3.05	0.11	0.06	0.61	4.90	8.60
2012	51312	2.69	0.10	0.05	0.49	6.01	10.56

Table 4 shows the results of the trend analyzes of the percentages of incompleteness only for those variables with a significant trend. It was observed that for the eight variables with a significant trend, six showed a decreasing trend. However, the percentages of incompleteness for the variables race/color and gestational age increased significantly in the period (Table 4).

Table 4. Analysis of the trend of the incompleteness percentage of maternal, gestational, labor and newborn variables in the SINASC of Mato Grosso, 2000 - 2012. Cuiabá, MT, 2015.

Variable	*Model	**r^2	P (value)	Trend
Maternas				
Age	y= 20606.875 -10.254 x	0.711	< 0.001	Decreasing
Occupation	y= 359071.374 - 178.022 x	0.318	0.045	Decreasing
Race/color	y= 635.312 - 166.633 x + 12.597 x^2	0.730	0.001	Increasing
Pregnancy and delivery				
Gestational age	y= -290044.800 + 144.886 x	0.441	0.013	Increasing
Newborn				
Apgar at the 1st min	y= 1423267.200 – 708.148 x	0.651	0.001	Decreasing
Apgar at the 5th min	y= 1388467.749 - 690.820 x	0.653	0.001	Decreasing
Birth weight	y= 6.241E151 *exp (-30.240 * x) In (y) = In (6.241E151) + (-.172 x)	0.439	0.014	Decreasing
Congenital anomaly	y= 272154.398 - 135.344 x	0.556	0.003	Decreasing

*Model: y = Percentage of coverage and x = year; ** r2 = Coefficient of Explanation.

DISCUSSION

The analysis of quality of SINASC of Mato Grosso allowed verifying progress in the completeness of this system information over the years. A similar behavior has been occurring in other states of the country[5,2].

The implementation of the new model of LBD in 2010 made it possible to reduce the incompleteness of system variables in the country when compared to previous years. For that purpose, a strategy of gradual substitution of LBD forms and the use of a computerized system capable of converting the values captured in the new model to the values compatible with those of the old model were adopted. In the Midwest region, in 2011 and 2012, 76% and 100% of the new forms were used, respectively[2].

The set of variables of the newborn's identification is important for the recognition of the demographic characteristics of the population, as well as to detect babies born in situations of vulnerability and risk. Among these variables, gender and birth weight have shown percentages of incompleteness below 1% in surveys conducted in other states of the

country[4,9], which was also observed in the results of this study.

Birth weight is crucial to know the characteristics of low birth weight infants and to support the planning of actions aimed at improving the quality of care, as well as to identify determinants that can be prevented, as this condition is one of the main factors associated with the greater probability of death in the neonatal period, besides having consequences for the growth and development throughout the child's life[10].

Despite the decrease in the percentage of incompleteness of the Apgar index, as of 2000, this remained as the newborn's variable with worse results, a reality also evidenced in states of the Northeast Region of the country[5]. This fact may be related to the quality of the immediate care provided to the newborn, since these variables are measured in the first minutes after delivery and may not be filled in when there is no professional qualified to perform this assessment at the place of birth[7].

As for the congenital anomaly, which in the initial years of this study had a good classification in that state, it was able to reach an excellent classification in 2004. However, it is necessary to alert the existence of difficulties in filling it, since the identification and diagnosis of congenital anomalies may not be performed soon after delivery[4,6], since some of them require evaluation and later diagnosis, such as heart diseases, for example, and are therefore underreported. With this in mind, the need to train health professionals to identify and report congenital anomalies in the system is highlighted[11].

Considering that congenital anomalies are the second basic cause of neonatal death, knowledge of the number and characteristics of live births carrying these diseases is fundamental for the planning of health actions and programs aimed at detection, early diagnosis and prevention, and organization of referral services capable of providing adequate assistance[11].

Regarding maternal variables, age presented an excellent classification in the studied period, with a decline in the percentage of incompleteness, a characteristic also observed in other studies[3,4,11,12]. The importance of knowing maternal age for the organization of prenatal, delivery and newborn care is important, considering the relationship of this variable with maternal mortality and neonatal morbidity and mortality[13,14].

The mother's marital status had a reduction of incompleteness in the country between 2000 and 2012, and from 2008 it assumed an excellent classification. It is observed that in 2010, with the reintroduction of the category stable union, which was withdrawn from LBD in 2003, the only year in the historical series in which this variable was not excellent in Mato Grosso, it was noticed a growth in the percentage of mothers who declared this situation at the expense of the option single [2]. In studies carried out in the states of Paraná and Espírito Santo[4,12] the variable of the mother's marital status was classified as excellent.

Regarding the educational variable, which may be associated with maternal mortality and neonatal morbidity and mortality[13,14], there was a reduction of incompleteness between 2000 and 2009 in the Northeast region states[5]. There was also a reduction in the incompleteness of this variable in the country between 2010 and 2012[2]. In the present study, despite the excellent classification, the results evidenced that the incompleteness of maternal schooling increased between 2010 and 2012.

As in Mato Grosso, studies carried out in other states of the country also showed occupation as the maternal variable with the highest percentages of incompleteness[4,7,9].

The Brazilian Classification of Occupations (CBO) of 2002 is used to codify the variable occupation, which must be filled in the most detailed way possible to allow good classification by the typist or coder [15]. In a study carried out in São Paulo, it was identified difficulty in filling this variable among the professionals responsible for this activity when the occupation referred by the mother was not included in the CBO, such as student[16]. The absence of data regarding the mother's occupation can cause damages in the analysis of this information, especially in studies with the objective of establishing relations between sociodemographic variables[17].

The variable race/color is important to identify possible inequalities in access to maternal and child health policies related to discrimination. So, its adequate completeness is significant, since data from this SINASC variable are used in the calculation of Brazilian Health System Performance Indexes, such as Proportion of live births of mothers who has attended seven or more prenatal consultations and Proportion of normal delivery, whose analysis is necessary to identify unequal ethnic-racial conditions and to guide the planning and implementation of public health policies for the promotion of equity[2,18].

The variable race/color was inserted in the LBD

in 1996, when it presented only 1.3% of completeness. The justification for the high rate of incompleteness was the difficulty to obtain the variable, since in this period it referred to the newborn and was collected based on the perception of the professional that filled the LBD and not by self-declaration. Although the variable had presented an increase in completeness in subsequent years, between 2011 and 2012, the percentage of completion of this variable fell sharply in the country [18]. In the present study, the variable was classified as excellent between the years 2000 and 2012, but presented an increasing trend of incompleteness.

Gestational age, important data for the identification of premature children, stood out, since it showed a significant increase of incompleteness between 2010 and 2012 in the country, from 0.4% to 4.8%. The Ministry of Health suggests that further investigations be carried out to detect the reason for the increase of this incompleteness. The change in the way this variable is collected does not justify this increase, since in the new version of the LBD a field was maintained in which it could also be registered the gestational age in weeks, as in the previous model[2].

Considering that prematurity and low birth weight are currently the most important causes of neonatal mortality in the country[10], the completeness of gestational age assumes significant importance. Despite the increase in the incompleteness of this variable, as previously described, the Ministry of Health reported an increase in the country's prematurity indexes in 2013, measured by the SINASC, indicating a possible improvement in the reliability of the variable, since research indicates underreporting of this data[2,19].

According to SINASC data, the prevalence of prematurity in the period from 2000 to 2010 varied between 6 and 7%; however, corrected estimates presented values between 11 and 12% in the same period, which indicates an underestimation of prematurity in the system. Since the implantation of the new version of LBD, there has been an important increase in the prevalence of prematurity calculated from SINASC data[19]. On the other hand, the WHO ranked Brazil as the tenth country in the world with the highest absolute number of preterm births, with a prevalence of 9.2%[20].

Variables related to the mother's parity are important sources of data for the calculation of fertility indicators. According to Ministry of Health data, the percentage of incompleteness of live births in previous pregnancies was 11.3% in 2000 and fell to 6.7% in 2012; on the other hand, the number of fetal losses/abortions in 2000 was 21.7% and reduced to 10.4% in 2012. Although there has been an improvement in the quality of completeness of these variables over time, they continue to be the one with the worse rate of completeness in the whole country and also in MT, even though it showed a discrete decrease in the percentage of incompleteness after the implementation of the new version of the LBD in 2010[2]. Percentages of incompleteness of these variables similar to those found in the present study were also described in other studies[3,12].

The number of prenatal consultations allows the monitoring of care conditions to women during pregnancy in relation to access to prenatal care services[2]. In the present study, this variable was classified as excellent in all years of the series, which was also observed by other authors[4,7,9].

Although there are differences in the percentage of incompleteness of variables among the Brazilian regions, there is a satisfactory intake of births throughout the country, with reduction of incompleteness and progress in the quality of the information available in SINASC[2].

Improvement in SINASC quality has been observed throughout the implementation period and is, among other factors, related to LBD filling with a reduction of percentage of incompleteness of its variables, in which the nursing team has a broad participation, contributing directly to the improvement of system data. The quality of the information registered is one of the factors capable of translating the quality of care. In line with this, there is a need to continue investments in order to improve the filling of the LBD, as well as to value the information production process[4,8].

Given the epidemiological importance of this system for health surveillance and maternal and child care and for the planning and orientation of policies, programs and actions to reduce the morbidity and mortality of this population, it is imperative that health workers be constantly trained and motivated to value the task of collecting and reporting system information with quality. In addition, it is the responsibility of system managers within the three governmental spheres to develop a systematic and regular evaluation plan aiming at the quality of the system.

Information production process has several steps,

and different parameters can be used to evaluate the quality of SINASC. This research analyzed only incompleteness. However, the results obtained combine with other studies already carried out and may subsidize investments in other researches on the theme and the planning of local actions and policies aimed at the use of SINASC. The results of this study can also be applied in the practice of child care, as well as in the training of the health professions, especially medical and nursing.

FINAL CONSIDERATIONS

The incompleteness of SINASC was excellent for most of the variables analyzed in this study, showing an increasing trend of only two variables: race/color and gestational age. Despite the good results, continuous monitoring and quality control of the system is necessary in order to ensure that information reliably reflects the characteristics of mothers and live births, as well as care for pregnancy and delivery.

ANÁLISE DA QUALIDADE DO SISTEMA DE INFORMAÇÕES SOBRE NASCIDOS VIVOS

RESUMO

Este estudo objetivou analisar a qualidade do Sistema de Informações sobre Nascidos Vivos em Mato Grosso, estado da região Centro-Oeste do país, por meio do percentual e da tendência de incompletude das variáveis do sistema, no período de 2000 a 2012, segundo as variáveis maternas, da gestação, do parto e do recém-nascido. Trata-se de um estudo ecológico de série temporal. A incompletude das variáveis foi verificada por meio do percentual de dados ignorados e não preenchidos, considerando excelente percentuais inferiores a 1%, boa entre 1% e 2,99%, regular entre 3% e 6,99% e ruim superior a 7%. Para a análise de tendência utilizou-se regressão polinomial. Os resultados mostraram que a qualidade do Sinasc é excelente, pois o percentual de incompletude da maioria das variáveis analisadas foi inferior a 1%. Todavia observou-se tendência crescente dos percentuais de incompletude para raça/cor e idade gestacional o que indica necessidade de monitoramento e controle de qualidade contínuo.

Palavras-chave: Estatísticas vitais. Sistemas de Informação. Nascidos Vivos. Declaração de Nascimento.

ANÁLISIS DE LA CALIDAD DEL SISTEMA DE INFORMACIONES SOBRE NACIDOS VIVOS

RESUMEN

Este estudio tuvo el objetivo de analizar la calidad del Sistema de Informaciones sobre Nacidos Vivos en Mato Grosso, estado de la región Centro-Oeste de Brasil, por medio del porcentaje y de la tendencia de limitación de las variables del sistema, en el período de 2000 a 2012, según las variables maternas, de la gestación, del parto y del recién nacido. Se trata de un estudio ecológico de series temporales. La limitación de las variables fue verificada por medio del porcentaje de datos ignorados y no rellenados, considerando como excelente porcentajes inferiores a 1%, bueno entre 1% y 2,99%, regular entre 3% y 6,99% y malo superior a 7%. Para el análisis de tendencia se utilizó regresión polinomial. Los resultados señalaron que la calidad del Sinasc es excelente, pues el porcentaje de limitación de la mayoría de las variables analizadas fue inferior a 1%. No obstante se observó tendencia creciente de los porcentajes de limitación para raza/color y edad gestacional lo que indica la necesidad de monitoreo y control de calidad continuos.

Palabras clave: Estadísticas vitales. Sistemas de Información. Nacidos Vivos. Declaración de Nacimiento.

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