

# EVALUATION OF CONGENITAL ANOMALIES IN PERNAMBUCO, BRAZIL, 2013-2022

*AValiação das Anomalias Congênitas em Pernambuco, Brasil, 2013-2022*

*EVALUACIÓN DE LAS ANOMALÍAS CONGÉNITAS EN PERNAMBUCO, BRASIL, 2013-2022*

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## ABSTRACT

**Objetivo:** Avaliar o sistema de vigilância de anomalias congênitas ao nascimento em Pernambuco, Brasil, de 2013 a 2022. **Métodos:** Estudo avaliativo baseado nos atributos qualidade dos dados (completude e consistência) e representatividade, conforme o Guia de Avaliação dos Sistemas de Vigilância em Saúde Pública do Centers for Disease Control and Prevention/USA. **Resultados:** Todas as variáveis apresentaram excelente completude, exceto a variável “ocupação”, em 2016, devido à ausência de dados. A consistência foi excelente, com a menor coerência (87,3%) observada na relação entre peso ao nascer e idade gestacional. A representatividade mostrou-se alta, salvo para as categorias “branca” e “parda” da variável raça/cor da(o) parturiente, que não foram representativas entre Pernambuco e Brasil. **Conclusão:** O estudo demonstrou a robustez dos dados do Sistema de Informações sobre Nascidos Vivos em Pernambuco, oferecendo subsídios para pesquisadores e gestores. Recomendam-se ações para o Ministério da Saúde e as secretarias estaduais e municipais de saúde.

**Descritores:** Leptospirose; Sistema de Informação em Saúde; Vigilância em Saúde Pública.

## RESUMO

**Objective:** To evaluate the congenital anomaly surveillance system at birth in Pernambuco, Brazil, from 2013 to 2022. **Methods:** An evaluative study based on data quality attributes (completeness and consistency) and representativeness, following the Public Health Surveillance Systems Evaluation Guide by the Centers for Disease Control and Prevention (CDC/USA). **Results:** All variables showed excellent completeness, except for “occupation” in 2016 due to missing data. Consistency was excellent, with the lowest coherence (87.3%) observed in the relationship between birth weight and gestational age. Representativeness was high, except for the “white” and “mixed-race” categories of the parturient's race/color variable, which were not representative of Pernambuco compared to Brazil. **Conclusion:** The study demonstrated the robustness of data from the Live Birth Information System in Pernambuco, providing support for researchers and policymakers. Recommendations include actions for the Ministry of Health, as well state and municipal health departments.

**Descriptors:** Weil Disease; Health Information System; Public Health Surveillance.

## RESUMEN

**Objetivo:** Evaluar el sistema de vigilancia de anomalías congénitas al nacer en Pernambuco, Brasil, entre 2013 y 2022. **Métodos:** Estudio evaluativo basado en los atributos de calidad de los datos (integridad y consistencia) y representatividad, según la Guía de Evaluación de los Sistemas de Vigilancia en Salud Pública de los Centers for Disease Control and Prevention (CDC/EE.UU.). **Resultados:** Todas las variables presentaron una excelente integridad, excepto la variable “ocupación” en 2016, debido a la falta de datos. La consistencia fue excelente, con la menor coherencia (87,3%) observada en la relación entre peso al nacer y edad gestacional. La representatividad fue alta, excepto en las categorías “blanca” y “mestiza” de la variable raza/color de la parturienta, que no fueron representativas entre Pernambuco y Brasil. **Conclusión:** El estudio demostró la solidez de los datos del Sistema de Informaciones sobre Nacidos Vivos en Pernambuco, proporcionando insumos para investigadores y gestores. Se recomiendan acciones para el Ministerio de Salud y las secretarías estatales y municipales de salud.

**Descriptores:** Enfermedad de Weil; Comunicación en Salud. Vigilancia en Salud Pública.

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## INTRODUCTION

Congenital anomalies (CAs) are functional and/or morphological changes in the embryo or fetus, identified during prenatal screening, at birth, or later in life<sup>1-3</sup>. Their origin is associated with environmental, behavioral, genetic, infectious, or multifactorial factors, though the etiology remains unknown in approximately 50% of cases<sup>3,4</sup>. Nevertheless, they are considered preventable through measures such as proper nutrition, genetic screening, early diagnosis, and immunization<sup>1,3-5</sup>.

CAs are the leading cause of infant mortality in high-income countries<sup>2</sup>. In Latin America and the Caribbean, they represent the second leading cause of death in children under five years of age. In Brazil, they accounted for 22.9% (n=7,399) of infant deaths in 2022, ranking as the second leading cause across all macro-regions of the country<sup>3,5</sup>. Globally, an estimated 2% to 5% of live births (LB) are affected by some type of CA<sup>1,3,5</sup>. However, Brazil shows signs of underreporting, with only 0.9% (n=23,583) of registered live births documented with CAs in 2022<sup>6</sup>.

In the 1990s, CA records transitioned from the Mortality Information System (SIM) to the Live Birth Information System (SINASC), which became the official source for reporting structural and visible CAs at birth<sup>2,7</sup>. SINASC uses the Live Birth Declaration (LBD), a mandatory document for all births in the country<sup>8</sup>. Reporting of CAs became compulsory with Law No. 13,685/2018, which established a priority list of CAs to enhance surveillance<sup>2,9</sup>.

This study aimed to evaluate the surveillance system for CAs at birth in Pernambuco, Brazil, from 2013 to 2022.

## METHODS

This study evaluated the quality and representativeness of data on live births with congenital anomalies in Pernambuco from 2013 to 2022, following the Updated Guidelines for Evaluating Public Health Surveillance Systems from the Centers for Disease Control and Prevention (CDC)<sup>10</sup>.

Pernambuco has 9,058,155 inhabitants (92.37 inhabitants/km<sup>2</sup>) distributed across 184 municipalities and the Fernando de Noronha district<sup>11</sup>. The study population comprised all reported cases of live births with congenital anomalies in Pernambuco during the study period. Data were obtained from the Live Birth Information System (SINASC), available through the Brazilian Unified Health System's Department of Informatics (DATASUS).

Two main attributes were analyzed: data quality (completeness and consistency) and representativeness. Completeness refers to the percentage of responses for each variable, calculated by subtracting incompleteness, which considers the sum of "ignored" and "blank" responses. The evaluation parameters for completeness were: excellent ( $\geq 95\%$ ), good (90-94.9%), fair (80-89.9%), poor (50-79.9%), or very poor ( $< 50\%$ )<sup>12-13</sup>. We evaluated 16 variables, including 4 mandatory ones (sex, place of birth, age, and municipality of residence of the mother) and 12 essential ones (birth weight, municipality of occurrence, maternal education, marital status, occupation, race/ethnicity of the mother, number of previous pregnancies, number of prenatal visits, month of prenatal care initiation, type of pregnancy, and type of delivery).

Consistency was assessed as the logical coherence between pairs of variables<sup>10</sup>. We analyzed the following relationships: reported anomaly versus ICD-10 code; birth weight (<2.5 kg) versus gestational age ( $\geq 37$  weeks); maternal age (10-14 years) versus number of previous pregnancies ( $\geq 4$ ); prenatal care initiation ( $\geq 8$ th month) versus number of visits ( $\geq 7$ ); place of birth (all except hospital) versus delivery type (cesarean); and delivery type (vaginal) versus whether cesarean occurred before labor began (all except “not applicable”). The same parameters used for completeness were applied to evaluate consistency. Overall data quality resulted from the combined analysis of these two attributes.

For representativeness, we compared Pernambuco with both the Northeast region and Brazil as a whole, considering variables such as sex, birth weight, race/ethnicity, and place of birth. Results were considered representative (R) if values from the Northeast or Brazil fell within  $\pm 10\%$  of Pernambuco's values (partial classification). The final classification deemed data representative if at least one comparison (with either the Northeast or Brazil) was classified as R.

Data analysis employed descriptive statistics (absolute and relative frequencies) using Epi Info® 7.2.6.0 and Microsoft® Excel 2019. Since the study used publicly available secondary data, ethical approval was waived according to Resolution No. 466/2012 of the Brazilian National Health Council.

## RESULTS

Between 2013 and 2022, a total of 1,340,436 live births were recorded in Pernambuco. The year 2015 stood out with the highest number of occurrences (145,024 live births), representing approximately 11% of all births during the study period. Conversely, 2022 had the lowest number of live births (117,437), accounting for 8.8% of the total.

Among all live births, 13,532 (1%) were diagnosed with some type of congenital anomaly (CA) at birth. The year 2015, due to the Zika virus epidemic and associated microcephaly cases, showed the highest frequency of CAs (1,809 cases), representing 13.4% of all CA cases during the period. The lowest number of live births with CAs occurred in 2013 (1,199 cases), comprising 8.9% of the total.

On average, the percentage of live births with detected CAs in Pernambuco during the study period was 1%. This finding suggests significant underreporting of CAs in the state when compared to global estimates.

Data completeness analysis revealed an overall excellent completeness rate of 98.8%, though variations existed across variables, categories, and years. The “Identification” category showed 99% completeness, with high completeness in sex (98.1%) and birth weight (100%) variables. The “Place of occurrence” category achieved 100% completeness for both variables. The “Mother” category had 97.3% completeness, though the occupation variable demonstrated only fair performance (86.2%), particularly in 2016 when no records were available. Other variables in this category performed excellently: education (99.3%), age (100%), marital status (99.3%), race/ethnicity (99.2%), and municipality of residence (100%).

The “Pregnancy and Delivery” category was classified as excellent (98.8%), with all variables performing equally well: the number of previous pregnancies (99.6%), the number of prenatal visits (99%), the month of prenatal care initiation (95.9%), the type of pregnancy (99.8%), and type of delivery (99.8%). These results are presented in greater detail in Table 1.

Data consistency analysis for live births with CAs showed an overall excellent rate of 97.6%, varying according to variable relationships and years analyzed. The variables “detected anomaly” and “anomaly code (ICD-10)” maintained excellent consistency (100%) across all years. The relationship between birth weight (<2.5 kg) and gestational age ( $\geq 37$  weeks) showed the lowest consistency (87.3%), classified as fair. Meanwhile, the relationship between maternal age (10-14 years) and number of previous pregnancies ( $\geq 4$ ) was excellent (100%).

Consistency between prenatal care initiation ( $\geq 8$ th month) and the number of visits ( $\geq 7$ ) was also excellent (98.4%), with minor annual variations. The relationship between the place of birth (all except hospital) and delivery type (cesarean) showed excellent consistency (99.7%) with minimal variation. Finally, the relationship between delivery type (vaginal) and “cesarean performed before labor began” remained stable and excellent (100%). These results are detailed in Table 2.

Table 1 – Completeness percentage of LBC filling according to selected variables and birth year, Pernambuco, 2013 to 2022 (N=13.532)

| BLOCK/VARIABLE                    | 2013<br>(N=1.199) | 2014<br>(N=1.226) | 2015<br>(N=1.809) | 2016<br>(N=1.517) | 2017<br>(N=1.321) | 2018<br>(N=1.278) | 2019<br>(N=1.293) | 2020<br>(N=1.280) | 2021<br>(N=1.300) | 2022<br>(N=1.309) | AVERAGE      | FILLING<br>LEVEL<br>GRADE |
|-----------------------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|--------------|---------------------------|
| <b>IDENTIFICATION</b>             | <b>99,1</b>       | <b>99,3</b>       | <b>99,1</b>       | <b>99,1</b>       | <b>98,9</b>       | <b>98,8</b>       | <b>98,8</b>       | <b>98,6</b>       | <b>99,0</b>       | <b>99,2</b>       | <b>99,0</b>  | <b>Excellent</b>          |
| Sex                               | 98,3              | 98,6              | 98,3              | 98,4              | 97,9              | 97,7              | 97,6              | 97,3              | 98,1              | 98,5              | 98,1         | Excellent                 |
| Birth weight                      | 99,9              | 100,0             | 99,9              | 99,9              | 100,0             | 99,9              | 100,0             | 100,0             | 100,0             | 100,0             | 100,0        | Excellent                 |
| <b>PLACE OF OCCURRENCE</b>        | <b>99,9</b>       | <b>100,0</b>      | <b>100,0</b>      | <b>100,0</b>      | <b>100,0</b>      | <b>100,0</b>      | <b>100,0</b>      | <b>100,0</b>      | <b>100,0</b>      | <b>100,0</b>      | <b>100,0</b> | <b>Excellent</b>          |
| Place of birth                    | 99,8              | 100,0             | 100,0             | 99,9              | 100,0             | 100,0             | 99,9              | 100,0             | 100,0             | 100,0             | 100,0        | Excellent                 |
| Municipality of occurrence        | 100,0             | 100,0             | 100,0             | 100,0             | 100,0             | 100,0             | 100,0             | 100,0             | 100,0             | 100,0             | 100,0        | Excellent                 |
| <b>PARTURIENT</b>                 | <b>98,8</b>       | <b>98,7</b>       | <b>99,0</b>       | <b>83,0</b>       | <b>98,9</b>       | <b>99,0</b>       | <b>99,0</b>       | <b>99,0</b>       | <b>99,1</b>       | <b>98,9</b>       | <b>97,3</b>  | <b>Excellent</b>          |
| Education level                   | 98,8              | 99,1              | 99,5              | 99,6              | 99,5              | 99,1              | 99,5              | 99,3              | 99,2              | 99,5              | 99,3         | Excellent                 |
| Age                               | 100,0             | 100,0             | 100,0             | 100,0             | 100,0             | 100,0             | 100,0             | 100,0             | 100,0             | 100,0             | 100,0        | Excellent                 |
| Marital status                    | 99,7              | 99,3              | 99,4              | 99,3              | 99,2              | 99,3              | 99,2              | 99,1              | 99,4              | 99,5              | 99,3         | Excellent                 |
| Race/ethnicity                    | 99,5              | 98,7              | 99,6              | 99,1              | 98,9              | 99,1              | 99,1              | 99,2              | 99,5              | 99,3              | 99,2         | Excellent                 |
| Municipality of residence         | 100,0             | 100,0             | 100,0             | 100,0             | 100,0             | 100,0             | 100,0             | 100,0             | 100,0             | 100,0             | 100,0        | Excellent                 |
| Occupation                        | 95,1              | 95,2              | 95,4              | 0,0               | 95,7              | 96,1              | 96,4              | 96,3              | 96,8              | 95,3              | 86,2         | Fair                      |
| <b>PREGNANCY AND DELIVERY</b>     | <b>98,3</b>       | <b>98,4</b>       | <b>98,9</b>       | <b>99,0</b>       | <b>99,0</b>       | <b>98,9</b>       | <b>99,2</b>       | <b>98,7</b>       | <b>98,9</b>       | <b>99,0</b>       | <b>98,8</b>  | <b>Excellent</b>          |
| Number of previous pregnancies    | 99,4              | 99,3              | 99,7              | 99,6              | 99,4              | 99,8              | 99,9              | 99,6              | 99,7              | 99,9              | 99,6         | Excellent                 |
| Number of prenatal visits         | 98,2              | 98,9              | 99,3              | 99,3              | 99,3              | 99,4              | 99,5              | 98,4              | 98,8              | 99,1              | 99,0         | Excellent                 |
| Month of prenatal care initiation | 94,4              | 94,8              | 95,9              | 96,2              | 96,2              | 95,9              | 96,8              | 96,2              | 95,9              | 96,6              | 95,9         | Excellent                 |
| Type of pregnancy                 | 99,7              | 99,6              | 99,7              | 99,8              | 100,0             | 99,8              | 99,9              | 99,7              | 99,9              | 99,6              | 99,8         | Excellent                 |
| Type of delivery                  | 99,7              | 99,5              | 99,7              | 99,9              | 100,0             | 99,8              | 99,8              | 99,8              | 99,9              | 99,6              | 99,8         | Excellent                 |
| <i>Annual average</i>             | <b>99,0</b>       | <b>99,1</b>       | <b>99,2</b>       | <b>95,3</b>       | <b>99,2</b>       | <b>99,2</b>       | <b>99,2</b>       | <b>99,1</b>       | <b>99,3</b>       | <b>99,3</b>       | <b>98,8</b>  | <b>Excellent</b>          |

**Source:** MS/SVSA/CGIAE – Sistema de Informações sobre Nascidos Vivos – INASC.

Table 2 – Consistency percentage in filling out the LBC according to selected variables and birth year, Pernambuco, 2013 to 2022 (N=13.532).

| VARIABLES/INFORMATION FIELDS                                                          | 2013        | 2014        | 2015        | 2016        | 2017        | 2018        | 2019        | 2020        | 2021        | 2022        | AVERAGE     | FILLING<br>LEVEL<br>GRADE |
|---------------------------------------------------------------------------------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|---------------------------|
|                                                                                       | (N=1.199)   | (N=1.226)   | (N=1.809)   | (N=1.517)   | (N=1.321)   | (N=1.278)   | (N=1.293)   | (N=1.280)   | (N=1.300)   | (N=1.309)   |             |                           |
| Detected anomaly × anomaly code (ICD-10)                                              | 100,0       | 100,0       | 99,9        | 100,0       | 100,0       | 100,0       | 100,0       | 99,9        | 100,0       | 99,8        | 100,0       | Excellent                 |
| Birth weight (<2.5kg) × gestational duration (≥37 weeks)                              | 87,2        | 89,4        | 84,1        | 85,1        | 88,2        | 87,5        | 86,5        | 88,8        | 87,8        | 88,6        | 87,3        | Fair                      |
| Age (10-14 years) × number of previous pregnancies (≥4)                               | 100,0       | 100,0       | 100,0       | 100,0       | 100,0       | 100,0       | 100,0       | 100,0       | 100,0       | 100,0       | 100,0       | Excellent                 |
| Prenatal initiation (≥8th month) × number of visits (≥7)                              | 96,7        | 97,1        | 99,2        | 98,9        | 98,4        | 98,5        | 98,7        | 98,8        | 98,8        | 98,7        | 98,4        | Excellent                 |
| Place of occurrence (all except hospital) × delivery type (cesarean)                  | 99,5        | 99,6        | 99,2        | 99,6        | 99,9        | 99,9        | 99,6        | 99,7        | 99,7        | 100,0       | 99,7        | Excellent                 |
| Delivery type (vaginal) × was cesarean performed before labor began? (all except N/A) | 100,0       | 100,0       | 100,0       | 100,0       | 100,0       | 100,0       | 100,0       | 100,0       | 100,0       | 100,0       | 100,0       | Excellent                 |
| <i>Annual average</i>                                                                 | <i>97,2</i> | <i>97,7</i> | <i>97,1</i> | <i>97,3</i> | <i>97,8</i> | <i>97,6</i> | <i>97,5</i> | <i>97,9</i> | <i>97,7</i> | <i>97,9</i> | <i>97,6</i> | <i>Excellent</i>          |

Source: MS/SVSA/CGIAE – Sistema de Informações sobre Nascidos Vivos – SINASC.

The data quality attribute was classified as excellent for all years analyzed. Annual averages ranged from 96.3% to 98.6%, with an overall excellent performance of 98.2%, as shown in Table 3.

Table 3- Classification of the data quality attribute according to completeness, consistency, and year of birth, Pernambuco, 2013-2022.

| YEAR           | DATA QUALITY |              |              |               |
|----------------|--------------|--------------|--------------|---------------|
|                | COMPLETENESS | CONSISTÊNCIA | COMPLETENESS | CLASSIFICAÇÃO |
| 2013           | 99,0         | 97,2         | 98,1         | Excellent     |
| 2014           | 99,1         | 97,7         | 98,4         | Excellent     |
| 2015           | 99,2         | 97,1         | 98,2         | Excellent     |
| 2016           | 95,3         | 97,3         | 96,3         | Excellent     |
| 2017           | 99,2         | 97,8         | 98,5         | Excellent     |
| 2018           | 99,2         | 97,6         | 98,4         | Excellent     |
| 2019           | 99,2         | 97,5         | 98,4         | Excellent     |
| 2020           | 99,1         | 97,9         | 98,5         | Excellent     |
| 2021           | 99,3         | 97,7         | 98,5         | Excellent     |
| 2022           | 99,3         | 97,9         | 98,6         | Excellent     |
| AVERAGE        | 98,8         | 97,6         | 98,2         | Excellent     |
| CLASSIFICATION | Excellent    | Excellent    | Excellent    | Excellent     |

**Source:** Prepared by the authors.

The representativeness analysis showed that Pernambuco's data were generally representative when compared to both the Northeast region and Brazil. Regarding personal characteristics, the variables of sex and birth weight were representative across all analyzed categories for both the Northeast and Brazil.

However, the race/ethnicity variable was representative for the Northeast in all categories but not for Brazil in the “white” and “mixed-race” categories. For place characteristics, the birth location variable was representative across all categories both for the Northeast and Brazil. Finally, in the temporal analysis, the birth year variable showed representativeness throughout the entire time series for both comparisons. Detailed results are presented in Table 4.

Table 4 – Classification of representativeness attribute according to variables related to person, place, and time, Pernambuco, Northeast region and Brazil, 2013 to 2022.

| REGIONS | PE         |       | Northeast  |       | Brazil      |       | CP        |        | CF |
|---------|------------|-------|------------|-------|-------------|-------|-----------|--------|----|
|         | (N=13.532) |       | (N=49.386) |       | (N=227.252) |       |           |        |    |
|         | n          | %     | n          | %     | n           | %     | Northeast | Brazil |    |
| PERSON  |            |       |            |       |             |       |           |        |    |
| Sex     |            |       |            |       |             |       | R         | R      | R  |
| Male    | 7.774      | 57.4% | 27.803     | 56.3% | 127.581     | 56.1% | R         | R      | R  |

|                                     |        |       |        |       |         |       |          |          |          |
|-------------------------------------|--------|-------|--------|-------|---------|-------|----------|----------|----------|
| Female                              | 5.497  | 40,6% | 20.603 | 41,7% | 96.439  | 42,4% | R        | R        | R        |
| Undefined                           | 261    | 1,9%  | 980    | 2,0%  | 3.232   | 1,4%  | R        | R        | R        |
| <b>Birth weight</b>                 |        |       |        |       |         |       | <b>R</b> | <b>R</b> | <b>R</b> |
| < 2,5 kg                            | 3.412  | 25,2% | 12.804 | 25,9% | 59.181  | 26,0% | R        | R        | R        |
| ≥ 2,5 kg                            | 10.115 | 74,7% | 36.577 | 74,1% | 168.028 | 73,9% | R        | R        | R        |
| Missing data                        | 5      | 0,0%  | 5      | 0,0%  | 43      | 0,0%  | R        | R        | R        |
| <b>Race/ethnicity of the mother</b> |        |       |        |       |         |       | <b>R</b> | <b>R</b> | <b>R</b> |
| White                               | 2.431  | 18,0% | 4.515  | 9,1%  | 86.145  | 37,9% | R        | NR       | R        |
| Black                               | 861    | 6,4%  | 3.170  | 6,4%  | 16.180  | 7,1%  | R        | R        | R        |
| Asian                               | 29     | 0,2%  | 164    | 0,3%  | 1.196   | 0,5%  | R        | R        | R        |
| Mixed-race/Pardo                    | 10.029 | 74,1% | 36.375 | 73,7% | 113.019 | 49,7% | R        | NR       | R        |
| Indigenous                          | 77     | 0,6%  | 177    | 0,4%  | 1.773   | 0,8%  | R        | R        | R        |
| Missing data                        | 105    | 0,8%  | 4.985  | 10,1% | 8.939   | 3,9%  | R        | R        | R        |
| <b>PLACE</b>                        |        |       |        |       |         |       |          |          |          |
| <b>Place of birth</b>               |        |       |        |       |         |       | <b>R</b> | <b>R</b> | <b>R</b> |
| Hospital                            | 13.415 | 99,1% | 48.578 | 98,4% | 224.103 | 98,6% | R        | R        | R        |
| Other healthcare facilities         | 55     | 0,4%  | 429    | 0,9%  | 1.363   | 0,6%  | R        | R        | R        |
| Home                                | 36     | 0,3%  | 201    | 0,4%  | 1.077   | 0,5%  | R        | R        | R        |
| Other                               | 22     | 0,2%  | 162    | 0,3%  | 556     | 0,2%  | R        | R        | R        |
| Missing data                        | 4      | 0,0%  | 16     | 0,0%  | 153     | 0,1%  | R        | R        | R        |
| <b>TIME</b>                         |        |       |        |       |         |       |          |          |          |
| <b>Year of birth</b>                |        |       |        |       |         |       | <b>R</b> | <b>R</b> | <b>R</b> |
| 2013                                | 1.199  | 8,9%  | 4.424  | 9,0%  | 21.934  | 9,7%  | R        | R        | R        |
| 2014                                | 1.226  | 9,1%  | 4.263  | 8,6%  | 21.058  | 9,3%  | R        | R        | R        |
| 2015                                | 1.809  | 13,4% | 5.446  | 11,0% | 22.676  | 10,0% | R        | R        | R        |
| 2016                                | 1.517  | 11,2% | 5.878  | 11,9% | 24.537  | 10,8% | R        | R        | R        |
| 2017                                | 1.321  | 9,8%  | 3.749  | 7,6%  | 22.599  | 9,9%  | R        | R        | R        |
| 2018                                | 1.278  | 9,4%  | 5.307  | 10,7% | 24.654  | 10,8% | R        | R        | R        |
| 2019                                | 1.293  | 9,6%  | 5.349  | 10,8% | 23.545  | 10,4% | R        | R        | R        |
| 2020                                | 1.280  | 9,5%  | 4.956  | 10,0% | 22.316  | 9,8%  | R        | R        | R        |
| 2021                                | 1.300  | 9,6%  | 5.011  | 10,1% | 21.659  | 9,5%  | R        | R        | R        |
| 2022                                | 1.309  | 9,7%  | 5.003  | 10,1% | 22.274  | 9,8%  | R        | R        | R        |

**Source:** MS/SVSA/CGIAE – Sistema de Informações sobre Nascidos Vivos – SINASC. CP = Partial classification; CF = Final classification; R = Representative; NR = Non-representative.

## DISCUSSION

The results highlight the excellent completeness of sex, birth weight, and place of birth variables in Pernambuco, corroborating previous studies<sup>13-17</sup>.

The occupation variable was classified as fair, reinforcing findings from a 2006-2010 evaluation of SINASC completeness in Brazil<sup>18</sup>. This was mainly due to missing data in 2016; excluding this year, completeness would reach 95.8%, classifying it as excellent. Despite Ministry of Health<sup>8</sup> guidelines discouraging categories such as “housewife” or “unemployed”, these were considered valid in this study, reflecting challenges already identified in the literature<sup>13</sup>.

Variables related to maternal characteristics (education, age, marital status, race/ethnicity, and municipality of residence) and pregnancy (number of prenatal visits, type of delivery, etc.) showed excellent completeness, aligning with previous studies<sup>14-15,19</sup>.

The analysis of data quality (completeness and consistency) revealed excellence in Pernambuco's SINASC, particularly in completeness, consistent with documented improvements in recent years<sup>23-24</sup>.

The predominance of hospital births in the state likely contributes to high data quality, as hospitals facilitate access to information and have qualified professionals to complete birth records.

Additionally, Hospital Epidemiological Surveillance units in major hospitals play a crucial role in improving the quality of health information systems<sup>25</sup>.

Regarding representativeness, the data reflect patterns in the Northeast and Brazil, except for the race/ethnicity variable, where the “white” and “mixed-race” categories were not representative, possibly due to the state's racial composition.

Study limitations include the scarcity of comparable studies on congenital anomalies, potential underreporting in secondary data, and possible impacts of the COVID-19 pandemic on registration during part of the study period.

## CONCLUSION

The study evaluated Pernambuco's congenital anomaly surveillance system from 2013 to 2022, classifying it as excellent in data quality and representation. Completeness was excellent overall, though there were some annual variations. Data consistency was also high, except for the relationship between birth weight and gestational age, which showed lower consistency, possibly related to the specific anomalies studied.

In the representativeness analysis, comparing Pernambuco with the Northeast and Brazil, only the “white” and “mixed-race” categories of maternal race/ethnicity were not representative. The robustness of the data reinforces the reliability of the surveillance system, supporting researchers and policymakers in understanding the phenomenon and developing strategies to improve health information systems, as well as informing local decision-making.

It is recommended that the Ministry of Health review and correct DATASUS data. The Pernambuco State Health Department should monitor data, train teams, and strengthen congenital anomaly reporting, while Municipal Health Departments should train professionals, emphasize anomaly notification, and establish routines for data assessment and correction.

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