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MATERNAL DEATH SURVEILLANCE SYSTEM IN CEARÁ, 2014-2023

SISTEMA DE VIGILÂNCIA DO ÓBITO MATERNO NO CEARÁ, 2014-2023

SISTEMA DE VIGILANCIA DE MUERTE MATERNA EN CEARÁ, 2014-2023

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ABSTRACT
Objective: This study aimed to assess the attributes of data quality, representativity, and timeliness of the maternal mortality surveillance system in Ceará from 2014 to 2023. **Methods:** The research followed an evaluation methodology focusing on attributes such as data quality, representativity, and timeliness, using tools like Epi Info™ 7.2, Office 365, and QGis for data analysis, processing, and presentation. **Results:** The system demonstrated high data completeness (99.2%) but only moderate consistency (79.5%), with discrepancies between death certificates and investigations. Representativity was excellent, accurately reflecting the profile of deceased women. However, notification (69.31%) and investigation (45.25%) timeliness were unsatisfactory. **Conclusion:** Despite progress, improvements in system consistency and efficiency are essential to strengthen surveillance and support effective policies to reduce maternal mortality.
Keywords: *Health Surveillance System; Evaluation; Maternal Mortality; Field Epidemiology.*

RESUMO
Objetivo: Este teve como objetivo avaliar os atributos de qualidade dos dados, representatividade e oportunidade do sistema de vigilância do óbito materno no Ceará no período de 2014 e 2023. **Métodos:** A pesquisa seguiu a metodologia de avalição de atributos como qualidade dos dados, representatividade e oportunidade, empregando ferramentas como Epi Info™ 7.2, Office 365 e QGis para análise, processamento e apresentação dos dados. **Resultados:** O sistema apresentou alta completitude dos dados (99,2%), mas consistência regular (79,5%), com discrepâncias entre declarações de óbito e investigações. A representatividade foi excelente, refletindo adequadamente o perfil das mulheres falecidas. No entanto, a oportunidade de notificação (69,31%) e investigação (45,25%) foi insatisfatória. **Conclusão:** Apesar dos avanços, melhorias na consistência e eficiência do sistema são essenciais para fortalecer a vigilância e apoiar políticas eficazes na redução da mortalidade materna.
Palavras-chave: *Sistema de Vigilância em Saúde; Avaliação; Mortalidade Materna; Epidemiologia de Campo.*

RESUMEN
Objetivo: Este estudio tuvo como objetivo evaluar los atributos de calidad de los datos, representatividad y oportunidad del sistema de vigilancia de la mortalidad materna en Ceará entre 2014 y 2023. **Métodos:** La investigación siguió una metodología de evaluación enfocada en atributos como calidad de los datos, representatividad y oportunidad, utilizando herramientas como Epi Info™ 7.2, Office 365 y QGis para el análisis, procesamiento y presentación de los datos. **Resultados:** El sistema mostró una alta completitud de los datos (99,2%), pero solo una consistencia moderada (79,5%), con discrepancias entre los certificados de defunción y las investigaciones. La representatividad fue excelente, reflejando con precisión el perfil de las mujeres fallecidas. Sin embargo, la oportunidad de notificación (69,31%) e investigación (45,25%) fue insatisfactoria. **Conclusión:** Apesar de los avances, mejorar la consistencia y eficiencia del sistema es esencial para fortalecer la vigilancia y apoyar políticas efectivas para reducir la mortalidad materna.
Descriptores: *Sistema de Vigilancia en Salud; Evaluación; Mortalidad Materna; Epidemiología de Campo.*

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INTRODUCTION

Maternal mortality is one of the greatest global public health challenges, reflecting inequalities in access to and quality of health services. The World Health Organization (WHO) estimates that, in 2020, approximately 287,000 women died from causes related to pregnancy and childbirth, the majority in low- and middle-income countries, including Brazil (1). In the national context, reducing these deaths is a priority for the Unified Health System (SUS) and is aligned with the Sustainable Development Goals (SDGs), especially target 3.1, which establishes the reduction of the Maternal Mortality Ratio (MMR) to less than 30 deaths per 100,000 live births by 2030 (2).

In Ceará, actions aimed at improving the quality of prenatal, childbirth, and postpartum care have been implemented, in addition to expanding epidemiological surveillance activities (3). However, studies indicate limitations in the effectiveness of the surveillance system, such as failures in notification, underreporting of cases, and delays in the conclusion of investigations (4). The literature emphasizes that well-structured surveillance systems are fundamental for supporting public policies and interventions aimed at preventing these deaths (5).

The relevance of this study lies in the need to evaluate the capacity of the maternal mortality surveillance system to produce high-quality information, identifying its limitations and proposing improvement strategies. By addressing aspects such as data quality, representativeness, and timeliness of the information, the study seeks to support actions that contribute to strengthening maternal health in the state and to tackling avoidable mortality.

Therefore, the objective of this study is to evaluate the maternal mortality surveillance system in the state of Ceará for the period from 2014 to 2023, with an emphasis on the attributes of data quality, representativeness, and timeliness, aiming to identify weaknesses and propose improvements.

METHODS

This study consists of a quantitative and descriptive evaluation of the maternal mortality epidemiological surveillance system, grounded in the methodology proposed by the Centers for Disease Control and Prevention (CDC). This methodology recommends the analysis of attributes such as data quality, representativeness, and timeliness to assess the performance of public health surveillance systems (1).

The research was conducted in the state of Ceará, based on data extracted in August 2023 from the Mortality Information System (SIM) – managed by the Ceará State Health Secretariat (SESA-CE), which is responsible for the epidemiological surveillance of maternal deaths. The study population encompassed all maternal deaths registered in the state's SIM between 2014 and 2023, totaling 830 cases. The deaths were characterized according to the International Classification of Diseases (ICD-10), including those that occurred during pregnancy, childbirth, and the puerperium (codes O00-O99) (6).

Data extraction was performed using the TabWin® tool, and the data were consolidated and analyzed using Microsoft Excel 365 and Epi Info™. Sociodemographic and clinical variables of the women were considered, in addition to indicators of com-

pleteness, consistency, representativeness, and timeliness related to the notification and investigation of the deaths. These evaluation criteria followed parameters established in the scientific literature, considering: data quality (completeness and consistency of the variables), representativeness (epidemiological profile of maternal deaths in the state), and timeliness (the time elapsed between notification and the conclusion of the investigation).

This study utilized anonymized secondary data, extracted from the Mortality Information System (SIM), which does not permit the identification of subjects. Therefore, in accordance with the National Health Council (CNS) Resolution No. 466/2012 and CNS Resolution No. 510/2016, it was exempted from submission to an Institutional Review Board (IRB). All ethical principles for research in health were rigorously respected.

RESULTS

DATA QUALITY

Table 1 presents the completeness of data for maternal death records in the state of Ceará for the period from 2014 to 2023, encompassing a total of 830 cases. The mean completeness of the fields evaluated was 97.0% (classified as excellent), which demonstrates the high quality of the records and the rigor in filling out essential information for epidemiological surveillance.

Table 1 - Data Completeness, according to Completed Fields, Type, and Classification, Ceará, 2014 – 2023 (N=830)

Field	Field Type (Completion)	n	Final Mean (% Completeness)	Classification
Type of death	Mandatory	830	100.0	Excellent
Date of death	Mandatory	830	100.0	Excellent
Age	Mandatory	830	100.0	Excellent
Sex	Mandatory	830	100.0	Excellent
Municipality of residence	Mandatory	830	100.0	Excellent
Place of death occurrence	Mandatory	830	100.0	Excellent
Code of municipality of occurrence	Mandatory	830	100.0	Excellent
Timing of death in the pregnancy-puerperal cycle	Mandatory	786	94.7	Good
Causes of death in Part I – Line A	Mandatory	814	98.1	Excellent
Death investigation	Essencial	759	91.4	Good
Skin color	Essencial	818	98.6	Excellent
Marital status	Essencial	801	96.5	Excellent
Education	Essencial	767	92.4	Good
Occupation	Essencial	737	88.8	Moderate
Medical assistance at time of death	Essencial	790	95.2	Excellent
Final Mean Classification (%)			**97.0**	**Excellent**

Source: Authors' own work, 2024.

The mandatory fields demonstrated full completeness, with 100% of the records filled for variables related to the type and date of death, age, sex, municipality, and place of occurrence, as well as the code of the municipality of occurrence. Notably, the timing of death in the pregnancy-puerperal cycle reached 94.7% completeness (classified as good), indicating potential challenges in filling this specific field.

Regarding the essential fields, completeness varied between excellent and moderate. Excellent indices were observed for the fields related to skin color (98.6%), marital status (96.5%), and medical assistance at the time of death (95.2%). Education and death investigation showed completeness considered good, with 92.4% and 91.4%, respectively. In contrast, the 'occupation' field showed the lowest completeness, with 88.8% (classified as moderate), pointing to significant gaps in filling this information and compromising more detailed analyses regarding the socioeconomic conditions of women who suffered maternal death.

Table 2 presents the evaluation of recorded data consistency, which indicated variations in coherence indices among the different fields analyzed. The indicator concerning women's age within the recommended age range (10 to 49 years) showed a consistency of 99.6%, while the gestational or post-gestational status at the time of death registered 92.8%. Both indicators showed high levels of coherence.

Table 2 - Data Consistency, according to Completed Fields, Type, and Classification, Ceará, 2014–2023 (N=830)

Indicator	n	Final Mean (% Consistency)	Classification
Age within the recommended range (10 to 49 years)	827	99.6	Excellent
Gestational or post-gestational status at the time of death	770	92.8	Excellent
Death was declared by a medical professional	684	82.4	Moderate
Associated maternal cause declared	542	65.3	Poor
Original basic cause of death is concordant with the final cause	496	59.7	Poor
Final Mean Classification (%)		**79.5**	**Moderate**

Source: Authors' own work, 2024.

The field related to the death being declared by a medical professional showed a consistency of 82.4%, indicating that some records either lacked this information or presented inconsistencies. Regarding the indicators related to the maternal cause, the associated cause was declared with consistency in 65.3% of the records, and the concordance between the original basic cause and the final cause of death was observed in 59.7% of the cases.

The final mean consistency of the evaluated data was 79.5%, reflecting the variation in coherence across the investigated fields. These results demonstrate that data consistency varies depending on the field analyzed, being higher for demographic and gestational information, and lower for aspects related to the cause of death and the medical declaration.

REPRESENTATIVENESS

The analysis of the epidemiological profile of women affected by maternal deaths revealed predominant demographic and clinical characteristics within the sample. Regarding the age group, women between 20 and 39 years represented the majority of cases, with equal percentages of 40.0% for the 20-29 and 30-39 age groups, totaling 80.0% of the recorded deaths. This distribution indicates a higher representativeness of women in active reproductive age, which is consistent with the epidemiological definition of maternal mortality.

Concerning skin color, most women were classified as *parda* (brown) (70.0%), reflecting the ethnic-racial composition of the local population and potentially pointing to social and health access inequalities that may influence the risk of maternal death. In terms of marital status, 51.0% of the women were single, which may suggest a social vulnerability associated with this group, although this association requires in-depth analysis in specific studies.

The most frequent level of education was 8 to 11 years of study (41.3%), indicating that a large portion of the women had an educational level equivalent to completed elementary school or incomplete high school, a factor that can impact the understanding of and access to health services.

The temporal distribution of death showed that the majority occurred during the puerperium (57.0%), followed by the gestational period (33.0%), and to a lesser extent, at the time of childbirth (10.0%). This information is relevant for directing surveillance and intervention strategies, given that the puerperium is a critical period for the development of complications.

In relation to the direct causes of death, hypertensive complications represented 25.0% of the cases, followed by obstetric hemorrhages (20.0%) and puerperal infections (18.0%). Indirect causes accounted for 15.0% of the deaths (Table 3).

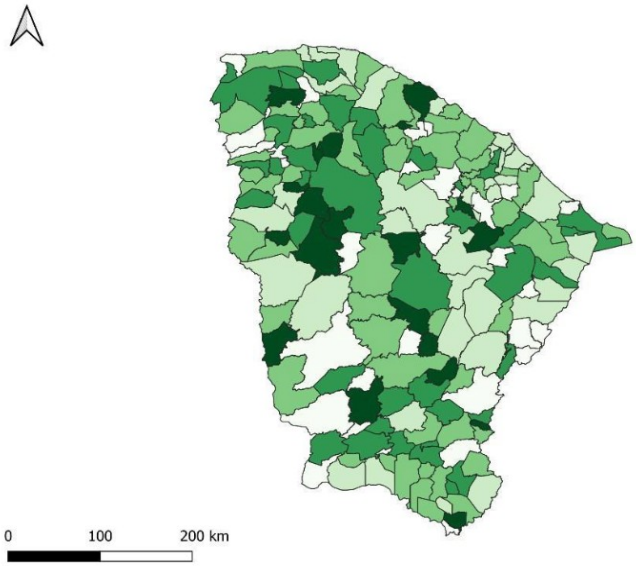
Table 3 - Epidemiological Profile of Women Affected by Maternal Deaths, Ceará, 2014–2023 (N=830)

Characteristic	n	(%)
Age group 20–29 years	332	40.0
Age group 30–39 years	332	40.0
Parda (Brown) skin color	581	70.0
Single marital status	423	51.0
Education (8–11 years)	343	41.3
Death occurred in the puerperium	473	57.0
Death occurred during pregnancy	274	33.0
Death occurred during childbirth	83	10.0
Hypertensive complications	208	25.0
Obstetric hemorrhages	166	20.0
Puerperal infections	149	18.0
Indirect causes	126	15.0

Source: Authors' own work, 2024.

The Maternal Mortality Ratio (MMR) during the period showed variability and was higher in small municipalities (<100,000 inhabitants), where health services are more limited. A peak in maternal mortality was observed in 2021, partly attributed to the impacts of the COVID-19 pandemic, which increased the incidence of deaths from respiratory and infectious complications (Figure 1).

Figure 1 - Spatial distribution of the MMR by municipality, Ceará, 2014–2023 (N=830)



Source: MS/SVS/CGIAE – Mortality Information System (SIM). Data updated in August 2024 and subject to change.

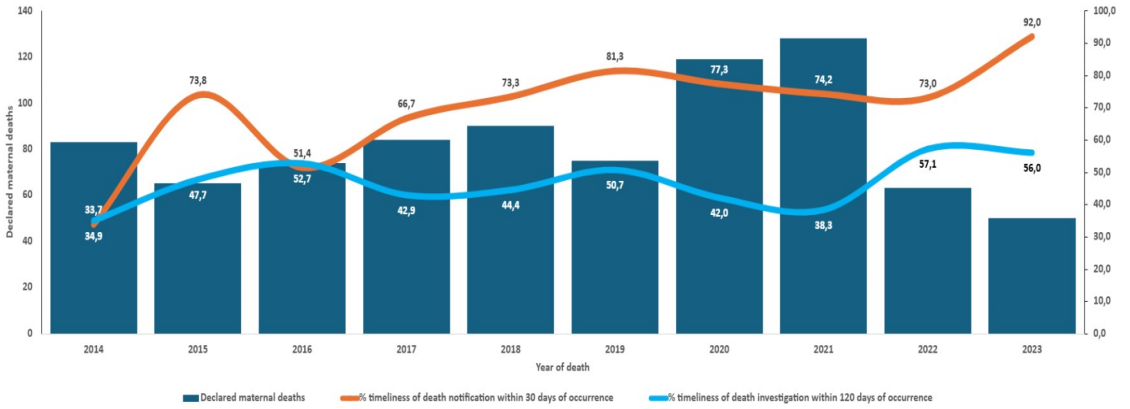
TIMELINESS

Timeliness was one of the attributes that showed the greatest need for improvement. The notification of maternal death within 30 days improved significantly over the period, evolving from 33.8% in 2014 to 92.0% in 2023. However, the complete investigation of deaths within the recommended deadline of 120 days is still insufficient, reaching only 56.0% in 2023.

It was identified that the main barrier to the timely completion of investigations was related to the limitation of human resources in the epidemiological surveillance teams, delays in obtaining medical records, and difficulty in conducting family interviews, directly impacting the capacity for case closure.

Figure 2 presents the evolution of notification and investigation over the years, highlighting the gradual progress in timely notification, but also the persistent low rate of investigations concluded within the appropriate time.

Figure 2 - Distribution of reported maternal deaths according to timeliness of notification and investigation, Ceará, 2014–2023 (N=830)



Source: MS/SVS/CGIAE – Mortality Information System (SIM). Data updated in August 2024 and subject to change.

DISCUSSION

The analyzed data indicate high levels of completeness for information recorded in the SIM, demonstrating a consistent standard in the filling of mandatory fields by the health teams (3). Conversely, variability was observed in the consistency of the information, with discrepancies between the initial data and the results of the epidemiological investigations, which may interfere with the accuracy of the analyses (4).

The proportion of maternal death investigations concluded within the established timeframe (45.25%) highlights operational aspects of the surveillance process. National studies report logistical difficulties in data collection and limitations in coordination among the sectors responsible for investigations, which justifies the observed percentages (5).

The COVID-19 pandemic was associated with an increase in deaths from indirect obstetric causes, such as respiratory complications and thromboembolic events. This trend has been documented in previous investigations that linked SARS-CoV-2 infection to adverse maternal health outcomes (6, 7). During the same period, there was a greater demand on health services, which may have influenced the access to and quality of care provided to pregnant and postpartum women (8, 9).

The occurrence of maternal deaths is related to social determinants, such as education, access to health services, and the structure of the healthcare network. The observation of a higher number of deaths among women with lower educational attainment may indicate barriers to accessing timely and adequate care during pregnancy, childbirth, and the puerperium (10–12).

Regarding the geographical distribution of deaths, a higher concentration was identified in urban areas. This pattern may be associated with the greater availability of health services and, consequently, higher reporting. Conversely, rural regions may present underreporting, emphasizing the importance of surveillance mechanisms that ensure territorial coverage (13, 14).

The technical literature describes that structured surveillance systems have a greater capacity for timely detection and response to adverse events, favoring the implementation of prevention efforts (15). International studies demonstrate that the integration between levels of care and the use of standardized investigation protocols can be associated with a reduction in maternal mortality (1).

CONCLUSION

The data analysis reveals high completeness and consistency in the demographic and gestational fields of maternal death records, while the quality of information related to the maternal cause and the formal declaration of death presents greater variability. The epidemiological profile indicates a predominance of deaths among *parda* (brown) women, aged between 20 and 39 years, with the majority occurring during the puerperium and the main causes associated with hypertensive complications, obstetric hemorrhages, and puerperal infections. These results highlight specific areas for the improvement of epidemiological surveillance and the targeting of maternal health actions.

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