

EVALUATION OF HUMAN ANTI-RABIES NOTIFICATION SURVEILLANCE, CEARÁ, 2018–2022

AVALIAÇÃO DAS NOTIFICAÇÕES ANTIRRÁBICO HUMANO, CEARÁ, 2018 – 2022

*EVALUACIÓN DE LA VIGILANCIA DE NOTIFICACIONES ANTIRRÁBICAS
HUMANAS EN CEARÁ, 2018–2022*

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ABSTRACT

Objective: To evaluate the epidemiological surveillance system for notifications of human anti-rabies services in Ceará, between 2018 and 2022. **Methods:** Retrospective descriptive evaluative study, with evaluation criteria based on the *Guidelines from the Centers for Disease Control and Prevention (CDC)* of the United States of America. **Results:** The results for data completeness and consistency were, for the most part, excellent, highlighting the sociodemographic variables with high indices. However, some treatment-related variables were of low completeness, such as "final condition of the animal" and "interruption of prophylaxis". The system was considered consistent, with coherence greater than 90% in most of the variations observed. It was considered representative, demonstrating an epidemiological pattern similar to that observed at the national level. **Conclusion:** Evaluation of the surveillance system revealed its ability to monitor anti-rabies accidents to prevent human rabies in the state, despite identified gaps in data quality.

Keywords: *Anger; Disease Notification; Epidemiological Monitoring; Health Information Systems.*

RESUMO

Objetivo: Avaliar o sistema de vigilância epidemiológica das notificações de atendimentos antirrâbicos humano no Ceará, entre 2018 e 2022. **Métodos:** Estudo avaliativo descritivo retrospectivo, com critérios de avaliação baseados no *Guidelines do Centers for Disease Control and Prevention (CDC)* dos Estados Unidos da América. **Resultados:** Os resultados para completude e consistência dos dados foram, em sua maioria, excelentes, destacando-se as variáveis sociodemográficas com índices elevados. No entanto, algumas variáveis relacionadas ao tratamento apresentaram baixa completude, como "condição final do animal" e "interrupção da profilaxia". O sistema foi considerado consistente, com coerência superior a 90% na maioria das variáveis analisadas. Foi considerado representativo, demonstrando um padrão epidemiológico semelhante ao observado em nível nacional. **Conclusão:** A avaliação do sistema de vigilância revelou sua capacidade de monitorar adequadamente os acidentes antirrâbicos a fim de evitar a raiva humana no estado, apesar das lacunas identificadas na qualidade dos dados.

Descritores: *Raiva; Notificação de Doença; Vigilância Epidemiológica; Sistema de Informação em Saúde.*

RESUMEN

Objetivo: Evaluar el sistema de vigilancia epidemiológica para notificaciones de servicios antirrâbicos humanos en Ceará, entre 2018 y 2022. **Métodos:** Estudio evaluativo descriptivo retrospectivo, con criterios de evaluación basados en las *Guías de los Centros para el Control y la Prevención de Enfermedades (CDC)* de los Estados Unidos de América. **Resultados:** Los resultados de completitud y consistencia de los datos fueron, en su mayoría, excelentes, destacándose las variables sociodemográficas con índices elevados. Sin embargo, algunas variables relacionadas con el tratamiento mostraron poca exhaustividad, como "estado final del animal" e "interrupción de la profilaxis". El sistema se consideró consistente, con una coherencia superior al 90% en la mayoría de las variables analizadas. Se consideró representativo, demostrando un patrón epidemiológico similar al observado a nivel nacional. **Conclusión:** La evaluación del sistema de vigilancia reveló su capacidad para monitorear adecuadamente los accidentes antirrâbicos para prevenir la rabia humana en el estado, a pesar de las brechas identificadas en la calidad de los datos.

Descriptores: *Ira; Notificación de Enfermedades; Monitoreo Epidemiológico; Sistemas de Información en Salud.*

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INTRODUCTION

Rabies is a zoonotic disease transmitted to humans through the inoculation of the *Rhabdovirus*, a neurotropic RNA virus from the *Rhabdoviridae* family, genus *Lyssavirus*, present in the saliva and secretions of infected animals. Transmission occurs mainly through bites, scratches, or licking, causing progressive and acute encephalitis. With a lethality rate close to 100% and high costs for preventive care, rabies remains a serious public health problem in regions where the virus is present ¹.

The disease is found on all continents. In Africa and Asia, it is endemic in most countries; in South America, it also occurs under endemic or epidemic conditions. In Brazil, there is high incidence in the North, Northeast, and Central-West regions, and in some states of the Southeast ².

There is no specific treatment for rabies; therefore, post-exposure prophylaxis must be rigorously administered to prevent the disease. To eliminate human rabies transmitted by dogs and cats, the Ministry of Health (MS) created the National Rabies Control Program (PNCR) in 1973. Control measures include vaccination of dogs and cats, prophylactic treatment of exposed individuals, epidemiological surveillance, laboratory diagnosis, animal population control, and health education ³.

Between 2009 and 2018, 38 cases of human rabies were reported in Brazil ⁴. In Ceará, six cases were recorded from 2007 to 2023, evidencing the circulation of the virus in the territory ⁵. All incidents involving animals potentially transmitting rabies to humans must be notified and assessed for the indication of post-exposure prophylaxis, which should be initiated as early as possible when indicated ¹.

Rabies prevention is based on prophylaxis, which can occur in two scenarios: pre-exposure and post-exposure, as well as re-exposure to the virus ⁶. Pre-exposure prophylaxis is indicated for professionals who work with or may come into contact with animals infected with the virus. Post-exposure prophylaxis is indicated only when the individual has been exposed to a potential risk of rabies virus infection. In all suspected cases, human rabies prophylaxis is the main control measure, requiring completion of the human anti-rabies care notification form, with interventions ranging from simple washing of the wound with soap and water to complete treatment with serum and vaccine ⁷.

The notification of events with potential risk of rabies transmission to humans is crucial for disease control. The form used in these cases is the human anti-rabies care form, which is part of the National Notifiable Diseases Information System (SINAN) and is a component of the rabies epidemiological surveillance program. Analysis of these notification forms enables understanding of the temporal and geographic distribution, as well as the socioeconomic and demographic profile of the affected population, serving as a basis for triggering surveillance, prevention, control, and human anti-rabies treatment actions ¹.

With the enactment of Ordinance No. 204/2016, all incidents caused by animals potentially transmitting rabies became subject to mandatory notification, to be integrated into SINAN through completion of a specific form for the condition ⁷. For

SINAN to support decision-making in public health according to local realities and improve anti-rabies care, it is necessary to ensure good completeness of information, regularity, and proper completion of all notification fields, reducing ignored or blank information and inconsistencies ⁸.

Notifications are essential as they allow observation of the magnitude of health events, enabling timely implementation of preventive measures and supporting the monitoring and evaluation of control actions by the surveillance system. The quality of health information systems is indispensable, as they serve as important tools for situational diagnosis, enabling the characterization of at-risk populations and supporting decision-making, planning, guidelines, and the creation of specific action strategies, thereby contributing to evidence-based health practice. Assessing information quality is therefore essential for analyzing the sanitary situation ⁹.

Thus, the objective of this study was to evaluate the epidemiological surveillance system for notifications of human anti-rabies care in Ceará, between 2018 and 2022.

METHODS

This is a retrospective, descriptive, and cross-sectional evaluative study with both quantitative and qualitative approaches. The study analyzed the attributes of notifications of human anti-rabies care based on secondary data from 198,264 post-exposure human anti-rabies notifications registered in SINAN in Ceará, Brazil, from 2013 to 2022. For the surveillance system analysis, a methodology adapted from the Centers for Disease Control and Prevention (CDC) ¹⁰ was used. The following attributes were evaluated: qualitative attributes—data quality assessed by completeness (Excellent: $\geq 95\%$; Good: $\geq 90\%$ and $< 95\%$; Regular: $\geq 70\%$ and $< 90\%$; Poor: $\geq 50\%$ and $< 70\%$; Very Poor: $< 50\%$) ¹¹ and consistency (Excellent: $\geq 90\%$ coherence; Regular: $70\%–89\%$; Low: $< 70\%$)—and quantitative attributes (representativeness).

The database was constructed using information provided by the Ministry of Health via the Department of Informatics of the Unified Health System (DATASUS) website, through Tabnet. Data were analyzed for absolute and relative frequency and central tendency using Epi Info™ 7.2.3.1 software. Spatial mapping was performed using QGIS 3.28.

RESULTS

Between 2018 and 2022, 198,254 cases of human anti-rabies care were notified in Ceará. The spatial distribution analysis of these notifications revealed important patterns that assist in understanding the incidence of rabies virus exposure and in defining control strategies.

For completeness, mandatory fields and essential epidemiological interest fields were analyzed, divided into three categories: sociodemographic (sex, age group, race/skin color, education, and municipality of residence); epidemiological background (type of exposure, wound location, wound, type of wound, species of attacking animal, animal condition, and animal subject to observation); and current prophylaxis (treatment indicated, final condition of the animal, interruption of prophylaxis, and indication for serum), as presented in Table 1.

Analysis of the completeness of sociodemographic variables showed that sex (99.93%), age group (100.00%), race/skin color (96.20%), and municipality of residence (100.00%) were classified as excellent. The education field had the lowest completeness in this group, at 53.98%, and was therefore classified as poor.

The second group of variables, epidemiological background, showed variation in completeness: “wound” (88.93%) and “animal subject to observation” (82.89%) were classified as regular; “type of wound” (90.01%) and “animal condition” (91.07%) as good; and “species of attacking animal” (100%), “type of exposure” (99.62%), and “wound location” (98.51%) as excellent.

The fields with the worst classification were those related to current treatment, corresponding to “case evolution.” The variables “final condition of the animal” (34.27%), “interruption of prophylaxis” (42.28%), and “indication for serum” (45.71%) received the lowest classification among all variables analyzed, being considered very poor. Only “treatment indicated” (97.82%) in this block achieved excellent completeness.

Table 1 - Evaluation of the anti-rabies care surveillance system according to the data completeness attribute in the state of Ceará, Brazil, 2018–2022 (N = 198,254).

Variables	Completeness (%)	Classification
Sociodemographic		
Sex	99.93%	Excellent
Age group	100.00%	Excellent
Race/Color	96.20%	Excellent
Education	53.98%	Poor
Municipality of residence	100.00%	Excellent
Epidemiological Background		
Type of exposure	99.62%	Excellent
Location of injury	98.51%	Excellent
Injury	88.93%	Regular
Type of injury	90.01%	Good
Species of attacking animal	100.00%	Excellent
Condition of the animal	91.07%	Good
Animal subject to observation	82.89%	Regular
Current Treatment		
Treatment indicated	97.82%	Excellent
Final condition of the animal	34.27%	Very Poor
Interruption of prophylaxis	42.28%	Very Poor
Indication for serum	45.71%	Very Poor

Source: Ministry of Health/SVS – Notifiable Diseases Information System (Sinan Net)

In an overall view of the 16 fields evaluated, 50% were classified as excellent, while good and regular together accounted for 25%, and poor and very poor together made up the remaining 25%.

The consistency of an information system is determined by the proportion of variables correlated with logical and non-contradictory values. In this study, the

possible relationships between the following variables were analyzed: “type of exposure” (indirect contact) *versus* “type of wound”; “type of exposure” (indirect contact) *versus* “treatment indicated”; “wound” (no wound) *versus* “type of wound”; “species of attacking animal” (wild) *versus* “treatment indicated”; and “animal subject to observation” (dog and cat) *versus* “treatment indicated”.

For the analysis of the “species of attacking animal” and “animal subject to observation” (dog and cat) compared to “treatment indicated”, the forms of treatment considered were those contained in the Human Rabies Pre-, Post-, and Re-exposure Prophylaxis Protocol of Ceará State No. 01, 03/22/2022 ¹², based on Technical Note No. 8/2022-CGZV/DEIDT/SVS/MS of March 10, 2022.

Regarding consistency analysis (Table 2), for “type of exposure” classified as “indirect contact” and “the variable wound” (no wound) compared to “type of wound”, an inconsistency was found in 1,794 forms (0.90%) in the first case and none (0.00%) in the second. When comparing “indirect contact”, “wild attacking animal”, and “dog and cat subject to observation” with the type of “treatment indicated”, there were 304 (0.15%), 1,037 (0.52%), and 81,141 (40.93%) forms with incoherent entries, respectively.

Tabela 2 - Percentual de consistência e avaliação das notificações dos atendimentos antirrábicos no estado do Ceará, Brasil, 2018-2022, (N= 198.254).

Checking Fields	2018 - 2022			
	n	Inconsistency (%)	Consistency (%)	Evaluation n
Type of exposure (indirect contact) vs. type of injury	1,794	0.90%	99.10%	Excellent
Type of exposure (indirect contact) vs. treatment indicated	304	0.15%	99.85%	Excellent
Injury (no injury) vs. type of injury	0	0.00%	100.00%	Excellent
Species of attacking animal (wild) vs. treatment indicated	1,037	0.52%	99.48%	Excellent
Animal subject to observation (dog and cat) vs. treatment indicated	81,141	40.93%	59.07%	Low

Source: Ministry of Health/SVS – Notifiable Diseases Information System (Sinan Net)

The consistency rate was excellent ($\geq 90\%$) in four out of five analyses and low ($< 70\%$) in one. The scarcity of studies evaluating this component highlights an important area for future research.

For representativeness, variables related to the “person” field were used. The results for sex, race, age group, and education were compared to national data and interpreted as representative when similar.

Comparison of the data showed similar results for the selected variables: the highest frequencies of notifications occurred in individuals aged 20–34 years (21.43%; 21.91%), male (51.64%; 52.61%), skin color/race brown (parda) (43.63%; 77.63%), and, regarding education, a high frequency of ignored or blank fields was identified (34.40%; 34.35%). Among valid entries for this variable, the highest frequency was for individuals with completed high school education (13.90%; 12.68%) (Table 3).

Table 3 - Representativeness of anti-rabies care cases in the state of Ceará, 2018–2022, compared to national data for the same period.

Characteristics	Brazil		Ceará		Evaluation	
	N	%	N	%	Result	Classification
Sex						
Female	1,632,833	48.32	93,828	47.32	Equal	Representative
Male	1,745,014	51.64	104,307	52.61		
Ignored/Blank	1,576	0.05	129	0.07		
Race/Color						
White	1,270,510	37.60	27,906	14.08	Equal	Representative
Black	199,687	5.91	7,262	3.66		
Yellow	23,178	0.69	886	0.45		
Mixed race (Parda)	1,474,362	43.63	153,909	77.63		
Indigenous	15,757	0.47	777	0.39		
Ignored/Blank	395,929	11.72	7,524	3.79		
Age group						
<1	42,218	1.25	2,803	1.41	Equal	Representative
1-4	242,638	7.18	13,116	6.62		
5-9	328,488	9.72	17,367	8.76		
10-14	244,823	7.24	12,835	6.47		
15-19	217,214	6.43	11,889	6.00		
20-34	724,111	21.43	43,431	21.91		
35-49	660,863	19.56	39,408	19.88		
50-64	562,483	16.64	33,555	16.92		
65-79	291,991	8.64	18,892	9.53		
80+	64,547	1.91	4,968	2.51		
Education						
Illiterate	48,556	1.44	6,954	3.51	Equal	Representative
1st–4th grade incomplete (Elementary)	290,041	8.58	20,433	10.31		
4th grade complete (Elementary)	123,560	3.66	8,197	4.13		
5th–8th grade incomplete (Elementary)	276,789	8.19	17,332	8.74		
Complete elementary school	131,125	3.88	7,283	3.67		

Incomplete high school	177,891	5.26	9,804	4.94
Complete high school	469,746	13.90	25,145	12.68
Incomplete higher education	99,277	2.94	4,200	2.12
Complete higher education	180,427	5.34	7,675	3.87
Not applicable	419,565	12.42	23,133	11.67
Ignored/Blank	1,162,446	34.40	68,106	34.35

Source: Notifiable Diseases Information System – Sinan Net. (2018–2022).

When comparing analyses at different levels (national and state), the anti-rabies notification system was found to be highly representative for all variables analyzed, as results followed the same pattern at both levels. In this study, notification completion showed the same epidemiological profile in the state as observed nationally, demonstrating consistency over the years for this condition.

DISCUSSION

The results of this study on the epidemiological surveillance system for human anti-rabies notifications in Ceará, between 2018 and 2022, revealed both advances and gaps that deserve attention. The analysis demonstrated good data representativeness, corroborating findings from national studies, such as that by Nascimento *et al.*¹³, which highlighted the importance of anti-rabies notifications as a fundamental tool for public health surveillance in Brazil. As observed in this study, Nascimento *et al.*'s work emphasized that notifications provide essential support for the formulation of strategies for the control and prevention of human rabies.

However, this study identified significant shortcomings in the completeness of fields related to current treatment, such as “final condition of the animal” and “interruption of prophylaxis,” with completeness rates below 50%. A similar situation was reported by Abath *et al.*¹¹, who identified inconsistencies and insufficient completion of critical variables in infectious disease surveillance records, which hinders epidemiological analysis and decision-making. The present study reinforces Abath *et al.*'s conclusion that ongoing professional training is essential to improve the quality of records.

Regarding data consistency, the results were positive, with most of the compared and evaluated variables showing coherence rates above 90%, classified as excellent. These findings are consistent with the study by Lopes *et al.*⁸, who analyzed accidents involving animals transmitting rabies in Rio Grande do Sul and also found that, although the consistency of records was satisfactory, there were important shortcomings in variables related to prophylactic conduct and indicated treatment.

In terms of representativeness, the data demonstrated a pattern similar to that found at the national level, as evidenced by reports from the Ministry of Health¹ and by studies such as those by Duarte and França¹⁴. These authors also pointed out that, although notifications in systems such as SINAN are generally reliable, issues such as

underreporting and poor completion of certain epidemiological fields may occur, as observed in this study for some variables with low completeness. This aligns with the findings of the present study, which revealed good representativeness, with values in the state coinciding with national data.

On the other hand, comparative analysis shows that the education variable had low completeness (53.98%), a pattern also observed by Braz *et al.*⁹ when evaluating malaria notifications. This may reflect the undervaluation of fields not immediately seen as essential, even though they are crucial for more detailed risk profile analyses.

This study complements existing literature by demonstrating that, despite shortcomings in completeness and consistency for some variables, the anti-rabies surveillance system in Ceará has a solid foundation for control actions. However, comparison with other studies reinforces the need for efforts to improve information quality, including investments in professional training and improvements in the digitalization of notification processes. It is also worth noting the scarcity of literature evaluating the data quality for this specific condition.

CONCLUSION

The results showed that, although SINAN demonstrates a good capacity to represent the epidemiological profile of human anti-rabies incidents and risk exposures, it still faces significant challenges regarding the quality of recorded data. Some epidemiologically important fields remain unfilled or are ignored.

The completeness of variables showed varied patterns: while sociodemographic variables were mostly classified as excellent, fields related to current treatment revealed low completion rates, with high incompleteness. Such gaps may compromise the system's capacity to provide robust information for decision-making and the implementation of control actions.

Data consistency was rated as excellent for most variable cross-analyses, demonstrating internal coherence of the information recorded, even in the face of identified operational difficulties. This result reinforces the utility of the system as a surveillance tool, though there are still areas to be improved.

Regarding representativeness, the system proved capable of adequately describing the epidemiological profile of anti-rabies care in the state, reflecting patterns consistent with national data. This highlights the importance of the system as a support tool for identifying at-risk populations and monitoring prophylactic actions in Ceará.

Given these results, it is concluded that the anti-rabies epidemiological surveillance system in Ceará is an essential tool for monitoring post-exposure incidents, but it requires specific interventions to achieve greater effectiveness. Among the main recommended actions are: periodic and ongoing training of health professionals on the importance of correctly completing notification forms; the implementation of standardized recording protocols, with emphasis on variables related to treatment and case follow-up; the regular conduct of audits and technical supervision to monitor the quality of information entered into the system; and, finally, the strengthening of digitalization in health units, with integrated and real-time systems that allow for the

automatic validation of mandatory fields and the reduction of inconsistencies and underreporting.

Such interventions are fundamental to ensuring greater completeness, consistency, and reliability of the data, thereby enhancing surveillance and contributing to more effective public health decision-making.

RECOMMENDATIONS

At the state and municipal levels, it is recommended to implement regular training for health professionals responsible for completing notification forms. These training sessions should address the importance of data completeness and consistency, emphasizing the impact of this information on the formulation of public policies and control actions. Additionally, it is essential to establish ongoing supervision and monitoring processes to identify incomplete fields and inconsistencies, enabling timely corrective measures.

At the federal level, digitalization of registration systems is another essential measure, as the use of digital tools can minimize manual errors and facilitate automatic validation of information. Currently, the system is still based on a non-online platform, where data entry is mostly carried out at municipal health departments rather than at each reporting unit.

It is also suggested that future studies further analyze the underlying causes of the gaps identified in this work, exploring operational, logistical, and institutional factors that influence data quality.

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