

# Snakebite cases in the municipalities of the State of Paraíba, Brazil

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## ABSTRACT

**Introduction:** This study investigated the epidemiological and clinical profile of snakebite cases reported from 2007 to 2012 in the municipalities of the Curimataú region, State of Paraíba, in northeastern Brazil. **Methods:** Data were collected from the Health Department of the State of Paraíba using the Injury Notification Information System data banks of the Health Ministry. **Results:** A total of 304 snakebite cases were studied. The cases occurred most frequently from April to June. The genera *Bothrops*, *Crotalus*, and *Micrurus* were responsible for 74.6%, 6.2%, and 1.3% of cases, respectively. Snakebite cases predominated in males living in rural areas and between 10 and 19 years old. The highest incidence of bites occurred on the feet. The majority of the victims received medical assistance within 1 to 3h after being bitten. With regard to severity, 48% of the cases were classified as mild, 26% as moderate, and 2.6% as severe. Successful cures predominated, and no deaths were reported. The average antivenom ampoule dose used for the treatment in some snakebite cases was lower than that recommended by the Health Ministry. **Conclusions:** Although our results show that Paraíba has a good level of medical care, there are serious deficiencies in recording snakebite information. These data indicate the need to improve the recording process for snakebite cases. Further training for health professionals seems to be necessary to optimize their skills in treating snakebite victims.

**Keywords:** *Bothrops*. *Crotalus*. Epidemiology. Human envenomation. Snakebite.

## INTRODUCTION

Snakebite envenomation represents a worldwide public health problem, particularly in tropical and subtropical countries<sup>1</sup>. Although antivenoms are produced by laboratories on every continent, the burden of snakebite envenomation, causing both morbidity and mortality, has a great impact on the population and healthcare systems, especially in Africa, Asia, Oceania, and Latin America<sup>2</sup>. Questions related to epidemiological research, access to treatment, and the training of health workers have been largely left out of national public policies<sup>1</sup>. In Brazil, approximately 30,000 snakebite cases are reported every year, with an incidence of 16 cases/100,000 inhabitants and a lethality rate of 0.45%<sup>3,4</sup>. The highest incidences of snakebites in the 2011 were recorded in the North (57.8 cases/100,000 inhabitants), Midwest (23.1 cases/100,000 inhabitants), and Northeast regions (15.1 cases/100,000 inhabitants)<sup>3</sup>. There is a predominance of snakebite cases during the hot and rainy

months, affecting mostly male rural workers aged between 10 and 40 years of age, mostly bitten on the hands and feet. Snakes of the genus *Bothrops* have been shown to be responsible for the majority of snakebite cases. Envenomation by snakes of the genus *Crotalus* are less frequent, and bites by *Lachesis* and *Micrurus* are rare<sup>4</sup>. Rural areas are more severely affected by snakebites, presenting high morbidity and mortality rates. This increased severity results from these communities' higher exposure to risk areas and from difficulties in accessing health centers that can provide snake antivenom. Numerous victims suffer permanent consequences due to the necrotic action of snake venoms as well as psychological consequences. The economic impact of these injuries is considerable, especially because most victims are young<sup>5</sup>. The information regarding the incidence of snakebites per region, types of venom, deaths, and the consequences of envenomation are essential for evaluating the problem and developing public policies aimed at reducing the number of accidents and improving medical help for victims<sup>6,7</sup>. In spite of a number of previous investigations<sup>8-10</sup>, the epidemiology of snakebites in the Northeastern region of Brazil is not yet well understood, most likely due to social and environmental changes that have occurred there in recent decades, the underreporting of snakebite cases, and deficiencies in collecting epidemiological data. To address this shortcoming, the current study analyzed the clinical and epidemiological profile of the snakebite cases reported from 2007 to 2012 in the municipalities of the Curimataú region, located in the State of Paraíba in northeastern Brazil.

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## METHODS

### Study area

The State of Paraíba covers an area of 56,372km<sup>2</sup>, and 98% of its territory is located within the *Drought Polygon* which is an area subjected to a prolonged period of drought annually<sup>11</sup>. The Curimataú region is located in the State of Paraíba and covers 5,241km<sup>2</sup> (**Figure 1**). This region is composed of 18 municipalities, with a population of approximately 213,159 inhabitants. These municipalities are small and have low population densities<sup>12</sup>. Almost the entire region has a low rainfall rate, high average temperatures, acute water deficits, generally thin and often salty soils, and caatinga vegetation<sup>13</sup>.

### Data collection

A descriptive study of the clinical-epidemiological characteristics of snakebites in the Curimataú region was

carried out. A retrospective epidemiological investigation was based on snakebite cases reported from 2007 to 2012 for the municipalities of this region (**Table 1**). Data were collected from the Health Department of the State of Paraíba using the SINAN (Injury Notification Information System) data banks of the Health Ministry. Epidemiological data were analyzed in relation to the sex and age of the victims, year and month of the snakebite, zone of occurrence (urban or rural), genus of the snake, part of the body bitten, and time elapsed between the snakebite and medical assistance. The variables investigated in clinical evaluations were as follows: local and systemic clinical manifestations, severity and evolution of the case, blood clotting time, and serotherapy. Regarding the genus of the offending snakes, the data obtained were based on the information given by the patients themselves and/or their companions as well as on the clinical observations of health professionals of the patients' signs and symptoms. Therefore, in the medical records analyzed in this study, the identification of the offending snake was not performed by experts. Only accidents involving aggressive

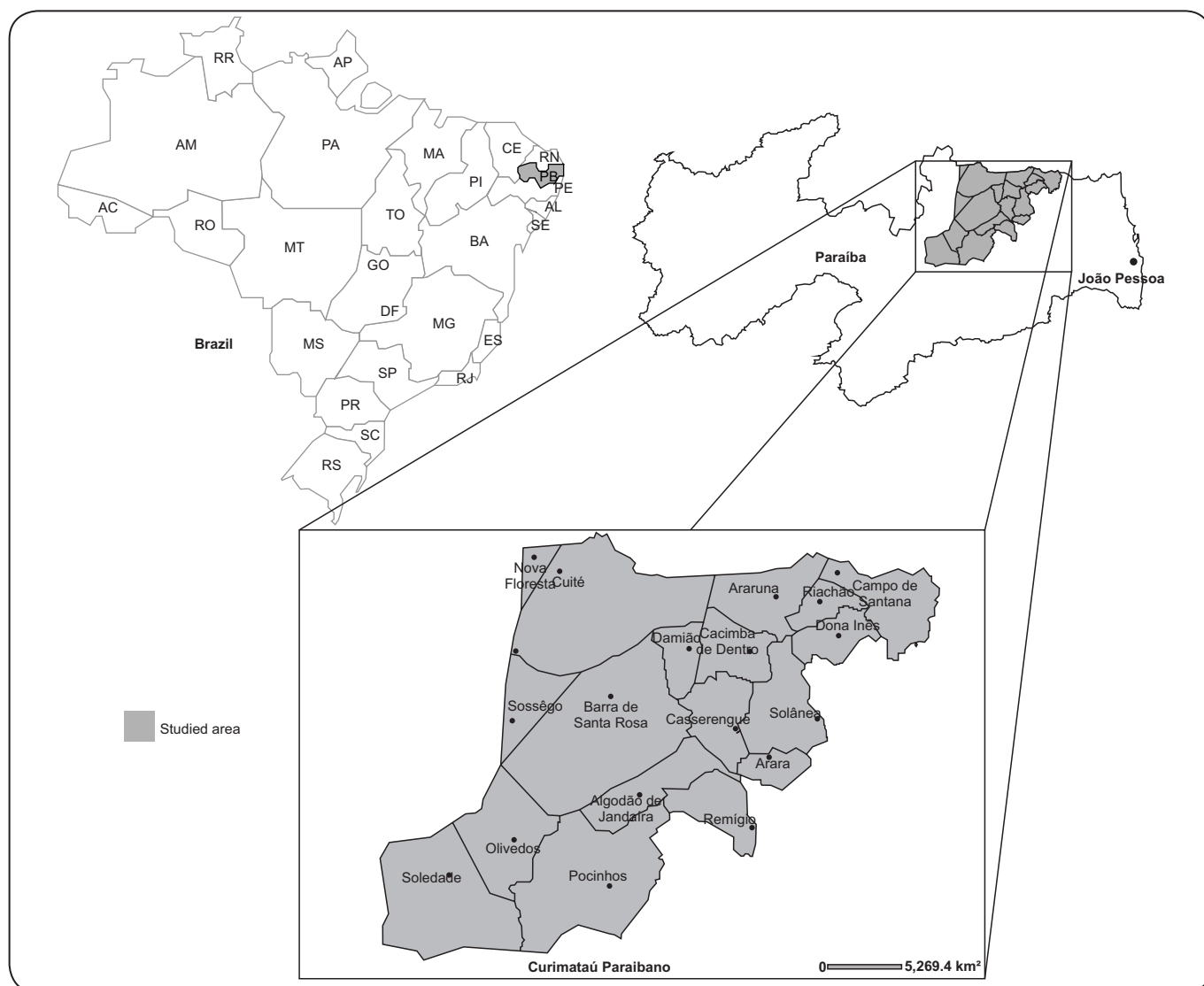


FIGURE 1 - Studied area of snakebite cases.

TABLE 1 - Distribution of snakebite cases registered in the Curimataú region, State of Paraíba, Brazil, from 2007 to 2012 according to quantitative demographic variables.

	Year						Total	
	2007	2008	2009	2010	2011	2012	n	%
<b>Seasonality</b>								
1 <sup>st</sup> trimester	14	9	15	16	15	15	84	27.6
2 <sup>nd</sup> trimester	18	7	19	17	4	12	77	25.3
3 <sup>rd</sup> trimester	13	13	20	19	13	13	91	30.0
4 <sup>th</sup> trimester	9	3	12	15	8	5	52	17.1
<b>Municipality</b>								
Cuité	7	5	9	18	11	4	54	17.8
Barra Santa Rosa	12	3	14	8	3	8	48	15.8
Pocinhos	4	2	7	9	5	11	38	12.5
Soledade	6	6	9	4	3	2	30	10.0
Damião	4	3	2	9	2	2	22	7.2
Araruna	8	6	3	2	2	0	21	7.0
Olivedos	2	1	7	3	2	4	19	6.2
Sossego	5	0	2	3	3	2	15	5.0
Remígio	3	3	3	1	1	0	11	3.6
Algodão de Jandaira	2	1	1	1	3	2	10	3.2
Casserengue	0	0	1	3	3	3	10	3.2
Nova Floresta	0	1	2	2	1	3	9	3.0
Cacimba de Dentro	1	0	2	1	1	0	5	1.6
Dona Inês	0	0	1	1	0	2	4	1.3
Riachão	0	0	1	0	0	2	3	1.0
Solânea	0	1	2	0	0	0	3	1.0
Arara	0	0	0	2	0	0	2	0.6
Campo de Santana	0	0	0	0	0	0	0	0.0
<b>Localities of occurrence</b>								
urban	7	5	5	1	2	4	24	7.9
rural	46	27	59	66	38	40	276	90.8
peri-urban	0	0	0	0	0	1	1	0.3
unknown	1	0	2	0	0	0	3	1.0
<b>Total</b>	<b>54</b>	<b>32</b>	<b>66</b>	<b>67</b>	<b>40</b>	<b>45</b>	<b>304</b>	<b>100.0</b>

venomous snakes were recognized and taken into account. Cases in which the snake was identified as non-venomous were ignored. The incidence of snakebites for the Curimataú region was calculated for the period from 2007 to 2012. Demographic and population data furnished by the Brazilian Institute of Geography and Statistics (IBGE) were used to calculate incidence rates. Statistical analyses were performed using simple frequency tests.

All statistical analyses were performed using the SPSS® (Statistical Package for Social Sciences) software version 13.0 for Windows.

#### Ethical considerations

This research was approved by the Ethics Research Committee of the Federal University of Paraíba (protocol number 107.700/2012) and followed the guidelines established by the Declaration of Helsinki.

## RESULTS

A total of 304 snakebite cases were notified in the Curimataú region between January 2007 and December 2012, with an incidence rate of 25 cases/100,000 inhabitants in 2007, 15 cases/100,000 inhabitants in 2008, 30 cases/100,000 inhabitants in 2009, 32 cases/100,000 inhabitants in 2010, 18 cases/100,000 inhabitants in 2011, and 21 cases/100,000 inhabitants in 2012. **Table 1** shows the snakebite data in terms of quantitative-demographic variables. Snakebites occurred during all months of the year, with the largest number of cases being reported in the third trimester (n=91; 30%). The highest frequency of snakebites was observed in the municipality of Cuité (n=54; 17.8%), followed by Barra de Santa Rosa (n=48; 15.8%); the lowest frequencies occurred in Arara (n=2; 0.7%), Solanêa (n=3; 0.9%), and Riachão (n= 3; 0.9%). No snakebites were registered in the municipality of Campo de

Santana during the period studied. The incidence of snakebites was higher in rural areas (n=276; 90.8%) when compared with urban areas. **Table 2** shows the individual characterization and circumstances of the reported snakebite cases. Victims were predominantly male (n=230; 75.6%), and the majority was not engaged in labor activity at the time of the accident (n=149; 49%). With regard to the occupation of the victims, in the 11% of the notification files in which this information was available, the highest percentage were students (n=19; 6.2%). The largest number of snakebites was observed in individuals aged between 10 and 19 years old (n=70; 23%). The area of the body bitten most often was the feet (n=155; 51%). Snakes of the genus *Bothrops* were responsible for 227 (74.6%) snakebite cases, the genus *Crotalus* for 19 (6.2%) cases, and the genus *Micrurus* for four (1.3%) cases. Regarding the time elapsed between the snakebite and medical assistance, 154 (50.6%) patients were attended within 1 to 3h after being bitten, and 24 (7.9%) patients within the first hour. The laboratory test to assess the blood coagulation

TABLE 2 - Distribution of snakebite cases registered in the Curimataú region, State of Paraíba, Brazil, from 2007 to 2012 according to epidemiological variables.

	Year						Total	
	2007	2008	2009	2010	2011	2012	n	%
Victim age group								
1  —  9	4	6	9	7	1	2	29	9.5
10  —  19	14	8	5	15	17	11	70	23.0
20  —  29	8	4	12	9	3	7	43	14.2
30  —  39	2	6	9	16	5	3	41	13.5
40  —  49	6	4	11	6	4	7	38	12.5
50  —  59	7	0	8	7	3	7	32	10.5
60  —  69	3	1	7	5	4	8	28	9.2
70  —  79	6	3	4	1	2	0	16	5.3
≥80	4	0	1	1	1	0	7	2.3
unknown	0	0	0	0	0	0	0	0.0
Victim gender								
male	45	21	52	53	24	35	230	75.7
female	9	11	14	14	16	10	74	24.3
total	54	32	66	67	40	45	304	100.0
Victim occupation								
student	1	4	5	5	3	1	19	6.3
farmer	2	0	4	0	0	0	6	2.0
homemaker	1	2	0	0	0	0	3	1.0
retired	4	0	0	0	0	0	4	1.3
nurse	0	1	0	0	0	0	1	0.3
unknown	46	25	57	62	37	44	271	89.1

Continue....

TABLE 2 - Continue.

	Year						Total	
	2007	2008	2009	2010	2011	2012	n	%
<b>Work-related accident</b>								
yes	29	11	27	24	14	15	120	39.5
no	21	17	33	30	24	24	149	49.0
unknown	4	4	6	13	2	6	35	11.5
<b>Part of the body bitten</b>								
foot	31	18	33	28	21	24	155	51.0
finger	6	3	12	15	9	4	49	16.0
hand	4	4	12	11	3	5	39	12.8
toe	3	0	2	8	4	9	26	8.6
leg	4	4	2	2	0	1	13	4.3
head	1	0	1	1	1	1	5	1.7
forearm	1	2	0	2	0	0	5	1.7
arm	0	2	0	0	2	0	4	1.3
thigh	1	0	0	0	0	0	1	0.3
torso	0	0	2	0	0	0	2	0.6
unknown	3	0	2	0	0	0	5	1.7
<b>Snake genus</b>								
<i>Bothrops</i>	45	28	46	49	32	27	227	74.7
<i>Crotalus</i>	0	1	7	7	2	2	19	6.2
<i>Micrurus</i>	3	0	0	1	0	0	4	1.3
unknown	6	3	13	10	6	16	54	17.8
<b>Coagulation time</b>								
normal	13	6	15	15	7	4	60	19.7
altered	18	10	24	34	19	18	123	40.5
unknown	23	16	27	18	14	23	121	39.8
<b>Antivenom administered</b>								
yes	49	28	54	66	34	40	271	89.1
no	5	3	10	1	3	2	24	7.9
unknown	0	1	2	0	3	3	9	3.0
<b>Time from bite until assistance (hours)</b>								
0  —  1	0	2	8	6	4	4	24	7.9
1  —  3	32	14	30	36	21	21	154	50.6
3  —  6	4	7	15	15	5	9	55	18.1
6  —  12	2	0	1	2	1	4	10	3.3
≥12	3	0	5	5	4	3	20	6.6
unknown	13	9	7	3	5	4	41	13.5
Total	54	32	66	67	40	45	304	100.0

TABLE 3 - Severity and evolution of snakebite cases registered in the Curimataú region, State of Paraíba, Brazil, from 2007 to 2012 according to the snake genus.

	Snake genus									
	<i>Bothrops</i> spp.		<i>Crotalus</i> spp.		<i>Micrurus</i> spp.		unknown		total	
	n	%	n	%	n	%	n	%	n	%
Severity										
mild	135	44.4	10	3.3	1	0.3	30	9.9	176	57.9
moderate	68	22.4	8	2.6	3	1.0	11	3.6	90	29.6
severe	8	2.6	0	0.0	0	0.0	4	1.3	12	4.0
unknown	16	5.3	1	0.3	0	0.0	9	3.0	26	8.5
Evolution of cases										
cured	200	65.8	15	5.0	4	1.3	48	15.8	267	87.9
death	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
unknown	27	8.9	4	1.3	0	0.0	6	2.0	37	12.1

time was conducted in 183 patients. The blood-clotting time was normal in 60 patients (<10 minutes), whereas 123 patients showed abnormal blood clotting time (from 10 to 30 minutes). Serotherapy was applied in 271 (89%) of the patients, and 24 (7.9%) patients received no antivenom. **Table 3** shows the clinical classification and evolution of the cases for each snake genus. Snakebite cases by *Bothrops* were mostly classified as mild (n=135; 44.4%), although the number of cases classified as moderate (n=68; 22.3%) was also significant, and eight (2.6%) cases were considered severe. The cases of envenomation by *Crotalus* were classified as mild (n=10; 9.8%) and moderate (n=8; 7.6%), and those involving *Micrurus* were classified as mild (n=1; 0.3%) and moderate (n=3; 0.9%). Successful cures predominated (267; 87.9%), and no deaths were reported.

## DISCUSSION

The incidence of snakebites, regardless of the species involved, varies from country to country and among regions in a country, depending on factors such as climate, ecological parameters, biodiversity, the distribution of venomous snakes, human population density, economic activities, and types of dwellings, among others<sup>14</sup>. The region studied includes compounded risk factors for exposure to snakebites as a result of its high average temperatures and high number individuals living in rural areas. Moreover, increased environmental degradation may contribute to the development of desertification processes and, consequently, to the reduction of natural habitats for snakes. The majority of the snakebite cases reported in the Curimataú municipalities occurred in rural areas. The snakebites occurred mostly from April to September, suggesting a seasonal distribution of these accidents in the region studied. In the State of Paraíba and various regions of Brazil, this period coincides with the rainy season. These findings indicate that preventive actions against snakebites should be carried out throughout

the year and intensified during the months of peak incidence. Knowledge of snake seasonality highlights the months in which there are higher risks of snakebites. This understanding is important because it alerts healthcare providers, helps establish strategies for the distribution and maintenance of antivenom stocks in health centers, and stimulates preventive education campaigns<sup>6</sup>. The increased number of snakebite cases during the rainy period was also observed in other areas of northeastern Brazil<sup>10</sup> as well as in the North<sup>15</sup>. Similarly, studies on the epidemiology of snakebites in the South<sup>16</sup> and the Southeast<sup>17</sup> found a higher incidence of snakebite cases during the rainy period, which occurs from October to April in these regions. The relationship among snakebites, rainy season, and farm labor reinforces the classification of these incidents as workplace accidents<sup>18,19</sup>. This situation generates strong medical, social, and economic impacts in Brazil, especially in the Northeast, where the populations most exposed to snakes, generally located in smaller and poorer municipalities, are also those less assisted by the government<sup>20</sup>.

Most victims were aged between 10 and 19 years (23%) or between 20 and 29 years (14.1%). Several cases were also observed in victims between 30 and 39 years old (13.5%), which is the age range with the largest concentration of individuals engaged in farm labor<sup>21</sup>. These findings are in agreement with other studies carried out in Brazil. Lima et al. showed that most snakebite victims in the State of Minas Gerais were aged 10 to 19 years<sup>21</sup>. Rojas et al. reported that snakebite victims in the State of Paraíba were mostly aged between 30 and 39 years<sup>17</sup>. Later studies also conducted in Paraíba reported that snakebites were most frequent in the age ranges of 10-29 years<sup>18</sup> and 11-20 years<sup>9</sup>. The genus *Bothrops* was responsible for the great majority of the snakebite cases (74.7%) reported during the studied period. This result is in accordance with other studies conducted in Brazil<sup>16</sup>. The predominance of snakebites by *Bothrops* may be attributed to the high diversity of species in this

genus and to the fact that they are typically aggressive<sup>17</sup>, occupy many diverse habitats<sup>8</sup>, are widely distributed in Brazil, and can be found in most ecosystems<sup>22</sup>. The high number of cases in which the snake genus was not identified (54 cases; 17.8%) may be an indicative of the lack of technical knowledge by both health workers (nurses and their assistants, pharmacists, doctors, and others) and the general population, who are usually not able to recognize important characteristics for identifying snake genera. However, in most snakebite cases, the recognition of the clinical manifestations and epidemiological history allow for a diagnosis of the type of poisoning. Although the notification file of the Health Ministry still classifies the genera of snakes as *Bothrops*, *Crotalus*, *Lachesis*, and *Micrurus*, it is important to note that the genus *Bothrops* was subdivided into *Bothrops*, *Bothropoides*, *Bothriopsis*, *Bothrocophias*, and *Rhinocerocephis*<sup>23</sup>. In the State of Paraíba, *Bothropoides erythromelas*, *Bothropoides neuwiedi*, *Bothrops leucurus*, *Bothrops atrox*, and *Bothriopsis bilineata*<sup>7,8,19</sup> are found. From 2006 to 2008, Toxicological Assistance and Information Centers of Paraíba registered 410 envenomation cases by snakes of the genera *Bothrops* and *Bothropoides*, with 8.5% of snakebites caused by *Bothropoides erythromelas*<sup>8</sup>. Further studies on the frequency of species and on the community structure of snakes in the Northeast region are necessary to better understand the species responsible for snakebites, which will inform the production of specific antivenom for the snakebite cases of this region.

In the present study, most snakebite cases were clinically classified as mild (48%) or moderate (26%). These results are in agreement with other epidemiological studies conducted in the State of Paraíba<sup>9,19</sup>. In contrast, studies carried out in other Brazilian regions showed higher incidences of moderate cases<sup>21</sup>. This divergence may be a result of differences in the venom components among genera and species of snakes. With regard to snakebites by *Bothrops*, most cases were classified as mild (44.4%), although the number of cases classified as moderate (22.3%) was also significant, and eight (2.6%) cases were considered severe. The cases of envenomation by *Crotalus* were classified as mild (9.8%) and moderate (7.6%), and those involving *Micrurus* were classified as mild (0.3%) and moderate (0.9%). Blood-clotting time was normal (<10min) in 60 patients and abnormal (from 10 to 30min) in 123 patients. Studies show that alterations in coagulation occur mainly in cases of moderate or severe envenomation but not in all mild cases, as only one-half of these cases develop a concomitant systemic envenomation<sup>14</sup>. In the current study, out of the 176 cases classified as mild, 33% presented blood coagulation disorders. A greater frequency of blood coagulation disorders was found in moderate (45%) and severe (58%) cases. The changes in blood coagulation time observed in this study are in agreement with data found in the literature<sup>9,10</sup>. The blood coagulation time has no value as a criterion for severity in snakebites, but it is used as a parameter in the diagnostic and clinical evolution of patients<sup>4</sup>. Most (58.5%) victims received medical assistance up to 3 hours after the snakebite. Earlier studies undertaken in Brazil<sup>20,22</sup> reported that more than 80% of the snakebite victims were attended within 6 hours after the bite. The time elapsed between the bite and medical assistance is of

critical importance to the prognosis of the victim<sup>24</sup>, with shorter time gaps improving the chances of avoiding complications such as necrosis, compartment syndrome, and acute renal insufficiency<sup>17</sup>. The low frequency of severe cases may be the most probable cause for the lack of deaths observed in the current study. Furthermore, the availability of antivenom and the construction and maintenance of secondary roads increasing the access to rural areas are important factors in explaining the lack of cases resulting in death. However, the lack of data on clinical classification in 26 (8.5%) patients and the evolution of the cases (12.1%) suggest that the actual mortality rate may be higher. The body areas most frequently bitten were the feet (51%) and the fingers (16%), similarly to what has been reported by previous researchers<sup>9</sup>.

The most frequent reactions in the bitten area were swelling (56%), pain (44%), ecchymosis (8.2%), and bleeding (7.5%). Of the 304 cases, systemic reactions were observed in only 99 cases. The majority of systemic symptoms were hemorrhage (n=31; 28.4%), neuroparalytic manifestations (n=26; 23.8%), vagal manifestations (n=25; 23%), myolitic manifestations (n=17; 15.6%), and renal manifestations (n=10; 9.15%). These local and systemic symptoms were the same as those found in other studies carried out in the State of Paraíba<sup>9,19</sup> as well as in other regions of Brazil<sup>6,23</sup>. Headache was observed in 23 (17.3%) patients, which may be due to fear and emotional tension induced by the bite. In snakebite cases involving *Crotalus*, pain at the bite site was observed in 15 cases. This symptom is not generally described as a local reaction induced by *Crotalus* venom<sup>25</sup>. This finding might be explained by possible differences between the venom of *Crotalus* species found in this region and other regions of Brazil. Antivenom was used in most (89%) victims, and the number of antivenom ampoules used in these treatments varied from 2 to 10. In 24 (7.9%) cases, the victims received no antivenom, likely because it was not available in the Health Center at the time of medical assistance. In snakebites by *Bothrops*, the mean number of antivenom ampoules used for mild and moderate cases was consistent with that recommended by the Health Ministry<sup>4</sup>. However, for severe cases, the average was lower than recommended. In accidents involving *Crotalus* and *Micrurus*, the average antivenom ampoules used for the treatment of mild, moderate, and severe cases were less than that recommended by the Health Ministry<sup>4</sup>. These findings show a lack of parameters in the use of antivenom and may also indicate healthcare providers who are uninformed with regard to case diagnosis and the use of antivenom. Inadequate use of antivenom was also observed in other studies performed in Paraíba<sup>19</sup>. Thus, training for these professionals on how to address snakebites is strongly recommended.

Various deficiencies were identified in the notification files, including a high proportion of cases in which the genus of the snake was not reported, the lack of accounts of the time of day when the accident occurred, the clinical evolution of the patient, and the time elapsed between the bite and initial treatment. These deficiencies in the clinical charts may be related to unusually high demands at the health centers, a lack of available time of the members of the health team, or the small number of workers at the health unit<sup>20</sup>. These disadvantageous situations

should be emphasized because they are all common in health care centers in northeastern Brazil and contribute to incomplete patient records. The small municipalities in the Northeast, especially those with fewer than 25,000 inhabitants and more distant from large urban centers, generally have few qualified health workers or staff able to collect proper information on snakebite cases. Treatments involving serious health problems and/or emergencies (e.g., snakebites) increase the chances of incompletely registering patient information, especially where health services have only minimum infrastructures. However, even under optimal conditions, recording medical information is often not prioritized in Brazil, frequently resulting in improperly filed and stored records. This practice is common even in university hospitals, with many patient charts being poorly filled out and lacking necessary information<sup>26</sup>. This situation is perpetuated by the fact that the curricula of university courses in medicine, nursing, and pharmacy are almost always deficient in their instruction on attacks by venomous animals, as are considerations about the health of rural workers in university courses of agronomy and veterinary medicine<sup>24</sup>. Accordingly, a further understanding of the snakebite epidemiology in northeastern Brazil seems to require better training for health workers and more adequate protocols for recording and filing victim information. Without basic infrastructure and training, it will be difficult to gather precise information on health problems related to snake attacks in towns and villages in northeastern Brazil, the risks involved in these incidents, or the logistics involved in the distribution of antivenom. The current study may contribute to a better comprehension of snakebites in the State of Paraíba, representing a useful instrument for identifying the conditions that increase the risk of snake attacks in northeastern Brazil. This knowledge may provide a basis for improving the assistance offered to victims and furnish important data for educational campaigns designed to prevent snakebites.

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## CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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