

Loxosceles SPIDER BITES IN THE STATE OF PARANÁ, BRAZIL: 1993-2000

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ABSTRACT: This study presents the epidemiological analysis of 20,699 reported spider bites involving the *Loxosceles* genus in the state of Paraná, Brazil, from 1993 to 2000. The incidence rate in the period was 290.24/100,000 inhabitants. The results show that 95.04% of the accidents occurred in two Health Regions of the state: greater metropolitan Curitiba (92.9%) and Irati (2.14%). The major incidence was recorded in greater metropolitan Curitiba (559.1/100,000). *Loxosceles* bites were more frequent in females (61%) than in males. Antivenin therapy was not necessary in 95.4% (19,662) of the cases. From the cases in which information about the time elapsed between the bite and medical treatment was recorded (9,679), 31.8% received treatment from 6 to 48 hours after the bite. Among the cases with severity rate recorded (12,096), 2.1% were severe, 50.4% moderate, and 47.4% mild. Seven deaths from *Loxosceles* bites were recorded, corresponding to a fatality rate of 0.03%.

KEY WORDS: *Loxosceles*, spiders, epidemiology, venomous animals, Brazil.

CORRESPONDENCE TO:

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INTRODUCTION

An analysis of spider bites in Brazil identifies Paraná State with the highest percentages when compared to other states of the country. Spider bites in Paraná, from 1998 to 2001, comprised 44% (27 364) of all the cases reported in Brazil and 72% of all the bites in the southern region of the country. In Paraná State, most spiders involved in such accidents belong to the *Loxosceles* genus. For the reporting periods, 1988-1989 and 1989-1990, bites by this genus represented 62.2% (595) and 77.4% (923) of the total, respectively (8, 10). In 2001, the high frequency of *Loxosceles* bites placed them second among all the reported bites by venomous animals in the state (8).

Although Paraná is considered a state with high percentages of spider bites, a more detailed analysis showed that, between 1989 and 1990, the capital city of Curitiba accounted for 52.7% of all the accidents reported (923) in the state. The bites occurred in urbanized areas of the city, and *Loxosceles intermedia* (the brown or fiddle spider) was the main species involved. Among the reported cases, the vast majority or 79.3% (732) received spider antivenin (10).

Given this context, knowledge of the epidemiological profile of accidents involving the *Loxosceles* genus in this state is of the utmost importance to aid in the prevention of bites and to organize a network for treating victims. Our study thus aims to analyze epidemiological aspects of spider bites by the genus *Loxosceles* from 1993 to 2000 in the state of Paraná.

MATERIALS AND METHODS

The study area in the state of Paraná consists of 399 municipalities, divided into 22 Health Regions (Regional de Saúde - RS). This study focused on the Health Region, consisting of its respective municipalities, as the basic unit of analysis, since it is the local management unit used by the Paraná State Secretariat of Health (Secretaria de Estado da Saúde do Paraná - SESA) and was considered, by the authors, the best unit of analysis for this study. For purposes of comparative analysis, we selected the Health Regions with the highest absolute and relative frequencies of cases and with the highest frequency of municipalities with bites within their area.

The selected Health Regions were the 2nd Region, or Greater Metropolitan Curitiba Area (GMCA), and the 4th Region, or Irati, since they comprised 95.04% of all such cases in the state. The 2nd Health Region consists of 29 municipalities, with Curitiba

(the state capital) as the urban hub. The total population is 2,962,030, of which 91% reside in the urban area and 9% in the rural area. The 4th Health Region, Irati, consists of 9 small municipalities, with Irati as the hub. The population of the municipalities in the 4th Region ranges from 5,600 to 23,000, except for Irati itself, with 53,113 inhabitants. Out of the total population (148,793), 56% live in the urban area and 44% in the rural area.

We analyzed epidemiological aspects of *Loxosceles* spider bites recorded on the Epidemiological Forms for Envenomations (Ficha Epidemiológica de Acidentes com Animais Peçonhentos - FEAAP) reported to the Environmental Health Center (Centro de Saúde Ambiental - CSA) of the State Secretariat of Health (SESA) from 1993 to 2000. The criteria for the spider bites reported are those presumed and/or confirmed by the physician at the local health service.

The criteria for classifying the severity of *Loxosceles* bites follow those of the Brazilian Ministry of Health (3): mild cases - *Loxosceles* identified as the causative agent of the bite, with characteristic lesion, no involvement of the patient's overall status, and laboratory tests within normal limits; moderate - with or without identification of *Loxosceles* at the moment of the bite, suggestive or characteristic lesion, with systemic alterations (skin rash, petechiae), and without laboratory alterations suggestive of hemolysis; severe cases – characteristic lesion, alteration of the patient's overall status (acute anemia, jaundice), rapid evolution, and laboratory alterations indicative of hemolysis. We chose to analyze the data from this period since they corresponded to the bites recorded by the two reporting systems (FEAAP and SINAN) in the State Secretariat of Health. The FEAAP is older and receives data reported by the Data System on Reportable Diseases (Sistema de Informação de Agravos de Notificação - SINAN), besides serving as the databank for epidemiological follow-up by the State Secretariat on all the cases reported in the state.

To estimate the incidence rates, we used the population counts for 1996 and 2000 and inter-census estimates for 1992-1995 and 1997, provided by the Brazilian Institute for Geography and Statistics, or National Census Bureau (Instituto Brasileiro de Geografia e Estatística - IBGE).

Distribution of frequencies was performed using EPI-INFO (v. 6.04), and the chi-square test (χ^2) was used with a significance level of $p \leq 0.05$. Variables obtained from FEAAP for analysis were: municipality of occurrence; Health Region of occurrence;

year of occurrence; age, sex, and occupation of the victim; month of occurrence; area of occurrence; circumstances; bite site; spider identification; severity; and antivenin therapy. Due to flaws in the records on symptoms resulting from the bites, it was not possible to include this variable in our analysis.

RESULTS

During the period studied, from 1993 to 2000, a total of 42,280 bites by venomous animals were reported, of which 48.9% (n=20,699) were bites by spiders of the genus *Loxosceles*. The accidents were recorded in only 44% (n=176) municipalities, mainly located in the south of Paraná (Figure 1). The highest concentration of cases was from November to March (Figure 2). The incidence rate for the period was 290.24/100,000 inhabitants.

The municipality of Curitiba had 76% (n=15,655) of all the cases reported in the state, as well as the highest incidence rate in the period (1,033 cases/100,000 inhabitants) (Figure 1). However, when analyzing the annual incidence rates per municipality, higher rates were observed in other municipalities such as Antonio Olinto (part of the 6th Health Region) in 1998, Araucária (2nd Health Region) in 2000, and Irati (4th Health Region) in 1999. Note that the 2nd Health Region, or GMCA, includes nine of the ten municipalities with the highest frequency of accidents (92.9% of the total), while the municipality of Irati (4th Health Region) occupies the sixth place.

Considering the number of municipalities with reported accidents according to the Health Region, Irati was the only one with cases reported in 100% of its municipalities, as compared to GMCA, with 93.1% of its municipalities reporting cases. However, in terms of number of *Loxosceles* bites, GMCA presented 92.61% of the total (19,097 bites), as compared to Irati, with 2.43% (502) of the cases reported statewide.

The incidence rate for spider bites in Irati increased significantly from 1998 onward, from 17.54/100,000 in 1997 to 99.86 in 1999, with a slight reduction in 2000 (to 87.37/100,000). GMCA showed an upward trend until 1995, with a drop in incidence in the following years: 111.09 in 1996, 90.17 in 1997, and 61.92 in 2000.

Comparing the frequency of bites per area of occurrence (urban versus rural), both GMCA and Irati showed a higher frequency in their urban areas (74.7% of the bites in GMCA and 62.4% in Irati, respectively). Note that the area of occurrence was not recorded in 23.7% of the cases in GMCA.

In addition, in Irati, the incidence rate for the period of study in the rural area (which includes 44% of the population) was 200.5 cases/100,000 inhabitants, as compared to the urban area (56% of the population), with 210.4 cases/100,000. In GMCA, the incidence rate for the rural area (with 9% of the population) was 48.0 cases/100,000, as compared to the urban area (91% of population), with 559.1 cases/100,000.

Loxosceles bites were significantly more frequent in females than in males in the two Health Regions. In GMCA, 63.7% of the bite victims were females, compared to 36.2% of males. In Irati, 58.8% of the bites were in females and 41.2% in males.

Stratification of cases by occupation showed that, in GMCA, children under seven years old, students (over seven), and “housewives” were the most frequent victims, with 3.9%, 2.2%, and 2.0% of the cases, respectively. In Irati, 13.5% involved rural workers, 10.0% students over seven years, 13.3% “housewives”, and 13.3% “other occupations”. In 90% of the cases in GMCA and 20.9% of those in Irati, the occupation of the victims was not recorded by FEAAP.

Frequency of *Loxosceles* bites by age group did not differ between the two Health Regions ($p=0.236$), and the 60-69 age group was the only one in which Irati recorded more bites than GMCA ($p=0.038$). The majority of victims were 20 to 49 years old in both GMCA (60.5%) and Irati (58.8%) (Table 1).

Lack of identifying information relevant to the species involved in the bite (type of spider “unknown”) was frequent in both Health Regions: 95.6% in GMCA and 70.5% in Irati. Meanwhile, the proportion of victims who reported having actually seen the spider at the time they were bitten was higher in Irati (19.9%) than in GMCA (2.7%) ($p<0.001$).

The following circumstances surrounding the spider bites as reported by the patients (e.g., while sleeping, while dressing, or bite unnoticed) began to be recorded in 1995, but only in GMCA. In the previous years the only information recorded in the two Health Regions included “unknown (not recorded), other, residence, and working”. A proportion of the cases in Irati (48.8%) occurred inside the house ($p<0.001$), despite the large proportion of cases where the place of occurrence was not recorded (40.6%). In GMCA, this information was not recorded in 33.9% of the cases, while 23.4% victims reported not having noticed where the bite occurred, 14.4% were sleeping, 12.9% were inside the house, and 9.8% were getting dressed while bitten.

Of all the *Loxosceles* bites in the state during the period studied, antivenin therapy was not necessary in 95.4% ($n=19,662$) of the cases. From the 958 cases (4.6%)

receiving antivenin therapy, 69.4% (n=665) received 5 vials, 23.7% (n=227) received 1 to 4 vials, and 6.8% (n=66) 6 to 10 vials. A total of 4,470 vials of spider or *Loxosceles* antivenin were used, or a mean of 4.6 ± 1.7 vials per case (n=958, range 1-10).

In GMCA, where the incidence rate was higher, 2.9% (n=554) of the cases received a total of 2,812 vials, or a mean of 5.1 ± 1.1 vials per case (n=554, range 1-10). From the treated group, 90.1% received 5 vials. By comparison, Irati reported a higher frequency of antivenin use during the same period (13.9% of the cases), but with a mean of 3.7 ± 1.8 vials/case (n=70, range 1-8). The majority of the cases treated with antivenin (58.6%) received 1 to 4 vials, and 35.7% received 5 vials.

Analysis of the variables pertaining to the time elapsed between the bite and the medical treatment showed that in 46.9% (n=9,679) of the cases in the state this interval was not recorded. Of the cases in which this information was recorded, 31.8% (n=6 564) received treatment from 6 to 48 hours after the bite. Among those treated, there was no significant difference between bites occurring in rural (34.5%) when compared to urban areas (35.8%) ($p=0.35$). However, the proportion of cases treated in less than 6 hours (15.1%) ($p<0.001$) and more than 48 hours (17.2%) ($p<0.001$) was significantly greater in rural areas.

Stratification by Health Region showed that the proportion of patients treated from 1 to 3 hours and from 6 to 48 hours after the bite in urban areas was not statistically different, comparing GMCA and Irati ($p=0.32$). However, in the urban area of GMCA, a significant proportion of patients were treated within one hour after the bite ($p<0.001$). In the urban area of Irati, patients received medical treatment later than in GMCA (Table 2).

Classification of cases as mild, moderate, or severe had already been recorded in GMCA since 1995, while Irati only began recording this information in 2000. Based on these data, we analyzed the breakdown of spider bites by severity for the state as a whole.

Among the cases with severity recorded (n=12,096), 258 (2.1%) were severe, 6,100 (50.4%) moderate, and 5,738 (47.4%) mild. Analysis by the time elapsed (hour by hour) showed that patients with severe bites tended to receive treatment mainly within an hour after the bite. Meanwhile, moderate and mild cases received treatment from 12 to 24 hours after the bite. No statistically significant differences were

observed in proportions of moderate and severe cases for the periods 6-12 hours, 24-48 hours, and 72 hours or more (Table 2).

The analysis grouped by hourly intervals shows that despite the percentages found in the first hour after the accident, a large proportion of severe (39.2%), moderate (44.3%), and mild cases (47.6%) received medical care from 6 to 24 hours after being bitten (Table 2).

From 1993 to 2000, seven deaths were recorded from *Loxosceles* bites, corresponding to a case-fatality rate of 0.03%. From the seven deaths, four occurred in the 2nd Health Region (GMCA), and one each in the 3rd Region (Ponta Grossa), 5th (Guarapuava), and 7th (Pato Branco). Of the four deaths recorded in GMCA, only one patient received spider antivenin; the patient received one vial and presented a hypersensitivity reaction to the antivenin.

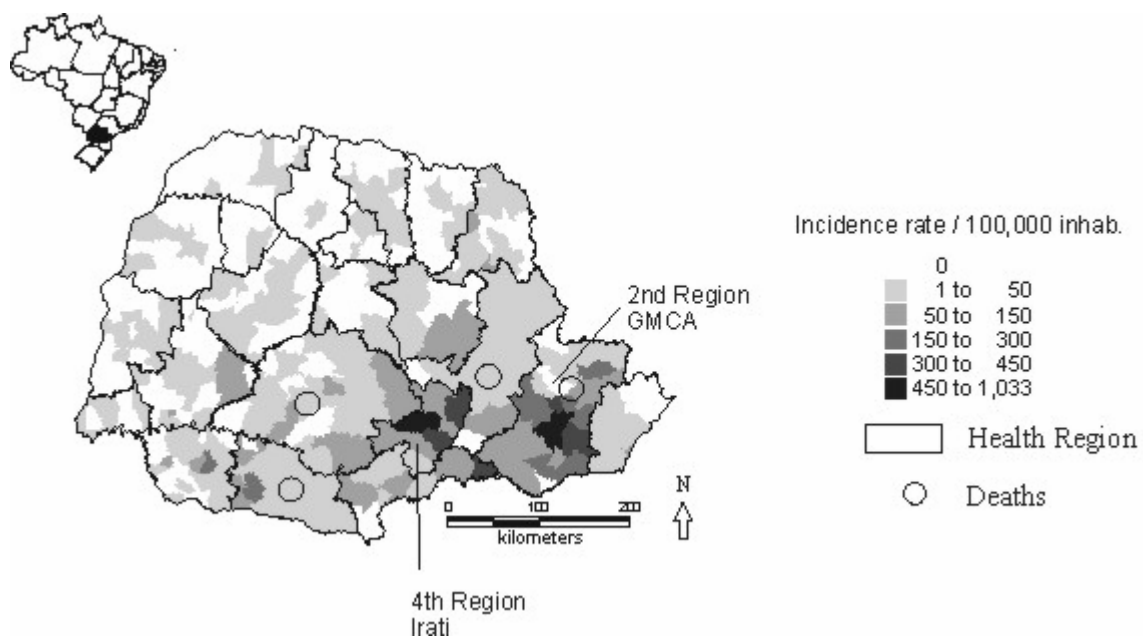


Figure 1: Spatial distribution of the incidence rate of *Loxosceles* bites and deaths in the state of Paraná, Brazil, 1993-2000.

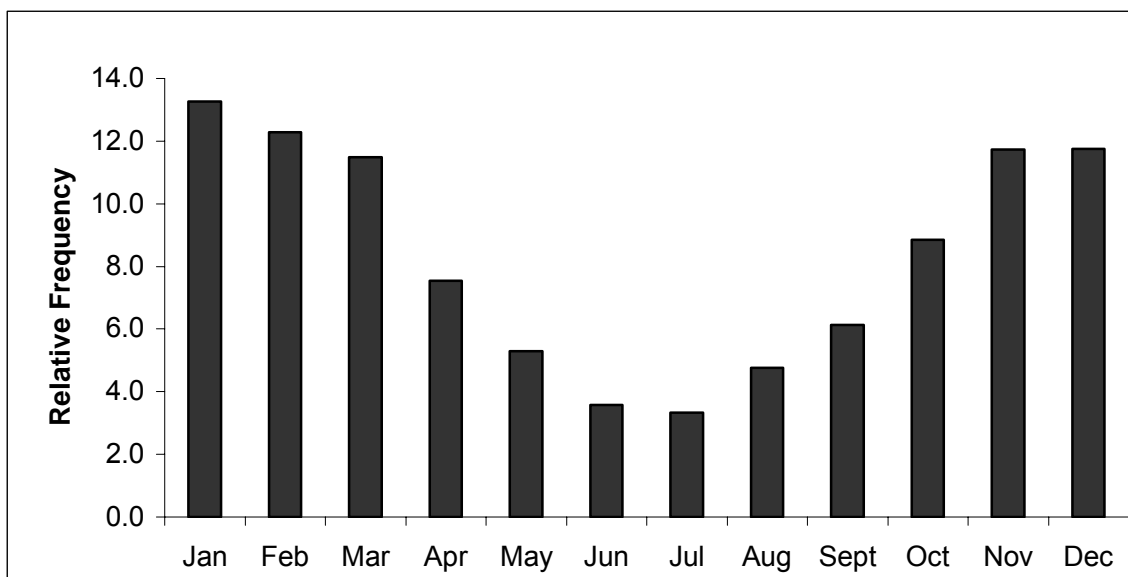


Figure 2: Frequency of *Loxosceles* spider bites (n=20,620) in the state of Paraná, 1993-2000.

Table 1: *Loxosceles* spider bites by age group, Paraná State, Brazil, 1993-2000.

Age group (years)	State		GMCA		Itari	
	n	%	N	%	n	%
1 5	1,080	5.4	983	5.3	20	4.0
5 10	1,160	5.8	1,080	5.8	22	4.4
10 15	1,198	6.0	1,112	6.0	30	6.0
15 20	1,832	9.1	1,717	9.2	47	9.4
20 30	4,636	23.0	4,321	23.2	107	21.4
30 40	4,263	21.2	3,946	21.2	98	19.6
40 50	3,227	16.0	2,994	16.1	89	17.8
50 60	1,609	8.0	1,464	7.9	49	9.8
60 70	780	3.9	691	3.7	27	5.4
70 80	287	1.4	263	1.4	9	1.8
≥ 80	53	0.3	50	0.3	1	0.2
Total	20,125	100.0	18,621	100.0	499	100.0

Table 2: Time elapsed between the *Loxosceles* bite and medical treatment, according to urban versus rural area and severity of the bite, Paraná State, Brazil, 1993-2000.

	00-01h	01-03h	03-06h	06-12h	12-24h	24-48h	48-72h	≥72h	Unknown	Total
GMCA**										
Rural (n)	4	13	12	11	18	13	5	14	35	125
%	3.2	10.4	9.6	8.8	14.4	10.4	4.0	11.2	28.0	100
Urban (n)	1,534	389	342	1,575	2,148	1,370	411	718	5,786	14,273
%	10.7	2.7	2.4	11.0	15.0	9.6	2.9	5.0	40.5	100
Irati										
Rural (n)	1	5	8	12	21	15	8	21	41	132
%	0.8	3.8	6.1	9.1	15.9	11.4	6.1	15.9	31.1	100
Urban (n)	10	4	15	30	47	34	19	40	114	313
%	3.2	1.3	4.8	9.6	15.0	10.9	6.1	12.8	36.4	100
Paraná										
Mild (n)	578	218	155	761	829	473	146	182	2,396	5,738
%	17.3	6.5	4.6	22.8	24.8	14.2	4.4	5.4	*	100
Moderate(n)	628	91	93	641	919	611	197	338	2,582	6,100
%	17.9	2.6	2.6	18.2	26.1	17.4	5.6	9.6	*	100
Severe (n)	40	7	5	30	30	25	2	14	105	258
%	26.1	4.6	3.3	19.6	19.6	16.3	1.3	9.2	*	100

* Time elapsed not recorded. ** Greater Metropolitan Curitiba Area

DISCUSSION

The large number of *Loxosceles* spider bites reported in our study is closely related to the heavy infestation of spiders from this genus, particularly *L. intermedia* species, in the state of Paraná (8). The seasonality of bites is consistent with patterns reported in the literature (7) and is related to the spiders' activity (6), principally locomotion, during the hottest months of the year, from November to March.

The geographic distribution of accidents, with the highest concentration of cases in municipalities belonging to the Greater Metropolitan Curitiba Area and Irati, may mean that the behavioral characteristics of the human population favor greater contact between humans and spiders in these two areas. Nevertheless, we should

not rule out the possibility that anthropic activity, especially resulting from the urbanization process, creates new environments favoring an increase in the concentration of spiders.

In addition, the temporal variation of incidence rates in the Health Regions is probably related to the public health measures taken at the time. In 1997 and 1999, the State Secretariat of Health provided training on envenomations for health professionals in all the Health Regions, covering biological aspects of the offending animals, epidemiology, diagnosis, treatment, and prevention of bites. This event is probably related to the increase in reported incidence in the Health Regions (especially in the Irati Health Region), demonstrating the positive results of the intervention, that is, improved diagnosis and reporting of accidents.

Reduction in the incidence of cases in GMCA beginning in 1995 was probably due to efforts by the municipality of Curitiba in educating the population on preventive measures, organization of early primary care measures, and training of health professionals in diagnosis and treatment.

The State Secretariat of Health's reporting system identified differences in bite rates in the rural and urban areas, a variable that had not been analyzed previously by other authors, although it is extremely important for epidemiological studies. The high frequency of bites in the urban areas of both Health Regions is consistent with the literature (7), even considering that GMCA is almost entirely urban. However, the risk of spider bites for the rural and urban populations is similar in both GMCA and Irati, when we analyze the data in relation to the exposed population.

The proportion of cases in females in both Health Regions is even higher than reported by other authors (7, 9), reinforcing the hypothesis concerning the relationship between accidents with female victims and bites inside the domicile. Unfortunately, it was not possible to perform a cross-analysis between this variable and the victim's occupation, since 90.0% and 20.9% of the cases recorded in GMCA and Irati, respectively, lacked information on occupation, thus highlighting a flaw in recording. In Irati, which provided better recording of the victims' occupation, rural workers (13.5%) and housewives (13.5%) were the most frequent victims. Proper recording of occupation is important for better characterizing the risk groups (1) and subsequently focusing measures on these groups in order to reduce morbidity.

The predominant age group of victims was 20 to 49 years, consistent with data from the literature (5, 7, 9, 10, 11, 12). Even with the high percentages of both unknown

data and victims who had not noticed the circumstances surrounding the bite, our results suggest a relationship between the nocturnal habits of *Loxosceles* spiders, increasing their scavenging for food and/or mating after dusk, and the age group of the work force, since 27.3% of the victims in GMCA were at home sleeping when they were bitten.

Although bites occurring while the victims are at home sleeping or getting dressed are characteristic of *Loxosceles* (7), the painless bite of *L. intermedia* species hinders the initial identification of the cause of envenomation. This occurs particularly in areas where physicians normally lack experience in this kind of treatment, due to the relatively low frequency of bites. It is important to recall that correct identification of the spider is crucial for orienting the diagnosis, treatment, and reporting of the injury, thereby reflecting appropriate control measures.

The nocturnal habits and painless bite of *Loxosceles* spiders favor the low frequency of identification of the offending spider (4, 10, 13). However, the high proportion of unknown spider identification (34.05%) in the two Health Regions suggests faulty notification.

As for antivenin treatment for *Loxosceles* bites, Paraná showed the lowest rate of use of all states in Brazil. According to the Brazilian Ministry of Health (3), spider antivenin therapy is controversial in the literature and varies according to the regional experience. This was emphasized by regional differences in the rate of antivenin treatment and the mean number of vials used per case in the two Health Regions analyzed.

The proportion of victims that received medical treatment between 6 and 48 hours after the bite (31.8%) was lower than in the South American (11, 12) and Brazilian literature (9, 14). The state of Paraná also showed a reduction in the time between the spider bite and treatment, since 68.1% (n=7,450) of the cases with this information recorded were treated within 24 hours after the bite, as compared to Ribeiro *et al.* (10), who reported that in 1989 and 1990, 50% of the cases received medical treatment 24 hours after the bite.

According to the literature, clinical manifestations of *Loxosceles* bites normally begin from 1 to 6 hours after the bite (3, 7, 9, 11, 12, 14). In our study, there was a high proportion of victims who received medical treatment within 3 hours of the accident in both urban and rural areas of the 2nd Health Region. Even so, the majority of victims received medical treatment from 6 to 48 hours after the bite. These findings may

suggest early treatment due to severity, better lay knowledge concerning spider bites by the victims, or faulty recording by health professionals. In other words, the health professionals may either be recording the moment of the actual spider bite as synonymous with the beginning of clinical manifestations or demonstrating difficulty in performing a correct diagnosis, especially in the initial stages of the injury, as reported by Málaque *et al.* (7).

Later medical treatment in the 4th Health Region is probably related to the population's limited knowledge concerning both *Loxosceles* bites as a whole and their potential severity. This was demonstrated by the increased reported incidence in this Health Region after 1997, when the State Secretariat of Health held a training program and awareness-raising campaign on bites by venomous animals.

Still, we cannot rule out the possibility of the population's improved access to health services, leading to a reduction in the time elapsed between the accident or onset of symptoms and the medical treatment. Unfortunately, our results do not allow for a conclusion as to the real factors involved, but they do suggest possibilities that deserve further investigation.

We observed a downward trend in the case-fatality rate from spider bites in the state of Paraná during the study period. From 1989 to 1990, the case-fatality rate was 0.2% (10), from 1990 to 1995, 0.1% (3), and from 1993 to 2000, 0.03%. These figures suggest improved treatment for the affected population, including their knowledge concerning procedures in case of bites.

Despite the low case-fatality rate, the number of spider bites is still high. The current scenario as described above indicates the urgent need for more effective measures by health systems managers at municipal and regional levels, including surveys on the degree of infestation by *Loxosceles* spiders and identification of the main foci of accidents. Training courses and updates on diagnosis and treatment of *Loxosceles* bites for health professionals should be optimized in order to improve the care for the affected populations and especially to improve both reporting as a whole and the quality of the data provided (2).

Thus, preventive activities against spider bites should be conducted throughout the year and intensified during the peak incidence months, according to the region's characteristics, besides targeting strategic areas and adapting to specific target groups whenever necessary.

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