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ARTIGO ORIGINAL

Arthropods of medical importance and profile of associated accidents for the municipality of São Miguel do Oeste, Santa Catarina state

Artrópodes de importância médica e perfil dos acidentes associados para o município de São Miguel do Oeste, Santa Catarina

Artrópodos de importancia médica y perfil de los accidentes asociados en la municipalidad de São Miguel do Oeste, provincia de Santa Catarina

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RESUMO

Justificativa e Objetivos: Artrópodes são de longe os animais mais comuns na Terra em indivíduos totais e táxons descritos. No Brasil, a importância dos acidentes por animais peçonhentos, nos quais se incluem acidentes por artrópodes peçonhentos, pode ser expressa pelos mais de 100 mil casos e cerca de 200 óbitos registrados ao ano. Os serviços públicos de saúde têm aumentado as notificações deste tipo de acidente nos estados da região sul do Brasil, principalmente os ocorridos na zona rural. Este acréscimo decorre das modificações do ambiente natural pelo desmatamento e pelos diferentes usos do solo pelo homem. O objetivo deste estudo foi descrever a ocorrência de acidentes com artrópodes peçonhentos e o perfil social dos acidentes associados no município de São Miguel do Oeste, no período de 2007 a 2016. **Métodos:** Trata-se de um transversal e retrospectivo, com dados obtidos nas fichas de notificação e investigação individual do Sistema de Informação de Agravos de Notificação (Sinan). **Resultados:** A predominância dos acidentes envolveu pessoas do sexo masculino para lonomismo e outras lagartas venenosas e do sexo feminino para loxoscelismo, ocorreram mais frequentemente no ambiente urbano e envolveram a faixa etária entre 20 a 59 anos, afetando a população economicamente ativa. **Conclusões:** O estudo contribui para a compreensão dos determinantes para a ocorrência de animais peçonhentos em uma região de fronteira e fornece embasamento para as políticas públicas de promoção da saúde e de prevenção de agravos.

Descritores: *Animais venenosos. Promoção de saúde. Saúde pública.*

ABSTRACT

Background and Objectives: Arthropods are by far the most common animals on Earth in total individuals and described taxa. In Brazil, the importance of accidents involving venomous animals, which include accidents with venomous arthropods, can be expressed by more than 100 thousand cases and about 200 recorded deaths per year. The public health services have increased the notifications of this type of accident in the states of the southern region of Brazil, mainly those occurred in the rural area. This increase is due to changes in the natural environment caused by deforestation and the different uses of the soil by man. The objective of this study was to describe the

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occurrence of accidents with venomous arthropods and the social profile of associated accidents in the municipality of São Miguel do Oeste, from 2007 to 2016. **Methods:** This is a cross-sectional and retrospective study, with data obtained from the notification forms and individual investigation of the Information System for Notifiable Diseases (Sinan). **Results:** The predominance of accidents involved men for lonomism and other venomous caterpillars and women for loxoscelism, accidents occurred more frequently in the urban environment and involved the age group between 20 and 59 years, affecting the economically active population. **Conclusions:** The study contributes to understand the determinants of the occurrence of venomous animals in a border area and provides a basis for public policies for health promotion and disease prevention.
Keywords: *Poisonous animals. Health promotion. Public health.*

RESUMEN

Justificación y Objetivos: Los artrópodos son de lejos los animales más comunes en la Tierra en individuos totales y taxones descritos. En Brasil, la importancia de los accidentes por animales venenosos, en los que se incluyen accidentes por artrópodos venenosos, puede ser expresada por los más de 100 mil casos y cerca de 200 muertes registradas al año. Los servicios públicos de salud han aumentado las notificaciones de este tipo de accidentes en los estados de la región sur de Brasil, principalmente los ocurridos en la zona rural. Este acrecimiento se deriva de las modificaciones del ambiente natural por la deforestación y por los diferentes usos del suelo por el hombre. El objetivo de este estudio fue describir la ocurrencia de accidentes con artrópodos venenosos y el perfil social de los accidentes asociados en el municipio de São Miguel del Oeste, en el período de 2007 a 2016. El objetivo de este estudio fue describir la ocurrencia de los accidentes con artrópodos venenosos y el perfil de los accidentes asociados en la municipalidad de São Miguel do Oeste, provincia de Santa Catarina, de 2007 a 2016. **Métodos:** Se trata de un estudio descriptivo exploratorio cuantitativo, con datos obtenidos de los formularios de notificación e investigación individual del Sistema de Información de Enfermedades de Declaración Obligatoria (Sinan). **Resultados:** El predominio de accidentes involucró a hombres para el lonomismo y otras orugas venenosas y mujeres para loxoscelismo. Los accidentes ocurrieron con mayor frecuencia en el entorno urbano e involucraron al grupo de edad entre 20 y 59 años, afectando a la población económicamente activa. **Conclusiones:** El estudio contribuye a comprender los determinantes de la presencia de animales venenosos en un área fronteriza y proporciona una base para las políticas públicas de promoción de la salud y prevención de enfermedades.
Palabras clave: *Animales venenosos Promoción de la salud. Salud pública.*

INTRODUCTION

Arthropods are the most common animals on Earth in total species and taxa described. The most recent systematic classification of the phylum Arthropoda subdivides it into four subphyla. The subphyla Chelicerata and Tetraconata are analyzed in this study, which include scorpions, spiders (Chelicerata, Arachnida), caterpillars (Tetraconata, Insecta, Lepidoptera), bees and wasps (Tetraconata, Insecta, Hymenoptera), whose orders contain some species of interest for public health.[1]

In 2016, the Ministry of Health (MS) of Brazil issued Ordinance Number 204/2016, which deals with the events of compulsory notification. In this instrument, accidents caused by venomous animals are included in the list of occurrences that must be reported to the competent agencies. In Brazil, the importance of accidents with venomous animals can be expressed by more than 100 thousand cases and about 200 deaths recorded per year. Based on the frequency and severity of recorded poisonings, MS allocated stinging caterpillars, snakes, scorpions, spiders and bees to the group of venomous animals.[1,2]

The public health services have increased the notifications of this type of accident in the states of southern Brazil, mainly those occurred in the rural area. This increase stems from changes in the natural environment caused by deforestation and the different uses of the soil by man. Environmental changes alter the ecological balance and the conversion of natural environments into areas of cultivation, pasture and urban constructions lead animals to seek food and shelter in human-occupied environments. Another relevant factor for increasing notifications of accidents involving venomous animals was the expansion of the Basic Health Care network, which gave the population greater access to health services.[1,2]

Only three genera of spiders are capable of causing accidents of medical interest: *Loxosceles, Phoneutria* and *Latrodectus*, being responsible for the majority of accidents in Brazil. The genus *Loxosceles* is cosmopolitan and contains more than 100 species with different degrees of medical importance. The brown spider, *Loxosceles intermedia* (Mello-Leitão, 1934) (Araneae, Sicariidae) is a species whose bite causes a health problem known as loxoscelismo. They exhibit typically sedentary and nocturnal habits and are not aggressive. Found in home environments, which facilitates contact with human beings, responding to the greater frequency of accidents recorded in Brazil. Accidents with this type of spider can be serious, and the bite is almost always imperceptible. The venom of the genus *Loxosceles* is a mixture of toxins composed basically of low molecular weight proteins with enzymatic or toxic action.[1,3-5]

Spiders of the genus *Phoneutria* are popularly known as armed spiders, because they present a position of attack in cases of danger. It includes eight species of wandering spiders that are distributed from Central America to the north of Argentina. Usually, they do not construct webs and during the day they remain hidden in logs, trunks, banana trees, palm trees or bromeliads, are nocturnal hunters and can be found in the peridomicilia-

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ry environment. *Phoneutria* accidents involving humans 91% of the time correspond to a mild condition described as local pain of variable intensity that usually radiates the root of the impaired nerve and may be accompanied by edema, erythema, and local sweating. Accidents classified as severe cause excruciating pain, intense sweating, blurred vision, excitotoxic manifestations and priapism, cardiovascular and respiratory discomfort. Some cases of phoneutrism can evolve to death.[1,3,6,7]

Spiders of the genus *Latrodectus* (Walcknaer, 1805) (Aranae: Theridiidae) have a worldwide distribution occurring on many continents and islands. The genus *Latrodectus* contains about 31 species of spiders identified, which are commonly known as black widows. Black widows are generalist predators of synanthropic habits and are found in the vicinity and less frequently inside the dwellings. The poisoning caused by the venom of this group of spiders is due to the presence of a group of neurotoxic proteins called latrotoxins, which bind to the proteins of the presynaptic membranes (latrophilin and neurexin), triggering the massive release of neurotransmitters. Their bites cause severe pain at the site of venom inoculation, which radiates, causing muscle cramps, spasms, motor disorders, salivation, sweating, hypertension, anxiety, mental excitement and agonizing pain. According to Haas (2012, page 27), "poisoning by this spider is especially severe in children, elderly, and in patients with preexisting cardiovascular disease".[8-11]

Scorpionism is a relevant public health problem in many tropical and subtropical countries. Scorpions of the family Buthidae are known to contain toxic peptides that may be dangerous to humans. In the New World, of the two genera of this family (*Centruroides* and *Tityus*) that can cause symptoms of intoxication, only *Tityus* is found in Central and South America (distributed from Panama to Argentina). The magnitude of the clinical status in humans is variable and linked to the patient characteristics such as body mass, sensitivity and immune response to venom, as well as scorpion characteristics such as the species, size and quantity of venom inoculated. A constant in the clinical condition due to scorpionism is local pain and paraesthesia. *Tityus serrulatus* (Lutz and Mello, 1922) and *Tityus bahiensis* (Perty, 1833) are the species found in southern Brazil, and the clinical manifestations of severe poisoning may include pulmonary edema, heart and respiratory failure and shock, in addition to local pain and systemic changes such as nausea, vomiting, agitation, tachycardia, hyperglycemia and leukocytosis.[1,12,13]

Lepidopterans are one of the largest orders of insects, with about 160,000 species described and encompassing insects known as moths, with a larval stage known popularly as a caterpillar. In Brazil, some Megalopygidae and Saturniidae (families of Lepidoptera) are known for causing adverse reactions in humans, most of which are due to exposure to the larval stage. Caterpillars of *Lonomia obliqua* (Walker, 1855) (Saturniidae, Hemileucinae) were found in fruit trees in the rural regions of southern and southeastern Brazil.[1] These caterpillars have gregarious and mimetic habits and descend from the tops of trees to the trunk, increasing the likelihood of accidents. Collectively, a series of spines symmetrically covers the body of the caterpillar and the contact of humans with these caterpillars is mainly made by the central axis from which the spines originate. The majority of patients affected present mild pain with burning, nausea, and headache. Progression to a severe hemorrhagic syndrome characterized by bruising, hematuria, bleeding from scars and mucous membranes, intracerebral bleeding, and acute renal failure may occur.[14]

The objective of the venom of bees and wasps is defense, fighting for territory and/or hunting, a venom which is a complex mixture of substances, mainly enzymes, peptides and biogenic amines. Its main components are melittin and phospholipase A_2, which constitute 50-75% of the total mass of the venom, although it has several other biologically active components. These proteins have pharmacological and allergenic actions capable of causing a series of physiological reactions in humans and animals. At the local level, after the sting, there is acute pain, which is absent spontaneously in a few minutes, pruritus and edema for several hours or days.[1,15]

Knowledge about the epidemiology and social factors involved in accidents with venomous arthropods is crucial to know the risk the population may be exposed in their daily and leisure activities and to the establishment of more specific prevention actions. Several works evaluated the accidents occurred in the municipality of Chapecó, in the western area of the State of Santa Catarina. This study is a pioneer in evaluating all reported cases of venomous arthropod accidents in a historical series of ten years in São Miguel do Oeste, a city located in the extreme western microregion of the State of Santa Catarina, in a border area between Brazil and Argentina. In this context, this study aimed to report the arthropods associated with poisoning accidents in the municipality of São Miguel do Oeste and describe the profile of accidents involving venomous arthropods.[16-19]

METHODS

This is a quantitative cross-sectional and retrospective study. It evaluates a historical series of ten years (2007 to 2016) of cases of accidents with venomous arthropods in the most populous municipality of the extreme western region of the State of Santa Catarina. São Miguel do Oeste is a municipality with an estimated population of 39,793 inhabitants. Located 26° 35' 50" S and 53° 31' 00" W, it is the largest city in the extreme western region of the State of Santa Catarina and the main city of Santa Catarina from the border with Argentina. São Miguel do Oeste is also a municipality that stands out in agriculture and livestock farming. Of the 234.3 km^2 of territory, 91.5% is part of the rural area.[20]

Data on accidents with venomous arthropods (spiders, scorpions and lepidopterans) were obtained from the notifications recorded in the Information System for Notifiable Diseases (SINAN). It is an online database and, even though it is of a public nature, authorization was

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requested for the use of data from the Epidemiological Health Surveillance sector of the municipality of São Miguel do Oeste. The records were obtained according to the taxon that caused the accident, date, sex, age, occupation and area of residence of the patient. The collection of these data occurred in June 2017 and was generated as a spreadsheet.

A descriptive analysis was performed based on the absolute and percentage frequencies to describe the arthropod taxa most frequently involved in accidents with poisoning and to characterize the profile of the population affected by sex, place of residence, schooling, age group and occupation. The annual number of cases for the period was grouped and compared, year by year, according to the monthly average number of notifications. The data were tabulated in a database built in Excel software for Windows (MICROSOFT Inc., 2010).

The data used in the study are of a public nature and are available for consultation at the sites of the Epidemiological Surveillance Office of the state of Santa Catarina. No information identifying patients was used, thus dispensing with the approval of the National Council of Research Ethics. However, an authorization of the municipal health manager was obtained.

RESULTS

A total of 1,367 accidents with venomous arthropods in the municipality of São Miguel do Oeste. A greater frequency of lonomism and accidents with other caterpillars was observed for men. Phoneutrism and scorpionism were not different as to sex. Cases of loxoscelism occurred mainly with women (Table 1). The number of accidents was considerably higher in the urban area, for all types of accidents evaluated. There was less differentiation in the incidence between rural and urban areas for scorpionism and lonomism (Table 1).

The accidents involved people with different levels of education. There were 149 notifications (10.89%) involving people with complete elementary school and 133 cases (9.72%) with complete high school (Table 2).

The age group with the highest frequency of accidents was between 20 and 29 years old, with 126 cases (9.22%), followed by 115 cases (8.41%) in the age group between 50 and 59 years, 111 cases (8.12%) between 40 and 49 years old and 101 cases (7.39%) between 30 and 39 years old (Table 2). The other age groups also presented cases, but with lower frequencies.

Most of the accidents affected farmers, students

Table 1. Profile of sex and locality of accidents with venomous arthropods registered in the municipality of São Miguel do Oeste, Santa Catarina state, 2007 to 2016.

Categoria profissional	Phoneutrism		Loxoscelism		Scorpionism		Lonomism		Other catterpillars	
	Total	%	Total	%	Total	%	Total	%	Total	%
Sex										
Male	156	50.1	65	36.9	26	45.6	74	70.4	71	62.2
Female	155	49.9	111	63.1	31	54.4	30	29.6	43	37.8
Area of residence										
Urban	214	69.3	103	60.6	38	67.9	37	67.3	105	92.1
Rural	95	30.7	67	39.4	18	32.1	18	32.7	9	7.9

Table 2. Education level, age group profile of people who suffered from accidents with venomous arthropods registered in the municipality of São Miguel do Oeste, Santa Catarina state, 2007 to 2016.

Schooling	Phoneutrism		Loxoscelism		Scorpionism		Lonomism		Other catterpillars	
	Total	%	Total	%	Total	%	Total	%	Total	%
Illiterate	0	0.0	1	0.6	0	0.0	1	1.0	0	0.0
First to fourth grade	8	2.6	13	7.7	3	5.3	17	16.3	4	3.5
Complete fourth grade	17	5.5	8	4.7	5	8.8	6	5.8	9	8.0
Fifth to ninth grade	65	21.0	23	13.6	15	26.3	15	14.4	13	11.5
Complete elementary school	73	23.6	31	18.3	11	19.3	15	14.4	19	16.8
Incomplete high school	56	18.1	20	11.8	7	12.3	16	15.4	16	14.2
Complete high school	36	11.7	42	24.9	13	22.8	16	15.4	26	23.0
Incomplete higher education	6	1.9	3	1.8	2	3.5	2	1.9	3	2.7
Complete higher education	10	3.2	6	3.6	0	0.0	1	1.0	6	5.3
White/ignored	17	3.2	15	4.7	1	1.8	15	14.4	10	4.4
Not applicable	28	9.1	14	8.3	0	0.0	0	0.0	12	10.6
Age										
1 to 4 years	23	7.6	12	7.0	0	0.0	5	4.8	7	6.1
5 to 9 years	8	2.6	4	2.3	0	0.0	14	13.5	12	10.5
10 to 14 years	13	4.3	1	0.6	3	5.2	15	14.4	12	10.5
15 to 19 years	24	7.9	7	4.1	4	6.9	13	12.5	14	12.3
20 to 29 years	56	18.5	28	16.4	12	20.7	10	9.6	20	17.5

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30 to 39 years	40	13.2	29	17.0	8	13.8	8	7.7	16	14.0
40 to 49 years	53	17.5	27	15.8	8	13.8	10	9.6	13	11.4
50 to 59 years	35	11.6	33	19.3	16	29.3	16	15.4	13	11.4
60 to 69 years	26	8.6	20	11.7	5	8.6	7	6.7	7	6.1
70 to 79 years	16	5.3	7	4.1	0	0.0	5	4.8	0	0.0
>80 years	8	2.6	3	1.8	1	1.7	1	1.0	0	0.0

and housewives, whose sum accounted for 53.9% of the total number of notifications (Table 3), demonstrating the profile of activity most prone to this type of accident.

The annual number of cases of loxoscelism, scorpionism, lonomism and accidents with other species of caterpillars was constant, whereas there was a marked increase in the cases of phoneutrism, especially in 2011, 2012 and 2013 (Figure 1). It is also possible to verify a subtle increase in the number of cases of loxoscelism in 2013, which remained stable and increased again in the last year of data collection, in 2016.

Table 3. Occupation profile of people who suffered from accidents with venomous arthropods registered in the municipality of São Miguel do Oeste, Santa Catarina state, in the period from 2007 to 2016.

Occupation	Number of accidents	%
Farmer	346	25.3
Student	252	18.4
Housewife	139	10.2
Retired	93	6.8
Bricklayer	53	3.9
Driver	33	2.4
Teacher	13	1.0
Merchant	12	0.9
Salesman	12	0.9
Cooker	8	0.6
Hodman	8	0.6
Others	269	19.7
White/Ignored	129	9.4
Total	1367	100

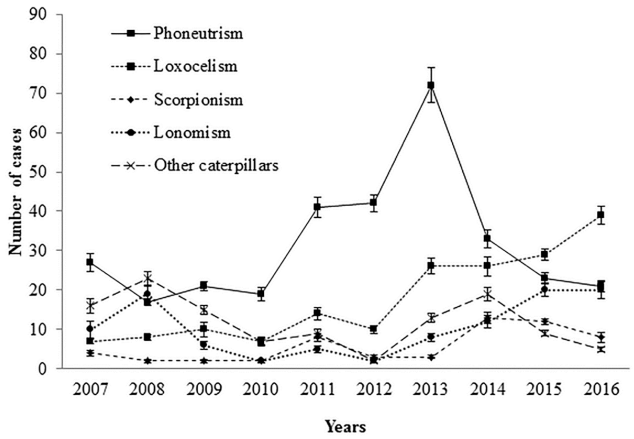

Figure 1. Comparison of the annual total number of accidents with venomous arthropods recorded in the municipality of São Miguel do Oeste, Santa Catarina state, from 2007 to 2016. The vertical bars indicate the standard deviation of the mean.

DISCUSSION

The highest number of cases of lonomism and accidents with caterpillar for men may be directly related to work and leisure activities. Work activities such as tree pruning, gardening and farming are usually performed by men and expose them directly to the risk of accidents with this group of venomous animals. On the other hand, cases of loxoscelism occurred mainly with women, which may be related to house chores (moving furniture and objects) and make them more frequently exposed to contact with arachnids. In the intra- and peri-domiciliary environments, this spider species is protected from predation and finds small insects that serve as food.[17,21]

Accidents with venomous arthropods occurred in greater occurrence in the urban zone, which can be explained by the greater concentration of the population of the municipality residing and having their activities in the urban perimeter. According to IBGE (2018), 88% of the municipal population is concentrated in this area. However, it is noted that farmers were the most affected if we consider the percentage of occupations of people who have suffered from accidents.[20]

The smaller differentiation in the number of cases between residence areas (urban and rural) only for scorpionism and lonomism may be the result from deforestation and urbanization, supporting the occurrence of these types of accidents. In the urban perimeter, city lighting attracts moths for egg laying on trees, mainly fruit trees, which represent sources of food for caterpillars of *L. obliqua* and favors the occurrence of accidents. Similarly, irregular occupation of areas contributes to the precarious conditions of housing, a poor waste collection system eventually allows for the accumulation of this and provides a suitable environment for the proliferation of scorpions, since they find shelter and a source of food that comes from the insects that proliferate in these sites.[2] In the rural area, the use of pesticides, the elimination of natural enemies and the adaptation of larvae to exotic plants are factors favoring an increase in the number of accidents involving stinging caterpillars.[18]

The results show a predominance in the number of accidents for people with schooling between complete elementary school and complete higher education (with its various subcategories), between 20 and 59 years of age, farmers, housewives or students. These results associate accidents with work or leisure activities, affect an economically active population, whose work activities are directly related to the environments where accidents occur. It is also important to highlight the high number of cases of phoneutrism and loxoscelism with children between 1 and 4 years of age, which reveals the need for

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greater attention of parents towards their children.[17]

When evaluating the data as a historical series, there was considerable constancy in the number of cases, except for a marked increase in the cases of phonutrism, especially in the years 2011, 2012 and 2013. According to the literature, there is a direct association between the incidence of this type of accident with the elevation of the ambient temperature, since the arthropods are more active during the reproduction period, in the hotter seasons of the year, when they leave their hiding places and can enter human dwellings.[6,21,22]

The prevention strategies for accidents with venomous animals, especially scorpions and spiders, are focused from the individual to the collective. In the individual sphere, changes in simple habits are highlighted, for example: inspecting shoes, clothing, bath and face towels, bed linen, floor cloth and carpets before using; away beds and cribs from the walls, avoiding hanging clothes outside the closet, being careful when entering the dwellings with firewood, plants, or materials that have remained outside for a certain time in order not to lead venomous animals into the home. Citizens must be active participants from their homes in case control, focusing mainly on the control of waste, debris and construction materials near the dwellings; often cleaning furniture, frames and curtains, corners of walls and vacant lots; using screens in windows and drains; cover cracks and holes, floors, ceilings and baseboards; controlling rodents that may exist in the area and combating insects, especially cockroaches.[1,11]

It is important to emphasize that the primary prevention of these health problems is not only limited to the population at risk, because in all events involving Public Health, the State fulfills the fundamental role in controlling these occurrences, especially in the decisions that are made while the public economic and environmental policies, especially those that will highlight the rational or non-rational use of natural and financial resources and their direct impacts on the population health. In the text "Ecosystem Approaches to Health - Prospects for Adoption in Brazil and in Latin American countries", it is argued that the perspective of population health, from an ecosystem viewpoint, necessarily requires comprehensive public policies and effective institutions to execute them. The ecosystem approach to health (AES) starts from the statement that health and disease manifestations develop complex societal contexts, giving a broader approach to the problems mentioned, and their ecosystems involved.[1,18]

Numerous published texts link the changes in the ecosystem and the environment to accidents with venomous animals. In addition to the biotic factors related to these species, the factors related to the inadequate use of the soil and the high degree of human interference must be taken into account. The destruction of natural areas (where environmental conditions are in equilibrium) creates conditions of ecological imbalance, where competition for spaces and resources between different species (interspecific competition) and between organisms of the same species (intraspecific competition) is quite strong. This "causes imbalances that affect the role of each species within the community of organisms, creating gaps in the ecological niches that allow the opportunistic species present in the surrounding environment to colonize the new gaps and to increase their populations". [16-19,23]

An ecosystem approach to research and management must be transdisciplinary and ensure the participation of different actors. Such characteristics provide a means for science to better deal with the complexity of ecosystems as well as health managers in defining and aiming reasonable social goals. The ecosystem approach is able to determine links between human health and activities or events that disrupt ecosystem status and function. Understanding these links can guide interventions and policy options that promote human health. The close relationship between the environment and health raises the need for actions and strategies at the ecosystem level that promote the health of the population and the preservation of the environment.[24,25,34]

Our results contribute to the planning of actions to prevent such accidents, since they provide specific data about risk groups in the border region of Brazil/Argentina, where the data were obtained and there are no previous studies. Likewise, Health Education actions are an essential factor for the promotion of health, quality of life, well-being of the population and for the prevention of accidents. Educational campaigns are thus fundamental for orientation of the population on prevention, as well as to contribute to the establishment of treatment actions when this type of accident occurs. Nevertheless, it should be borne in mind that accidents with venomous animals are sometimes neglected and/or unknown by a considerable portion of the population, and therefore, victims often do not seek medical attention, leading to underreporting.[17,19]

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