

**ECOLOGICAL STUDY OF ACCIDENTS CAUSED BY CROTALUS SP SNAKES  
IN BRAZIL BETWEEN 2010 AND 2023**

**ESTUDO ECOLÓGICO DOS ACIDENTES CAUSADOS PELAS SERPENTES  
CROTALUS SP NO BRASIL ENTRE 2010 E 2023**

**ESTUDIO ECOLÓGICO DE LOS ACCIDENTES CAUSADOS POR SERPIENTES  
CROTALUS SP EN BRASIL ENTRE 2010 Y 2023**

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**ABSTRACT**

**Introduction:** Accidents caused by venomous snakes represent an important challenge for public health, especially in rural regions of countries with tropical climates. It is estimated that, annually, there are about 5 million snakebites in the world, resulting in approximately 100 thousand deaths. In Brazil, the genera Bothrops and Crotalus stand out, the latter being associated with higher lethality and severe clinical manifestations, such as neurotoxicity, myotoxicity, and acute renal failure. In addition to the clinical repercussions, these accidents have relevant economic and social impacts, especially because they affect individuals of working age in rural areas. Early

**Goal:** To investigate the epidemiological profile of accidents caused by snakes of the genus Crotalus in Brazil between 2010 and 2023, analyzing mortality, regional distribution, seasonal variation, sex, age group, and anatomical site of the bite, in order to identify relevant patterns for surveillance and public health.

**Methodology:** This is an ecological, descriptive and retrospective study, based on secondary data extracted from the Notifiable Diseases Information System (SINAN/DATASUS). All cases registered in the country between 2010 and 2023 were included. The variables analyzed included: absolute number of cases and deaths, mortality rate, regional distribution, seasonality, gender, age group, and location of the bite. Statistical analysis was performed by means of descriptive statistics, using absolute and relative frequencies, with processing in Microsoft Excel.

**Results and discussion:** There was a continuous growth in the number of notified snakebites, from 124,920 cases in 2010 to 340,819 in 2023. In total, 296,475 botropic and

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34,080 crotalic accidents were recorded, with mortality rates of 0.42% and 0.95%, respectively. Crotalic cases were more concentrated in the Northeast (37.8%) and Southeast (35.2%) regions, being more frequent in the hot and rainy months (January to March), which accounted for 34% of the notifications. There was a predominance of males (80%) and adults of working age (20 to 59 years: 22,209 cases), which reflects the greater occupational exposure in agricultural activities. The bites occurred mainly on the lower limbs (65.2%), followed by the upper limbs (20.2%), often during the inadvertent handling of the animals in the rural work environment. These epidemiological variations appear to be associated with environmental, climatic, and occupational factors that increase the risk of contact with snakes.

**Conclusions:** Crotalic accidents predominantly occurred adult men living in rural areas, especially in the rainy months, with more frequent injuries in the lower limbs. These findings reinforce the importance of public policies aimed at prevention, such as the provision of personal protective equipment (PPE) and the training of health teams for timely diagnosis and treatment. Among the limitations of the study, the use of secondary data, subject to underreporting and lack of detailed clinical information, stands out. Even so, the results contribute to guide future research on environmental determinants and the effectiveness of serum therapy in different regions of the country.

**Keywords:** Crotalus. Snake Bites. Epidemiology.

## RESUMO

**Introdução:** Os acidentes provocados por serpentes peçonhentas representam um importante desafio para a saúde pública, sobretudo em regiões rurais de países de clima tropical. Estima-se que, anualmente, ocorram cerca de 5 milhões de envenenamentos ofídicos no mundo, resultando em aproximadamente 100 mil mortes. No Brasil, destacam-se os gêneros *Bothrops* e *Crotalus*, sendo este último associado a maior letalidade e a manifestações clínicas severas, como neurotoxicidade, miotoxicidade e insuficiência renal aguda. Além das repercussões clínicas, esses acidentes acarretam impactos econômicos e sociais relevantes, especialmente por atingirem indivíduos em idade produtiva das zonas rurais. A administração precoce do soro antiofídico é fundamental para reduzir a mortalidade e as complicações decorrentes do envenenamento.

**Objetivo:** Investigar o perfil epidemiológico dos acidentes causados por serpentes do gênero *Crotalus* no Brasil entre 2010 e 2023, analisando mortalidade, distribuição regional, variação sazonal, sexo, faixa etária e local anatômico da picada, com o intuito de identificar padrões relevantes para a vigilância e a saúde pública.

**Metodologia:** Trata-se de um estudo ecológico, descritivo e retrospectivo, baseado em dados secundários extraídos do Sistema de Informação de Agravos de Notificação (SINAN/DATASUS). Foram incluídos todos os casos registrados no país entre 2010 e 2023. As variáveis analisadas compreenderam: número absoluto de casos e óbitos, taxa de mortalidade, distribuição regional, sazonalidade, sexo, faixa etária e local da picada. A análise estatística foi realizada por meio de estatística descritiva, utilizando frequências absolutas e relativas, com processamento no Microsoft Excel.

**Resultados e discussão:** Verificou-se crescimento contínuo no número de acidentes ofídicos notificados, passando de 124.920 casos em 2010 para 340.819 em 2023. No total, foram registrados 296.475 acidentes botrópicos e 34.080 crotálicos, com taxas de

mortalidade de 0,42% e 0,95%, respectivamente. Os casos crotálicos apresentaram maior concentração nas regiões Nordeste (37,8%) e Sudeste (35,2%), sendo mais frequentes nos meses quentes e chuvosos (janeiro a março), que responderam por 34% das notificações. Predominaram indivíduos do sexo masculino (80%) e adultos em idade produtiva (20 a 59 anos: 22.209 casos), o que reflete a maior exposição ocupacional em atividades agropecuárias. As picadas ocorreram principalmente nos membros inferiores (65,2%), seguidas dos membros superiores (20,2%), frequentemente durante o manuseio inadvertido dos animais no ambiente de trabalho rural. Essas variações epidemiológicas parecem estar associadas a fatores ambientais, climáticos e ocupacionais que aumentam o risco de contato com serpentes.

**Conclusões:** Os acidentes crotálicos acometeram, predominantemente, homens adultos residentes em áreas rurais, especialmente nos meses chuvosos, com lesões mais frequentes em membros inferiores. Esses achados reforçam a importância de políticas públicas voltadas à prevenção, como a oferta de equipamentos de proteção individual (EPIs) e a capacitação das equipes de saúde para diagnóstico e tratamento oportunos. Entre as limitações do estudo, destaca-se o uso de dados secundários, sujeitos a subnotificação e à falta de informações clínicas detalhadas. Ainda assim, os resultados contribuem para orientar futuras pesquisas sobre os determinantes ambientais e a efetividade da soroterapia em distintas regiões do país.

**Palavras-chave:** Crotalus. Mordeduras de Serpentes. Epidemiologia.

## RESUMEN

**Introducción:** Los accidentes provocados por serpientes venenosas representan un importante desafío para la salud pública, especialmente en regiones rurales de países con clima tropical. Se estima que, anualmente, ocurren alrededor de 5 millones de mordeduras de serpientes en el mundo, resultando en aproximadamente 100 mil muertes. En Brasil, destacan los géneros Bothrops y Crotalus, siendo este último asociado con mayor letalidad y manifestaciones clínicas graves como neurotoxicidad, miotoxicidad e insuficiencia renal aguda. Además de las repercusiones clínicas, estos accidentes generan impactos económicos y sociales relevantes, especialmente por afectar a individuos en edad productiva de áreas rurales. La administración temprana del suero antiofídico es fundamental para reducir la mortalidad y las complicaciones del envenenamiento.

**Objetivo:** Investigar el perfil epidemiológico de los accidentes causados por serpientes del género Crotalus en Brasil entre 2010 y 2023, analizando mortalidad, distribución regional, variación estacional, sexo, grupo de edad y sitio anatómico de la mordedura para identificar patrones relevantes para la vigilancia y la salud pública.

**Metodología:** Se trata de un estudio ecológico, descriptivo y retrospectivo, basado en datos secundarios extraídos del Sistema de Información de Enfermedades de Notificación (SINAN/DATASUS). Se incluyeron todos los casos registrados en el país entre 2010 y 2023. Las variables analizadas incluyeron número absoluto de casos y muertes, tasa de mortalidad, distribución regional, estacionalidad, sexo, grupo de edad y localización de la mordedura. El análisis estadístico se realizó mediante estadística descriptiva, con frecuencias absolutas y relativas procesadas en Microsoft Excel.



**Resultados y discusión:** Se observó un crecimiento continuo en el número de accidentes ofídicos notificados, pasando de 124.920 casos en 2010 a 340.819 en 2023. En total, se registraron 296.475 accidentes botrópicos y 34.080 crotálicos, con tasas de mortalidad de 0,42% y 0,95%, respectivamente. Los casos crotálicos se concentraron en mayor proporción en las regiones Nordeste (37,8%) y Sudeste (35,2%), siendo más frecuentes en los meses cálidos y lluviosos (enero a marzo), que representaron el 34% de las notificaciones. Hubo predominio de hombres (80%) y de adultos en edad productiva (20 a 59 años: 22.209 casos), lo que refleja mayor exposición ocupacional en actividades agrícolas. Las mordeduras ocurrieron principalmente en miembros inferiores (65,2%), seguidas de los superiores (20,2%), muchas veces durante la manipulación inadvertida de los animales en entornos rurales de trabajo. Estas variaciones epidemiológicas parecen estar asociadas con factores ambientales, climáticos y ocupacionales que incrementan el riesgo de contacto con serpientes.

**Conclusiones:** Los accidentes crotálicos ocurrieron predominantemente en hombres adultos residentes en áreas rurales, especialmente en los meses lluviosos, con lesiones más frecuentes en miembros inferiores. Estos hallazgos refuerzan la importancia de políticas públicas orientadas a la prevención, como la provisión de equipos de protección personal (EPP) y la capacitación de los equipos de salud para el diagnóstico y tratamiento oportunos. Entre las limitaciones del estudio destaca el uso de datos secundarios, sujetos a subregistro y a la falta de información clínica detallada. Aun así, los resultados contribuyen a orientar futuras investigaciones sobre los determinantes ambientales y la efectividad de la terapia con suero antiofídico en diferentes regiones del país.

**Palabras clave:** Crotalus. Mordeduras de Serpientes. Epidemiología.

## 1 INTRODUCTION

Accidents with venomous snakes represent an important public health problem, especially in tropical and subtropical regions, being classified by the World Health Organization (WHO) as neglected tropical diseases (WHO, 2023). Snakebites continue to be one of the most important causes of morbidity and mortality in these regions, especially in rural areas of developing countries (AFROZ et al., 2024). It is estimated that between 4.5 and 5.4 million snake bites occur worldwide annually, resulting in 1.8 to 2.7 million cases of envenomation and between 81,000 and 130,000 deaths (WHO, 2023; LONGBOTTOM et al., 2022). These numbers, however, are considered underestimated due to the lack of adequate epidemiological surveillance systems in several regions, which further aggravates the problem (AFROZ et al., 2024).

In Brazil, snakebites of medical importance are caused by snakes of the Viperidae and Elapidae families. Records of envenomations by snakes of the Viperidae family are present in about 99.5% of the accidents and are caused by the genera *Bothrops* (popularly known as jararacas, jararacuçu and urutus), *Crotalus* (rattlesnakes) and *Lachesis* (surucucus). The Elapidae family (0.5% of accidents) is represented by the genus *Micrurus* (true corals) (BRASIL, 2024).

Identifying the snake involved in the accident, when possible, can be an important step towards correct diagnosis and treatment. Despite this, the animal should not be killed or captured, and it is ideal to record the snake through photography, maintaining safety precautions. The corals have a slender body and colored rings, while the presence of retractable anterior fangs and loreal pit are characteristic of snakes of the Viperidae family, and the *Bothrops* have designs similar to an old telephone hook in the mesh. Meanwhile, rattlesnakes have diamond designs on their bodies, and the occurrence of the rattle on the tail also confirms their identification (WHO, 2023).

The genus *Crotalus* belongs to the subfamily Crotalinae, known for the presence of a specialized sensory organ: the loreal pit, which allows the detection of heat radiated by prey, facilitating hunting, especially in conditions of low visibility. In addition, another striking feature of these snakes is the presence of a rattle at the end of the tail, formed by interconnected segments of keratin that expand as the snake sheds its skin. When shaken rapidly, these segments produce an unmistakable sound, which serves as an important defense mechanism. Rattlesnakes use this sound both to alert potential predators and as a form of warning when they feel threatened or angry, thus avoiding direct confrontations (CLARK et

al., 2022; TOZETTI et al., 2013). These snakes have predominantly nocturnal habits, being more active at dusk and during the night, when they go out in search of food. During the day, they usually take shelter in hidden places, such as burrows, between rocks or under dense vegetation (TOZETTI et al., 2013).

The clinical occurrence of the signs and symptoms caused by the toxins present in the venom will define the need for treatment. Although snakes of the genus *Bothrops* cause the highest number of accidents and greater morbidity, accidents caused by rattlesnakes, although less frequent, are associated with higher complication rates, including a higher mortality rate (DA SILVA et al., 2023; CERON et al., 2021), this situation is mainly caused by the late recognition of clinical and laboratory changes, which is frequent in neglected diseases, leading to late heterologous serum therapy (more than 6 hours after the accident), a time when there is usually more important rhabdomyolysis and the consequent possibility of kidney damage, often irreversible.

The morbidity and mortality present in crotalic accidents is mainly due to crotoxin and crotamine, which are some of the proteins present in the venom responsible for inducing the neurotoxic and myotoxic syndrome of envenomation, causing manifestations such as blurred vision, eyelid ptosis, muscle weakness, respiratory failure, rhabdomyolysis, and acute renal failure (COLOMBINI et al., 2023). Thus, the clinical-laboratory picture plays a fundamental role in defining treatment, since specific serum therapy, started early, is crucial for reducing complications and mortality (WHO, 2023).

Given the relevance and particularities of envenomations caused by snakes of the genus *Crotalus*, it is extremely important to better understand the epidemiological profile for the proper management of these cases.

## 2 METHODOLOGY

The present study consists of a descriptive and retrospective documentary research, based on secondary data from the Notifiable Diseases Information System (SINAN) and the Epidemiological Bulletins of the Ministry of Health for the period from 2010 to 2023. Accidents involving venomous snakes were counted and the cases involving crotalic accidents were detailed. The variables of interest included: number of reported cases, mortality rate, distribution by geographic region, seasonality, age group, sex, and location of the bite. The analysis was carried out in a quantitative and descriptive manner, allowing the identification of epidemiological patterns and relevant risk factors.



### 3 RESULTS AND DISCUSSION

Data on snakebites in Brazil, between 2010 and 2023, reveal a growing panorama in the number of reported cases, accompanied by a low mortality rate. The increase in the number of accidents is evident over the years, from 124,920 cases in 2010 to 340,819 in 2023, which represents a significant growth of almost 173% and, although snakes of the genus *Bothrops* are responsible for most cases, the mortality rate associated with envenomations by this genus was 0.42%, (BRAZIL, 2024).

**Table 1**

*Brazil - Reported Cases*

Year	Ign/White	Bothrops	Crotalus	Micrurus	Lachesis	Non-venomous	Total
2010	98504	21604	2383	210	1033	1186	124920
2011	111149	21843	2493	229	1008	1244	137966
2012	116382	20488	2166	236	874	1263	141409
2013	135503	19867	1822	240	913	1330	159675
2014	145447	18881	1790	198	806	1359	168481
2015	148193	19595	1975	209	718	1473	172163
2016	150786	18857	2177	244	519	1536	174119
2017	197877	20337	2521	285	476	1919	223415
2018	241263	21094	2747	288	548	2224	268164
2019	256731	23467	2930	378	601	2628	286735
2020	232896	23604	3132	310	452	2442	262836
2021	228139	23518	2735	301	323	2190	257206
2022	264675	21627	2563	370	303	2218	291756
2023	312752	21693	2646	379	397	2952	340819
<b>Total</b>	2640297	296475	34080	3877	8971	25964	3009664

Source: Ministry of Health - SINAN (2024).

In contrast, accidents involving the genus *Crotalus*, which account for about 10 to 20% of accidents by venomous snakes, had a much higher mortality rate, about 0.95%. Although these accidents are numerically lower than those of *bothrops*, the consequences of



envenomation are more serious due to the occurrence of rhabdomyolysis which, if not treated early and properly, can lead to kidney failure and, consequently, to the death of these patients (BRASIL, 2024; DA SILVA; BROOK; et al., 2023; PHAN, 2023).

The analysis of the geographical distribution of cases of envenomation by *Crotalus* snakes between 2010 and 2023 shows a significant concentration in the Northeast and Southeast regions of the country. The Northeast region registered 12,877 cases, with emphasis on the states of Bahia (2,375) and Maranhão (5,107), where rural activities, hot weather and interaction with the natural environment favor contact with snakes. The Southeast region, in turn, had a total of 11,994 cases, led by Minas Gerais, which accounted for 8,325 cases. The predominance of this region can be explained by the vast territorial extension with a predominance of rural characteristics, where there is greater exposure to these reptiles (BRASIL, 2024; TOZETTI et al., 2013).

**Table 2**

*United States - Crotalus*

Region/State	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	Total
<b>North Region</b>	<b>183</b>	<b>194</b>	<b>179</b>	<b>199</b>	<b>155</b>	<b>188</b>	<b>192</b>	<b>211</b>	<b>257</b>	<b>259</b>	<b>297</b>	<b>259</b>	<b>217</b>	<b>205</b>	<b>2995</b>
RO	5	2	5	4	6	6	7	2	4	11	8	8	1	7	76
AC	1	3	-	-	4	3	5	3	3	2	1	5	-	1	31
AM	3	3	12	9	6	2	13	1	7	6	8	9	12	11	102
RR	14	34	48	38	24	28	33	62	99	53	60	59	53	43	648
PA	63	56	53	68	47	46	29	43	36	42	50	64	59	40	696
AP	3	5	5	6	5	13	12	5	8	15	7	3	5	4	96
l'm	94	91	56	74	63	90	93	95	100	130	163	111	87	99	1346
<b>Northeast Region</b>	<b>878</b>	<b>870</b>	<b>652</b>	<b>552</b>	<b>617</b>	<b>738</b>	<b>836</b>	<b>859</b>	<b>1119</b>	<b>1265</b>	<b>1351</b>	<b>1131</b>	<b>968</b>	<b>1041</b>	<b>12877</b>
MA	368	367	254	255	239	277	321	351	604	641	586	380	246	218	5107
PI	59	64	59	45	49	54	79	73	104	102	142	97	84	102	1113
EC	83	51	42	25	51	52	83	67	55	79	88	99	66	86	927
RN	40	18	27	22	16	35	40	31	40	48	50	65	33	41	506
PB	38	40	38	16	21	35	17	34	28	35	65	71	66	85	589
PE	85	120	61	68	91	98	113	120	126	148	149	129	176	177	1661
AL	25	16	12	21	23	32	35	37	25	40	56	58	45	39	464
IF	14	10	3	9	9	13	6	6	9	16	7	9	14	10	135
BA	166	184	156	91	118	142	142	140	128	156	208	223	238	283	2375
<b>Southeast Region</b>	<b>743</b>	<b>855</b>	<b>830</b>	<b>722</b>	<b>648</b>	<b>686</b>	<b>766</b>	<b>981</b>	<b>946</b>	<b>940</b>	<b>1040</b>	<b>907</b>	<b>992</b>	<b>938</b>	<b>11994</b>



MG	547	625	598	491	430	431	509	672	650	670	759	610	687	646	8325
ES	4	3	5	4	-	3	6	11	7	2	-	-	-	-	45
RJ	12	14	20	11	24	19	15	21	30	21	26	15	32	27	287
SP	180	213	207	216	194	233	236	277	259	247	255	282	273	265	3337
<b>South Region</b>	<b>116</b>	<b>116</b>	<b>124</b>	<b>99</b>	<b>111</b>	<b>94</b>	<b>113</b>	<b>121</b>	<b>144</b>	<b>118</b>	<b>133</b>	<b>101</b>	<b>97</b>	<b>163</b>	<b>1650</b>
PR	104	108	111	89	97	80	106	109	131	107	123	91	87	151	1494
SC	5	5	6	7	8	9	4	4	5	4	5	7	6	6	81
RS	7	3	7	3	6	5	3	8	8	7	5	3	4	6	75
<b>Midwest Region</b>	<b>463</b>	<b>458</b>	<b>381</b>	<b>250</b>	<b>259</b>	<b>269</b>	<b>270</b>	<b>349</b>	<b>281</b>	<b>348</b>	<b>311</b>	<b>337</b>	<b>289</b>	<b>299</b>	<b>4564</b>
MS	50	54	67	29	42	48	53	61	44	61	40	48	32	30	659
MT	108	79	88	54	65	56	51	53	55	71	50	47	63	79	919
GO	286	291	207	150	139	149	150	207	164	194	203	211	174	161	2686
DF	19	34	19	17	13	16	16	28	18	22	18	31	20	29	300
<b>Total</b>	<b>2383</b>	<b>2493</b>	<b>2166</b>	<b>1822</b>	<b>1790</b>	<b>1975</b>	<b>2177</b>	<b>2521</b>	<b>2747</b>	<b>2930</b>	<b>3132</b>	<b>2735</b>	<b>2563</b>	<b>2646</b>	<b>34080</b>

Source: Ministry of Health - SINAN (2024).

In the North region, which accounted for 2,995 cases, the state of Tocantins had the highest number of occurrences (1,346) followed by Roraima (648), where the presence of reptiles can be explained by the transition between biomes and forests. The Central-West region registered 4,564 cases, with Goiás being the state with the highest incidence (2,686), which may be related to high agricultural activity and the cerrado. In the south of the country, a region that accounted for 1,650 cases in total, the state of Paraná concentrated 1,494 of these occurrences, reflecting the areas of Atlantic Forest and local agricultural practices (BRASIL, 2024).

The analysis of the monthly data in which the cases occurred reveals a clear seasonality, with a higher incidence in the first months of the year. January, February and March concentrated 11,834 cases, representing 34% of the total. This increase in the first months of the year may be related to the warmer and more humid weather, coinciding with greater snake activity and greater circulation of people in agricultural areas (BRASIL, 2024; TOZETTI et al., 2013; ARAÚJO et al., 2023).

**Table 3***United States – Crotalus*

Accident month	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	Total
January	270	317	249	219	207	222	214	299	322	341	402	338	229	269	3898
February	288	244	242	187	187	197	272	287	286	321	393	312	305	278	3799
Landmark	266	308	305	196	201	219	237	308	312	325	349	320	362	329	4037
April	228	234	243	199	171	185	266	246	239	253	323	296	284	243	3410
May	205	250	177	179	156	150	176	210	224	286	272	212	220	242	2959
June	136	195	125	130	140	158	138	163	195	221	217	218	157	162	2355
July	148	142	112	100	104	125	107	129	172	167	192	148	128	153	1927
August	111	145	95	92	98	143	119	139	146	158	132	134	115	138	1765
September	122	131	115	88	115	144	102	127	159	174	155	162	154	143	1891
October	173	118	133	119	117	127	160	196	220	183	200	215	181	208	2350
November	201	186	178	153	145	150	184	201	206	213	204	184	204	237	2646
December	235	223	192	160	149	155	202	216	266	288	293	196	224	244	3043
<b>Total</b>	<b>2383</b>	<b>2493</b>	<b>2166</b>	<b>1822</b>	<b>1790</b>	<b>1975</b>	<b>2177</b>	<b>2521</b>	<b>2747</b>	<b>2930</b>	<b>3132</b>	<b>2735</b>	<b>2563</b>	<b>2646</b>	<b>34080</b>

Source: Ministry of Health - SINAN (2024).

The winter months, such as June (2,355 cases) and July (1,927 cases), had the lowest number of accidents, possibly due to less activity of both snakes and people in rural areas during this period. However, October and November showed a new increase in cases, possibly due to the resumption of agricultural activities and a greater presence of snakes after winter (BRASIL, 2024).

### 3.1 AGE GROUP

The distribution of accidents by age group reveals that most victims are in the 20 to 39 age group, with a total of 11,000 cases, followed by the 40 to 59 age group, which had 11,209 cases. These data indicate that young and middle-aged adults, particularly those engaged in agricultural activities and outdoor work, are more exposed to the risk of Crotalus bites (BRASIL, 2024; ARAÚJO et al., 2023).

**Table 4**

*United States – Crotalus*

Age group	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	Total
Blank/IGN	1	-	-	1	-	-	-	-	-	-	-	-	1	2	5
<1 Year	25	20	26	23	16	30	21	36	35	29	32	30	21	27	371
1 - 4 years	38	44	32	32	34	31	57	50	59	54	50	60	52	32	625
5 - 9 years	107	112	92	77	69	71	72	101	91	118	160	131	83	62	1346
10 - 14 Years	154	160	148	104	111	91	110	149	117	157	191	150	118	110	1870
15 - 19 years old	221	208	171	131	144	144	185	175	205	224	259	177	171	153	2568
20 - 39 years old	799	835	740	614	604	625	695	834	931	938	1001	829	766	789	11000
40 - 59 years old	747	804	693	589	563	663	736	820	919	966	984	903	857	965	11209
60 - 64 years old	117	130	86	80	90	117	108	158	154	173	186	165	193	206	1963
65 - 69 years old	94	74	79	82	64	100	92	91	106	124	111	119	131	127	1394
70 - 79 years old	65	86	85	67	77	69	81	80	100	130	126	138	130	141	1375
> 80 years	15	20	14	22	18	34	20	27	30	17	32	33	40	32	354
<b>Total</b>	<b>2383</b>	<b>2493</b>	<b>2166</b>	<b>1822</b>	<b>1790</b>	<b>1975</b>	<b>2177</b>	<b>2521</b>	<b>2747</b>	<b>2930</b>	<b>3132</b>	<b>2735</b>	<b>2563</b>	<b>2646</b>	<b>34080</b>

Source: Ministry of Health - SINAN (2024).

Children and adolescents aged 0 to 19 years add up to 6,780 cases, which corresponds to approximately 20% of the total. This age group requires special attention, since children are more vulnerable to the toxic effects of the poison due to their smaller body volume and greater difficulty in their physiological response to poisoning. On the other hand, the elderly, especially those over 60 years of age, accounted for 5,086 cases. This group is particularly susceptible to serious complications, including kidney failure and coagulopathies, due to the presence of comorbidities and physical frailty (BRASIL, 2024; DA SILVA et al., 2023).

### 3.2 GENDER

**Table 5***United States – Crotalus*

Accident year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	Total
Ignored	1	1	-	-	-	-	1	-	1	-	-	-	-	1	5
Male	1930	1972	1744	1449	1433	1575	1713	2007	2171	2335	2524	2140	2011	2071	27075
Female	452	520	422	373	357	400	463	514	575	595	608	595	552	574	7000
<b>Total</b>	<b>2383</b>	<b>2493</b>	<b>2166</b>	<b>1822</b>	<b>1790</b>	<b>1975</b>	<b>2177</b>	<b>2521</b>	<b>2747</b>	<b>2930</b>	<b>3132</b>	<b>2735</b>	<b>2563</b>	<b>2646</b>	<b>34080</b>

Source: Ministry of Health - SINAN (2024).

The data indicate that accidents involving *Crotalus* snakes predominantly affect males, with 27,075 cases, compared to 7,000 cases in females, between 2010 and 2023. This corresponds to a proportion of approximately 80% of cases occurring in men. This disparity can be explained by the greater presence of men in rural and risky activities, such as agriculture and livestock, which favor contact with snakes (BRASIL, 2024).

### 3.3 STING LOCATION

**Table 6***United States – Crotalus*

Sting Location	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	Total
Ign/Blank	41	51	30	25	32	35	36	36	34	39	52	66	46	37	560
Head	16	23	30	20	16	29	33	37	38	55	42	40	35	31	445
Arm	58	54	37	37	35	37	40	60	63	74	63	72	66	63	759
Forearm	36	41	45	32	30	29	38	46	50	47	56	46	43	37	576
Hand	282	265	266	228	263	256	317	324	397	374	354	365	356	391	4438
Finger of the hand	162	149	160	134	124	131	152	208	179	196	225	210	211	205	2446
Trunk	12	13	14	17	11	12	18	14	27	26	21	20	30	27	262
Thigh	15	21	23	12	20	26	20	28	21	17	32	34	30	33	332
Leg	736	750	644	563	526	588	586	662	784	793	877	758	727	758	9752
Foot	897	986	816	680	635	733	844	944	1029	1150	1241	988	897	934	12774
Toe	128	140	101	74	98	99	93	162	125	159	169	136	122	130	1736
<b>Total</b>	<b>2383</b>	<b>2493</b>	<b>2166</b>	<b>1822</b>	<b>1790</b>	<b>1975</b>	<b>2177</b>	<b>2521</b>	<b>2747</b>	<b>2930</b>	<b>3132</b>	<b>2735</b>	<b>2563</b>	<b>2646</b>	<b>34080</b>

Source: Ministry of Health - SINAN (2024).

The bite site is another important factor in the analysis of *Crotalus* accidents. Most bites occur in the lower limbs, mainly in the foot (12,774 cases) and leg (9,752 cases). This reflects the natural behavior of snakes, which attack when they feel threatened, especially when people walk through areas of dense vegetation or manipulate the soil, where snakes often hide. Bites on the upper limbs, including hands and fingers, add up to 6,884 cases, suggesting that many of these occurrences may happen during the inadvertent handling of snakes or in situations of direct attack (BRASIL, 2024).

#### 4 CONCLUSION

As the accidents occurred mainly in rural areas, in the hottest and humid months, affecting the upper and lower limbs of young and middle-aged adults, in agricultural and outdoor activities, the need for prevention campaigns is fundamental, reinforcing the need for the correct use of personal protective equipment for the most exposed population and awareness of the health teams regarding the characteristics of these accidents in order to provide adequate care, without delay, minimizing possible complications.

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