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Original Article
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Casuistry of xenarthrans treated at the Veterinary Hospital of the Federal University of Pará, Brazilian Amazon[1]

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ABSTRACT.- Almeida D.V.C., Matos P.C.M., Soares A.R.B., Lopes C.T.A. & Domingues S.F.S. 2023. **Casuistry of xenarthrans treated at the Veterinary Hospital of the Federal University of Pará, Brazilian Amazon**. *Pesquisa Veterinária Brasileira 43:e07058, 2023*. Instituto de Medicina Veterinária, Universidade Federal do Pará, Campus II, Rodovia BR-316 Km 62, Castanhal, PA 68743-970, Brazil. E-mail: deboramedvet22@gmail.com

The present study aimed to analyze the casuistry of xenarthrans treated at the veterinary hospital of the Federal University of Pará to quantify the most important cases for clinical care and identify the main species, sex, age group, origin, and destination of the animals admitted. The data were collected from January 2013 to August 2020. The variables analyzed were the number of animals by species, sex, age group, weight (kilograms), form of admission (rescue or guardianship), person responsible for the admission of the animal, origin, circumstances of admission, length of stay (days), and evolution or destination of the animal (release, captivity, death, euthanasia, or escape). Fisher's exact test was used to determine whether disease incidence was related to sex and whether animal mortality was influenced by sex and disease. The chi-square test was used to determine whether mortality differed by age group. Ninety-two (92) xenarthrans were included: 66 *Bradypus variegatus*, 10 *Choloepus didactylus*, 15 *Tamandua tetradactyla*, and one *Dasypus novemcinctus*. The animals were mainly from the municipality of Castanhal (70%) and were acquired through rescue (88%, *B. variegatus*; 80%, *C. didactylus*; 100%, *T. tetradactyla),* a significant proportion of which was per natural persons (88%, *B. variegatus*; 80%, *C. didactylus*; 100%, *T. tetradactyla*). The most important circumstances that led to the admission of the animals were as follows: animals for examination (42%, n=39), young animals at risk (9%, n=8), hit by a vehicle (8%, n=7), respiratory disease (7%, n=6), fall from a tree (5%, n=5), and electrotrauma (5%, n=5). Release was the most common destination of animals after hospitalization (59% *B. variegatus*, 50% *C. didactylus*, and 66% *T. tetradactyla*). The sex of the animals did not affect the incidence of disease or mortality in any species. In contrast, mortality of *B. variegatus* was significantly higher in animals admitted with disease (p=0.000). Mortality in cubs of this species was higher than that in juveniles and adults (p=0.003).

INDEX TERMS: Retrospective study, amazon region, wild fauna, xenarthrans, sloths, anteater, armadillo.

RESUMO.- [**Casuística de Xenarthras atendidos no Hospital Veterinário da Universidade Federal do Pará, Amazônia brasileira.**] O objetivo deste trabalho foi analisar a casuística dos Xenarthras atendidos no Hospital Veterinário da Universidade Federal do Pará (UFPA), a fim de quantificar as principais ocorrências para atendimento clínico, identificar as principais espécies, o sexo, a faixa etária, a procedência e destinação dos animais recebidos. Os dados foram obtidos entre janeiro de 2013 a agosto de 2020. As variáveis analisadas foram número de animais por espécie, sexo, faixa etária, peso (quilogramas), forma de recebimento (resgate, tutela), responsável pelo encaminhamento do animal ao hospital, procedência, circunstância de admissão, tempo de internação (dias) e evolução ou destinação do animal recebido (soltura, cativeiro, morte, eutanásia, fuga).

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O teste de Fisher foi utilizado para avaliar se a ocorrência de doenças estava relacionada ao sexo, bem como se a mortalidade animal foi influenciada pelo sexo e por enfermidades. O teste Qui-quadrado foi utilizado para avaliar se a mortalidade diferiu em relação à faixa etária. Um total de 92 animais Xenarthras foi admitido, composto por 66 *Bradypus variegatus*, 10 *Choloepus didactylus*, 15 *Tamandua tetradactyla* e um *Dasypus novemcinctus*. Os animais foram procedentes principalmente do município de Castanhal (70%), sendo o resgate a principal forma de aquisição dos animais (88%, *B. Variegatus*; 80%, *C. Didactylus*; 100%, *T. tetradactyla*), realizado em maior parte por pessoa física (88%, *B. Variegatus*; 80%, *C. Didactylus*; 100%, *T. tetradactyla*). O sexo dos animais não influenciou a ocorrência de doenças ou mortalidade em nenhuma espécie. Por outro lado, a mortalidade de *B. variegatus* foi significativamente maior naqueles animais admitidos com alguma enfermidade (p=0,000). A mortalidade em filhotes desta espécie foi maior quando comparada com as categorias jovem e adulta (p=0,003).

TERMOS DE INDEXAÇÃO: Estudo retrospectivo, região amazônica, fauna silvestre, Xenarthras, bichos-preguiça, tamanduá, tatu.

INTRODUCTION

The xenarthrans are mammals from the orders Cingulata and Pilosa, including armadillos, sloths, and anteaters (Medri et al. 2011, Miranda 2014). They consist of 38 species divided into six families: Dasypodidae and Chlamyphoridae with 22 armadillo species; Myrmecophagidae and Cyclopedidae with 10 anteater species; Bradypodidae with four species of three-toed sloths; and Megalonychidae with two species of two-toed sloths (Miranda et al. 2018, Schoch et al. 2020).

In terms of behavior, xenarthrans are solitary, meeting only briefly to mate, with parental care limited to the first few months of life (Miranda 2014). Depending on the species, they may be active during the day or night.

Armadillos and anteaters feed mainly on insects such as ants and termites. Conversely, sloths include folivores and omnivores species (Ruiz & Huarianga 2014, Superina et al. 2014, Oliger & Nicolai 2017).

Factors that have contributed to the decline of xenarthran populations include those related to anthropization, such as runovers, electrocution, and hunting for human consumption. These events have promoted the need for medical care for xenarthrans in veterinary clinics and hospitals (Lima et al. 2012, Costa 2014, Bernegossi et al. 2018, Carmo et al. 2019, Benarrós et al. 2020a).

In addition, some of the species involved in such events are included in the International Union for Conservation of Nature Red List of Threatened Species, such as the giant anteater (*Myrmecophaga tridactyla*) and collared sloth (*Bradypus torquatus*), which have been classified as vulnerable species (Chiarello & Moraes-Barros 2014, Miranda et al. 2014); thus drawing greater attention to the records of such incidents in these animal groups.

Therefore, the objective of this study was to analyze the casuistry of xenarthrans treated at the Veterinary Hospital of the "Universidade Federal do Pará" (UFPA); quantify the main occurrences of clinical care; identify the main species, sex, age group, origin, and destination of the animals admitted; and correlate sex, age group, morbidity, and mortality of the treated animals.

MATERIALS AND METHODS

The current study was approved by the animal ethics committee (CEUA/UFPA; protocol 9293261020). Data were collected from the medical records of xenarthrans treated at the wild animals' sector of the Veterinary Hospital (HV-SAS) of UFPA, located in the municipality of Castanhal, in the state of Pará (01O18'41.28" S; 47O56'50.04" W), where the regional climate, according to the Köppen climate classification, is tropical monsoon with an average annual temperature of 27°C (Alvares et al. 2013, Souza et al. 2019). The study was conducted from January 2013 to August 2020.

Each medical record was considered as a clinical consultation for case collection. The variables tabulated were the number of animals treated by species, sex, age group, body weight (kg), form of admission, person responsible for bringing each animal to the veterinary clinic, origin, circumstances of admission, length of stay (days), and the evolution or destination of the animal in terms of release, captivity, death, euthanasia, or escape.

The admitted animals were categorized as cubs, juveniles, or adults, as previously described for anteaters (Miranda 2014), armadillos (Superina et al. 2014), and sloths (Oliger & Nicolai 2017) to determine the age range. The admission form was cataloged as rescue, voluntary delivery, or guardianship, following the conceptual basis established in "Conselho Nacional do Meio Ambiente" Resolution 457 (CONAMA 2013). In addition, among the entities responsible for referring animals to veterinary hospitals, those defined in Federal Law 6.938/1981 were identified. These include the Brazilian Institute of Environment and Renewable Natural Resources, the Chico Mendes Institute for Biodiversity Conservation, sectoral entities such as the State Secretariat for Environment and Sustainability, and local entities such as the Municipal Environmental Secretariats. In addition, other public entities such as military firefighting groups, military police, municipal guards, and the Municipal Secretariat of Agriculture and Livestock were also recorded. Private legal entities and natural persons were also registered.

The location of the animals was indicated based on the municipality of origin in the state of Pará on a point map using a free and open-source geographic information system version 3.8.2. For animals from the municipality of Castanhal, where the HV-SAS website is located, the location of the animals was also indicated on the region's main roads, the city center, and the municipality's road network.

Circumstances of admission were recorded as clinically healthy animals visiting only for examination, young animals at risk, animals found alone or orphaned after the death of their mothers, and animals hit by a vehicle, fallen from trees, or traumatized by electrocution. In this context, animals that showed no changes after clinical evaluation were considered healthy and referred for release. In contrast, animals with injuries caused by trauma or clinical changes in the respiratory system were classified as sick. In many cases, the history or cause of the changes was not provided by the animal holder upon admission to the hospital, so they were included in the "other" category corresponding to other reasons for admission.

Finally, statistical analyses were performed separately for each Xenarthra species. Fisher's exact test was used to examine whether the frequency of disease occurrence differed between the sexes and whether there was a correlation between mortality and sex or between mortality and diseases diagnosed in the animals. Data were subjected to a chi-square test to determine whether mortality differed between age groups. All statistical analyses were performed using BioEstat 5.0, with a significance level of α=0.05.

RESULTS

Ninety-two xenarthrans were cared for at the HV-SAS during the evaluation period, including 66 (72%) three-toed sloths (*Bradypus variegatus*), 10 (11%) two-toed sloths (*Choloepus didactylus*), 15 (16%) anteaters (*Tamandua tetradactyla*), and one (1%) nine-banded armadillo (*Dasypus novemcinctus*). Figure 1 shows the number of species served annually. Males of *B. variegatus* were the most frequently cared species, accounting for 54% of all entries. In contrast, for *C. didactylus* and *T. tetradactyla*, 60% of the treated specimens were females. Adult animals were the most frequently brought to the hospital: 59% of *B. variegatus*, 60% of *C. didactylus*, and 86% of *T. tetradactyla*. Body weights (kg) by age group, sex, and species are listed in Table 1.

Rescue was the most common form of admission, with 88% for *B. variegatus*, 80% for *C. didactylus*, and 100% for *T. tetradactyla*, most of which were referrals from individuals (Table 1). Animals were mainly from the mesoregion of Belém and northeastern Pará, with the majority coming from the municipality of Castanhal (70%, n=64). The cases comprised 68% *B. variegatus* (n=45/66), 50% *C. didactylus* (n=5/10), 86.6% *T. tetradactyla* (n=13/15), and 100% *D. novemcinctus* (n=1).

Other occurrences were recorded in the municipalities of Santa Izabel (7%, n=6), Inhangapi (3%, n=3), São Miguel do Guamá (2%, n=2), Igarapé-Açu (2%, n=2), and Barcarena (2%, n=2). Only one xenarthran animal was found from each of the following municipalities: Benevides, Ananindeua, Belém, São Francisco do Pará, Curuçá, Santarém Novo, Capitão Poço, Marudá, Bragança, Tailândia, Novo Repartimento, Paragominas, and Santa Maria do Pará (14%, n=13).

Figure 2 shows maps of the state of Pará (A) and the municipalities from which the animals originated (B), including the municipality of Castanhal and its surroundings, highlighting the distribution associated with the main highways of the region (C) and the city center and road network of the city (D).

The most frequent reasons for seeking clinical care for animals were as follows: clinically healthy animals only for examination (42%, n=39), young animals at risk (9%, n=8), hit by a vehicle (8%, n=7), respiratory changes (7%, n=6), fall from trees (5%, n=5), shock due to electrical discharge (5%, n=5), and aggression from dogs (4%, n=4) and humans (4%, n=4). Less frequently, animals were admitted for other conditions, such as oral mucosal injuries, skin lesions, neurologic signs, claw fractures, hypoglycemia, and myiasis (15%, n=14).

The average length of hospital stay varied depending on the type and cause of admission. Specimens of *B. variegatus* were destined for release (59% of animals), *C. didactylus* (50% of animals), and *T. tetradactyla* (66% of animals) (Table 1). Only one animal of the species *D. novemcinctus* was treated at HV-SAS: a female juvenile with a body weight of 0.6 kg and respiratory alterations rescued by the military firefighters' group in 2014. The animal was treated for eight days, but its clinical presentation resulted in death.

Statistical analyses revealed no significant differences in the number of clinical visits or mortality between males and females (Table 2). In contrast, the mortality of *B. variegatus* was significantly higher in the diseased animals (p=0.000). This difference was not observed in other species, as most animals did not die. In *B. variegatus*, mortality was significantly higher in cubs than in juveniles and adults (p=0.003).

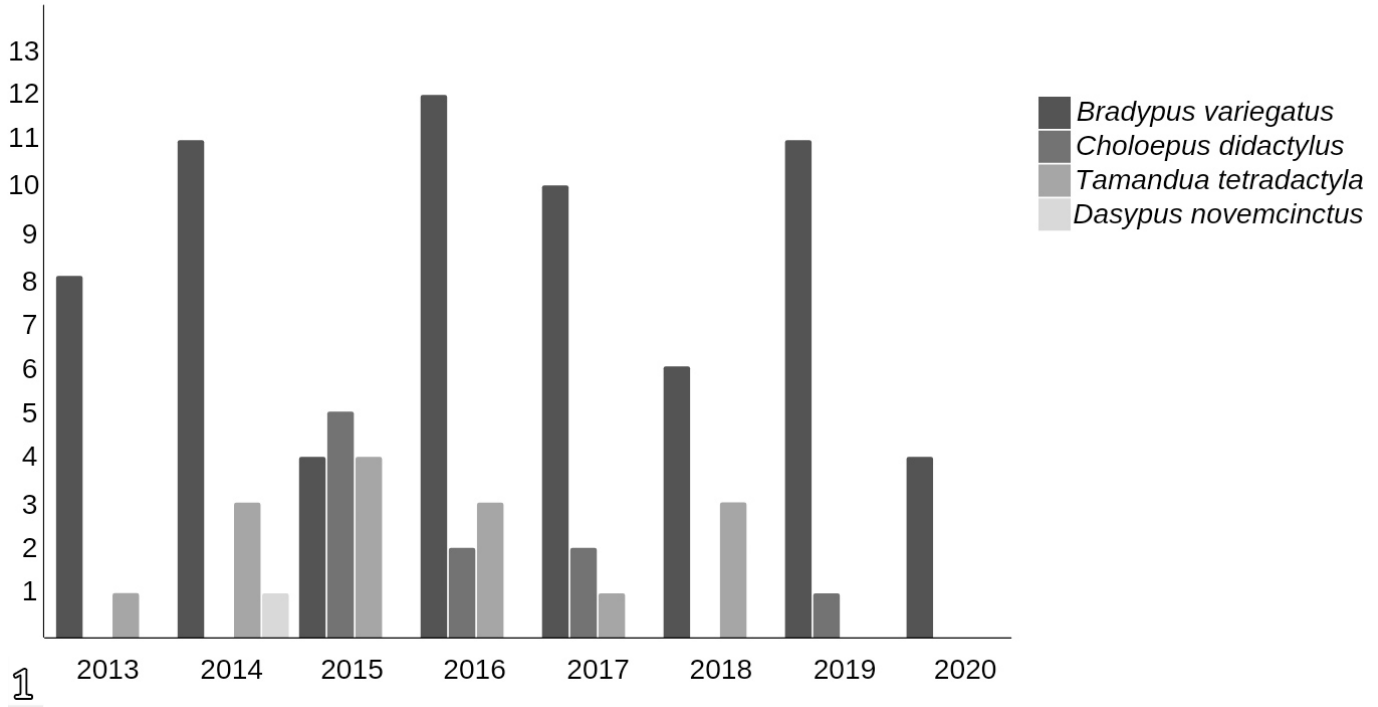

Fig.1. Species of the superorder Xenarthra admitted from January 2013 to August 2020 in UFPA HV-SAS.

Table 1. Specific data by the individual, recording and clinical variables, and development/destination of *Bradypus variegatus*, *Choloepus didactylus*, and *Tamandua tetradactyla*

Variable	Species of Xenarthra					
	Bradypus variegatus		*Choloepus didactylus*		*Tamandua tetradactyla*	
Sex						
Male	54% (36/66)		30% (3/10)		13% (2/15)	
Female	41% (27/66)		60% (6/10)		60% (9/15)	
Not identified	5% (3/66)		10% (1/10)		27% (4/15)	
Age range						
Cubs	18% (12/66)		40% (4/10)		7% (1/15)	
Juveniles	23% (15/66)		-		7% (1/15)	
Adults	59% (39/66)		60% (6/10)		86% (13/15)	
Average weight (Kg ± Standard deviation)						
	Males	Females	Males	Females	Males	Females
Cubs	0.654 (±0.38)	0.484 (±0.21)	0.545	1.353 (±0.06)	-	1.77
Juveniles	1.888 (±0.36)	1.642 (±0.43)	-	-	-	3.20
Adults	2.939 (±0.33)	2.959 (±0.59)	6.9 (±1.5)	6.177 (±0.93)	4.48 (±0.73)	3.79 (±0.67)
Form of admission						
Rescue	88% (58/66)		80% (8/10)		100% (15/15)	
Voluntary delivery	3% (2/66)		20% (2/10)		-	
Guardianship	3% (2/66)		-		-	
Uninformed	6% (4/66)		-		-	
Entities responsible for referring animals to the Veterinary Hospital						
Public entity Sisnama	15% (10/66)		40% (4/10)		-	
Other public entity	38% (25/66)		10% (1/10)		40% (6/15)	
Private legal entities	3% (2/66)		-		7% (1/15)	
Natural persons	44% (29/66)		50% (5/10)		53% (8/15)	
Circumstances of admission						
Healthy animals	45% (30/66)		20% (2/10)		46% (7/15)	
vulnerable puppies	9% (6/66)		20% (2/10)-		-	
Hit by a vehicle	11% (7/66)		-		-	
Respiratory changes	6% (4/66)		-		7% (1/15)	
Fallen from trees	8% (5/66)		-		-	
Electrical trauma	4% (3/66)		10% (1/10)		7% (1/15)	
Aggression from dogs	3% (2/66)		-		13% (2/15)	
Human aggression	3% (2/66)		20% (2/10)		-	
Others	11% (7/66)		30% (3/10)		27% (4/15)	
Average length of hospital stay in days (± standard deviation); (minimum-maximum)						
Healthy animals	3.79 (±5.56); (1-27)		66.5 (±89.8); (3 – 130)		2.85 (±1.34); (1-5)	
Vulnerable puppies	89.67 (±76.38); (16-208)		90 (±57.98); (49 – 131)		-	
Hit by a vehicle	45.86 (±58.9); (1-142)		-		-	
Respiratory changes	6 (±6.38); (1-15)		-		5	
Fallen from trees	12.8 (±5.97); (5-18)		-		-	
Electrical trauma	11.66 (±14.36); (1-28)		150		270	
Aggression from dogs	203.5 (±17.68); (191-216)		-		2 (±1.41); (1-3)	
Human aggression	98 (±123.04); (11-185)		240.5 (±317.49); (16-465)		-	
Others	25.14 (±25.1); (1-67)		88.33 (±103.73); (1-203)		19.75 (±18.54); (2-45)	
Evolution/destination of the animal						
Release	59% (39/66)		50% (5/10)		66% (10/15)	
Captivity	1.5% (1/66)		10% (1/10)		-	
Death	38% (25/66)		40% (4/10)		20% (3/15)	
Euthanasia	1.5% (1/66)		-		-	
Escape	-		-		7% (1/15)	
Medical release	-		-		7% (1/15)	

Animals brought by caregivers were medically released.

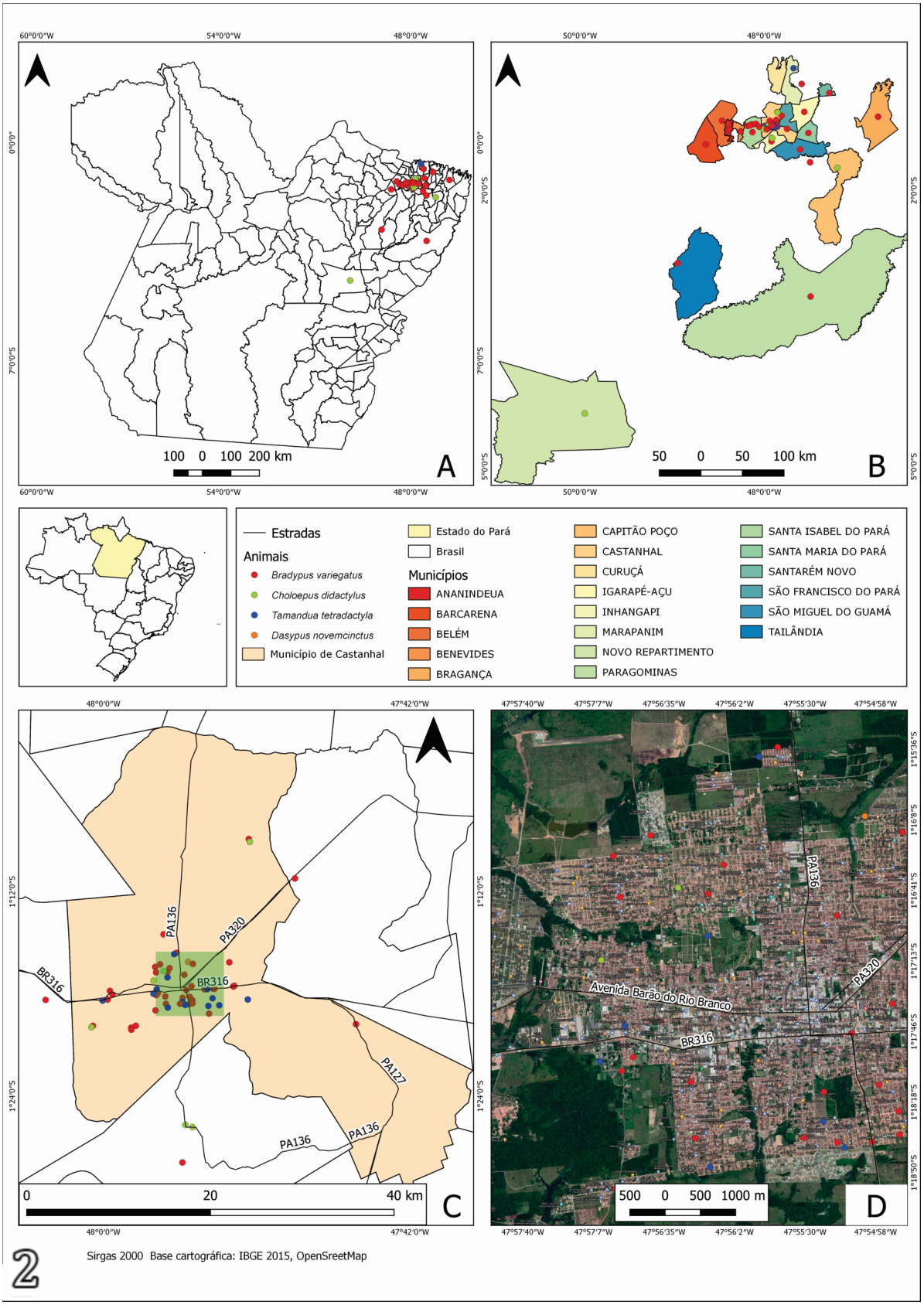

Fig.2. Origin of animals of the superorder Xenarthra treated in UFPA HV-SAS from January 2013 to August 2020 in the state of Pará (A), in the municipality in the metropolitan region, northeast and southeast of Pará (B), in the municipality of Castanhal and surroundings, considering the relationship with the main highways of the area (C), and in the municipality of Castanhal, considering the city center and the road network of the city (D).

Table 2. The incidence of diseases and mortality in the species studied in the current study, followed by the statistical analysis results (significance level α=0.05)

Variable	*Bradypus variegatus*	*p*	*Choloepus didactylus*	*p*	*Tamandua tetradactyla*	*p*
Occurrence of diseases according to sex*						
Male	47% (17/36)	1.000	100% (3/3)	0.464	100% (2/2)	0.491
Female	44% (12/27)		50% (3/6)		55% (5/9)	
Mortality according to sex *						
Male	44%(16/36)	0.298	66% (2/3)	0.523	100% (2/2)	0.109
Female	30% (8/27)		33% (2/6)		22% (2/9)	
Mortality according to the presence or absence of diseases						
Healthy	14% (5/36)	0.000	25% (1/4)	0.571	0% (0/7)	0.200
Sick	70% (21/30)		50% (3/6)		37% (3/8)	
Mortality according to age group						
Cubs	83% (10/12)	0.003	NA**		NA	
Juveniles	27% (4/15)		NA	-	NA	-
Adults	31% (12/39)		NA		NA	

* Sexes of three *B. variegatus* and one *C. didactylus* were not identified; therefore, the sum of males and females was less than the total number of animals,
** NA = not evaluated.

DISCUSSION

Data on the origin, referral, and admission of mammals of the superorder Xenarthra referred for care to a veterinary hospital in the Brazilian Amazon were evaluated. Previously, a case study was conducted at the National University of Colombia on young sloths with diseases mainly acquired in captivity, with a small number of visits (n=12) (Riaño et al. 2016). In contrast, the present study included four species of Xenarthra, with many specimens evaluated, except for the nine-banded armadillo, which was rescued.

Although the animals treated at the HV-SAS/UFPA are not at risk of extinction, and their species are classified as Least Concern (Aguiar & Fonseca 2008, ICMBio 2018), the clinical care of the Xenarthra superorder in the Brazilian Amazon reflects the destruction of their habitat caused by urbanization and the consequent deforestation, fragmentation, and road construction. A previous study reported that hunting and trampling have contributed to the decrease in this population (Miranda 2014).

The greater number of visits to common sloths (*Bradypus variegatus*), when compared to other species, may be associated with the geographical distribution of these animals as well as with biological and behavioral factors. This species is widely distributed throughout Brazil and is found mainly in the Amazon and Atlantic Forests (Paglia et al. 2012) and in various plant strata and degraded areas (Costa 2014). In addition, they are diurnal animals (Lima et al. 2018), which makes them more visible in anthropogenic environments because they have low metabolism and move slowly across the ground, making them vulnerable to predation, being run over, or captured in nature; however, their slow movement also increases their chances of being rescued in risk situations (Pauli et al. 2016). In contrast, sloths (*Choloepus didactylus*) have a relatively restricted distribution in northern Brazil (Trinca et al. 2006) and are camouflaged in tree canopies (Costa 2014). Further, these animals are nocturnal, similar to *Tamandua tetradactyla* and *Dasypus novemcinctus* (Miranda 2014), which may have contributed to the lower records of these species.

Miranda (2014) added that Xenarthrae are solitary, making them more vulnerable to attacks by other animals (Smith 2007), unlike those living in packs, where they protect themselves from different threats. Another aspect is that adults, the most attended age group of the studied species, travel in search of sexual partners or because of pressure from environmental fragmentation (Silva et al. 2017). In contrast, the offspring under maternal care and juveniles are poorly visualized, as they have a more limited displacement (Silva et al. 2017, Laino et al. 2020). Adults are also hunted for meat consumption, a practice already registered in the state of Pará (Baía Júnior et al. 2010, Cajaiba et al. 2015).

Regarding the more frequent attendance of animals from the Metropolitan Mesoregions of Belém and Northeast of Pará, the possible reasons are the interurban connections and their proximity to the municipality of Castanhal, the headquarters of the veterinary hospitals, which provides services similar to those of an average Amazonian city. (Trindade Júnior 2011). Therefore, the high occurrence of *B. variegatus* and *T. tetradactyla* in this city may be associated with the accelerated and disorderly urbanization process over the last 30 years (Souza et al. 2017), in which there has been habitat fragmentation of these animals, with the consequent invasion of secondary vegetation (Miranda 2014).

In this context, as most of these animals are susceptible to anthropogenic activities, the individuals who circulate in environments are prone to accidents and face risks, such as accidents while crossing roads, the presence of hunters, trees close to electrical wiring (Oliger & Nicolai 2017), and rescue or capture, which may justify the findings of this study. This scenario may also have contributed to capturing clinically healthy animals, a category with the highest number of admissions, as commonly observed for *B. variegatus* and *T. tetradactyla*. The lack of knowledge in individuals about the ecological relationship between the animal and its habitat possibly led them to capture specimens in unnecessary situations, for example, when they could simply ensure the safe crossing of animals in a fragmented habitat.

The second major cause of Xenarthra care recorded in this study was sloths in vulnerable situations. A retrospective study conducted at the Sanctuary of the Sloths in Costa Rica indicated that 29.1% (211/725) of the admitted animals were orphaned sloth pups (Oliger & Nicolai 2017). Although those responsible for delivery did not report their histories at the time of admission, the possibility of the occurrence of other factors that would lead them to be found alone or separated from their mothers, such as a fallen calf from a tree or predatory hunting by the mother, respectively, must be considered.

Among sloths with alterations, injuries from runovers or falls from a tree were the most common causes of admission to HV-SAS. In addition, although these animals are arboreal, they may eventually descend to the ground (Miranda 2014), and their slow mobility makes them vulnerable to being run over by vehicles (Glista et al. 2009, Sássi et al. 2013, Oliger & Nicolai 2017), which may explain the detections mainly in the municipality of Castanhal, where most animals were found near or along highways.

In a retrospective study of pedestrian roadkill in xenarthrans, the authors reported that the Center for Medicine and Research in Wild Animals (CEMPAS) in the state of São Paulo provided clinical care to 46 wild anteaters (*T. tetradactyla*), in which 36.96% (17/46) were admitted due to roadkill, with incidents mainly related to the SP-300 highway (Bernegossi et al. 2018). A recent study also found that runover trauma was the most common reason for admission, accounting for 31% (44/141) of the injury cases of free-ranging anteaters and armadillos (Torres 2019). Wildlife car crashes on highways, which are frequently reported (Sássi et al. 2013, Ramos-Abrantes et al. 2018, Castro et al. 2020), are mainly related to the construction of these roads and the resulting habitat fragmentation, which affects natural displacement in the search for food, refuge, or sexual partners.

Electrical trauma is also common for the admission of arboreal species such as sloths and anteaters. Arboreal species in urban areas are highly susceptible to electrical trauma because they spend most of their time in the canopy and, in some cases, climb poles or move along power distribution lines near their habitats (Lima et al. 2012, Kumar & Kumar 2015, Carmo et al. 2019). The electrocution case in *T. tetradactyla* discussed in this casuistry was reported by Gering et al. (2017) and is the first report of this type of accident in this species. The case occurred at night when the animal was startled by a flashlight and climbed a pole, where it came into contact with the power grid. Although lesser anteaters live mainly in trees, they also use the ground for rest and food (Rodrigues & Marinho-Filho 2003), which may make this species less vulnerable to electrocution accidents.

Among the animals treated at the Veterinary Hospital, the species *C. didactylus* and *T. tetradactyla* were the only ones successfully treated after electrical trauma. In contrast, all animals of the species *B. variegatus* died. In these cases, the intensity of the shock, the resistance of the tissue, and the course of the current are some of the factors related to the severity of the injury (Magarão et al. 2011), and the currents that pass through the heart carry a higher risk of mortality. Another factor that may have influenced the mortality in these animals was the delay in emergency care, which is essential for stabilizing and improving the prognosis of animals who underwent electrocution (Gering et al. 2017).

Other causes of admission for anteaters include aggression from dogs and tegumentary lesions in the tail, limbs, and claws. These animals were found in anthropogenic and peridomestic areas; therefore, they were more vulnerable to attacks by dogs. Although the causes of the tegumentary injuries are unknown, it is reasonable to speculate that the trauma occurred when unskilled individuals captured the animals. Dog aggression is among the greatest threats to anteaters (Rojano 2014). A study conducted by CEMPAS in São Paulo found that dogs attacked 21.74% (10/46) of the treated animals, the second most common cause of admission.

The average length of stay of animals admitted for treatment varied according to the reason for admission, animal type, and disease course. The current study demonstrates the success of the conjunct action of the Veterinary Hospital team and environmental authorities in terms of management and monitoring of the release, especially for animals admitted as clinically healthy, with a shorter average hospitalization time. Knowledge of the animal's area of origin, the presence of food and shelter, and the speedy triggering of environmental entities was crucial for the immediate release of rescued animals, as provided in the normative instruction for ecological protection (ICMBio 2014).

The average hospitalization times for *B. variegatus* and *C. didactylus* cubs were similar at approximately 90 days. Most juveniles that remained in captivity to grow for subsequent release developed gastric (such as compaction and tympanism) or respiratory (such as aspiration pneumonia) diseases and eventually died.

However, in recent years, there have been advances in the management protocol for artificially raising these animals for a period of up to six months, in which a progressive increase in body mass has been observed through the establishment of a diet, the frequency of feeding, and a weaning protocol for these species (Benarrós et al. 2020b). In animals admitted with electrical trauma, the hospitalization time was shorter in three-toed sloths owing to the severity of the injuries and the difficulty of handling them in captivity, quickly bringing them close to death. In contrast, the hospitalization time was longer for the two-toed sloths and lesser anteaters because treating and fully recovering the animals to a healthy state took longer.

A high mortality rate occurred in individuals of *B. variegatus* who were hospitalized with some disease. Caring for these hospitalized animals in captivity appears difficult, as they are highly susceptible to adaptive stress, resulting in immunological depression (Lima et al. 2012). In addition, the main limiting factors are mimicking the natural environment that provides the necessary conditions for thermoregulation of the species (Miranda 2014) and diet adequacy (Diniz & Oliveira 1999, Superina et al. 2008). Most importantly, the dietary requirements of this species in the wild include the consumption of algae (rich in carbohydrates, lipids, and proteins) that grow on the fur of the animal, which is coordinated by a mutualistic relationship between sloths, moths, and algae (Pauli et al. 2014).

The high mortality rate of sick *B. variegatus* cubs reared in this study is similar to that in previous studies (Mckenzie et al. 2005, Oliger & Nicolai 2017). Cub handling is generally complex and requires special care, such as controlling humidity, temperature, and feeding, especially during feed changes

(transition from liquid to paste feed) or even over the amount ingested to avoid aspiration, which can occur with excessive feeding. (Oliger & Nicolai 2017). The results showed that animal recovery was more difficult when hospitalization was associated with complications, such as trauma due to a fall, fracture, or pneumonia, as the cubs died despite intensive care.

CONCLUSIONS

The data presented in the present study show the profile and process of care of xenarthran animals at a veterinary hospital in the Brazilian Amazon.

During the study period, admissions were of *Bradypus variegatus*, followed by *Tamandua tetradactyla* and *Choloepus didactylus*, mainly adults, under rescue conditions, which, in most cases, were performed by natural persons. Most cases occurred in the municipality of Castanhal.

The mortality rate of *B. variegatus* was significantly higher in animals with certain diseases. The mortality rate of the cubs of this species was higher than that of juveniles and adults.

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