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Casuistry of primates in a veterinary center in Paraguay: retrospective report 2004-2025

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Non-human primates play a fundamental role in tropical ecosystems, contributing to key ecological processes such as seed dispersal and the maintenance of community structure, while also holding significant evolutionary, cultural, and social value. Despite their importance, illegal trafficking of primates is rife. In Paraguay, five native primate species are recognized, several of which are affected by illegal trade and inadequate captive management. This study reports the species and main clinical findings of non-human primates transferred to the Departamento de Recursos Faunísticos y Medio Natural of the Facultad de Ciencias Veterinarias, Universidad Nacional de Asunción, between 2004 and 2025. Data were obtained from individual medical records, considering only primary diagnoses, and included information on taxonomy, origin, diet, and clinical condition of individuals. A total of 292 primates of seven genera were registered, with *Sapajus cay* being the most frequent species (50%), followed by *Alouatta caraya* (31.8%) and *Aotus azarae* (10.6%). Across all species, the most common reasons for consultation were routine check-ups, trauma, digestive disorders, infectious diseases, and respiratory conditions. Trauma and tetanus were recurrent findings, highlighting the impact of poor management and exposure to anthropogenic risks. In more than 88% of cases, diets were classified as incomplete or inappropriate, typically characterized by excessive sweet fruits, processed foods, and a lack of fiber, contrasting sharply with species-specific nutritional requirements. Information on animal origin was frequently missing, although available data indicated widespread national and transboundary illegal trafficking. The results emphasize the consequences of illegal possession and inadequate captive conditions on primate health and welfare, as well as the associated risks to conservation and public health due to zoonotic and anthropozoonotic diseases. Strengthening wildlife law enforcement, improving public awareness, and developing standardized protocols for rescue and rehabilitation are urgently needed in Paraguay.

Keywords: Anthropozoonosis, illegal wildlife traffic, Paraguay, primates, zoonosis.

Los primates no humanos desempeñan un papel fundamental en los ecosistemas tropicales, ya que contribuyen a procesos ecológicos clave, como la dispersión de semillas y el mantenimiento de la estructura de las comunidades, al tiempo que tienen un importante valor evolutivo, cultural y social. A pesar de su importancia, el tráfico ilegal de primates es muy frecuente. En Paraguay se reconocen cinco especies de primates nativos, varias de las cuales se ven afectadas por el comercio ilegal y la gestión inadecuada en cautividad. Este estudio informa sobre la composición de las especies y los principales hallazgos clínicos de los primates no humanos trasladados al Departamento de Recursos Faunísticos y Medio Natural de la Facultad de Ciencias Veterinarias de la Universidad Nacional de Asunción entre 2004 y 2025. Los datos se obtuvieron de los expedientes médicos individuales, teniendo en cuenta únicamente los diagnósticos primarios, e incluyeron información sobre taxonomía, origen, dieta y estado clínico. Se registraron un total de 292 primates, siendo *Sapajus cay* la especie más frecuente (50 %), seguida de *Alouatta caraya* (31,8 %) y *Aotus azarae* (10,6 %). En todas las especies, los motivos más comunes de consulta fueron revisiones rutinarias, traumatismos, trastornos digestivos, enfermedades infecciosas y afecciones respiratorias. Los traumatismos y el tétanos fueron hallazgos recurrentes, lo que pone de relieve el impacto de la mala gestión y la exposición a riesgos antropogénicos. En más del 88 % de los casos, las dietas se clasificaron como incompletas o inadecuadas, caracterizadas típicamente por un exceso de frutas dulces, alimentos procesados y una falta de fibra, lo que contrasta fuertemente con los requisitos nutricionales específicos de cada especie. A menudo faltaba información sobre el origen de los animales, aunque los datos disponibles indicaban un tráfico ilegal generalizado a nivel nacional y transfronterizo. Los resultados ponen de relieve las consecuencias de la posesión ilegal y las condiciones inadecuadas de cautiverio para la salud y el bienestar de los primates, así como los riesgos asociados para la conservación y la salud pública debido a las enfermedades zoonóticas y antropozoonóticas. En Paraguay es urgente reforzar la aplicación de la legislación sobre fauna silvestre, mejorar la sensibilización del público y elaborar protocolos normalizados para el rescate y la rehabilitación.

Palabras clave: antropozoonosis, Paraguay, primates, tráfico ilegal de fauna, zoonosis.

Non-human primates (hereafter primates) are vitally important to tropical biodiversity and to many ecosystem functions, processes, and services, such as seed dispersal and the maintenance of community structures (Estrada *et al.* 2017; Fergnani *et al.* 2020). They are our closest living biological relatives, provide us with fundamental information about human evolution, and play an important role in the livelihoods, cultures, and religions of many societies. Paradoxically, unsustainable human activities are now the main force threatening primate populations (Estrada *et al.* 2017).

Primates face an imminent extinction crisis, with around 93% of species characterized by declining

populations and 65% of species classified as Vulnerable, Endangered, or Critically Endangered (Estrada and Garber 2022). Population declines in approximately 75% of species are associated with deforestation and habitat loss resulting from agricultural expansion, livestock farming, and natural resource extraction. Other pressures that negatively affect primate populations include unsustainable hunting of wild animals, the illegal pet trade, expansion of road networks, transmission of zoonotic diseases, and climate change (Estrada *et al.* 2020).

There are five species of primates recorded in Paraguay: *Alouatta caraya* (Atelidae), *Aotus azarae* (Aotidae), *Mico melanurus* (Callithrichidae), *Sapajus cay* (Cebidae), and *Plecturocebus pallescens* (Pitheciidae). Two species (*A. azarae* and *P. pallescens*) have been classified as Least Concern (LC), while *A. caraya* and *M. melanurus* are classified as Near Threatened (NT), and *S. cay* is classified as Vulnerable (Vu) (Bicca-Marques *et al.* 2021; Milagres *et al.* 2021; Rímoli *et al.* 2021; Rumiz *et al.* 2021; Rímoli *et al.* 2022). On a national level, *S. cay*, *A. caraya* and *A. azarae* are classified as LC, although it has been suggested that *S. cay* be upgraded to Vulnerable (Cartes *et al.* 2017; Smith and Lusseau 2024). On the other hand, *M. melanurus* was categorized as Vulnerable due to habitat loss from land conversion and fragmentation of remaining forests, and probable hunting for the pet trade is mentioned (Cartes *et al.* 2017). In contrast, *P. pallescens* is categorized as Near Threatened (NT) due to the severe deforestation process affecting the Paraguayan Chaco (Cartes *et al.* 2017).

In South America, illegal primate trafficking is a major factor in the decline of native primate populations, but the absence of clear legal frameworks, insufficient financial and human resources allocated to controlling and combating trafficking, and the lack of established protocols for the rescue, rehabilitation, and reintroduction of animals hinder any effort to eliminate established trafficking schemes (Estrada-Cely and González 2008; Tirira 2013; Shanee *et al.* 2017; Shanee *et al.* 2023). Paraguay has been a member of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) since 1976, and the Law 96/92 "On Wildlife" prohibits the trade of wild animals that do not come from legally authorized breeding facilities. As such, there is currently no legal way to obtain a primate for domestic ownership in the country.

The objective of this study is to report on the main clinical findings of the primate species transferred to the Departamento de Recursos Faunísticos y Medio Natural of the Facultad de Ciencias Veterinarias, Universidad Nacional de Asunción, in the city of San Lorenzo, over a twenty-year period (2004-2025).

Materials and methods

The data were obtained from the individual medical records of primates stored in the Departamento de Recursos Faunísticos y Medio Natural of the Facultad de Ciencias Veterinarias (FCV), Universidad Nacional de Asunción (UNA) from 2004 to 2025. All medical records are annual, and in most years the department was closed during the month of January. For all medical records, only the primary diagnosis was considered.

From each medical record we obtained the date of consultation, annual individual medical record number, taxon, weight in grams (if recorded), sex (if recorded), age as recorded (if recorded), origin (if recorded), time with current owner, description of the diet offered by current owner, diagnosis, and subclassification of the diagnosis (e.g., trauma, caused by a vehicle or by another animal). All the data were obtained as registered in the medical records. The diagnosis of the primate upon arrival was established based on the available information and classified into the following categories: routine check-up, dermatological, digestive, unspecified (when a definitive diagnosis could not be reached), poisoning, management (e.g., problems caused by inappropriate housing or husbandry), neoplasia, nutritional (e.g., metabolic bone disease or diabetes), reproductive, respiratory, trauma, infectious, or undefined (when left blank).

As for the food provided, given that the food offered to different animals varied greatly, diets were classified as "incomplete or inadequate" or "adequate," based on the species' known feeding ecology.

To analyze the data, measures of central tendency and dispersion were calculated for quantitative data, and absolute frequency and relative frequency (as percentages) were analyzed for qualitative data.

Results

Between 2004 and 2025, 292 primates were registered in the Departamento de Recursos Faunísticos y Medio Natural, FCV-UNA. The number of individuals per taxon is shown in Table 1.

The most common species was Azara's capuchin monkey (*Sapajus cay*), recorded in 146 clinical records (50% of the total). Of these, 78 were male, 41 were female, and 28 records did not specify sex. Weight was recorded in 107 records, with an average weight of 1350.8 ± 906.6 grams. Age was not recorded uniformly: in 114 records, age was reported numerically, with an average age of 44.3 months;

Table 1. The number of individuals per primate species registered in clinical files.

Taxon	Number
Sapajus cay	146
Alouatta caraya	93
Aotus azarae	31
Callithrix jacchus	8
Callithrix spp.	4
Plecturocebus pallescens	4
Saimiri spp.	3
Saguinus fuscicollis	1
No Data	2
Total	**292**

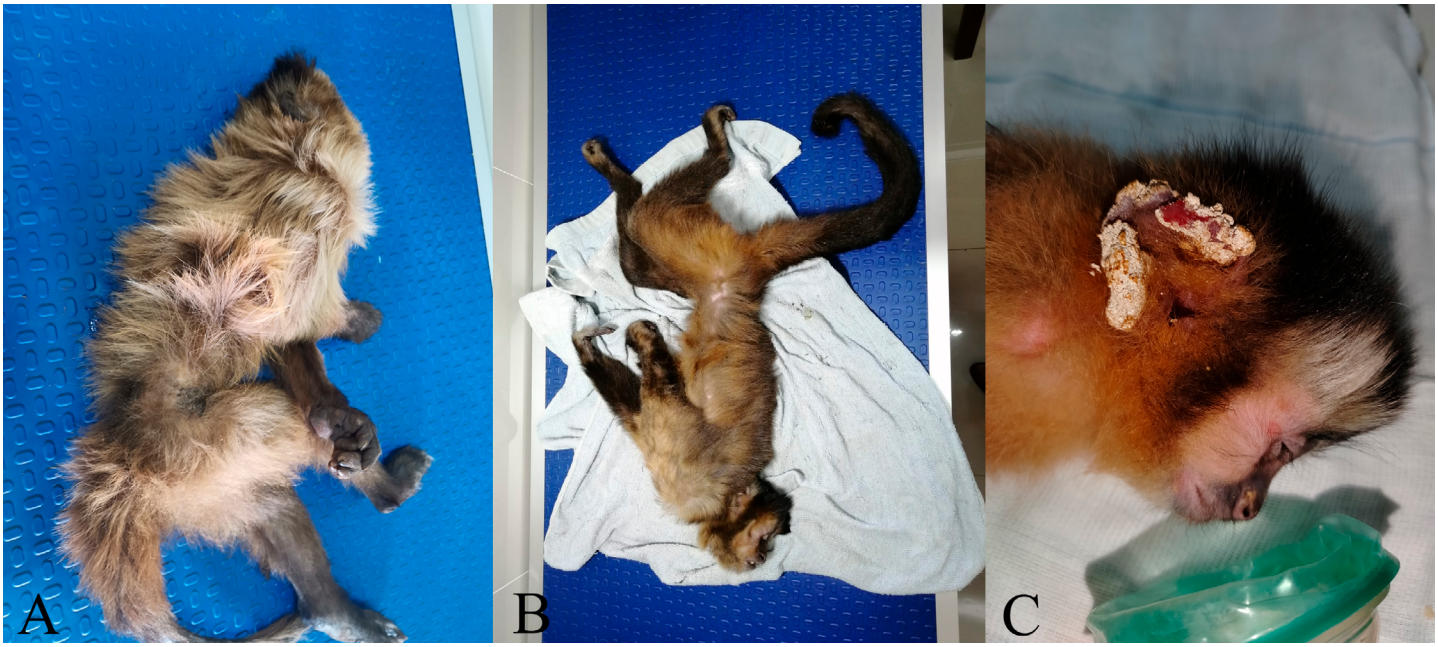

Figure 1. Individuals of *Sapajus cay* affected by electrocution (A), tetanus (B), and dermatologic affection (C).

Table 2. Most frequent causes of consultation for the main species transferred to the FCV-UNA from 2004 – 2025.

	***S. cay* (n=146)**	***A. caraya* (n=93)**	***A. azarae* (n=31)**
Routine check-up	37 (25.3%)	21 (22%)	6 (19.4%)
Dermatological	16 (11%)	6 (6.5%)	0
Digestive	13 (8.9%)	28 (30.1%)	1 (3.2%)
Respiratory	13 (8.9%)	5 (5.4%)	9 (29%)
Trauma	25 (17.1%)	17 (18.3%)	7 (22.6%)
Infectious	19 (13%)	3 (3.2%)	4 (12.9%)
Undefined	18 (12.3%)	6 (6.5%)	2 (6.5%)

some records reported age by standard classifications, where 12 were recorded as "juvenile" and 10 as "adult"; and in 10 records, age was not recorded. The main reason for consultation was routine check-up (25.3%, n=37), followed by trauma (17.1%, n=25) (Table 2). Trauma was sub-classified according to cause, with four cases due to electricity (Figure 1A), four due to dog attacks, three due to human attacks, two due to burns, and 12 cases with no established cause. Infectious processes accounted for 13% (n=19) of the records, with 16 cases of tetanus (Figure 1B), one case of *Mycobacterium tuberculosis* infection, and two unspecified infections. Finally, 16 cases (11%) of various dermatological conditions (ectoparasites, abscesses, and mycosis) (Figure 1C), 13 cases (8.9%) of digestive disorders (mainly undefined gastroenteritis), and 13 (8.9%) cases of undefined respiratory disorders were reported.

The diet offered to capuchin individuals varied greatly between patients. In 89.7% (n=131) of cases, the capuchin monkeys were provided with an incomplete or inappropriate diet, consisting of an excess of sweet fruits, sweets, cold cuts and sausages, soft drinks, coffee and caffeinated beverages, dairy products, and/or fried foods. Only in four cases was a diet reported that could be considered appropriate for the species. In three files, only "varied diet" is reported, and in eight files, the diet was not described.

Eighty-six (58.9%) records did not include information on the origin of the individuals. However, six records mentioned "Chaco", nine cases reported municipal markets (mainly Mercado N°4 in Asunción), and 45 records reported 35 different cities in the Oriental Region of Paraguay as the origin.

The second most common species recorded was the black-and-gold howler monkey (*Alouatta caraya*), recorded for 93 clinical records (31.8% of total records). Of these, 39 were male, 39 female, and 15 records did not specify sex. Weight was recorded in 78 records, with a mean weight of 2,182.9 ± 210.8 grams. Age was recorded numerically in 77 records, with a mean of 18.8 ± 31.2 months. Other records reported the age by standard classifications, where five were recorded as "juvenile," six as "adult," and in five records, the age was not recorded. The main reason for consultation was digestive disorders, reported for 28 records (30.1%), with six cases of parasitic gastroenteritis, three cases of bacterial gastroenteritis, nine cases of undefined gastroenteritis, one case of stomatitis, one case of hemorrhoids, and eight undefined cases. Routine check-ups were recorded in 21 files (22%). This was followed by trauma in 17 files (18.3%), mainly due to undefined causes (10/17) and electricity (3/17), dermatological conditions in six files, respiratory conditions in five files, three cases of tetanus, and six files without diagnosis (Table 2).

Eighty-two records (88.2%) described a diet that was incomplete or inadequate for the species, mainly due to an excess of sweet fruits, lean meat, pasta, white rice, dairy products, and a general lack of fiber. Only four files reported a diet that could be considered appropriate, and 7 files did not describe the food.

Fifty files (53.8%) did not record the origin of the indi-

Figure 2. Individual of *Aotus azarae* positive to HSV-1 presenting a characteristic palpebral ulcer.

viduals. However, eleven forms mentioned "Chaco", seven report municipal markets (mainly Mercado N° 4 in Asunción), three mention the city of Acahay, and 22 report 17 different cities in the Oriental Region of Paraguay as the origin.

The Azara's owl monkey (*Aotus azarae*, called Ka'i Pyharé in the Guaraní language), was recorded in 31 clinical records (10.6% of total records). Of these, 18 were female, 7 male, and 6 records did not specify the sex. Weight was recorded in 27 records, with a mean of 570.85 ±256.5 grams. Age was recorded numerically in 22 records, with a mean of 8.7 months (±5.4); and some records reported age by standard classifications, where four were recorded as "juvenile", one as "adult", and in four records age was not recorded. The main reason for consultation was undefined respiratory condition (n=9), followed by trauma (n=7), and infectious disease (n=4), including three cases of encephalitis caused by Herpes Simplex Virus (Figure 2) and one case of tetanus. Six records were registered as routine check-ups (19.4%), and two records did not report a diagnosis (Table 2).

Twenty-eight records (90.3%), described an incomplete or inadequate diet for the species, mainly consisting of homemade food, sweets, dairy products, lean meat, bread, and excessive amounts of sweet fruits. Only one clinical record described a diet that could be considered appropriate, and two records did not describe the diet at all.

Sixteen records (51.6%) did not include information on the origin of the individuals. Five records mentioned "Chaco"; six records mentioned four cities in the Oriental Region of Paraguay (Asunción, San Lorenzo, Emboscada, and Loma Grande); two records mentioned municipal markets (Asunción and the other unidentified); and two medical records report two different cities in the Occidental Region of Paraguay (Puerto José Falcón and Pozo Colorado) as the origin.

The medical records of individuals of the genus *Callithrix* did not contain sufficient data. The white-coated titi, *Plecturocebus pallescens* (Ka'i ygau in Guaraní language), was recorded in four medical records. Of these, three were female and one was male, with a mean weight of 338.75 grams (195 - 600) and an average age of 8.8 months (5 - 12). Two records did not indicate the origin of the animals; one mentioned the city of Villarrica, and another mentioned the city of Pozo Colorado. Three patients of the genus *Saimiri* (species not identified) were recorded (two females and one male), with a mean weight of 331.6 grams (305-360), all reported as originating in Bolivia.

It is worth mentioning that one adult female was recorded under the species *Saguinus fuscicollis*. The animal's weight was not recorded, but it was reported as originating from Brazil and was diagnosed with a nonspecific respiratory infection.

Discussion

The Azara's capuchin monkey (*S. cay)* is a species distributed throughout eastern Paraguay, including Asunción (MADES *et al.* 2021), as well as part of the humid Chaco, matching the reported origin of the animals in this manuscript. The species' feeding habits are plastic and opportunistic. Its diet in the wild is complex, consisting of a wide variety of food items, and is closely related to the availability of food in the ecosystem (Smith *et al.* 2022), unlike the limited and nutritionally inadequate range of food items reported in clinical records, including dairy products, excess sweet fruits, lean meat, processed foods, fried foods, sweets, and soft drinks, among others. The mean weight reported in the findings is within the expected mean weight for the species (1200 g in females, 4500 g in males), although closer to the minimum range (Verona and Pissinatti 2014), which could be related to the inadequate diet or to the fact that the published mean weight refers to adult weight.

The black howler monkey (*A. caraya*) is distributed in humid ecosystems associated with riparian forests, mainly present in the Pantanal and Lower Chaco ecoregions, although it has a wide distribution in eastern Paraguay (Cartes *et al.* 2018), matching the origin of the animals recorded. The mean weight reported in the findings is below the expected minimum weight for the species (5800 g), which may be related to the fact that the mean age of the animals was still far from sexual maturity, when they should reach adult weight (Verona and Pissinatti 2014), or inadequate management, due to the complexities of managing the species in captivity and the negative impact on the animals' health (Cubas 1996; Pastor-Nieto 2014).

Regarding these two species, our findings match reports from other countries in that the families Cebidae and Atelidae present the highest number of cases under human care, with trauma also being one of the main reasons for veterinary consultation, albeit also putting particular emphasis on the impact of infectious diseases on the animals' quality of life (Cubas 1996; Varela *et al.* 2010; Nolasco 2017; Yllescas Barrientos 2019).

Azara's owl monkey (*A. azarae*) is an arboreal species that inhabits tropical and xerophytic forests, with its Paraguayan distribution limited to the humid Chaco and the semi-arid forests of the dry Chaco (Cartes *et al.* 2018; Weiler *et al.* 2019). The reported origins of the species indicate widespread trafficking at the national level. The species' diet is flexible and includes flowers, fruits, leaves, and invertebrates (Weiler *et al.* 2019; van der Heide *et al.* 2023), which is very different from the visibly inappropriate diet reported in this study. The mean weight reported is similar to the known lower range expected for the species (600 to 1000 grams), although this range involved a predominance of young individuals, still far from sexual maturity (Calle and Joslin 2014; Verona and Pissinatti 2014), which can differ from the expected adult weight.

The genus *Callithrix* currently comprises six species, all endemic to southern and eastern Brazil, associated with the Atlantic Forest, the Cerrado, and the Caatinga (Malukiewicz *et al.* 2020). *C. jacchus* is one of the smallest species in the genus and is native to the Atlantic Forest and Caatinga (in the states of Maranhao, Piauí, Ceará, Rio

Grande do Norte, Paraíba, Pernambuco, Alagoas, Bahia, and Tocantins; Rylands *et al.* 2009), so the presence of the species in Paraguay is indicative of illegal transnational trafficking. These species feed on fruits, gum, and invertebrates (Castro and Araújo 2007; Abreu *et al.* 2016), representing great complexities for captive management due to the particularities of their digestive system (Caton *et al.* 1996). As for animals classified only as genus *Callithrix* spp., the following alternatives can be assumed: (1) individuals of the species *C. jacchus*, or some other species of the current genus, or (2) individuals classified according to the old nomenclature of *Mico melanurus* (formerly *Callithrix argentata*) (Rylands *et al.* 2009).

White-coated titi, *P. pallescens*, is an arboreal and gregarious species associated with the northern Paraguayan Chaco. It inhabits xerophytic forests as well as transitional Chaco-Chiquitano forests, and feeds mainly on fruits, although it also eats leaves and insects (Cartes *et al.* 2018; Weiler *et al.* 2019; Tomas *et al.* 2022). The mean weight of the species ranges between 510 and 730 grams, notably higher than the values reported in the present study, although this could be associated with the young mean age reported (Calle and Joslin 2014; Tomas *et al.* 2022). The genus *Saimiri* is widely distributed in South America, strongly associated with the Amazon basin, even reaching Central America (Thorington 1985). They weigh between 750 and 1100 grams, depending on the species, and feed on insects, fruits, flowers, and leaves (May 2013; Calle and Joslin 2014). Regardless of the species in question, the animals reported originate from illegal cross-border trafficking, matching with what is reported in the clinical records.

With regard to the report of *Saguinus fuscicollis*, the species' range is far from Paraguayan territory (Buckner *et al.* 2015), and to the authors' knowledge, no other individuals of this species have been reported in the country. There are no morphometric data to corroborate the coincidence with the aforementioned species, and it has not been possible to contact the person responsible for the animal, probably because it is an old clinical record. Considering these limitations, we believe that this report most likely represents a misidentification of a specimen belonging to another species.

Regarding the various digestive disorders reported in different species, in most cases a definitive diagnosis could not be made. Among the etiologies that cause digestive disorders in non-human primates, various forms of viral hepatitis are described; bacterial disorders caused by *Shigella* spp., *Salmonella* spp., *Yersinia* spp., *Campylobacter* spp., *Mycobacterium* spp., various parasitic infections, including those caused by Acanthocephala and Entamoebidae, and even dental caries (Verona and Pissinatti 2014; Dib *et al.* 2023). In captivity, the predisposition to digestive system conditions can increase mainly due to stress, confinement, and inadequate diets offered to animals (Suleman *et al.* 1995; Tarara *et al.* 1995; Suleman *et al.* 2000). In *A. caraya*, for example, the diet in the wild is based mainly on leaves from various plant families, followed by fruits and flowers (Ludwig *et al.* 2008), requiring high amounts of fiber, in stark contrast to what is offered to animals in captivity. Diets high in fiber are essential for maintaining the intestinal microbiota in folivorous species, promoting the development of more diverse microbial populations, which increases nutrient utilization and improves food passage through the digestive tract. This, together with greater foraging opportunities, ultimately results in greater animal welfare (Edwards and Ullrey 1999; Nijboer 2006; Kišidayová *et al.* 2009; Lawless *et al.* 2025).

With regard to respiratory conditions, although in most cases no causative agent is identified, the diagnosis of *Mycobacterium tuberculosis* in one animal was noted. Disease by *Mycobacterium* spp. has already been reported in primates of the genus *Sapajus* in Argentina and Brazil, highlighting the potential impact on public health associated with the fact that these species are often kept as pets (Ehlers *et al.* 2020; Lamattina *et al.* 2025; Vetter and Insfrán 2025). Other microorganisms associated with respiratory conditions in non-human primates are *Klebsiella pneumoniae*, *Staphylococcus* spp., *Streptococcus* spp., *Pasteurella multocida*, and *Bordetella bronchiseptica* (Verona and Pissinatti 2014), with the possible presence of *K. pneumoniae* in non-human primates being of particular importance, as it is a zoonotic agent capable of causing severe respiratory symptoms, leading to multisystemic disease and sepsis (Soto *et al.* 2012; Anzai *et al.* 2017; Saputro *et al.* 2023; Strich *et al.* 2025).

Among the dermatological conditions reported in non-human primates are dermatophytosis (caused by *Trichophyton* spp., *Microsporum* spp., or *Epidermophyton* spp.), dermatophilosis, nocardiosis (Migaki 1986), scabies (caused by *Demodex* spp., *Sarcoptes scabiei*, or *Psorergates* spp.; Bernstein and Didiert 2009), and leishmaniasis (Garcez *et al.* 2002; Voltarelli *et al.* 2009; Santos and de Oliveira 2020), all of which have zoonotic potential. Bacterial infections usually occur as secondary infections following injuries or fights, although under certain conditions, infections can occur from the skin's natural microbiota, such as *Staphylococcus* spp. and *Streptococcus* spp., as well as *Pseudomonas* spp. (Bernstein and Didiert 2009; Oliveira and Santos 2023). Apparently, some species are natural carriers of *Malassezia* spp. (Neves *et al.* 2017; Coutinho *et al.* 2020). Nutritional deficiencies, allergies, and some neoplasms can also have cutaneous manifestations in primates, although there is not much information on this subject (Beniashvili 1989; Juan-Sallés *et al.* 2001; Bernstein and Didiert 2009; Miller 2012; Díaz-Delgado *et al.* 2018; Ehlers *et al.* 2022).

A study from Brazil cites trauma as the leading cause of death in primates, with trauma from vehicle collisions, interspecific aggression, and electrocution being the most common causes in free-living animals (Ehlers *et al.* 2022), matching the present report. In other studies, the casuistry varies, but trauma remains among the three main conditions affecting primates, along with infectious diseases and

nutritional disorders (Varela *et al.* 2010; Yllescas Barrientos 2019). Gram-positive anaerobic bacillus *Clostridium tetani*, present in the soil, can enter the body through skin lesions caused by trauma and produce toxins that cause a condition known as tetanus, causing trismus, opisthotonos, and epileptiform seizures (Luisto 1993; Kessler *et al.* 2006; Springer *et al.* 2009; Oliveira and Santos 2023).

Although not many diagnoses accompanied by the etiological agent are mentioned, it should be noted that non-human primates can be carriers and transmitters of important zoonoses such as the rabies virus (particularly in *Callithrix* spp.), Alphavirus, *Trypanosoma* spp., *Leishmania* spp., *Toxoplasma gondii*, *Plasmodium* spp., as well as suffer from anthropozoonoses such as SARS-CoV-2, Herpes Simplex Virus-1, and *Mycobacterium tuberculosis* (Diaz *et al.* 2007; Estrada-Cely *et al.* 2011; Kotait *et al.* 2019; Ehlers *et al.* 2020; Dubey *et al.* 2021; Rondón *et al.* 2021; Diaz *et al.* 2024; Mendoza *et al.* 2024; Vetter *et al.* 2025). The potential impact of zoonoses and anthropozoonoses on conservation efforts, as well as on public health, must be considered.

In addition to this, debate should be generated regarding the ethical and legal questions surrounding the captive possession of non-human primates outside accredited zoological institutions. In Paraguay, the legal framework prohibits the sale and purchase of wild animals, including primates. Despite this prohibition, there is a provision that allows for the legal registration of wild animals kept in human care without the need to prove their origin beyond a sworn statement. This, combined with the ease of sale and limited oversight, has led to the normalization of domestic ownership of many species, including their display on social media. This fosters a culture of impulsive acquisition of juvenile primates, which are abandoned once they reach puberty. To date, there have been no final convictions for primate trafficking in Paraguay. The constant exposure of primates of unknown origin, with an unknown microbial load and subjected to extremely stressful conditions, combined with a lack of understanding regarding their environmental and nutritional needs, as well as their behavioral requirements, creates conditions conducive to the transmission of pathogens between humans and animals. These pathogens can cause serious illness in both humans and primates and can easily become sources of infection (Mendoza *et al.* 2024). As a countermeasure, various law enforcement agencies must be integrated, and they can utilize new animal welfare laws to discourage the keeping of these animals in homes. The enforcement of exemplary sentences, such as those handed down for animal abuse, combined with educational campaigns featuring real-life cases of zoonoses and anthropozoonoses, can be the first step toward reducing the impact of primate trafficking in the country.

Conclusions

The objective of this study was to report the main clinical findings regarding primates transferred to the Departamento de Recursos Faunísticos y Medio Natural at the Universidad Nacional de Asunción. The data indicate that four of the five species recorded in Paraguay are affected by illegal trafficking and unregulated private ownership, although *Sapajus cay* and *Alouatta caraya* are the most affected. Routine checkups are frequent, but various cases of health issues are also recorded, primarily trauma, digestive and respiratory conditions, and infectious diseases. It is worth noting that many medical records contain incomplete data and/or remain undiagnosed. This is the first case report on primates in Paraguay and may help identify key species for controlling illegal trafficking.

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Declaration of Artificial Intelligence use

No artificial intelligence tools were used in the preparation of this manuscript.

Author contributions

Joerg Richard Vetter contributed to the manuscript's conception, design, data analysis, and writing. Mauricio E. Martínez contributed to the data collection, data analysis, and writing.

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