

Raptor rehabilitation in Florida: Admission reasons, care duration, and release rates during the last fifteen years

Rehabilitácia dravcov na Floride: Dôvody prijatia, dĺžka starostlivosti a miera vypustenia v priebehu posledných pätnástich rokov

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Abstract: Wildlife rehabilitators treat thousands of raptors yearly, providing an opportunity to better understand species' biology, the changing environment, and the dangers raptors encounter in the wild. However, that data is siloed within individual facilities, making it challenging to understand the wider impact of rehabilitation and the dangers raptors face. Data were collected from 50 facilities across the state of Florida, United States of America, from 2009 to early 2023, representing 54,574 patients of 39 species. Patient intake at these facilities doubled between 2010 and 2020 over a relatively stable number of facilities (average = 31.5/year) with an average release rate of 36.6% (range 31.7 – 41.5%). Release rates varied significantly from 21% to 57% between species with over 100 recorded patients.

Comparing release rates with the “cause for admission” provided a more nuanced understanding of what was affecting raptor patients and their release rates. Trauma was the most common cause of admission (40.2%) and has been relatively consistent year over year. For those patients with more specific identification attributes, 65% were male, 50% were adults, and patients spent an average of 16.6 days in care. The data provided in this study has the potential to make fundamental changes to raptor rehabilitation policies and encourage more collaboration between rehabilitators and researchers for the betterment of the patients in care.

Abstrakt: Rehabilitačné zariadenia voľne žijúcich živočíchov každoročne ošetrí tisíce dravcov, čo poskytuje príležitosť lepšie pochopiť biológiu jednotlivých druhov, meniace sa životné prostredie a nebezpečenstvá, s ktorými sa dravce stretávajú vo voľnej prírode. Tieto údaje sú však v rámci jednotlivých zariadení izolované, čo sťažuje pochopenie širšieho vplyvu rehabilitácie a nebezpečenstiev, ktorým dravce čelia. Predložený príspevok sumarizuje údaje z 50 zariadení v štáte Florida v Spojených štátoch amerických od roku 2009 do začiatku roka 2023, čo predstavuje informácie o 54574 pacientov, 39 druhov dravcov. Počet prijatých pacientov v týchto zariadeniach sa v rokoch 2010 až 2020 zdvojnásobil v porovnaní s relatívne stabilným počtom zariadení (priemer = 31,5/rok) s priemernou mierou vypustenia 36,6% (rozsah: 31,7 - 41,5%).

Miera vypustenia sa výrazne líšila od 21% do 57 % medzi druhmi s viac ako 100 zaznamenanými pacientmi. Porovnanie miery vypustenia s „príčinou prijatia“ umožnilo lepšie pochopiť, ohrozenia jednotlivých druhov dravcov. Úraz (trauma) bol najčastejšou príčinou prijatia (40,2%) a bol medziročne relatívne konzistentný. V prípade pacientov s jednoznačnými identifikačnými znakmi sa jednalo 65% samcov a 50% dospelých jedincov. Pacienti strávili v starostlivosti v priemere 16,6 dňa. Údaje uvedené v tejto štúdii majú potenciál priniesť zásadné zmeny v politike rehabilitácie dravcov a podporiť väčšiu spoluprácu medzi rehabilitačnými a výskumnými inštitúciami v záujme zlepšenia starostlivosti o dravce.

Key words: birds of prey, wildlife, avian, mortality, conservation, red-shouldered hawk, eastern screech owl

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Introduction

Hundreds of thousands of injured wildlife patients are brought into rehabilitation facilities annually (Cope et al. 2022; Willette et al. 2023). Sharing this patient data could allow rehabilitation professionals to understand the threats facing local wildlife populations.

Across Florida alone, tens of thousands of birds are treated annually at wildlife rehabilitation facilities, resulting in a valuable pool of avian patient data (Pahl 2024). Combining and analyzing this data makes it possible to understand common ailments, treatment success rates, trends, and periodic fluctuations in patient intake volumes. Evaluating these large-scale data sets is an invaluable resource that can serve as the foundation of future studies, detect trends, make hypotheses, and potentially extrapolate those findings nationally or globally.

Unfortunately, there has been a distinct lack of studies using large-scale patient data sets in wildlife rehabilitation and raptor rehabilitation in particular. Table S1 (see the Supplementary File for all “S” Tables and Figures) lists sixteen raptor studies, including over 33,000 patients with release rates ranging from 16% to 45%. The majority of these studies are based on data obtained from single facilities, resulting in a very limited scope (Rodríguez et al. 2010; Montesdeoca et al. 2016; Hernandez et al. 2018; Zoubi et al. 2020; Cummings et al. 2022; Mbali Mashele et al. 2022). For example, a study conducted in Florida that looked at a single facility included data on 390 patients and found that 82% of the patients were suffering from trauma while the patients had an overall release rate of 21% (Deem et al. 1998).

Across these studies, trauma is consistently the most frequent, or one of the most frequent, causes of admission in some cases making up more than 70% of patients (Fix & Barrows 1990; Kratter & Steadman 2020). The available studies also illustrate how little is known about patients’ age, sex, and duration of care with those distinctions often being omitted entirely or only being available for small portions of the total data sets (Molina-López et al. 2013; Panter et al. 2022).

One Australian study evaluated a large data set of 250,688 birds using 19 categories to identify the reason for admission including the chance of release for each category (Kwok et al. 2021). Unfortunately, patients were only classified as birds limiting the depth of analysis available. The most detailed study focused on 22,538 raptor patients from 34 facilities in the Czech Republic. It broke down the cause of injury into 13 categories but did not include patient sex, age, or duration of care (Lukesova et al. 2022). This study includes 54,574 patient records from Florida

and aims to provide a detailed analysis of raptor rehabilitation covering disposition, species, age, and reason for admission over a 14-year period.

This study aimed to provide rehabilitators and researchers a consolidated view of trends and insights to provide better care for wildlife, understand the largest threats facing raptors, and have sufficient data to support future research and planning. This information will allow rehabilitators to customize treatment protocols and potentially secure funding to continue their important work saving native wildlife while increasing the knowledge of the wider scientific community. The ultimate goal is to provide the data necessary to employ new methods and innovative treatments to increase raptor release rates while ensuring they have the greatest possible chance of long-term survival.

Methods

Data sources and collection methods

This dataset of 54,574 raptor patient records spanning 2009 to early 2023 was included in a larger project focused on Florida avian rehabilitation outcomes (Pahl 2024). The data used in the larger study were acquired directly from wildlife rehabilitation facilities, information management systems including WILD-ONE, and through the federal government’s required reporting of migratory species by rehabilitators (Table S2) (Pahl 2024).

Although the data spans 2009 through 2023, this study primarily focuses on 2010 to 2021 to ensure adequate data to analyse and determine trends (Fig. S1). The inclusion or exclusion of data from 2009, 2022, and 2023 is clearly noted throughout this study. An average of 31.5 facilities reported patient data annually of the 51 total facilities represented. Not all facilities were open for the entire length of the study and some facilities were missing data from select years that were either lost or unavailable. Raptor intake rates at these facilities have generally trended up each year. There were 16,767 (30.7%) raptor patient records from 16 facilities that included more extensive patient information, including the cause of injury, age, sex, weight, duration of care, and location found. Rehabilitators reported “cause of injury” in 15,003 (27.5%) raptor patient records which were consolidated and normalized into 38 categories to accurately analyse the cause of injury (Table 1). Between 2009 and 2021, 6,176 (11.3%) records included an identified sex. Males represented 65% (4,015) and females 35% (2,161) (Table 2). Patient age was included in 16,072 (29.4%) records as either egg, hatchling, nestling, fledgling, juvenile, or adult (Table 3).

Tab. 1. Raptor reason for admittance. A list of all of the causes of injury ordered by the „count“ for a given category. This table includes the number of patients represented and the release rate percentage for each category.

Tab. 1. Dôvod starostlivosti o dravce. Zoznam všetkých príčin úrazu zoradených podľa „počtu“ pre danú kategóriu. Tabuľka obsahuje počet pacientov a percento miery vypustenia pre každú kategóriu.

Reason for Admittance	Count	Overall Mix*	Released
Trauma	6033	40.2%	25.5%
Fell from nest	2268	15.1%	56.7%
Hit by car	1928	12.9%	25.3%
Clinically Healthy	683	4.6%	89.3%
Emaciation	536	3.6%	39.3%
Animal Attack	370	2.5%	38.6%
Feather loss	294	2.0%	46.9%
Electrocution	275	1.8%	5.0%
Nest destroyed	236	1.6%	68.6%
Gunshot	193	1.3%	26.1%
Side of road	178	1.2%	29.2%
Entanglement	164	1.1%	44.1%
Window Collision	158	1.1%	41.1%
Trapped	139	0.9%	56.9%
Toxin	135	0.9%	41.2%
Entanglement - fishing line	116	0.8%	69.3%
Collision	115	0.8%	25.9%
Not Flying	113	0.8%	32.7%
Poisoned	105	0.7%	41.8%
Human interference	100	0.7%	45.5%
Disease	95	0.6%	24.2%
Age Related	83	0.6%	53.9%
Eye Issue	82	0.6%	25.6%
Waterlogged	71	0.5%	66.2%
Birth defect	68	0.5%	26.5%
Orphan	66	0.4%	68.8%
Parasites	62	0.4%	68.3%
Weakness	62	0.4%	18.0%
Dehydration**	46	0.3%	52.2%
Avian Pox	46	0.3%	18.6%
Burn	43	0.3%	11.9%
Unknown illness	42	0.3%	29.0%
Hypothermia	30	0.2%	33.3%
Aspergillosis	23	0.2%	17.4%
Weather	17	0.1%	81.3%
Fishing hook	14	0.1%	35.7%
Oiled	13	0.1%	61.5%
Plastic***	1	0.0%	100.0%
Total****	15003		36.1%

*Overall Mix provides the percentage of the total patients with a known cause of admission for the specific category

**Dehydration only had 46 cases where it was the primary or only listed ailment, but it was included as a secondary ailment for 1,275 (8.5%) total patients. At least 538 patients included both dehydration and emaciation as ailments

***This category only included a single patient but it was included because of its highly unique nature. The patient reportedly ingested a plastic bag and then excreted it once it made its way through its digestive tract.

****The total represents the total number of patients and the overall release rate for all patients with a known reason for admission.

One note about the injury data: a single cause of injury was assigned based on severity resulting in the patient volumes of categories like emaciation, dehydration, and parasites representing a smaller portion of the total numbers. For example, emaciation included 536 (3.6%) patients as the primary reason for admittance, but 2,407 (16%) patients listed emaciation as one of their ailments, with the majority being considered secondary ailments. If emaciation had been treated as the primary ailment, it would have been the second most frequent reason for admittance.

Tab. 2. Raptor breakdown by sex. A breakdown of admitted patient sex ordered by the total number of patients with an identified sex.

Tab. 2. Rozdelenie dravcov podľa pohlavia. Rozdelenie prijatého pohlavia pacienta zoradené podľa celkového počtu pacientov s identifikovaným pohlavím.

Species	Female	Male	Total
red shouldered hawk	352	1312	1664
bald eagle	397	558	955
osprey	266	668	934
barred owl	340	404	744
eastern screech owl	214	268	482
Cooper's hawk	185	236	421
red tailed hawk	126	225	351
American kestrel	79	150	229
great horned owl	112	104	216
black vulture	16	16	32
sharp-shinned hawk	11	17	28
merlin	10	13	23
peregrine falcon	13	10	23
barn owl	11	5	16
turkey vulture	3	8	11
swallow-tailed kite	6	4	10
short-tailed hawk	2	6	8
crested caracara	3	4	7
Mississippi kite	4	3	7
broad-winged hawk	3	2	5
burrowing owl	3	1	4
northern harrier	4	0	4
short-eared owl	0	1	1
snail kite	1	0	1
Total	2161	4015	6176

Data conflicts and normalization

Since data were obtained from various sources, it was necessary to normalize the formats and naming conventions to address discrepancies and ensure consistency in causes of injury, age, and final disposition. The injuries' descriptions varied widely as no controlled vocabulary was employed across facilities, resulting in spelling variations, acronyms, and thousands of unique

Tab. 3. Raptor breakdown by age. A breakdown of raptor ages ordered by the total number of patients with an identified age range from eggs to adult patients. This table includes the ages of every patient in the study with a reported age.**Tab. 3.** Rozdelenie dravcov podľa veku. Rozdelenie veku dravcov zoradené podľa celkového počtu pacientov s identifikovaným vekovým rozsahom od vajíček po dospelých pacientov. Táto tabuľka obsahuje vek každého pacienta v štúdií s uvedeným vekom.

Species	Egg*	Hatchling	Nestling	Fledgling	Juvenile	Adult	Total
red shouldered hawk	3	82	549	529	1156	1598	3917
eastern screech owl	4	203	566	446	253	1232	2704
barred owl	1	47	137	139	140	1337	1801
osprey	6	9	116	396	266	907	1700
Cooper's hawk	1	22	103	93	508	409	1136
bald eagle	0	3	113	143	191	662	1112
great horned owl	7	77	117	132	61	324	718
red tailed hawk	0	5	22	40	335	316	718
black vulture	1	7	14	11	129	437	599
turkey vulture	0	0	3	4	119	326	452
American kestrel	0	17	32	68	29	167	313
broad-winged hawk	0	2	0	10	113	95	220
barn owl	1	36	37	26	14	48	162
Mississippi kite	0	16	5	41	19	43	124
sharp-shinned hawk	0	2	0	4	54	36	96
peregrine falcon	0	0	0	0	35	41	76
swallow-tailed kite	0	0	7	13	10	32	62
merlin	0	0	0	0	19	29	48
burrowing owl	0	1	0	0	5	32	38
crested caracara	0	0	1	2	11	14	28
short-tailed hawk	0	0	0	0	11	15	26
common kestrel	0	0	0	0	0	4	4
northern harrier	0	0	0	0	0	4	4
snail kite	0	0	0	0	3	1	4
short-eared owl	0	0	0	0	0	3	3
Swainson's hawk	0	0	0	0	1	2	3
common black hawk	0	0	0	0	0	1	1
flamulated owl	0	0	0	0	0	1	1
roadside hawk	0	0	0	0	1	0	1
western screech owl	0	0	0	0	1	0	1
Total	24	529	1822	2097	3484	8116	16072
Breakdown	0.1%	3.3%	11.3%	13.0%	21.7%	50.5%	100.0%

*Two of the 24 admitted eggs were released, one barred owl and one great horned owl. The barred owl was released after 77 days in care and the great horned owl was determined to be healthy and was re-nested the same day it was brought into the rehabilitation facility

terms. In other available studies focused on raptor rehabilitation, they tended to group reasons for admission together in their broadest categories to make it easier to understand and simplify the results while working with the available data (Wendell et al. 2002; Rodríguez et al. 2010).

Some cause of injury categories could have fallen under the broad “trauma” category (e.g., fishing hook, animal attack, side of road, and window collision) but were broken out to provide a more detailed representation of the data. Many of the facilities provided more details on the patient’s injuries in their records but due to the variability and lack of consistency, that data was not included in this study.

Cause of admission

Simplifying the cause of admission was critical to understand what threats raptors face in their natural environment and potentially how to mitigate or eliminate those threats. Many patients might suffer from multiple ailments simultaneously (e.g., dehydration, mites, not standing, and fractured wing) in which case the most severe or life-threatening issue was selected as the primary ailment – fractured wing in this case. Similar studies have used this model (Long et al. 2020). Other studies that included cause of injury kept the categories under ten but one broke trauma into 12 subcategories (Morishita et al. 1998; Harris and Sleeman 2007; Rodríguez et al. 2010).

In some studies, being hit by car was included under the broader category of trauma, while in others, it was included under collisions (Fix & Barrows 1990; Rodríguez et al. 2010). For this study, hit by car was separated to better illustrate its impact on raptors and provide some separation between other documented collisions or the general trauma category.

The data also included 15,549 (28.5%) patients with

both the exact date of admittance and final disposition. The inclusion of both dates provides an opportunity to understand patient volumes throughout the year and the duration of care for each species. It also provides a better idea of injury recovery time. Patients that were listed as Dead on Arrival (DOA), adopted, pending, or with care over 365 days were excluded, leaving 15,507 patients (Table 4).

Tab. 4. Duration of care by raptor species count. A breakdown of patient's duration of care ordered by the total patient days in care and including the total, average, maximum, median, and standard deviation. Standard deviation was not listed for species represented by a single patient day in care.

Tab. 4. Trvanie starostlivosti podľa počtu jednotlivých druhov dravcov. Rozdelenie trvania starostlivosti o pacienta podľa celkového počtu dní v starostlivosti pacienta vrátane celkovej, priemernej, maximálnej, strednej dĺžky starostlivosti a štandardnej odchýlky. Smerodajná odchýlka nebola uvedená pre druhy reprezentované jedným pacientom za deň v starostlivosti.

Species	Days in Care				Standard Deviation
	Total*	Average	Maximum	Median	
red shouldered hawk	3790	14.5	365	2	24.1
eastern screech owl	2692	23.9	284	7	31.6
barred owl	1734	16.2	269	2	30.9
osprey	1664	14.0	365	2	29.0
Cooper's hawk	1180	9.0	296	1	22.2
bald eagle	830	20.8	365	6	38.5
red tailed hawk	691	18.3	264	2	32.2
great horned owl	667	22.8	311	3	38.3
black vulture	606	10.9	358	1	27.3
turkey vulture	467	9.6	242	1	23.1
American kestrel	301	15.4	325	2	28.3
broad-winged hawk	244	12.4	185	4	23.5
barn owl	150	26.8	153	9	33.5
Mississippi kite	115	22.0	273	14	36.7
sharp-shinned hawk	101	13.5	279	1	38.1
peregrine falcon	71	13.7	283	1	38.2
swallow-tailed kite	56	18.9	167	5.5	35.8
merlin	42	11.6	156	2	26.9
burrowing owl	41	13.7	190	2	36.1
short-tailed hawk	23	14.5	66	3	19.0
crested caracara	18	32.6	177	5	49.3
common kestrel	4	1.0	1	1	0.0
northern harrier	4	12.8	23	13.5	11.9
snail kite	4	20.3	40	20	21.7
short-eared owl	3	26.7	50	29	24.6
Swainson's hawk	3	17.7	39	10	18.7
common black hawk	1	1.0	1	1	-
flammulated owl	1	3.0	3	3	-
long-eared owl	1	1.0	1	1	-
roadside hawk	1	1.0	1	1	-
western screech owl	1	20.0	20	20	-
white-tailed kite	1	52.0	52	52	-
Total	15507	16.6	365	2	29.6

*Some patients had incredibly long durations of care including one patient representing over 2,000 days, seven representing over 1,000 days, and 34 representing over a year in care. At this point, it is impossible to determine if the long-term patients were a reporting error; if they ended up getting adopted as an education or foster animal; the facility failed to report the final disposition, or if the raptor was in care that entire time. 42 patients fell within this category and were removed from these calculations. Patients that were listed as DOA, adopted, pending, transferred, and unknown were also removed. (This footnote also applies to tables 7 and 8).

Results

Intake trends

During the fifteen-year study (2009–2023), the eastern screech owl (*Megascops asio*) was the most frequently admitted species (20%) and the annual intake numbers more than doubled during the study. The red-shouldered hawk (*Buteo lineatus*) represented 19% of all intakes with an increase of 238%. Rounding out the top three species was the osprey (*Pandion haliaetus*) representing 12% of the intakes and a 138% intake increase during the study duration. These three species made up 52%, or 28,248 patient intakes, of the 39 total species (Table 5). In 2010, they represented 45% of all intakes and by 2021 they had grown to 58% of the annual species intake.

Disposition trends

The primary goal of rehabilitators continues to be the successful release of patients back into the wild. Based on the data, rehabilitators are challenged by having to treat twice as many patients with a relatively similar number of facilities and presumably rehabilitators. The overall release rate in this study was 35.1% (36.6% if DOA patients are removed). The barn owl (*Tyto alba*) had the highest release rate (57%) while the black vulture (*Coragyps atratus*) had the lowest (21%).

When analyzing the overall release rates, the data shows a steady decline from 2010 (40%) through 2021 (31.4%). This 8.6 - point decrease is offset by an 8 - point increase in patients being euthanized (2010 = 28.5%; 2021 = 36.6%).

Threatened species

According to the Red List published by the International Union for Conservation on Nature (IUCN), all 39 species represented in this study are designated as Least Concern (IUCN 2024). However, there are three species listed as threatened within the state of Florida: the American kestrel (*Falco sparverius*), the burrowing owl (*Athene cunicularia*), and the crested caracara (*Caracara cheriway*) which is also listed as federally threatened (Species Profiles n.d.).

There were 1,174 American kestrel patients admitted with an above-average release rate of 41%. However, the data showed an accelerating upward trend in patient intake starting with 60 patients in 2010 and culminating with 167 individual patients in 2021 (178% increase).

The American kestrel spent an average of 15.4 ± 28.3 days in care ($\pm$ SD; median = 2 days), across patients with a known duration (Table 4).

The burrowing owl had 1,265 individual patients

and also showed an upward trend in patient numbers (99% increase from 2010 to 2021). Like the American kestrel, the burrowing owl had an above-average release rate of 43% and spent an average of 13.7 ± 36.1 days in care (median = 2 days) across patients with a known duration.

The crested caracara had a much lower patient volume at only 97 individuals with a below-average release rate of 27%. Between 2010 and 2021, the crested caracara had an average intake rate of eight patients a year with a total of 96 patients. The crested caracara patients that included duration of care spent an average of 32.6 ± 49.3 days in care, the second highest overall (median = 5 days).

Patient admittance by month

There were 16,765 patients (31%) with a known admittance date. May had the highest admittance rate (15.9%) while September (4.7%) had the lowest rate (Fig. S2). This pattern was true for ten of the twelve years (Fig. S3). The reason for the large spike in May admittance rates becomes apparent when patient age is considered (Fig. S4). Adult patient intake rates dip in September but remain relatively consistent throughout the year, while immature patients have an apparent increase in the spring and summer months, and there are almost no intakes from September to February (Fig. S5; S6).

Patient sex

The red-shouldered hawk represented by far the highest number of patients with an identified sex while also having the largest difference between sexes across all species with 1,312 (78.8%) males and 352 (21.2%) females. The great horned owl (*Bubo virginianus*) was the only species with an identified sex with more female (51.9%) than male patients.

Age

By combining hatchlings, nestlings, fledglings, and juvenile patients into an immature category, they represented just under half (49%) of the patients with a known age while the mature adult patients make up just over half (51%).

Across the 15,577 patients (28%) with known age, after the removal of DOA patients, the average release rate got progressively lower as the patient got older, except for eggs (Table 6). Hatchlings had the highest average release rate of any age group at 71.4% while adult patients had a 28.6% average release rate.

Tab. 5. Total patient disposition. This is the final disposition breakdown for all of the raptors represented in this study including the percentages for the release rate, euthanization rate, death rate, total patient volume, and the release rate percentage with the removal of DOA patients. The standard terminology includes Released; Transferred; Pending; Euthanized; Died; and Dead On Arrival (DOA). The data included 22 patients with an unknown final disposition and 206 patients that were not deemed healthy enough for release and were adopted as education animals instead of being euthanized. The species identifications of 45 (0.08%) admitted patients were listed as unknown or partially unknown and are shown at the bottom of this table.

Tab. 5. Celková dispozícia pacientov. Konečné rozdelenie dispozícií všetkých dravcov zastúpených v tejto štúdii vrátane percentuálnych podielov miery vypustenia, miery eutanázie, miery úmrtnosti, celkového objemu pacientov a percentuálneho podielu miery prepustenia s odstránením pacientov s DOA. Štandardná terminológia zahŕňa vypustenie; premiestnenie; čakanie; eutanáziu; uhynutie; a uhynutie pri príchode (DOA). Údaje zahŕňali 22 pacientov s neznámou konečnou dispozíciou a 206 pacientov, ktorí neboli považovaní za dostatočne zdravých na prepustenie a namiesto eutanázie boli adoptovaní ako zvieratá pre vzdelávanie. Druhovú identifikáciu 45 (0,08 %) prijatých pacientov bola uvedená ako neznáma alebo čiastočne neznáma a je uvedená na konci tejto tabuľky.

Common Name	Patient Intake			Released			Euthanized		Dead		Transferred	DOA*	Pending	Adopted	Unknown
	Patient Count	%	**12 Year Increase	Patient Count	Rate	Rate less DOA*	Patient Count	Rate	Patient Count	Rate					
eastern screech owl	11011	20.2%	114%	5154	46.8%	48.4%	2301	20.9%	2154	19.6%	818	366	178	37	3
red-shouldered hawk	10584	19.4%	238%	3615	34.2%	35.3%	3602	34.0%	2065	19.5%	736	339	200	25	2
osprey	6653	12.2%	138%	1630	24.5%	25.7%	2508	37.7%	1733	26.0%	391	308	69	8	6
barred owl	4792	8.8%	82%	1430	29.8%	30.8%	2028	42.3%	550	11.5%	479	146	141	18	0
Cooper's hawk	4610	8.4%	7%	1570	34.1%	35.8%	1516	32.9%	960	20.8%	259	221	80	3	1
great horned owl	2435	4.5%	49%	1029	42.3%	43.4%	637	26.2%	319	13.1%	279	66	81	19	5
black vulture	2416	4.4%	38%	495	20.5%	21.1%	1378	57.0%	305	12.6%	113	72	46	7	0
bald eagle	2053	3.8%	50%	541	26.4%	30.9%	613	29.9%	197	9.6%	288	305	80	28	1
red-tailed hawk	1915	3.5%	9%	582	30.4%	31.1%	713	37.2%	289	15.1%	192	43	87	8	1
turkey vulture	1789	3.3%	47%	499	27.9%	28.7%	872	48.7%	251	14.0%	64	52	49	2	0
burrowing owl	1265	2.3%	132%	512	40.5%	43.4%	397	31.4%	237	18.7%	20	84	13	2	0
American kestrel	1174	2.2%	178%	469	39.9%	41.0%	258	22.0%	210	17.9%	155	31	39	12	0
broad-winged hawk	1072	2.0%	197%	534	49.8%	50.9%	140	13.1%	282	26.3%	41	22	50	1	2
barn owl	985	1.8%	82%	546	55.4%	57.0%	159	16.1%	126	12.8%	55	27	66	5	1
sharp-shinned hawk	387	0.7%		108	27.9%	30.9%	83	21.4%	142	36.7%	10	37	7	0	0
peregrine falcon	298	0.5%		106	35.6%	36.9%	74	24.8%	44	14.8%	40	11	19	4	0
Mississippi kite	266	0.5%		92	34.6%	34.7%	72	27.1%	40	15.0%	42	1	15	4	0
swallow-tailed kite	263	0.5%		80	30.4%	31.5%	59	22.4%	49	18.6%	52	9	6	8	0
merlin	252	0.5%		63	25.0%	25.9%	88	34.9%	64	25.4%	15	9	9	4	0
short-tailed hawk	113	0.2%		36	31.9%	32.4%	40	35.4%	19	16.8%	8	2	7	1	0
northern crested caracara	97	0.2%		26	26.8%	27.1%	30	30.9%	14	14.4%	11	1	8	7	0
northern harrier	30	0.1%		12	40.0%	40.0%	6	20.0%	11	36.7%	0	0	1	0	0
snail kite	25	0.0%		9	36.0%	40.9%	3	12.0%	9	36.0%	0	3	0	1	0
Swainson's hawk	12	0.0%		7	58.3%	63.6%	1	8.3%	1	8.3%	0	1	2	0	0
short-eared owl	11	0.0%		7	63.6%	63.6%	2	18.2%	2	18.2%	0	0	0	0	0
Harris's hawk	4	0.0%		0	0.0%	0.0%	0	0.0%	2	50.0%	1	0	0	1	0
common kestrel	3	0.0%		1	33.3%	33.3%	1	33.3%	0	0.0%	0	0	0	1	0
long-eared owl	2	0.0%		1	50.0%	50.0%	0	0.0%	1	50.0%	0	0	0	0	0
rough-legged hawk	2	0.0%		1	50.0%	50.0%	0	0.0%	1	50.0%	0	0	0	0	0
common black hawk	1	0.0%		1	100%	100%	0	0.0%	0	0.0%	0	0	0	0	0
Eurasian eagle-owl	1	0.0%		0	0.0%	0.0%	1	100%	0	0.0%	0	0	0	0	0
ferruginous hawk	1	0.0%		0	0.0%	0.0%	1	100%	0	0.0%	0	0	0	0	0
flamulated owl	1	0.0%		0	0.0%	0.0%	0	0.0%	1	100%	0	0	0	0	0
golden eagle	1	0.0%		0	0.0%	0.0%	0	0.0%	0	0.0%	0	1	0	0	0
mottled owl	1	0.0%		0	0.0%	0.0%	0	0.0%	1	100%	0	0	0	0	0
northern goshawk	1	0.0%		0	0.0%	0.0%	0	0.0%	1	100%	0	0	0	0	0
roadside hawk	1	0.0%		0	0.0%	0.0%	0	0.0%	0	0.0%	0	1	0	0	0
western screech owl	1	0.0%		1	100%	100%	0	0.0%	0	0.0%	0	0	0	0	0
white-tailed kite	1	0.0%		0	0.0%	0.0%	0	0.0%	0	0.0%	0	0	1	0	0

Tab. 5. continuation / pokračovanie

Common Name	Patient Intake			Released			Euthanized		Dead		Transferred	DOA*	Pending	Adopted	Unknown
	Patient Count	%	**12 Year Increase	Patient Count	Rate	Rate less DOA*	Patient Count	Rate	Patient Count	Rate					
unknown - hawk	23	0.0%		0	0.0%	0.0%	10	43.5%	1	4.3%	5	7	0	0	0
unknown - vulture	10	0.0%		2	20%	28.6%	5	50.0%	0	0.0%	0	3	0	0	0
unknown - owl	9	0.0%		0	0.0%	0.0%	4	44.4%	0	0.0%	0	5	0	0	0
unknown - raptor	2	0.0%		0	0.0%	0.0%	0	0.0%	1	50%	1	0	0	0	0
unknown - falcon	1	0.0%		0	0.0%	0.0%	0	0.0%	0	0.0%	0	1	0	0	0
Grand total	54574	100%		19159	35.1%	36.6%	17602	32.3%	10082	18.5%	4075	2174	1254	206	22
Total percentages	100%			35.1%			32.3%		18.5%		7.5%	4.0%	2.3%	0.4%	0.0%

* DOA: Dead On Arrival

**The 12 years covers 2010 to 2021

Injuries sustained

“Trauma” was by far the leading cause of injury, representing 40.2% of the 15,003 patients and had one of the lowest release rates (25.5%) of any cause of injury (Table 1).

“Fell from nest” was the second most frequent cause of admission (15%) and almost exclusively affected sub-adult patients (99.2%), resulting in a 56.7% average release rate, but results differed depending on the species (Table 1). Eastern screech and barred owls (*Strix varia*) had release rates above 70%, while ospreys had a 37.1% and Cooper’s hawks (*Astur cooperii*) had a 15.4% release rate for “fell from nest” (Table S3).

The Figure S7 highlights the annual impact injuries have on a month-to-month basis. While “trauma” and “hit by car” are relatively consistent throughout the year, age-related causes of admission, like nest destroyed, begin to spike in April/May (41%) before falling dramatically in August.

Duration of care

There were 15,512 raptor patients (28%) representing 32 species in the study with specifically recorded patient care start and end dates. The average duration of care over the period was 16.6 ± 29.7 days (± SD; median = 2 days) for patients with a duration of care under 365 days (46 patients received 365 or more days of care) and excluding DOA patients (Table 4). Of the top ten species, the average duration of care spanned from 9 days (Cooper’s hawk) to 23.9 days (eastern screech owl). From 2010 to 2020, the number of patients per year with recorded care data increased by 66% while the annual average days in care decreased from 15.8 days to 13.6 days for the top ten species. During the same period, euthanization rates increased nearly three times (183%) compared to a 54%

increase in “died” and a 44.5% increase in released or transferred patients.

There were 14,023 patients with both an identified cause of injury and duration of care under one year with an average duration of 17.3 ± 30.3 days (median = 2 days; Table 7). Of those patients, over two-thirds (68.4%) fell under the categories of “trauma”, “fell from nest”, and “hit by car”. In this study, “trauma” was by far the most prevalent cause of injury (40.7%). Fell from nest, nest destroyed, clinically healthy, and orphaned all had higher than average durations of care. In contrast, trauma, electrocution, and being hit by car all had below-average durations of care. Patients spent progressively less time in care the older they were, except for eggs. Hatchlings averaged the most time in care at 38.8 days ± 38.9 days (median = 32 days; Table 8).

Tab. 6. Raptor release rate by age. This is a breakdown of the release rates for raptors based on their age which also includes the total number of patients represented and the number of patients released.

Tab. 6. Rýchlosť vypustenia dravca podľa veku. Miera vypustenia dravcov na základe ich veku, ktorý zahŕňa aj celkový počet zastúpených pacientov a počet vypustených pacientov.

Age	Number of Patients	Released Patients	Release Rate*
Hatchling	528	377	71.4%
Nestling	1782	1016	57.0%
Fledgling	2054	1070	52.1%
Juvenile	3395	1083	31.9%
Adult	7796	2232	28.6%
Egg	22	2	9.1%
Total	15577	5780	37.1%

*DOA patients removed from release rate calculations

Tab. 7. Duration of care by cause of injury. A breakdown of patient's duration of care in relation to the patient's cause of injury ordered by the total patient days in care and including the total, average, maximum, median, and standard deviation (SD). SD was not listed for species represented by a single patient day in care.

Tab. 7. Dĺžka starostlivosti o pacienta vo vzťahu k príčine zranenia podľa počtu dní vrátane celkovej, priemernej, maximálnej, strednej dĺžky starostlivosti a smerodajnej odchýlky (SD). SD nie je uvedená pre druhy s jedným pacientom za deň v starostlivosti.

Cause of Injury	Days in Care				SD
	Total*	Average	Max.	Median	
Trauma	5707	13.4	365	1	29.2
Fell from nest	2170	24.1	311	15	29.7
Hit by car	1723	12.8	365	1	26.6
Clinically Healthy	671	33.1	225	27	31.8
Emaciation	512	18.8	278	5	30.4
Animal Attack	329	20.2	297	4	35.2
Feather loss	284	24.6	315	5	44.9
Nest destroyed	216	31.5	139	29	29.3
Electrocution	213	6.5	138	1	15.6
Gunshot	182	21.0	264	1	37.6
Side of road	154	12.6	284	2	27.3
Entanglement	149	20.8	283	4	39.9
Window Collision	144	18.0	296	3	39.8
Toxin	130	11.2	173	5	20.7
Trapped	129	11.4	129	2	20.3
Entanglement - fishing line	109	25.5	227	14	38.1
Not Flying	106	13.2	124	1	20.8
Collision	104	13.3	236	1.5	30.9
Poisoned	103	7.1	44	3	8.7
Disease	94	16.7	215	3	30.8
Human interference	85	32.2	325	13	49.6
Eye Issue	74	10.7	91	1	20.0
Age Related	71	18.1	92	9	22.9
Waterlogged	69	9.8	57	2	12.8
Birth defect	64	17.1	103	4	24.6
Orphan	64	42.2	117	46	31.5
Parasites	58	20.7	70	19.5	15.1
Weakness	55	3.7	47	1	8.0
Dehydration	44	19.7	86	10	24.3
Avian Pox	39	29.4	208	4	45.6
Unknown illness	38	10.6	130	1	22.9
Burn	36	20.1	115	2	33.6
Hypothermia	30	8.4	40	2	11.7
Aspergillosis	23	18.5	63	15	17.7
Weather	16	28.1	74	19.5	27.0
fishing hook	14	10.9	61	2	17.4
Oiled	13	21.4	89	15	25.0
Plastic	1	13.0	13	13	
Total	14023	17.3	365	2	30.3

*Some patients had incredibly long durations of care including one patient representing over 2,000 days, seven representing over 1,000 days, and 34 representing over a year in care. At this point, it is impossible to determine if the long-term patients were a reporting error; if they ended up getting adopted as an education or foster animal; the facility failed to report the final disposition, or if the raptor was in care that entire time. 42 patients fell within this category and were removed from these calculations. Patients that were listed as DOA, adopted, pending, transferred, and unknown were also removed. max. - maximum; SD-standard deviation

Discussion

Study comparison

Wildlife rehabilitators interact with a wide variety of species and injury types daily while contending with limited funding and information regarding those species and injuries. Single-patient case studies and experimental techniques are a precious resource when determining how to treat a patient, but understanding the state of the wider population and the injuries they encounter is critical. Data on the wider population provides the necessary context to understand how a particular species adapts to the environment while providing comparisons for similar species in the same region.

Rehabilitation-focused single-species studies from the Czech Republic (Lukesova et al. 2021) and Louisiana (Cummings et al. 2022) found release rates of 15.9% and 21%, respectively, with trauma being the most frequent cause of admission in the first and age-related in the second study (Table S1). Trauma was the third most frequent cause in the second study (Cummings et al. 2022). Interestingly, a later Czech Republic study reported on the same 34 rehabilitation centres, including all raptor species, across 22,538 patients (Lukesova et al. 2022). It found the most frequent cause of admission changed from nestling (age-related) to trauma (26.5%), followed by “young” (22.9%) (Lukesova et al. 2022). The release rate also increased from 15.9% focused on common kestrels to 42.4% across all species (Lukesova et al. 2021; 2022). This difference illustrates the importance of conducting broader studies to understand what is happening across a region and the inclusion of various species. Raptor release rates appear to fluctuate broadly throughout the existing studies. Comparing nine raptor studies spanning the United States, Europe, and Africa, release rates ranged from 21% (Florida – 390 patients) to 48% (South Africa – 242 patients) (Fix & Barrows 1990; Deem et al. 1998; Rodríguez et al. 2010; Molina-López et al. 2013; Hernandez et al. 2018; Maphalala et al. 2021; Cococetta et al. 2022; Mbali Mashale et al. 2022; Panter et al. 2022). These studies evaluated raptor intake levels ranging from 60 to 6,221 patients. The release rate for this study of 54,574 patients was 36.6% which falls well within the release rates of previous studies and represents the largest raptor study to date (Table S1).

Limitations in reporting

Current federal reporting classifications do not provide many opportunities to fully understand rehabilitation statistics in a way that reflects the reality rehabilitators face. Across the board, release rates almost always fall

Tab. 8. Duration of care by patient age. This is a breakdown of patient's duration of care by their age, including the total and average days spent in care. Breaking down the duration of care by age provides results that make complete sense when combined with the types of injuries typically faced by different age groups and the release rates of those age groups.

Tab. 8. Trvanie starostlivosti podľa veku pacienta, vrátane celkového a priemerného počtu dní strávených v starostlivosti. Rozdelenie trvania starostlivosti podľa veku poskytuje výsledky, ktoré dávajú význam v kombinácii s typmi zranení, ktorým zvyčajne čelia rôzne vekové skupiny, a mierou ich prepustenia.

Age Category	Total Days in Care*	Average Days in Care
Adult	7509	13.4
Juvenile	3281	13.6
Fledgling	2017	21.9
Nestling	1724	25.5
Hatchling	513	38.8
Egg	20	13.8
Total	15064	16.9

*Some patients had incredibly long durations of care including one patient representing over 2,000 days, seven representing over 1,000 days, and 34 representing over a year in care. At this point, it is impossible to determine if the long-term patients were a reporting error; if they ended up getting adopted as an education or foster animal; the facility failed to report the final disposition, or if the raptor was in care that entire time. Forty two patients fell within this category and were removed from these calculations.

under 50% and are not improving. This can potentially paint the rehabilitation field in a negative light. However, by factoring in the number of patients who do not survive the first 24 hours (euthanized, die on arrival, or die within a day), rehabilitators have a better understanding of where to invest their limited time and resources to prioritise the patients who have any realistic chance of survival.

Understandably, not every facility has the capacity to keep detailed records on the cause of a patient's admission, age, or sex. However, many could adopt the distinction between patients that died or were euthanized within or after 24 hours with little to no extra burden, and we strongly encourage them to do so. Identifying those designations provides a much better understanding of the patient's health and the facility's ability to render care. Understanding how many patients could have reasonably been helped by a facility would provide valuable context when interpreting rehabilitation's impact and value on native wildlife.

Duration of care

The overall median duration of care was two days, categorized by both species and cause of injury, with 25% of species and 21% of injured patients having a median of

only one day. Those numbers are a clear indicator of how many patients arrive at a rehabilitation facility on the brink of death. That idea is further supported by the fact that only 8.5% of known duration patients were released after one day or less in care, whereas 60.4% died and 72.3% were euthanized on their first day of care. It is assumed that rehabilitators have become more aware of the viability of their patients and have chosen euthanization as the appropriate treatment plan. Euthanizing patients almost immediately upon arrival is not unique to this study. A study from Spain found that euthanized patients had a median care duration of one day while orphaned young had an average time to release of 59 days (Molina-López et al. 2013).

Within this study, the causes of injury that primarily affected young patients resulted in longer care durations like falling from a nest, nest destruction, human interference, and being orphaned. That finding is further supported by the fact that as patients got older, they spent less time in care, except for eggs (Table 8).

A study from the Czech Republic that focused on common kestrels found that patients that were released spent an average of 35 days in care, whereas euthanization typically occurred on day one, and death occurred within 11 days (Lukesova et al. 2021). A larger study provided similar results regarding the duration of care separated out using the same method (Lukesova et al. 2022). When the duration of care was broken down by patients that were released, died, or euthanized in this study, the results were similar to those existing Czech Republic studies.

Investigating the duration of care by disposition further supports the idea that, in many cases, patients are not surviving long enough in care for rehabilitators to make a noticeable difference (Fig. S8). By uniformly including the 24-hour designations, rehabilitators and researchers would have a much more accurate representation of rehabilitation disposition rates. Unfortunately, the designations are only slowly being adopted; only ten facilities included the 24-hour designation within this study. When DOA was added to the federal reporting forms in 2010, it clarified patient disposition significantly, allowing researchers to remove DOA patients from the release rate calculations.

Month of admittance

In ten of the twelve years studied, May represented the greatest number of patients admitted. This spike can be explained by the increase in immature patients starting in April and peaking in May. The increase in hatchlings occurred in April, followed by increased fledgling intakes

in May. These findings are similar to other studies that indicate similar patient increase patterns during the spring, primarily made up of young patients, although those studies found June to be the month with the highest admission rate (Wendell et al. 2002; Cococchetta et al. 2022). Spring also marked a high point for age-related causes of admission, such as being orphaned, falling from a nest, hatching defect, and/or a nest destroyed in this study and also the existing literature (Rodríguez et al. 2010; Rozsypalová et al. 2022). In contrast, the trends for “trauma” and “hit by car” remained relatively flat (Figure S7).

Understanding when to expect an influx of immature birds can be valuable information for rehabilitation facilities enabling them to better plan by purchasing necessary dietary foods and hiring seasonal workers and interns.

Patient sex

Available studies identified patients’ sex 13 to 57.4% of the time (Deem et al. 1998; Rozsypalová et al. 2022; Table S1). In this study, 6,176 (11.3%) patients had an identified sex. Although low as a percent of the total, the actual number represents more identified sex patients than the 16 referenced sources combined (4,823 cases). The study’s most significant difference was the balance of male to female patients. The combined referenced studies showed a nearly balanced sex ratio of patients (Deem et al. 1998; Molina-López et al. 2011; 2013; Cococchetta et al. 2022; Panter et al. 2022; Rozsypalová et al. 2022; Table S1). It is unclear why this study was more heavily weighted toward male patients (65%). There could have been bias in the identification process, or sexual identification through external features is unreliable, or it is easier and more definitive to determine the male gender.

Patient age

Except for eggs, categorising ages into hatchling, nestling, fledgling, and juvenile proved a valuable distinction when trying to understand when patients were admitted. Considering that the term juvenile is often used as a blanket identifier for hatchlings, nestlings, fledglings, and juveniles, it was interesting to see the apparent differences in when those age groups were admitted and how those admission rates evolved from one age group to the next over each year (Fig. S4). That clear evolution illustrates the value of separating out those age groups to provide more detail for rehabilitators on what to expect at different times of the year and when to expect those transitions to occur.

The other interesting trend was the marked decrease in adult intakes starting in late spring and continuing through the summer. Monthly patient intake dropped from an average of 733 patients per month in the October through May timeframe to 561 patients per month June through September – a 25% drop in patient intake. This could be associated with parents caring for their young, particularly females.

Except for eggs, the release rates of patients based on age were the opposite of the patient volumes with hatchlings having the highest release rate and adults having the lowest release rate. This is most likely a result of the different injuries suffered by these age groups, with immature patients primarily being admitted due to their age, while adults were admitted mainly due to severe physical injuries. That same trend is evident in much of the available literature (Hanson et al. 2021; Lukesova et al. 2021). Some studies represent a higher volume of first-year or juvenile birds while others represent higher volumes of adult birds (Deem et al. 1998; Rozsypalová et al. 2022). There does not seem to be a conclusive trend in patient ages. Specific species had a higher percentage of young birds with higher release rates, as evidenced by the barn, eastern screech, and great horned owls (Table S4).

Cause of injury

In this study, as in many others, “trauma” was the most frequent cause of injury in part due to trauma being a catch-all term for physical injuries (Fix & Barrows 1990; Komnenou et al. 2005). Trauma includes a wide variety of injuries, such as broken wings and legs, punctures, amputations, and bruising. Trauma could also be used when describing a patient with multiple ailments or injuries. The breadth and ease of identifying a patient with trauma may also be a factor in why trauma is often listed as the most common cause of admittance in studies (Fig. S9). Across several different studies, patients admitted due to trauma had a lower rate of release than many other injury categories [e.g., trauma (24.3%) orphaned (77.9%) (Molina-López et al. 2013); trauma (19%) orphaned (76%) predation (34%) (Panter et al. 2022)].

Age also showed consistent trends. Patients were evenly split between adults (49%) and non-adults (51%) but there was a consistent trend that was very much related to age (Fig. S10). Non-adults were more susceptible to the categories of nest destroyed, orphaned, fell from nest, avian pox, and age-related, while adults were more associated with the categories of hit by car, toxin, not flying, entanglement, disease, and trauma.

Orphaned, or patients admitted due to their young age, was often one of the top three reasons for admission in this study and within the available literature (Wendell et al. 2002; Hanson et al. 2021).

Understanding patient injuries provides context for release rates and valuable information on what is causing the most harm to wildlife and what injuries have the best or worst chance of release. Some injuries have excellent and others have abysmal prognoses. For example, electrocution patients had a 5% average release rate, the lowest in this study, which might affect how a rehabilitator chooses to treat that type of injury in the future.

One of the most interesting areas of analysis is inspecting patient injury and care treatments to determine where to allocate the limited and valuable rehabilitation resources. Rehabilitators can only impact patients who have the potential to survive/recover. Therefore, by analyzing those patients who survived the initial 48 hours and have a 67% survival rate, rehabilitators can narrow their view of where they should focus (Table S5). For example, treating a “waterlogged” patient requires, on average, 17.5 days of care with an 87% release rate compared to a burn patient that requires 59 days of care on average with an 18% release rate.

Being able to anticipate how long a patient will need to remain in care based on the cause of injury, species, and age can have significant benefits for rehabilitators, including determining how much more food to purchase and deciding whether or not to accept a new patient. With an average of 16.6 days, rehabilitating a patient can involve significant commitment of time and resources.

To conclude, based on our expertise and the wealth of data collected, we encourage wildlife rehabilitators to adhere to the following three recommendations.

Recommendations

Data collection

Understanding the time it takes to treat and determine the final patient disposition is critical in understanding the patient’s chance of survival and the treatment requirements. Some facilities have added the designations “Died in 24 Hours” and “Euthanized in 24 Hours” which provide additional fidelity to the care provided. However, it is recommended that facilities capture both the intake and final disposition date and time. This would eliminate the need for these two dispositions.

Only 28% of the reporting facilities captured the final disposition date. Knowing a patient’s actual days in care associated with a particular injury, diagnosis and treatment plan allows rehabilitators to define better

resource allocation plans. It also highlights areas of study for researchers and clinicians to experiment with potential new treatment plans that would result in fewer days in care and increased patient release rates.

Data sharing

One of rehabilitators’ largest challenges is finding insights into the latest state of raptor, and more broadly, avian care and up-to-the-minute trends (e.g., avian influenza). Today, data is spread between different facilities, the US government, state governments and independent record capture vendors; it is stored in different formats (pdf, scans, relational databases, and handwritten notes); and can take at least 18 months to be published. The recommendation is to establish a centralised data capture and repository platform for all facilities and practitioners to record patient data, investigate treatment options, and analyse trends.

This would allow smaller facilities to use a standardized system to consistently capture the necessary data for government reporting requirements and industry analysis. It would also lead to increased data integrity as the community of rehabilitators would provide more data oversight with a professional perspective.

Finally, this data-sharing platform would make real-time data available to rehabilitators to identify trends like avian influenza as they unfold. Increasing the quality of data produced will undoubtedly attract more interest from researchers, which could stimulate additional funding for a field that primarily relies on donations.

Diagnosis and treatment categorization

Over 40% of the patients in this study had an identified injury of “trauma.” In the other referenced research, six studies had trauma designations ranging from 58% to 82% of the patients. Unfortunately, the trauma designation provides little to no insight into the reason for admittance. A patient is either healthy or not healthy. Not healthy equates to trauma.

The recommendation is to first classify the patient with a high-level observation: healthy vs. not healthy (trauma). Then, the necessary subcategories for each condition should be provided, allowing for multiple injuries or ailments for patients who are not healthy. Healthy patients would include subcategories like “clinically healthy,” “orphaned,” or “fell from nest”.

Listing a more accurate injury diagnosis like “poisoned” or “hit by car” and adding the treatment methods would allow other rehabilitators to address better injuries they potentially have never seen. These methods

would include new treatment methods, drug selections, dosage calculations, enclosure design, and expected recovery times.

The data provided in this study has the potential to make fundamental changes to raptor rehabilitation policies and encourage more collaboration between rehabilitators and researchers for the betterment of the patients in care.

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Supplementary material

The Supplementary material for this article can be found online at: <https://sciendo.com/journal/SRJ>

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