

# Comparative study of causes of death and life expectancy in carnivorous pets (II)

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## SUMMARY

The authors report a comparative study of causes of death recorded during one year, respectively among 785 dogs and 259 cats. Observed differences appeared to be correlated with the animals' way of life rather than with constitutional factors. Cats' free wandering preponderantly exposes them to road accidents, poisoning and infectious diseases. 50 % of the cats under study met their death in such ways before the age of 8 years, whereas the mortality rate for dogs for the same period was 18 %. Chronic organ disease and cancer were associated to a 12 year life expectancy in both species. This corresponds on average to a 3 year reduction in life span. Usually, identical tissue locations were found for these diseases, although renal failure appeared to be significantly more frequent among cats, whereas locomotor system diseases such as osteoarthritis/paralysis and cardiac diseases especially affected dogs. Thus, carnivorous pets' health essentially rests on regular follow-up of vaccination protocols and early detection of age-related diseases as of 8 years of age. Nonetheless, the prevention of straying remains an essential life-expectancy factor.

**KEY-WORDS :** epidemiology - mortality - pediatrics - geriatrics - dog - cat.

## RÉSUMÉ

**Étude comparée des causes de mortalité et des espérances de vie chez les carnivores domestiques (II). Par D. MOREAU, P. CATHELAIN et A. LACHERETZ.**

Les auteurs présentent une étude comparative des causes de mortalité enregistrées sur une année, respectivement chez 785 chiens et 259 chats. Les différences observées apparaissent plus volontiers liées aux modes de vie des animaux qu'à l'intervention de facteurs constitutionnels. La libre circulation des chats les expose de façon prépondérante aux accidents de la circulation, aux empoisonnements et aux maladies infectieuses. 50 % des chats étudiés ont ainsi trouvé la mort avant l'âge de 8 ans, alors que chez les chiens et pour la même période, le taux de mortalité est de 18 %. Les affections chroniques d'organe et les cancers associent, dans les deux espèces, une espérance de vie de 12 ans. Ceci correspond en moyenne, à une réduction de 3 ans de la durée de vie des animaux. L'on retrouve habituellement dans ces maladies les mêmes localisations tissulaires, encore que les insuffisances rénales apparaissent significativement plus fréquentes chez les chats et qu'inversement, les affections de l'appareil locomoteur de type arthrose/paralysie et les atteintes cardiaques concernent surtout les chiens. La santé des carnivores domestiques repose ainsi, et essentiellement, sur un suivi régulier des protocoles de vaccination et l'association, dès l'âge de 8 ans, d'un dépistage des maladies liées au vieillissement. Il n'en demeure pas moins que la prévention de la divagation reste un facteur essentiel de longévité.

**MOTS-CLÉS :** épidémiologie - mortalité - pédiatrie - gériatrie - chien - chat.

## Introduction

In a previous study [8] we showed that carnivorous pets' life expectancy (L.E.) is tending to catch up with their physiological life span, with a mean reference which can be established as 15 years. This trend is the result of an extensive regression in pediatric mortality, including road accidents

(L.E. = 3.6 years), infectious diseases (L.E. = 5.3 years) and poisoning (L.E. = 5.5 years).

In contrast, the end of life is essentially brought forward by a few years as a result of cessation of therapy (L.E. = 11.4 years), chronic organ disease (L.E. = 11.8 years), or cancer (L.E. = 12.1 years). Prevention or attenuation of these conse-

quences of aging requires undertaking their detection as early as 8 years of age, when animals enter their second half of life.

The aim of the present study was to compare the causes of death recorded respectively among dogs and cats, and to specify the significance of the observed differences.

## 1) Materials and methods

### 1) ANIMALS

The corpses of the 1,044 animals studied, comprising 785 dogs (75 %) and 259 cats (25 %), had been sent to the incineration center of Beauvoir in Cambrésie (France) during the year 1999. They came from 15 veterinary clinics working exclusively with this center and which had agreed to provide information on habitat and cause of death for each animal, in addition to the usual data (species, breed, sex, and age). Males (53.8 %, N = 562/1,044) were significantly more numerous than females (42.6 %, N = 482/1,044). This difference was equivalent for both species (dogs : 418 males (53.3 %) and 367 females (46.7 %) ; cats : 144 males (55.6 %) and 115 females (44.4 %)) [5, 8].

### 2) STATISTICAL ANALYSIS

The data were analyzed with 5 % risk by chi-square test or by comparison of means  $\pm$  semi-interquartile range. Life expectancies correspond to weighted means of death age observed in each population and sub-population under study.

## 2) Results

### 1) MORTALITY CATEGORIES

The various causes of death observed in the two species can be classified into 4 prevalent etiological categories (Table I). In increasing frequency order, for all animals taken together, these are : convenience euthanasia (7.6 %, N = 79/1,044), death resulting from accidents (10.8 %, N = 113/1,044), natural death (17.9 %, N = 187/1,044) and death resulting from disease (63.7 %, N = 665/1,044).

The results reported in Table I show that the two species differ with respect to these categories ; this is moreover confirmed by the statistical analysis. Cats appear to be especially subject to accidental death (dogs = 6.0 %, cats = 25.5 %), whereas, reciprocally, dogs are significantly more frequently prey to other causes of death.

### 2) MORTALITY RESULTING FROM ACCIDENTS

In both species, accidental deaths are essentially due to road accidents (dogs = 57.4 %, N = 27/47 ; cats = 40.9 %, N = 27/66) or to poisoning (dogs = 29.8 %, N = 14/47 ; cats = 39.5 %, N = 26/66 (Table II).

Even so, in both cases, cats appear to be the main victims. Road accidents affect them 3 times more as often as dogs (dogs = 3.4 %, N = 27/785 ; cats = 10.4 %, N = 27/259), and poisoning almost 6 times (5.64) as often (dogs = 1.8 %, N = 14/785 ; cats = 10.0 %, N = 26/259).

### 3) MORTALITY RELATED TO DISEASE

The various diseases involved in animals's deaths are reported in Table III. They comprise chronic organ diseases (48.6 %, N = 323/665), cancer (38.8 %, N = 258/665) and infectious diseases (12.6 %, N = 84/665). Comparative distribution analysis reveals 3 different categories of expression.

The first category represents diseases of which the percentage expression varies very significantly from one species to the other. Such is the case for infectious diseases, prevalent among cats (dogs = 4.9 %, N = 25/515 ; cats = 39.4 %, N = 59/150), for cardiac diseases, more frequent among dogs (dogs = 9.7 %, N = 50/515 ; cats = 1.3 %, N = 2/150), and for locomotor system diseases, reported only in dogs (dogs = 14.0 %, N = 72/515).

The second category represents diseases with significant inter-species difference in distribution and with risk lying between 5 % and 2 %. These are renal failure, more frequent among cats (dogs = 12.0 %, N = 62/515 ; cats = 18.7 %, N = 62/515) and tumors, more frequent among dogs (dogs = 41.2 %, N = 212/515 ; cats = 30.7 %, N = 46/150).

The third category represents diseases showing similar distribution as causes of death in the two species. These include, in particular, cerebral disease (dogs = 5.5 %, N = 28/515 ; cats = 2.7 %, N = 4/32), metritis (dogs = 4.6 %, N = 24/515 ; cats = 2.0 %, N = 2/150) and diabetes (dogs = 4.0 %, N = 21/515 ; cats = 5.0 %, N = 5/150).

### 4) MORTALITY RELATED TO INFECTIOUS DISEASE

The 25 cases observed among dogs (3.2 %, N = 25/785) mainly resulted from parvovirus (40.0 %, N = 10/25) and distemper (32.0 %, N = 8/25). These two diseases taken together account for 72.0 % of recorded infectious diseases (N = 18/25).

The 59 cases reported among cats (22.8 %, N = 59/259) essentially involved retrovirus (72.8 %, N = 43/59) and infectious peritonitis (15.3 %, N = 9/59). These two diseases taken together account for 88.1 % of mortality related to infectious disease (N = 52/59).

### 5) MORTALITY RESULTING FROM CANCER

Cancer location was specified in 157 cases out of 258 (60.8 %). Mammary tumors were prevalent (42.0 %, N = 66/157). Other locations were variously represented : hepatic (16.0 %, N = 25/157), lymphoid (13.4 %, N = 21/157), osseous (10.8 %, N = 17/157), cerebral (10.2 %, N = 16/157) or pulmonary locations (7.6 %, N = 12/157). There were no significant inter-species differences in distribution (Table IV).

	Euthanasia	Accidents	Natural death	Disease
Dogs N = 785	068 (08.7%)	047 (06.0%)	155 (19.7%)	515 (65.6%)
Cats N = 259	011 (04.2%)	066 (25.5%)	032 (12.4%)	150 (57.9%)
Total N = 1,044	079 (07.6%)	113 (10.8%)	187 (17.9%)	665 (63.7%)

TABLE I. — Frequencies of causes of death observed in dogs and cats (number of cases (percentage)).

	Road	Poisoning	Other	Total
Dogs	27 (57.4%)	14 (29.8%)	06 (12.8%)	047 (100%)
Cats	27 (40.9%)	26 (39.5%)	13 (19.6%)	066 (100%)
Total	54 (47.8%)	40 (35.4%)	19 (16.8%)	113 (100%)

TABLE II. — Frequencies of deaths resulting from accident. (Other = Hunting accidents, tumbles, bites between animals).

Disease	Dogs	Cats	Total	Difference
Infectious diseases	025(04.9%)	059 (39.4%)	084 (012.6%)	S (0.1%)
	NC	NC	NC	NC
Cardiac diseases	050 (09.7%)	002 (01.3%)	052 (07.8%)	S (0.1%)
	050 (10.2%)	002 (02.2%)	052 (08.9%)	S (0.1%)
Arthritis/paralysis	072 (14.0%)	000 (00.0%)	072 (10.8%)	S (0.1%)
	072 (14.7%)	000 (00.0%)	072 (12.4%)	S (0.1%)
Renal failure	062 (12.0%)	028 (18.7%)	090 (13.5%)	S (5%, 2%)
	062 (12.7%)	028 (30.8%)	090 (15.5%)	S (0.1%)
Cancer	212 (41.2%)	046 (30.7%)	258 (38.8%)	S (5%, 2%)
	212 (43.2%)	046 (50.5%)	258 (44.5%)	NS (5%)
Cerebral diseases	028 (05.5%)	004 (02.7%)	032 (04.8%)	NS (5%)
	028 (05.7%)	004 (04.4%)	032 (05.5%)	NS (5%)
Metritis	024 (04.6%)	003 (02.0%)	027 (04.0%)	NS (5%)
	024 (04.9%)	003 (3.33%)	027 (04.6%)	NS (5%)
Diabetes	021 (04.1%)	005 (03.3%)	026 (03.9%)	NS (5%)
	021 (04.3%)	005 (05.5%)	026 (04.5%)	NS (5%)
Other	021 (04.1%)	003 (02.0%)	024 (03.8%)	NS (5%)
	021 (04.3%)	003 (03.3%)	024 (03.1%)	NS (5%)
Total	N = 515	N = 150	N = 665	
	N = 490	N = 091	N = 581	

TABLE III. — Frequencies of mortality related to a disease. The first line takes into account all the cases, the second disregards infectious disease. (NC = Not Calculated). S ( ) = significant difference of risk ( ). NS (5 %) = non significant difference of risk 5 %.

6) MORTALITY RESULTING FROM EUTHANASIA

Convenience euthanasia accounted for 7.6 % of cases (N = 79/1,044). It was most often motivated by the animal's aggressiveness (60.7 %, N = 48/79) or cessation of therapy (20.3 %, N = 16/79). The low number of cases reported for cats (N = 11) precludes comparative analysis with dogs (N = 68) (Table V).

7) LIFE EXPECTANCIES AND SURVIVAL RATES

For dogs and cats taken together, and whatever the cause of death, mean life expectancy was nearly 11 years (10.85 ± 0.31). This general mean nonetheless covers two significantly different facts, as the mean life expectancy for dogs was 11.5 years (11.50 ± 0.33), and 9 years (8.90 ± 0.73) for cats.

Likewise, Tables VI and VII show that mortality rates differ significantly by age group :

— to the detriment of cats, during the period from 0 to 8 years, mortality rates during this period being respectively 18.1 % for dogs (N = 142/785) and 49.0 % for cats (N = 127/259) ;

— to the detriment of dogs, during the period from 11 to 15 years, mortality rates during this period being respectively 70.3 % for dogs (N = 348/495) and 51.8 % for cats (N = 56/108).

On the other hand, mortality rates are equivalent between the two species during the periods from 8 to 11 years (dogs = 23.0 % ; cats = 18.2 %) and from 15 to 20 years or more (100 %).

3) Discussion

1) MORTALITY CAUSES AND MORTALITY RATES

Generally speaking, dogs and cats die from the same causes, although some significant quantitative differences are noticeable.

— Infectious diseases and accidents, including road accidents and poisoning, account preponderantly for cats' mortality (48.3, N = 125/259) [1], but only moderately for dogs' mortality (10.4 %, N = 82/785) [7].

— Chronic organ disease, cancer and euthanasia by cessation of therapy are, on the other hand, more frequently involved in deaths recorded for dogs (dogs = 64.2 %, N = 504/785 ; cats = 35.9 %, N = 93/259) [4, 9, 10].

This distribution is moreover associated with mortality rates which, up to the age of 8 years or almost half the animals' life span, are respectively 49.0 % for cats and 18.1 % for dogs. Concurrently, the life expectancies calculated for the two species are significantly different.

2) CAUSES OF DEATH AND LIFE EXPECTANCY

Life expectancy is respectively 11.5 years for dogs and 9 years for cats. Two abstractions are worth performing : natural death (dogs, N = 155/785 ; cats, N = 32/259) and death related to external events, including in particular infectious diseases, accidents and euthanasia other than as cessation of therapy. Resulting values for life expectancy are equivalent,

Location	Dogs	Cats	Total
Mammary	54 (43.9%)	12 (35.3%)	66 (42.0%)
Hepatic	20 (16.3%)	05 (14.7%)	25 (16.0%)
Lymphoid	15 (12.2%)	06 (17.65%)	21 (13.4%)
Osseous	11 (08.9%)	06 (17.65%)	17 (10.8%)
Cerebral	13 (10.6%)	03 (08.8%)	16 (10.2%)
Pulmonary	10 (08.2%)	02 (05.9%)	12 (07.6%)
Sub-total	123 (100%)	24 (100%)	157 (100%)
Other	089	12	101
Total	212	46	258

TABLE IV. — Frequencies of cancers and of their location.

Motivations	Dogs	Cats	Total
Aggressiveness	44 (64.7%)	04 (36.4%)	48 (60.7%)
Cessation of therapy	14 (20.6%)	02 (18.2%)	16 (20.3%)
Other	10 (14.7%)	05 (45.4%)	15 (19.0%)
Total	68 (100%)	11 (100%)	79 (100%)

TABLE V. — Frequencies of causes of euthanasia requests. (Other : including moving house or owner's decease.

Age group in years	Number of live dogs	Number of registered deaths	Mortality rate (%)	Survival rate (%)
[ 0 – 1 [	785	032	04.1	100
[ 1 – 3 [	753	039	05.2	95.9
[ 3 – 5 [	714	019	02.7	90.9
[ 5 – 8 [	695	052	07.5	88.5
[ 8 – 11[	643	148	23.0	81.9
[11 – 15[	495	348	70.3	63.0
[15 – 20[	147	140	95.2	18.7
≥ 20	007	007	100	00.9

TABLE VI. — Breakdown of deaths registered for dogs by age-group : Numbers of dogs living at the beginning of a period — Number of registered deaths per group — Mortality rate per group — Survival rate at the beginning of period. Life expectancy = 11.5 years  $\pm$  0.33.

Age group In years	Number of cats	Number of registered death	Mortality rate (%)	Survival rate (%)
[ 0 – 1 [	259	24	09.3	100
[ 1 – 3 [	235	42	17.9	90.7
[ 3 – 5 [	193	25	12.9	74.5
[ 5 – 8 [	168	36	21.4	64.9
[ 8 – 11[	132	24	18.2	51.0
[11 – 15[	108	56	51.8	41.7
[15 – 20[	052	49	94.2	20.1
≥ 20	003	03	100	01.1

TABLE VII. — Breakdown of deaths registered for cats by age-group : Numbers of cats living at the beginning of a period — Number of registered deaths by group — Mortality rate per group — Survival rate at the beginning of period. Life expectancy = 8.90 years  $\pm$  0.73.

reaching 12 years for both species. Practically, this corresponds to the life expectancy of animals which died from chronic organ disease or cancer.

By likewise correcting the comparative study of mortality related to a disease (Table III), i.e., by disregarding infectious diseases, and taking into consideration only chronic organ diseases and cancer, one can conclude that : (i) cancer, cerebral failure, diabetes and metritis occur with the same percentages in both species ; (ii) locomotor system diseases such as paralysis/osteoarthritis and cardiac diseases are mostly encountered among dogs [2] ; (iii) on the other hand, renal failure is prevalent among cats.

These inter-species differences do not modify life expectancies related to aging diseases in the two species (12 years) : these diseases are generally associated to similar life expectancies [8].

## Conclusion

Causes of death observed in dogs and cats vary much more as a function of way of life than of constitutional factors.

Cats' free wandering increases their risk of road accidents, poisoning and infectious diseases. Lack of vaccination against infectious peritonitis and retrovirosis (F.I.V.) is a worsening factor. As a result, 18 % of dogs under study die before they are 8 years old, whereas for cats, for the same period, the mortality rate reaches 50 %.

Chronic organ disease and cancer are, in both species, associated with a life expectancy of 12 years. This corresponds, on average, to a 3-year reduction in life span (20 %). Usually, the same tissue locations are found for these diseases, even though renal failure appears to be significantly more frequent among cats, whereas locomotor system diseases such as paralysis/osteoarthritis and cardiac diseases occur mostly in dogs.

Thus, carnivorous pets' health rests essentially on a regular follow-up of vaccination protocols [6] and early detection of diseases related to aging, as of 8 years of age or almost half the animals' life span. Treatment will be all the more effective [3, 10]. Nonetheless, prevention of straying remains an essential factor of lifespan.

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