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Study of the demographic profile and life expectancy of the canine population registered in the Companion Animals Information System (SIAC)

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"A viagem não acaba nunca. Só os viajantes acabam. E mesmo estes podem prolongar-se em memória, em lembrança, em narrativa (...). É preciso voltar aos passos que foram dados, para os repetir, e para traçar caminhos novos ao lado deles. É preciso recomeçar a viagem. Sempre."

José Saramago

The following article is part of this dissertation, available in section 9:

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ABSTRACT

This study aimed to provide a comprehensive picture of the life expectancy of dogs in Portugal, focusing on the impact of diverse factors including breed, sex, size, and skull shape. The final dataset, gathering data from the national registry database, consisted of 278,116 dogs with confirmed deaths. The density of the dog population was notably greater in coastal areas, especially in urban centers such as Lisbon and Porto. Large breeds were more frequent in almost all districts. The mean lifespan at birth for all the dogs was around 8.91 years, with the female dogs tended to have a similar lifespan to male dogs. The analysis of life expectancy at birth for the 20 most common non-Portuguese breeds and 10 Portuguese breeds revealed that Yorkshire Terriers had the highest life expectancy (10.89 years) and French Bulldogs the lowest (6.27 years). Size and cephalic index were found to be influential factors, with large brachycephalic breeds exhibiting shorter life expectancies and smaller, mesocephalic breeds experiencing longer lifespans. Additionally, the cephalic index had a more substantial impact on life expectancy compared to body size. These findings enhance the understanding of the factors influencing canine longevity and aid in developing strategies to improve the health and lifespan of companion dog.

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BIC- Bayesian Information Criterion

CROs - Official animal collection centers

FCI - Fédération Cynologique Internationale

FEDIAF - European Pet Food Industry Federation

KC - UK Kennel Club

ICNF - Institute for the Conservation of Nature and Forests

SIAC - Official national dog registry database

1. INTRODUCTION

The health of animals directly affects the health of the public and influences the well-being of individuals and populations within ecosystems [1]. This connection is emphasized through the concept of One Health, which acknowledges the interdependence of human, animal, and environmental health, and emphasizes the importance of collaboration and communication among various disciplines and sectors to address health issues that affect all three domains [2].

Dogs play an important role in the one health approach as they live closely to humans and can act as sentinels for various infectious diseases and environmental hazards, making them essential for surveillance and monitoring purposes [3–5].

The demographic characteristics of dog populations are critical to comprehending and managing zoonotic diseases. As major reservoirs of various pathogens capable of infecting humans, domestic dogs present as a critical feature in the transmission of zoonoses. Understanding their population dynamics, behavior, and ecological interactions is essential for assessing zoonotic risks and implementing effective control measures [6]. For instance, highlighting the demographic characteristics of dog populations can guide public health strategies aimed to mitigate the transmission of zoonotic diseases such as echinococcosis, which is notably influenced by dog behavior and fecal contamination in the environment [7].

The epidemiological landscape of dog-mediated zoonotic diseases is further complicated by the presence of semi-roaming and free-roaming dog populations, which can act as vectors for zoonotic diseases, including rabies, leishmaniosis, and echinococcosis [8,9]. In Portugal, official numbers from the 2023 annual activity report on official animal collection centers (CROs) highlight the growing problem of stray animals in the country and the ongoing disparity between the number of animals collected and those adopted. In 2023, nearly 15,000 more stray animals were reported. Notably, these figures do not account for animals taken in by shelters run by animal welfare organizations [10]. A recent study conducted in collaboration with the Institute for the Conservation of Nature and Forests (ICNF), has provided important insights into the stray animal population in Portugal. The first National Census of Stray Animals estimates that there are about 101,015 stray dogs living in Portugal. The findings also revealed significant differences between cats and dogs in terms of owner responsibility. Most dog owners exhibit higher levels of responsible ownership, including proper identification, registration, and supervision of their animals' outdoor access when compared to cat owners. The study also identifies a correlation between lower household incomes and a higher presence of stray animals, suggesting that economic difficulties may be a limiting factor in responsible pet ownership practices [11].

Several demographic factors such as breed, size of the animal, and health status can have a significant impact in their longevity. Research indicates that the life expectancy of dogs is closely tied to their breed, with smaller breeds generally living longer than larger ones. [12–16]. Furthermore, a recent study using data from the Dog Aging Project [17] found that dog size, along with age, is a significant predictor of disease risk, with larger dogs being more susceptible to various diseases, including skin problems, orthopedic issues, gastrointestinal problems, ear/nose/throat issues, cancer, neurological disorders, endocrine disorders, and infectious diseases.

Research on the longevity of mixed-breed versus purebred dogs has yielded mixed results, with most studies suggesting that mixed-breed dogs live longer than purebred dogs [14,18–21]. However, a more recent study [16] has cast some uncertainty on this notion, revealing that almost half of purebred dogs (47.1%) actually had a longer median survival estimate than crossbreds. Moreover, only 25.8% of the purebred dogs had a shorter lifespan and 27.1% did not show any significant difference in lifespan when compared to mixed-breed dogs.

2. RESEARCH OBJECTIVES

This research project was designed to provide a comprehensive analysis of the demographic profile of the owned dog population in Portugal, using data sourced from the official national dog registry database (SIAC) [22]. The study aims to explore a range of critical factors, including identifying the most common dog breeds and examining their distribution patterns across different regions of the country.

The primary objective of this study was to extract and analyze reliable data from the SIAC database to assess the life expectancy at birth of the companion dog population in Portugal. For the first time, period lifetables were created for the 20 most common non-Portuguese and 10 Portuguese dog breeds. This study also aimed to identify significant variations in life expectancy at birth, considering factors such as sex, breed, body size, and skull shape.

3. LITERATURE REVIEW

Data on the demography of owned dogs in Portugal is still scarce. In 2024, the European Pet Food Industry Federation (FEDIAF) reported a total of 2,840,000 dogs [23], marking an increase from 1,775,000 in 2012 [24]. This figure represents the highest number recorded within the analyzed period.

Mandatory dog identification with a microchip and registration have become widespread practices in many European countries in recent years [25–28]. In Portugal, according to Decree No. 312/2003 and Decree No. 315/2009, microchipping is mandatory for all companion dogs born after July 1st, 2008. For dangerous or potentially dangerous dogs, breeding dogs, commercial or profit-making dogs, microchipping has been in place since July 2004.

SIAC is the official registry for companion animals in Portugal, primarily dogs and cats. This centralized system allows the government to regulate and control animal populations, ensuring vaccinations against rabies and other diseases, thereby enhancing public health and safety. It provides valuable data on registered dogs, helping authorities understand pet demographics and trends, develop policies for population control, and address issues like overpopulation and stray animals. Additionally, SIAC aids in tracking lost pets, increasing the chances of reuniting them with their owners and discouraging abandonment.

As some pet owners fail to follow the regulations by accurately registering their pets or updating information on their status, such as death or transfer of ownership, the accuracy of this registration database is considered uncertain. According to an online survey in 2020 with 111 responses, the proportion of pets with a microchip in Portugal was just 65.4%. Although Lisbonhad the lowest compliance rate at 39.5%, no significant differences were observed among the regions. It is important to note that the results of the surveymay be biased, as it included cats which were not legally required to have a microchip identification at the time of the survey [29].

A recent 2023 study, based on 1,047 responses from an online questionnaire, found that 77% of the dogs surveyed were microchipped. The authors further concluded that the likelihood of microchipping was higher when dogs were acquired specifically for companionship rather than being obtained from the street [30].

Registries like SIAC provide a structured and comprehensive database that can facilitate research into various factors influencing the longevity of companion dogs. By collecting and analyzing demographic data and breed information, registries can help identify trends and correlations that contribute to the understanding of canine lifespan.

Most dog breeds tend to have similar lifespan patterns, with a lower mortality rate during young adulthood that gradually increases, peaking in their senior years [12,14,31,32]. Additionally, studies have highlighted significant similarities in the age-related disease risk between humans and dogs, with causes of death such as neoplastic, congenital, and metabolic factors following comparable age trajectories in both species [33].

There is no universally adopted standard for how dog mortality data should be collected, recorded, and reported to allow for accurate comparisons across studies and populations. Two commonly used methods in survival analysis are the Kaplan–Meier analysis, Cox proportional hazards regression [34], and the Chiang method using life tables [35].

The Cox regression and Kaplan–Meier methods are often used in longitudinal studies focusing on time-to-event outcomes, allowing for the inclusion of multiple covariates. These methods typically deal with both censored and uncensored data. Censoring occurs when the event is not observed. Using these methods, the median survival time can be compared across groups even if not all individuals have a recorded date of death [36,37].

Life tables are commonly used in demography, epidemiology, and public health to estimate survival rates, mortality rates, and life expectancy [38]. There are two primary types of life tables—cohort life tables and current life tables. Each offers a unique perspective on mortality rates and life expectancy, allowing for the analysis of different aspects of population dynamics. A cohort life table, also known as a generation life table, tracks the mortality experience of a specific group over their entire lifetime. It provides a detailed picture of how mortality rates change over time for a particular generation, considering both observed and projected improvements in mortality [39]. On the other hand, a current or period life table offers a hypothetical representation of a group's mortality experience if they were exposed to the mortality rates of a specific time period throughout their whole lifespan. It is based on the death rates prevailing in that year, regardless of the age of the individuals experiencing those deaths. Period life tables can be created using more recent data, allowing for a more up-to-date picture of mortality trends [40].

Creating a comprehensive life table represents a unique challenge, primarily due to the need for a vast dataset that captures the diverse breed structures and health factors present across different canine populations. The task's complexity is further exacerbated by variations in breeding practices, environmental influences, genetic and health-related factors [21,36,41,42], and access to veterinary care, which can vary significantly between geographical regions [43,44].

Despite these challenges, researchers in several countries have made valuable contributions to this field. A study carried out by KendyTzu-yun Teng and their team members [45] explored the life expectancy of different dog breeds, using data from over 30,000 dogs to construct life tables for companion dogs. The life expectancy at age 0 determined for UK dogs was 11.23 years. Female dogs lived longer than males. Life expectancy varied widely between breeds, from 12.72 years for Jack Russell Terriers to 4.53 years for French Bulldogs. A more recent study [19] in the USA used clinical records from over 1,000 hospitals to create life expectancy tables for dogs and cats. The study considered various factors that could impact life expectancy, including surveyyear, gender, adult body size for purebred dogs, and median lifetime body condition score. For dogs, life expectancy at birth was 12.69 years and it increased as body size decreased, and survey years went up.

To date, no published research has specifically addressed this topic within the Portuguese context, presenting an opportunity for further investigation and contribution to the body of knowledge on canine demography, longevity and survival in different cultural and geographical settings.

4. MATERIALS AND METHODS

4.1 Study population

The total study population of this study encompassed all registered in SIAC database since 01/01/1970 to 21/09/2023. A total of 3,056,906 dogs were selected from the SIAC records for further analysis with date of registration between January 1st, 2000, and December 31st, 2022. Data from the year 2023 was not considered for this study, as it was still being collected.

In figure 1 is possible to observe the evolution of records of dogs in this database. There was a peak beginning in 2004 which corresponds to the time when microchipping became initially mandatory by law. For each additional year since 2006, the mean number of records increased by about 152,230 dogs until it reached a peak in 2020 during the pandemic. For the following two years,there was a decrease in the number of records by about 22,783 dogs.

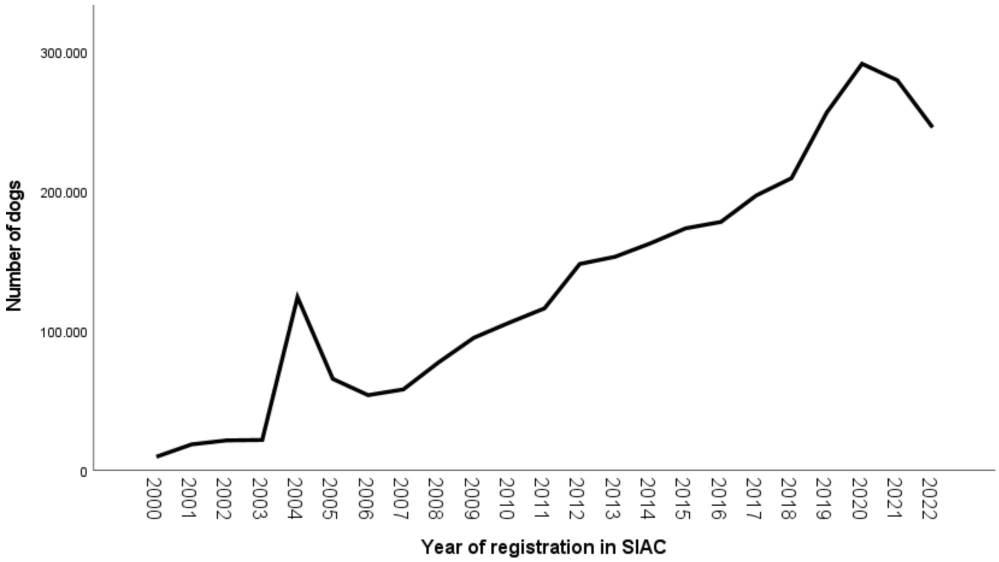

Figure 1-Number of records by year of registration in SIAC.

To maintain accurate and up-to-date information, the registry should be updated in the event of a dog's disappearance, relocation, transfer of ownership, or death. Figure 2 shows the evolution of death records across the years in the database. There was steady increase starting in 2012 largely due to the fact that death notifications were only able to be entered into the database in 2012. Furthermore, in 2019, the reporting of deaths became mandatory by law.

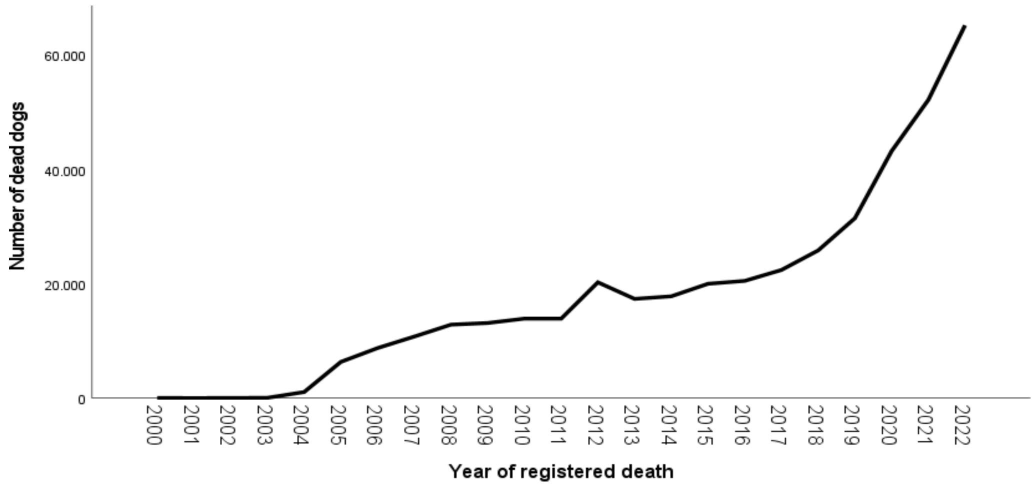

Figure 2-Number of dogs with registered death by year in SIAC.

There are 2,592,531 dogs (84.8%) recorded as "alive" having only their date of birth registered, while 464,375 dogs (15.2%) have both their date of birth and date of death registered, and are therefore considered “dead”.

Figure 3 shows the age pyramid of the dogs included in the study. The number of dogs marked as "alive" is larger among younger age groups, reaching its peak at age 2. The population gradually decreases with age, showing a significant decline after age 11.

Notably, 130,897 animals, constituting 4.3% of the sample, are recorded as "alive" or “dead” beyond the age of 20, which suggests the possibility of "phantom" entries where animals are incorrectly labeled as "alive" or “dead” with implausible ages.

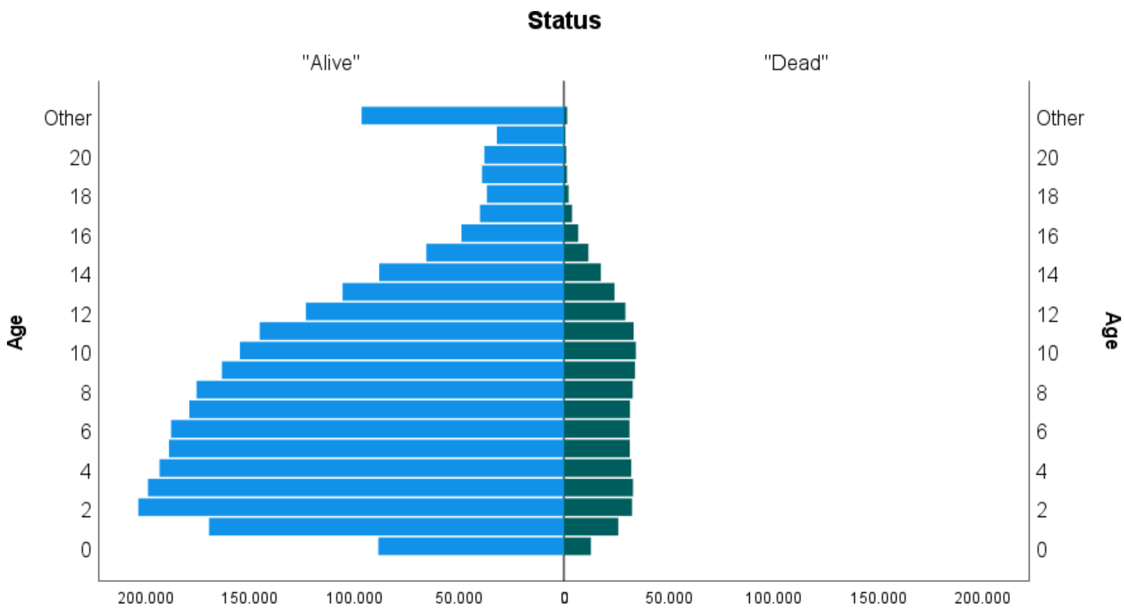

Figure 3-Age Pyramid of the Canine Population by status.

4.2 Data extraction

To protect privacy, all records were anonymized by encrypting each animal's identification number. The data extracted for this study included demographic information (breed, sex, date of birth, neutered status, and date of death) and geographic location (parish, county, and district of owner's residence). Owner-reported parameters, including the date of birth and pedigree status, are provided at the time of the dog's registration in the database. The lifespan was calculated based on the period from the reported date of birth to the date of death.

4.3 Data Cleaning and Statistical Analyses

To ensure greater data accuracy, the database underwent a cleaning process involving the removal of specific records meeting the following criteria: (a) deceased before 1 January 2013 or after 31 December 2022, (b) with a negative lifespan, (c) lacking essential birth or mortality information, and (d) missing breed or sex details.

The official recording of animal deaths in the database was considered inadequate, leading to the potential existence of "phantom" entries where animals were inaccurately labeled as "alive" or implausibly old.

To address this uncertainty caused by delayed death notifications, which often overestimated lifespans and delayed birth notifications, which tended to underestimate lifespans in certain breeds, we adopted a two-stage approach. First, guided by prior assumptions, we identified three possible groups, namely delayed death notifications ("phantom" entries), delayed birth notifications, and not delayed death and birth notifications ("standard"). Next, we employed outlier modeling using a finite mixtures approach [46] with the MCLUST package in R to determine the optimal number of age subgroups for each chosen breed. We assumed the variable/unequal variance for the one-dimensional clustering and tested the number clusters between 1 and 4. The analysis determined the most suitable number groups by evaluating the Bayesian Information Criterion (BIC) and identifying the corresponding number of subgroups.

The age distribution ofeach cluster was then examined to determine if they fit into the "delayed birth notification" or "phantom entries" categories. If these groups were considered plausible, they were excluded from the final weight calculation. Figures 4 and 5 illustrate the rationale behind this process.

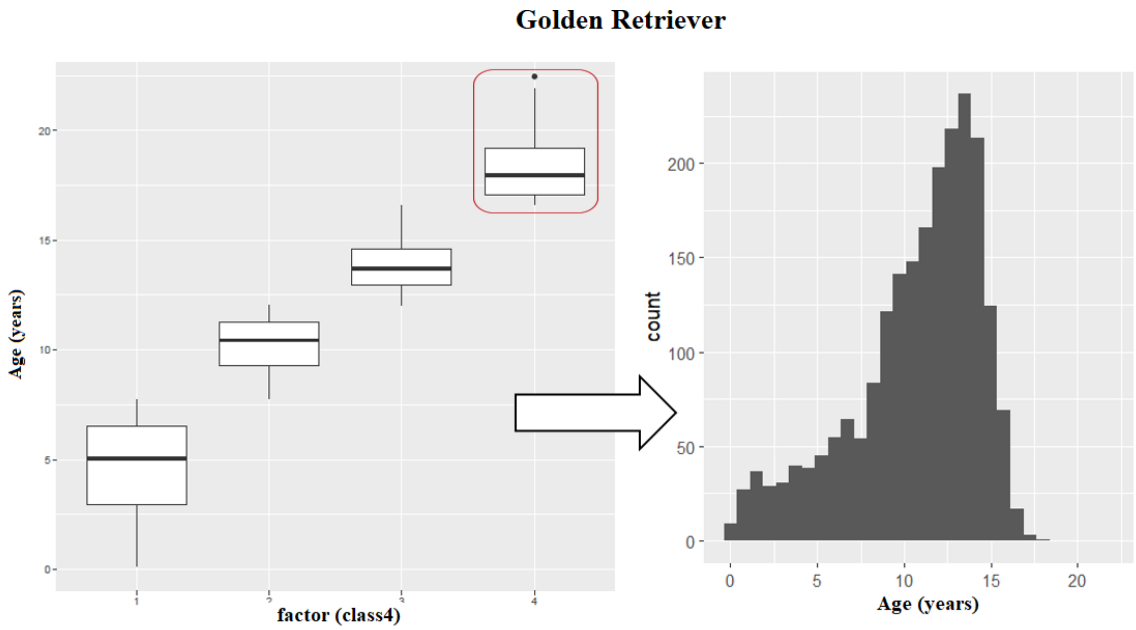

Figure 4- Finite Mixtures Approach for the Golden Retriever Breed. The age distribution of Cluster 4 was included into the "phantom entries" category and was therefore removed from the final weight calculation.

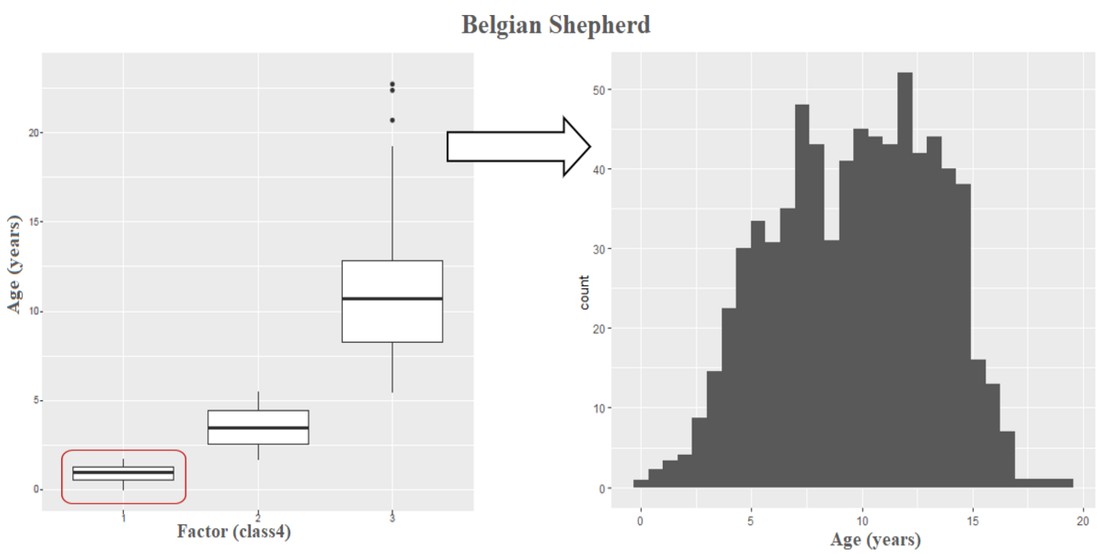

Figure 5 - Finite Mixtures Approach for the Belgian Shepherd Breed. The age distribution of Cluster 1 was included into the "delayed birth notification" category and was therefore removed from the final weight calculation.

The objective was to develop an algorithm that estimated a weight indicating the plausibility of a given age for each selected breed. Once the algorithm converged, individuals were grouped according to the probability of belonging to each cluster, considering the existing group membership probabilities. Based on these criteria, we excluded clusters with lower age distributions from the final analysis in 20 selected breeds. This step aimed to reduce bias towards higher mortality rates in young adulthood, thereby improving the accuracy of estimating life expectancy in later years. Additionally, the clusters with the highest age distributions were excluded in 12 breeds to minimize uncertainty associated with implausibly old dogs ("phantom" entries).

A hypothetical life table was created for the Portuguese companion dog population, encompassing all dogsin the dataset. Dogs recognized by the UK Kennel Club (KC) [47] or Fédération Cynologique Internationale (FCI) [48] were classified as purebred, while all others were categorized as crossbreeds in the dataset. An arbitrary cut-off of 100 dogs per breed was established for creating life tables and determining each breed's life expectancy at birth. A total of 79 purebreds met this criterion and were includedin the analysis for differences in size and cephalic index. Data on body size were sourced from KC nomenclature, while the classification of the cephalic index, which describes the shape of their skull, was based on the FCI literature and previous studies [16]. This information was then used to classify the animals into three groups based on their body size and cephalic index.

Statistical analysis was performed using SPSS 28.0.1.0 and R version 4.3.2. A sub-analysis was performed on the estimated life expectancy without taking into account the variability within estimated values. A paired sample t-test was conducted to assess differences in life expectancy at birth between the sexes. To analyze the effect of body size and cephalic index on life expectancy at birth, general linear modeling was employed. Full factorial models were specified to account for potential interactions among independent variables. Effect sizes were calculated using partial eta-squared, which estimated the proportion of variance in the dependent variable explained by each independent variable. The total variance explained by the model was the sum of all partial eta-squared values. A p-value of less than 0.05 was considered statistically significant.

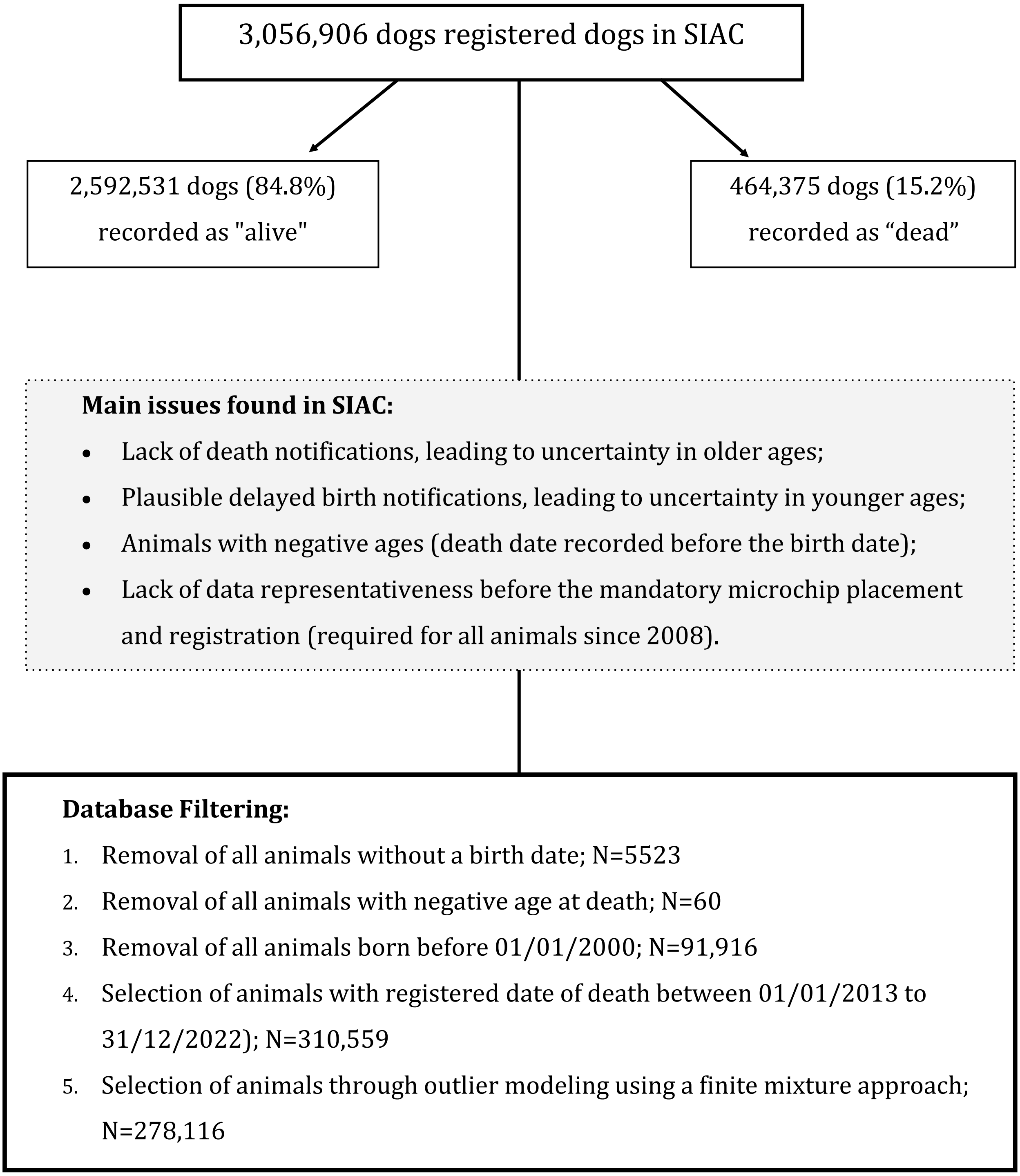

Figure 6 - Flow diagram of selection process.

4.4 Construction of Life Tables

After summarizing the demographics of the cleaned data using descriptive statistics, a life table was constructed for the ten-year time frame using the Chiang adjusted method [35,49]. The construction of a life table involves the use of a one-year age interval (x, x + 1) and focuses on two primary variables—the number of individuals alive at age x, and dx, representing the number of deaths occurring within the same age interval (x, x + 1). The central death rate [m(x)] is calculated as the ratio of the number of dead dogs to the total study population, and the conditional probability of death in a one-year ageinterval [q(x)] is calculated as the product of the central death rate and the proportion of pets surviving to the end of the age interval [a(x)], under the assumption that deaths are distributed evenly across the entire year. To calculate the number of pets surviving to age x [l(x)], we assumed a hypotheticalpopulation of 100,000 pets at birth and applied an estimated mortality regime tosimulate their survival over time. The number of pet years lived at age x [L(x)] was calculated as the sum of pets surviving until age (x + 1) and the fraction of pets surviving in age interval (x, x + 1) was simplified to $[(l(x) + l(x + 1)]/2$.

The total number of years lived beyond age x was calculated by summing the number of years lived in each age interval starting from age x, $T(x) = \sum L(x)$.

Life expectancy at year x was then calculated as $e(x) = T(x)/l(x)$, where l(x) is the number of pets surviving to age x. Confidence intervals (CIs) at the 95% level were calculated for each year using the mean e(x) and standard deviation. For each subpopulation, the variables P(x) and d(x) specific to that subpopulation were used to recalculate the intermediate variables, m(x), q(x), l(x), L(x), and T(x).

5. RESULTS

A total of 310,559 dogs with confirmed deaths were selected from the SIAC records between January 1st, 2013, and December 31st, 2022. After applying the mixed modeling approach as described in the methods, a refined dataset of 278,116 dogs remained, providing a reliable foundation for further analysis.
The final analytic dataset included 286 purebred breeds, with 194,146 (69.8%) purebred dogs and 83,970 (30.2%) mixed-breed dogs. There were in total 138,325 females (49.7%) and 139,791 males (50.3%).

5.1 Geographical distribution of registered dogs

The geographical data of the dogs in this study indicated a significantly higher number of animals in coastal areas, particularly in urban centers like Lisbon and Porto, compared to inland regions, as shown in figure 7.

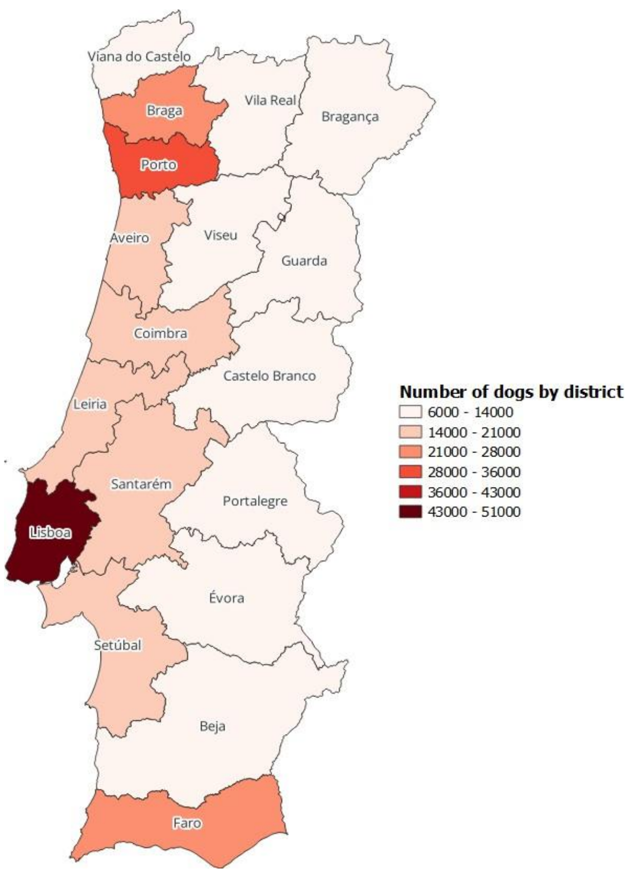

Figure 7 - Geographical distribution of registered dogs.

5.2 Geographical distribution of the most common breeds (non-Portuguese)

The canine population included in this study reflects a diverse array of breeds, with the Labrador Retriever standing out as the top non-Portuguese breed. With a total 13,263 registered dogs, is mainly present in densely populated districts such as Porto and Lisbon but also in districts as Aveiro, Coimbra, Viana do Castelo, and Viseu. German Shepherds, with 11,542 dogs registered in the study, are also popular, particularly in the districts of Braga, Setúbal, and Vila Real. Brittany Spaniels, with a total of 7,903 dogs included in the study, are primarily bred for hunting in Portugal and more prevalent in districts of Beja, Castelo Branco, Évora, Faro, Portalegre, and Santarém. In recentyears, smaller breeds like the Yorkshire Terrier, with a total of 3,533 dogs in the study, have been gaining popularity in urban and high-density cities, and are more commonly found in Braga, Lisbon, Porto, and Setúbal.

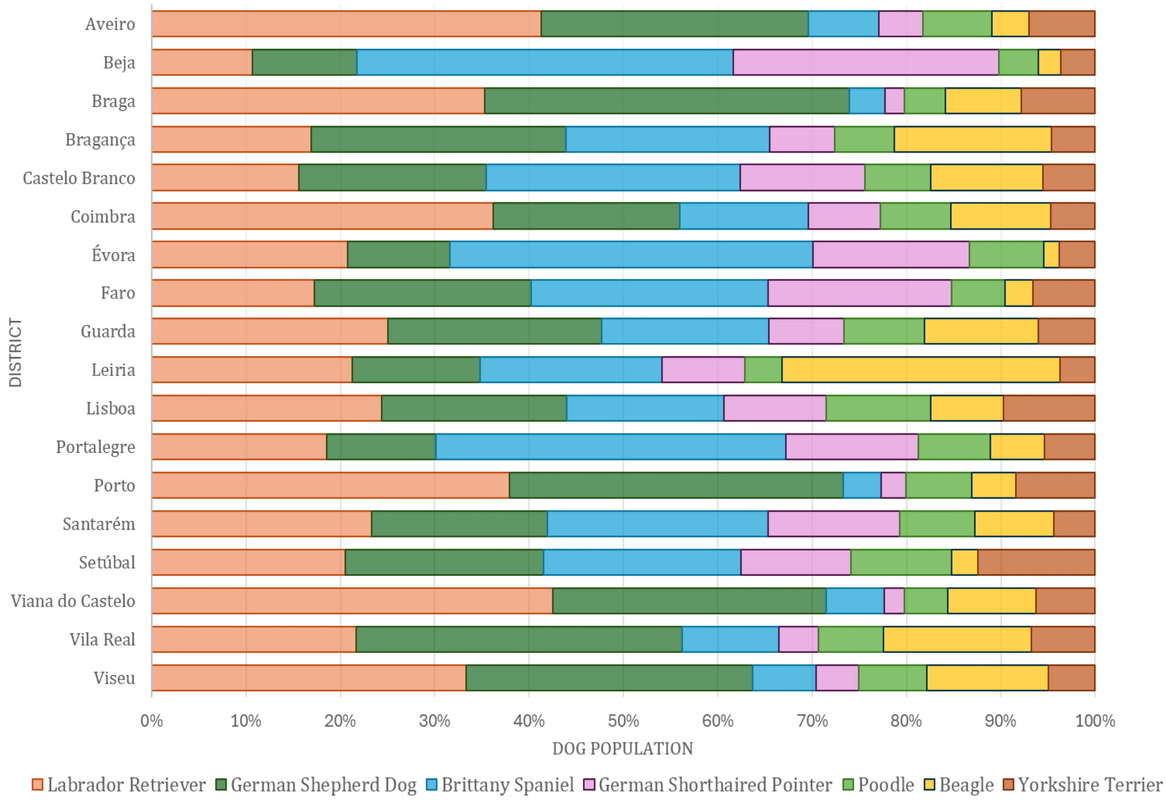

Figure 8 - Proportional distribution of the most common breeds (non-Portuguese).

5.3 Geographic distribution of the Portuguese dog breeds

The most prevalent Portuguese breed across all districts is the Portuguese Podengo, with 77,706 registered dogs (excluded from Figure 9 due to scale considerations).

The Estrela Mountain Dog, with 3,536 dogs registered in the study, is also a popular Portuguese breed, particularly in the districts of Aveiro, Braga, Castelo Branco, Coimbra, Guarda, Lisbon, Porto, and Viseu. The Alentejo Mastiff is popular in its origin districts such as Beja, Évora, Faro, Portalegre, Santarém, and Setúbal. The Transmontano Mastiff, with 1,009 dogs included in this study, is mainly found in its native regions of Bragança and Vila Real. Finally, the Castro Laboreiro Dog, with 767 exemplars, is characteristic of the Minho region and is therefore most prevalent in the district of Viana do Castelo.

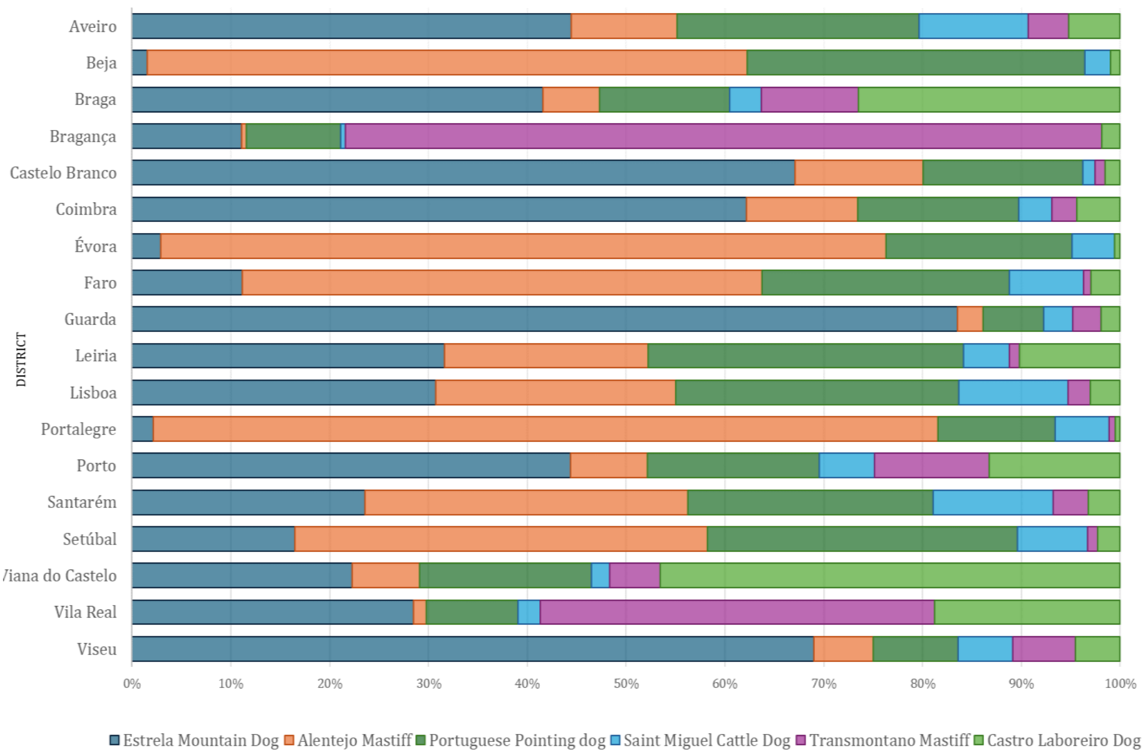

Figure 9 - Proportional distribution of the most common Portuguese breeds.

5.4 Geographic distribution by cephalic index and body size

Among the 79 selected breeds, each with a minimum of 100 dogs, 22 were categorized as small (27.9%) with 101,251 individual dogs, 28 breeds (35.4%) were classified as medium with 34,630 dogs, while large-sized dogs constituted 29 breeds (36.7%) with 52,436 dogs.

Large breeds were more frequent in all districts except Beja and Évora, where Brittany Spaniels were more prevalent. Smaller breeds were the least frequent in all districts except Leiria, due to the higher proportion of Beagles in this district.

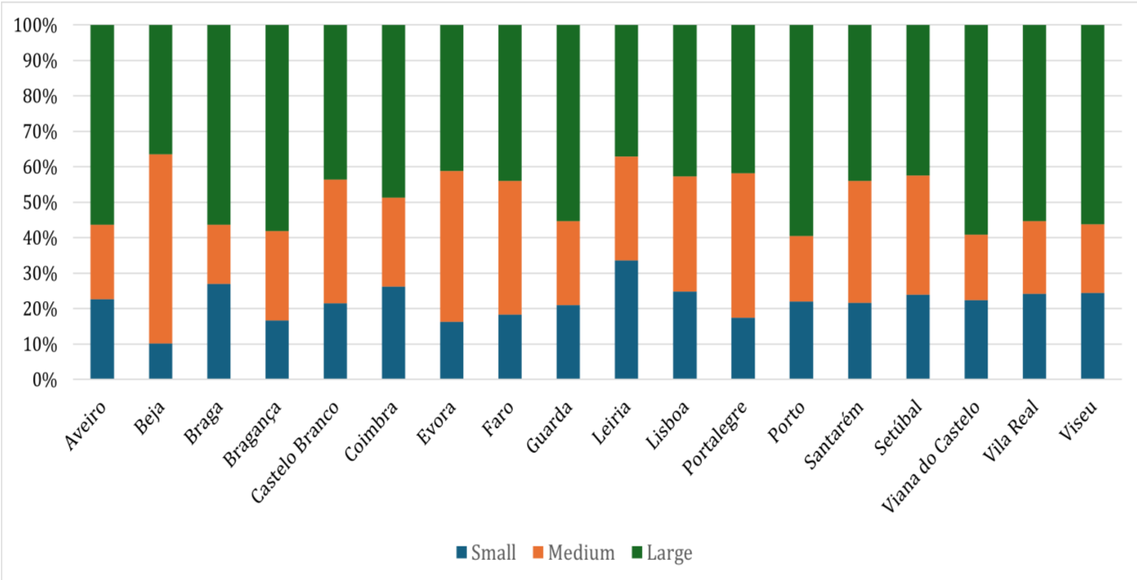

Figure 10 - Proportional distribution of each body size by district

When examining the cephalic index distribution among the 79 breeds, 15 were identified as brachycephalic (18.8%) with 12,636 dogs, 16 as dolichocephalic (21.3%) with 101,064 dogs, and 48 as mesocephalic (60%) with 74,617 dogs.

Across all districts in Portugal, brachycephalic breeds were the least frequent compared to other cephalic indexes, as shown in figure 11.

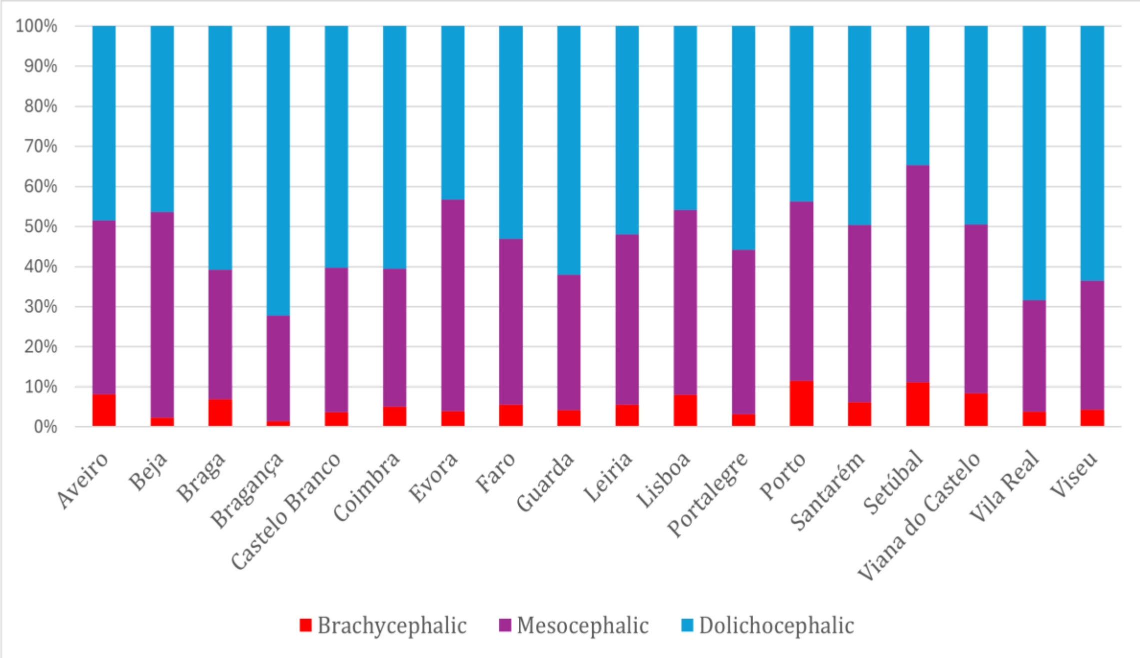

Figure 11 - Proportional distribution of each cephalic index by district

5.5 Life expectancy of registered dogs

The data revealed that, on average, the life expectancy at birth for a dog born in Portugal was around 8.91 years (8.43 - 9.39). Table 1 provides an overview of the current lifespan of registered dogs of all breeds and crossbreed combined.

The female dogs tended to have a similar lifespan to the male dogs, with a mean lifespan at birth of 8.95 years (8.51–9.39), compared to 8.88 years (8.37–9.39) for the males, as shown in Figure 12 and Supplementary Table S1 (Females) and Table S2 (Males). The trend in life expectancy across age groups appears to be similar regardless of sex.

Table 1 - Current life table of Portuguese companion dogs registered in SIAC (all pure breeds and crossbreed combined).

Age interval in years (x, x + 1)	*Number living at age x l(x)*	*Number dying in the age interval (x,x+1) d(x)*	*Conditional Probability of death q(x)*	*Proportion surviving to age x a(x)*	*Number of dog-years lived at age x L(x)*	*Total number of dog-years lived from year x t(x)*	*Life expectancy for dogs in the age interval (x, x + 1) e(x)*
0 - 1	278116	4158	0.01	1.00	99258	891040	8.91 (8.43 - 9.39)
1 – 2	273958	9145	0.03	0.99	96899	791782	8.04 (7.36 - 8.71)
2 – 3	264813	14143	0.05	0.95	92803	694883	7.29 (6.49 - 8.10)
3 - 4	250670	17632	0.07	0.90	87256	602080	6.67 (5.79 - 7.54)
4 – 5	233038	19150	0.08	0.84	80865	514824	6.12 (5.21 - 7.02)
5 – 6	213888	19529	0.09	0.78	74157	433959	5.60 (4.69 - 6.50)
6 – 7	194359	20130	0.10	0.71	67287	359802	5.08 (4.18 - 5.99)
7 – 8	174229	20490	0.11	0.64	60259	292515	4.58 (3.68 - 5.49)
8 – 9	153739	21644	0.13	0.57	52986	232256	4.10 (3.17 - 5.02)
9 - 10	132095	22591	0.16	0.49	45376	179270	3.64 (2.69 - 4.59)
10 – 11	109504	23262	0.19	0.41	37512	133893	3.23 (2.25 - 4.21)
11 – 12	86242	22518	0.23	0.34	29656	96382	2.87 (1.87 - 3.88)
12 – 13	63724	20011	0.27	0.26	22285	66726	2.59 (1.56 - 3.62)
13 - 14	43713	16041	0.31	0.19	15874	44441	2.37 (1.31 - 3.42)
14 – 15	27672	11297	0.34	0.13	10764	28567	2.20 (1.14 - 3.26)
15 – 16	16375	7317	0.37	0.09	7002	17803	2.08 (1.01 - 3.15)
16 – 17	9058	4267	0.38	0.05	4401	10801	1.99 (0.92 - 3.05)
17 – 18	4791	2287	0.39	0.03	2716	6400	1.90 (0.87 - 2.93)
18 – 19	2504	1201	0.39	0.02	1668	3684	1.78 (0.81 - 2.76)
19 – 20	1303	680	0.41	0.01	1006	2016	1.59 (0.66 - 2.52)
20 – 21	623	382	0.47	0.01	569	1010	1.36 (0.48 - 2.24)
21 – 22	290	241	0.59	0.00	279	441	1.12 (0.23 - 2.01)
22 - 23	49	49	1.00	0.00	163	163	1.00 (0.02 - 1.98)

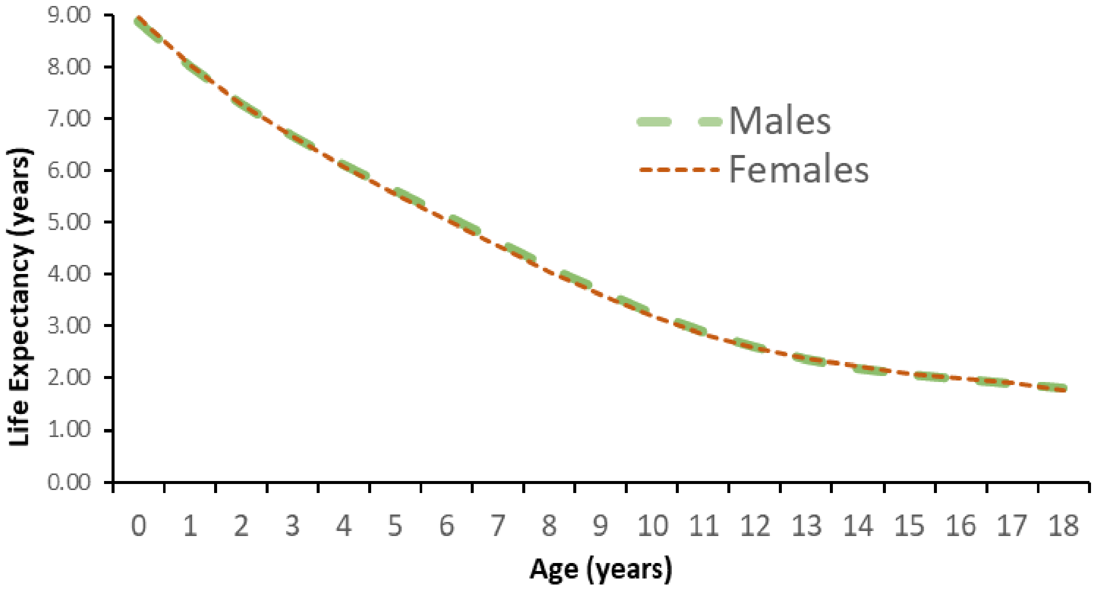

Figure 12 - Life expectancy for female and male dogs across different ages.

5.6. Life expectancy at birth for most common breeds (non-Portuguese)

The findings presented in Table 2 summarize the results for the top 20 non-Portuguese breeds, each comprising a minimum of 1000 individuals and collectively representing 54% of the dataset. At age 0, the Yorkshire Terrier exhibited the highest life expectancy (11.7 years), while the French Bulldog showed the lowest life expectancy (6.29 years). Results of life expectancy at birth for both females and males across the top 20 breeds are also shown in Table 2.

For the majority of breeds (70%), females exhibited higher life expectancy at birth compared to males, although these differences were not statistically significant [$t(9) = -1.310$. $p = 0.206$)].

Life tables constructed for the top ten individual breeds (Portuguese and non-Portuguese) are available in the supplementary material (Supplementary Table S3 to Supplementary Table S12).

Table 2 - Key statistics extracted from life tables for 20 most common non-Portuguese dog breeds in decrescent order of life expectancy at birth.

Breed	*Population size*	*Life expectancy at age 0*	*Life expectancy at age 0 for males*	*Life expectancy at age 0 for females*	*Body Size*	*Cephalic Index*
Yorkshire Terrier	3533	11.70 (11.55 - 11.86)	11.80 (11.64 - 11.96)	11.61 (11.46 - 11.75)	Small	Mesocephalic
English Cocker Spaniel	2044	11.02 (10.44 - 11.60)	10.91 (10.34 - 11.49)	11.13 (10.54 - 11.72)	Small	Mesocephalic
Golden Retriever	2167	10.97 (10.45 - 11.49)	11.06 (10.56 - 11.56)	10.87 (10.31 - 11.42)	Large	Mesocephalic
Dachshund	1281	10.90 (10.69 - 11.11)	10.93 (10.68 - 11.18)	10.89 (10.72 - 11.07)	Small	Dolichocephalic
Poodle	4116	10.85 (10.25 - 11.45)	10.74 (10.20 - 11.29)	10.96 (10.29 - 11.62)	Medium	Dolichocephalic
English Pointer	1493	10.78 (10.64 - 10.92)	10.77 (10.64 - 10.90)	10.80 (10.65 - 10.94)	Medium	Mesocephalic
English Setter	1516	10.41 (10.24 - 10.57)	10.36 (10.19 - 10.54)	10.45 (10.29 - 10.60)	Large	Mesocephalic
Brittany Spaniel	7903	10.28 (10.08 - 10.48)	10.44 (10.24 - 10.64)	10.13 (9.93 - 10.33)	Medium	Mesocephalic
Dalmatian	1019	10.22 (9.64 - 10.79)	9.97 (9.42 - 10.52)	10.56 (9.95 - 11.17)	Medium	Mesocephalic
Labrador Retriever	13263	9.77 (9.03 - 10.50)	9.68 (8.94 - 10.42)	9.88 (9.16 - 10.61)	Large	Mesocephalic
Crossbreed	83970	9.48 (9.13 – 9.84)	9.35 (8.99 - 9.70)	9.64 (9.28 - 10.00)	NA	NA
Rottweiler	3406	9.30 (8.75 - 9.85)	9.29 (8.78 - 9.81)	9.31 (8.73 - 9.90)	Large	Mesocephalic
Boxer	3432	9.15 (8.59-9.71)	9.10 (8.52 - 9.68)	9.22 (8.68 - 9.76)	Large	Brachycephalic
Beagle	4064	9.06 (8.89 - 9.23)	9.27 (9.08 - 9.46)	8.96 (8.81 - 9.10)	Small	Mesocephalic
Miniature Pinscher	2921	8.74 (8.20 - 9.29)	8.64 (8.08 - 9.20)	8.88 (8.35 - 9.40)	Small	Dolichocephalic
Chihuahua	1446	8.46 (8.03 - 8.89)	8.57 (8.13 - 9.02)	8.40 (7.99 - 8.81)	Small	Brachycephalic
German Shepherd Dog	11542	8.31 (7.55 - 9.08)	8.26 (7.53 - 8.99)	8.39 (7.58 - 9.20)	Large	Dolichocephalic
German Shorthaired Pointer	7371	7.98 (7.53 -8.43)	7.93 (7.43 -8.42)	8.03 (7.66 -8.44)	Medium	Mesocephalic
Great Dane	1186	6.98 (6.36 - 7.59)	6.90 (6.26 - 7.54)	7.05 (6.46 - 7.64)	Large	Dolichocephalic
French Bulldog	2726	6.29 (5.44 - 7.14)	6.22 (5.41 - 7.04)	6.32 (5.44 - 7.21)	Small	Brachycephalic

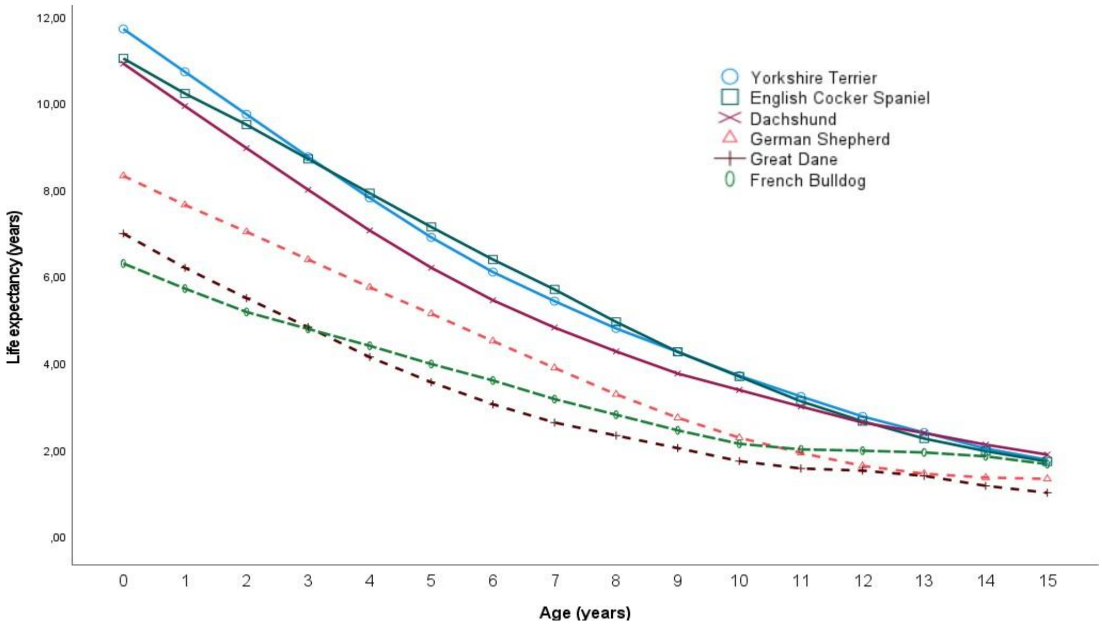

Figure 13 - Life expectancy comparison between three non - Portuguese breeds with shorter lifespans (represented by dashed lines) and three breeds with a longer lifespan (represented by a solid line) across different ages.

5.7. Life expectancy at birth for Portuguese dog breeds

The results for the top 10 most frequent Portuguese breeds are outlined in Table 3. The mean life expectancy at birth for the Portuguese breeds was 8.3 years. The mean life expectancy at birth for the female Portuguese breeds was 8.34 years and for male Portuguese breeds was 8.15. More than half (60%) of the female Portuguese breeds presented a higher life expectancy at birth though these differences were not statistically significant [$t(9) = -1.409$. $p = 0.192$)].

Among the ten Portuguese breeds, only one was classified as small, while half of them fell into the large size category, and the remaining four were categorized as medium-sized. At age 0, the Portuguese Water Dog displayed the highest life expectancy (10.85 years), while the Transmontano Mastiff exhibited the lowest life expectancy (6.71 years).

Figure 14 allows the comparison between the life paths of various Portuguese dog breeds. It highlights the top three breeds with shorter lifespans (represented by dashed lines) and three breeds with longer lifespans (represented by solid lines).

Table 3 - Key statistics extracted from life tables for 10 top Portuguese breeds in decrescent order of life expectancy at birth.

Breed	*Population size*	*Life expectancy at age 0*	*Life expectancy at age 0 for males*	*Life expectancy at age 0 for females*	*Body Size*	*Cephalic Index*
Portuguese Water Dog	384	10.85 (9.80 - 11.89)	10.51 (9.47 - 11.55)	10.25 (9.17 - 11.33)	Medium	Mesocephalic
Portuguese Pointing dog	2560	9.23 (8.84 - 9.61)	9.35 (8.95 - 9.75)	9.10 (8.74 - 9.47)	Medium	Mesocephalic
Terceira Cattle Dog	104	8.62 (7.78 - 9.46)	8.16 (7.05 - 9.27)	8.92 (8.41 - 9.43)	Medium	Mesocephalic
Castro Laboreiro Dog	810	8.44 (7.71 - 9.16)	8.14 (7.46 - 8.82)	8.78 (7.99 - 9.58)	Large	Mesocephalic
Alentejo Mastiff	3486	8.03 (7.73 - 8.33)	7.96 (7.67 - 8.24)	8.14 (7.82 - 8.46)	Large	Mesocephalic
Portuguese Sheepdog	435	7.93 (7,35 - 8,51)	7.88 (7.24 - 8.51)	7.99 (7.47 - 8.50)	Medium	Mesocephalic
Portuguese Podengo	77706	7.86 (7.51 - 8.22)	7.78 (7.39 - 8.16)	7.92 (7.58 - 8.26)	Small	Dolichocephalic
Saint Miguel Cattle Dog	1553	7.81 (7.10 - 8.51)	7.81 (7.05 - 8.58)	7.80 (7.09 - 8.51)	Large	Mesocephalic
Estrela Mountain Dog	3536	7.50 (6.66 - 8.33)	7.06 (6.23 - 7.88)	7.91 (7.06 - 8.75)	Large	Mesocephalic
Transmontano Mastiff	1009	6.73 (6.35 – 711)	6.80 (6.42 - 7.19)	6.55 (6.18 - 6.92)	Large	Mesocephalic

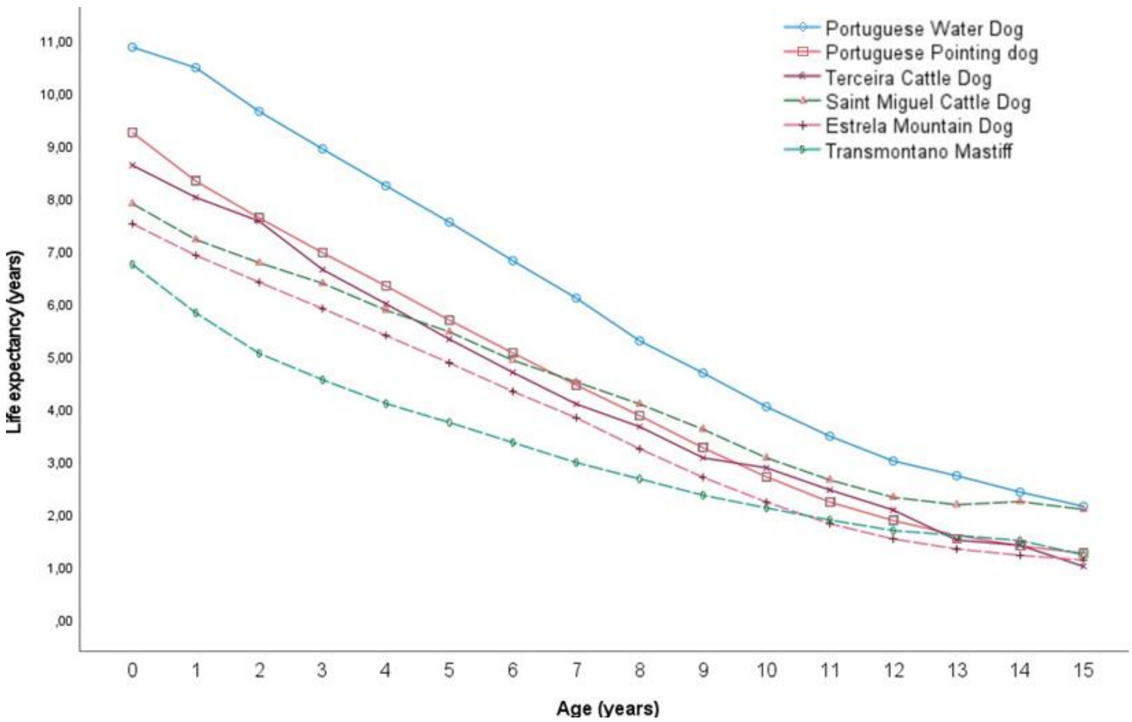

Figure 14 - Life expectancy comparison between three Portuguese breeds with shorter lifespans (represented by dashed lines) and three Portuguese breeds with a longer lifespan (represented by a solid line) across different ages.

5.8. Life expectancy at birth by cephalic index and body size

An analysis of the data revealed that smaller breeds had the highest mean lifespan at birth, with a mean of 9.52 years, followed closely by medium-sized breeds with a mean of 9.26 years, and larger breeds with a mean of 8.53 years. When the breeds were grouped by head size, the data showed that the brachycephalic breeds had the lowest mean lifespan at birth with a mean of 7.99 years, compared to the dolichocephalic breeds with a mean of 8.86 years and the mesocephalic breeds with a mean of 9.47 years.

Further exploration within each cephalic index category revealed that large brachycephalic breeds, such as Neapolitan Mastiffs, Spanish Mastiffs, or Cane Corso, exhibited shorter a life expectancy at birth. Among small brachycephalic breeds, the French Bulldog stood out as an outlier with unusuallyshort lifespan of 6.29 years, which was the lowest among all breeds.

In dolichocephalic breeds, while large breeds had the lower mean life expectancy, the gap between medium and large breeds was narrower with substantial diversity among individual breeds, Finally, among mesocephalic breeds, small breeds like the Yorkshire Terrier and Bichon Frisé presented the highest life expectancy at birth of the dataset.

The general linear model univariate analysis revealed that life expectancy at birth was significantly associated with body size and cephalic index. The effect size was considered large for cephalic index [F (2,76) = 6.93, p = 0.002, $\eta 2$ = 0.165)] and medium for body size [F (2,76) = 5.25, p = 0.008, $\eta 2$ = 0.13)]. The interaction between life expectancy, body size, and cephalic index was not significant ($p > 0.05$). These results are illustrated in Figure 15.

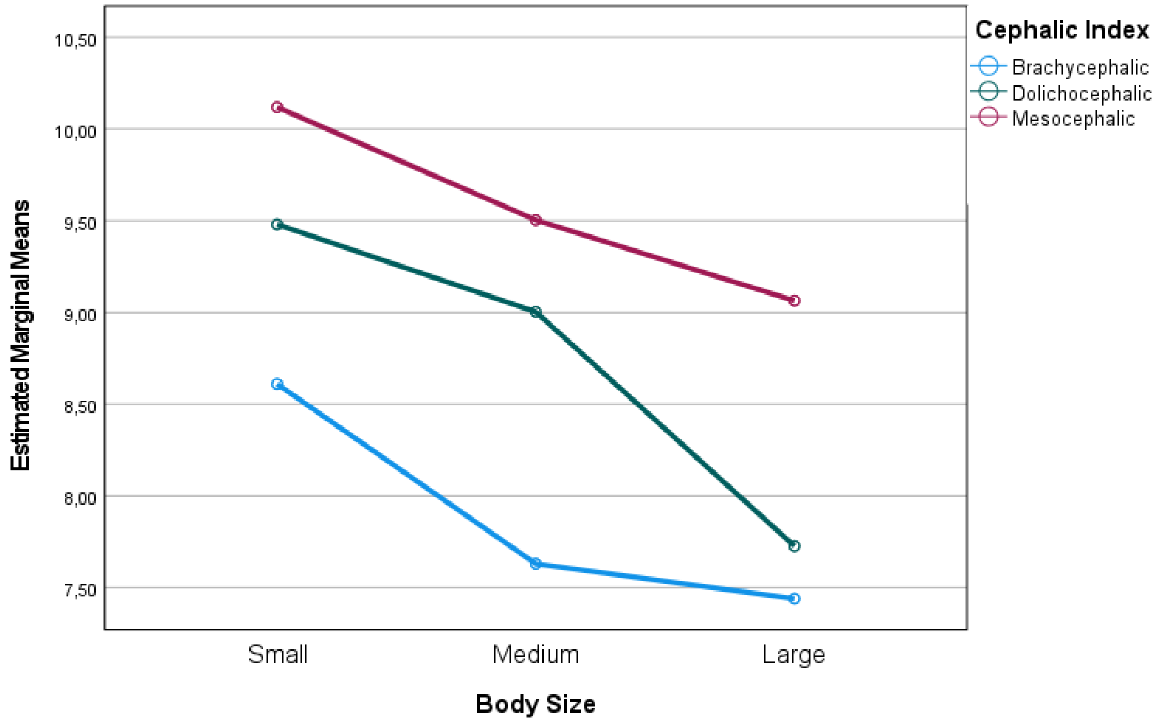

Figure 15 - Plot showing marginal means of life expectancy by body size for each cephalic index.

6. DISCUSSION

The contemporary view of dogs as family members illustrates a deep emotional connection between humans and their canine companions. This bond is defined by mutual affection and social support, all of which are key elements of family relationships. Studies reveal that a significant majority of pet owners, with as many as 91% in the United States and 88% in Australia, consider their dogs to be part of their family [50,51]. This transformation in perception highlights the changing role of pets in human life, transcending from mere companions to cherished family members.

The COVID-19 pandemic profoundly impacted pet adoption rates, particularly for dogs, as many individuals sought companionship during periods of social isolation, reflecting a worldwide surge in dog adoptions [52,53]. This trend was also evident in the peak of registrations observed in our database in 2020.

It is undeniable that proper care and attention to various aspects of a pet's life can significantly impact their longevity and overall health. Providing proper care, including regular exercise and mental stimulation, are essential for extending a pet's lifespan [54]. Moreover, a combination of high-quality nutrition, appropriate husbandry, and healthcare have been identified as important factors in achieving exceptional longevity [55,56]. Most of our understanding of canine longevity comes from analyzing various data sources, including veterinary medical center records [13,15,21,57], private practice medical records [14,36,58], pet insurance company data [18,59–62], owner surveys [12,20,31,32,63], and even pet cemetery records [64,65]. While each source provides valuable insights, they also have limitations that affect their reliability and representativeness.

A key strength of our study is its broad scope, which enabled us to analyze data from over 3 million dogs across the country. This research benefits from a second important strength, the data's high representativity, derived from the use of a comprehensive national database encompassing information on all registered dogs in Portugal. This vast repository of information helps mitigate selection and representation biases, thereby enhancing the accuracy and completeness of the findings. Furthermore, the fact that microchipping has been compulsory since 2008 contributes to the dataset's robustness, yielding a detailed portrait of the Portuguese dog population.

The spatial distribution of registered dogs in the database aligns with the demographic trend towards coastal areas observed in the Portuguese human population [66]. Previous research has shown a positive correlation between human population density and pet ownership. Urban areas generally have higher rates of dog ownership than rural regions, due to factors like accessibility to veterinary services, pet-friendly infrastructure, and social norms favoring pet ownership in densely populated areas [67]. This is consistent with findings from other studies indicating that pet ownership is often associated with higher income levels and stable living conditions, which are more common in urban areas compared to rural settings [68].

The general life expectancy at birth for the dogs included in this study was lower than the life expectancy of dogs from the United Kingdom (11.23 years) [45], United States of America (12.69 years) [19], and Japan (13.7 years) [65]. It is crucial to acknowledge that all these studies were conducted in different countries, at different points in time and with different sample populations. The lack of a standardized method for reporting and recording dog mortality data across these studies further complicates the assessment of lifespan accuracy. Variations in methodology, study groups, and factors such as weight and breed make it challenging to compare and derive definitive conclusions from the data available. Analyzing canine lifespan through mortality data often excludes individuals from the same birth year who were still alive at the time of data collection. This exclusion can result in lifespan underestimation, known as right-censoring, since the full lifespan of these individuals is not fully captured [37]. Techniques like the Kaplan–Meier analysis and Cox regression canmitigate this issue in longitudinal studies with multiple data points [36,42,58].
However, the retrospective nature of our study and the limitations of available data make it challenging to directly apply these methods and compare lifespan estimates across different studies.

Our study found the top seven breeds with a mean lifespan exceeding 11 years; five were small-sized (American Cocker Spaniel, Bichon Frisé, English

Cocker Spaniel, West Highland White Terrier and Yorkshire Terrier) and two were medium-sized breeds (Standard Schnauzer and Samoyed). When analyzing the relationship between life expectancy at birth, cephalic index and body size, the findings became more evident and consistent with the prior research, indicating a link between smaller body size and increased lifespan in dogs [19,36,58,65].

On the other side, findings about the breeds with the lowest life expectancy are also similar to other studies [19,36,65]. Among the breeds with a life expectancy at birth of just under 7 years old were six large breeds (Spanish Mastiff, Transmontano Mastiff, Neapolitan Mastiff, Great Dane and Cane Corso) and one small breed (French Bulldog). The shorter lifespan of large breed dogs may be attributed to several possible mechanisms. Artificial selection has played a significant role in shaping the characteristics of dog breeds, and it is plausible that the emphasis on size has inadvertently led to the preservation of genetic factors that influence accelerated aging, leading to a reduced lifespan [15,21]. Factors such as oxidative stress and cellular metabolism have been implicated in the differences in longevity between large and small breed dogs [63,69,70]. Telomere length, which is associated with aging and longevity, has also been linked to individual breed lifespan. Studies have shown that telomeres shorten with age in dogs at a rate that is proportionate to the difference in mean lifespan between dogs and humans. Additionally, the length of telomeres varies between breeds, with larger breeds such as the Great Dane having shorter telomeres [71].

Our study's findings also indicate that among the 10 dog breeds with shorter lifespans, brachycephalic breeds account for half of the total. This is consistent with the previous research [45,72] which highlighted the reduced longevity of flat-faced breeds compared to their non-brachycephalic breeds. French Bulldogs have the lowest life expectancy at birth among all breeds, a trend potentially influenced, to some extent, by their swift rise in popularity in recent years. According to data from our records in SIAC, the number of French Bulldogs registered in the Portugal rose from 1234 individuals in 2013 to 7554 in 2022. A notable trend is the increasing popularity of brachycephalic breeds, such as French Bulldogs and Pugs is also noticeable in other studies. Research indicates that the aesthetic appeal of these breeds often outweighs concerns regarding their health and longevity among potential owners [73]. This phenomenon is particularly evident in urban environments where smaller, flat-faced dogs are perceived as more suitable for apartment living, leading to a surge in their acquisition [31]. This surge in popularity means that there are proportionally more young animals in this population compared to other breeds, decreasing their life expectancy.

Purebred dogs exhibited both longer and shorter lifespan estimates compared to crossbred dogs. Approximately 42% of purebreds lived longer than crossbreds, challenging the common belief that crossbreds are universally healthier. Furthermore, this observation aligns with recent findings published [16].

The findings of our study suggest that both body size and cephalic index significantly influence the life expectancy of dogs at birth. The effect size of cephalic index was considered large, while that of body size was considered medium. This implies that cephalic index has a more substantial impact on life expectancy compared to body size. However, there was no interaction effect between body size and cephalic index on life expectancy, indicating that these two factors independently influence the life expectancy of dogs. The absence of an interaction effect suggests that the relationship between life expectancy and one factor (e.g., body size) remains consistent regardless of the level of the other factor (e.g., cephalic index). These results contribute to our understanding of the factors that influence the life expectancy of dogs, which could potentially aid in predicting life expectancy and developing strategies to improve the health and longevity of dogs.

For the specific analyses considering size and cephalic index, we focused exclusively on 79 purebred breeds, each with a minimum of 100 individuals. This approach was chosen to ensure statistical reliability and consistency in our data. Mixed-breed dogs were excluded from these analyses due to their significant variability in size and head shape. In future studies, gathering more detailed data on mixed-breed dogs, including precise measurements of their size and head shapes, could enable their meaningful inclusion in cephalic index and size analyses, providing a more comprehensive overview of life expectancy across the entire canine population.

Our study did not thoroughly investigate the influence of non-biological factors, including owner demographics, management styles, and breed function, on the likelihood of early mortality in the Portuguese canine population. Moreover, it did not examine the specific causes of death for various dog breeds across different age groups. This absence of data regarding the reasons for mortality may introduce bias, given that distinct breeds could exhibit diverse susceptibilities to specific diseases or health issues. Additionally, the practice of euthanasia might result in a shorter overall lifespan compared to the potential lifespan if the dogs were allowed to pass away naturally.

The accuracy of certain information provided by dog owners, such as breed and date of birth or death, could not be verified during data collection. For instance, the absence of cross-checking with pedigree records may have resulted in dogs of mixed breeds being mistakenly classified as purebred, potentially inflating the numbers of certain breeds, such as the Portuguese Podengo.

Furthermore, the accuracy of the age at death information may have been compromised in some cases due to owners' uncertainty regarding their dog's precise date of birth, particularly when the dog had been adopted or rehomed. Additionally, the reported da

The date of death could also be inaccurately documented, either because pet owners delayed notifying the practice or due to entry errors made by veterinary staff. Also, collecting data on whether dogs died naturally or were euthanized would help in understanding the factors leading to mortality and lower life expectancy estimates.

To mitigate this bias, rigorous data cleaning methods were employed, enhancing the accuracy of the final dataset, although some residual uncertainty persists. We cross-referenced age at death distributions for consistency against databases provided in the other studies [12,14,31,45,74]. Although the reduced dataset may have affected the representation of the original study population, the initial datasets were sufficiently large to compensate for this.

7. CONCLUSION

This study provides a comprehensive overview of the life expectancy of dogs in Portugal, emphasizing the impact of various factors such as breed, sex, size, and skull shape. By utilizing a robust dataset from the national registry database, encompassing 278,116 dogs with confirmed deaths, we were able to draw significant insights into the canine population in Portugal

As the landscape of pet ownership continues to evolve, the ongoing development and utilization of SIAC will be essential for ensuring the health and well-being of both pets and their human companions.

While the current analysis focused on purebred dogs, future research should aim to include mixed-breed dogs and delve deeper into non-biological factors such as owner demographics and management styles.

In conclusion, this study enriches the understanding of canine longevity in Portugal and has significant implications for veterinary medicine, pet ownership practices, and future breeds selection. The findings highlight the needfor targeted strategies to improve the health and lifespan of dogs, particularly forbreeds with known health vulnerabilities. Continued research, incorporating more comprehensive data and advanced analytical methods, will be essential for furthering our understanding of the factors that influence the life expectancy of dogs.

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9. SUPPLEMENTARY MATERIALS

Table S1: Current life table of female Portuguese companion dogs registered in SIAC (all pure breeds and crossbreed combined).

Age interval in years (x. x + 1)	Number living at age x (lx)	Number dying in (x.x+1) (dx)	Conditional Probability of death (qx)	Proportion surviving to age x	Number of dog-years lived at age x L(x)	Total number of dog-years lived from year x T(x)	Life expectancy for dogs in the age interval (x. x + 1) e(x)
0 - 1	138325	1751	0.01	1.00	99371	894574	8.95 (8.51 - 9.39)
1 – 2	136574	4275	0.03	0.99	97220	795203	8.05 (7.40 - 8.71)
2 – 3	132299	6892	0.05	0.96	93269	697982	7.29 (6.50 - 8.09)
3 - 4	125407	8587	0.07	0.91	87833	604713	6.66 (5.79 - 7.52)
4 – 5	116820	9394	0.08	0.85	81547	516880	6.09 (5.20 - 6.98)
5 – 6	107426	9802	0.09	0.78	74853	435333	5.56 (4.66 - 6.46)
6 – 7	97624	10109	0.10	0.71	67922	360480	5.05 (4.14 - 5.95)
7 – 8	87515	10411	0.11	0.64	60789	292558	4.54 (3.63 - 5.45)
8 – 9	77104	11034	0.13	0.57	53356	231769	4.05 (3.13 - 4.98)
9 - 10	66070	11665	0.16	0.50	45519	178414	3.60 (2.64 - 4.56)
10 – 11	54405	11783	0.20	0.42	37446	132894	3.20 (2.22 - 4.19)
11 – 12	42622	11384	0.24	0.33	29457	95448	2.86 (1.84 - 3.87)
12 – 13	31238	9990	0.28	0.26	22005	65991	2.59 (1.54 - 3.63)
13 - 14	21248	7827	0.31	0.18	15611	43986	2.38 (1.32 - 3.44)
14 – 15	13421	5390	0.33	0.13	10606	28375	2.23 (1.17 - 3.29)
15 – 16	8030	3563	0.36	0.08	6937	17769	2.10 (1.03 - 3.17)
16 – 17	4467	2061	0.37	0.05	4386	10833	2.01 (0.95 - 3.06)
17 – 18	2407	1133	0.38	0.03	2732	6446	1.91 (0.88 - 2.94)
18 - 19	1273	636	0.40	0.02	1671	3715	1.78 (0.78 - 2.78)
19 – 20	638	317	0.40	0.01	1005	2044	1.63 (0.71 - 2.55)
20 – 21	321	196	0.47	0.01	579	1039	1.38 (0.49 - 2.26)
21 - 22	125	100	0.57	0.00	287	460	1.15 (0.26 - 2.03)
22 - 23	25	25	1.00	0.00	173	173	1.00 (0.01 - 1.99)

Table S2: Current life table of male Portuguese companion dogs registered in SIAC (all pure breeds and crossbreed combined).

Age interval in years (x. x + 1)	Number living at age x (lx)	Number dying in (x.x+1) (dx)	Conditional Probability of death (qx)	Proportion surviving to age x	Number of dog-years lived at age x L(x)	Total number of dog-years lived from year x T(x)	Life expectancy for dogs in the age interval (x. x + 1) e(x)
0 - 1	154824	5256	0.03	1.00	98331	849685	8.50 (7.80 - 9.20)
1 – 2	149569	8613	0.06	0.97	93957	751778	7.78 (6.91 - 8.65)
2 – 3	140956	9821	0.07	0.91	88180	657821	7.21 (6.29 - 8.12)
3 - 4	131134	10091	0.07	0.85	81954	569642	6.69 (5.77 - 7.61)
4 – 5	121044	10174	0.08	0.79	75623	487687	6.19 (5.27 - 7.11)
5 – 6	110870	9949	0.09	0.72	69334	412064	5.69 (4.78 - 6.59)
6 – 7	100921	10203	0.10	0.66	63037	342730	5.18 (4.27 - 6.08)
7 – 8	90718	10320	0.11	0.60	56629	279693	4.67 (3.77 - 5.58)
8 – 9	80398	10959	0.13	0.53	50001	223063	4.18 (3.25 - 5.10)
9 - 10	69439	11351	0.15	0.47	43072	173063	3.71 (2.78 - 4.65)
10 – 11	58088	11960	0.19	0.40	35860	129990	3.29 (2.31 - 4.26)
11 – 12	46127	11618	0.22	0.32	28570	94130	2.93 (1.93 - 3.93)
12 – 13	34510	10512	0.26	0.25	21672	65560	2.63 (1.60 - 3.65)
13 - 14	23998	8670	0.31	0.18	15560	43889	2.39 (1.34- 3.44)
14 – 15	15327	6285	0.34	0.13	10580	28329	2.22 (1.15 - 3.29)
15 – 16	9042	3989	0.36	0.08	6891	17749	2.11 (1.04 - 3.18)
16 – 17	5053	2350	0.38	0.05	4357	10858	2.02 (0.95- 3.09)
17 – 18	2703	1260	0.38	0.03	2712	6500	1.94 (0.91 - 2.98)
18 - 19	1443	636	0.36	0.02	1704	3789	1.82 (0.88 - 2.77)
19 – 20	807	417	0.41	0.01	1056	2084	1.57 (0.66 - 2.48)
20 – 21	390	232	0.46	0.01	604	1028	1.31 (0.49 -2.14)
21 - 22	158	158	1.00	0.00	424	424	1.00 (0.02-1.98)

Table S3: Current life table of crossbreed dogs registered in SIAC.

Age interval in years (x. x + 1)	Number living at age x (lx)	Number dying in (x.x+1) (dx)	Conditional Probability of death (qx)	Proportion surviving to age x	Number of dog-years lived at age x L(x)	Total number of dog-years lived from year x T(x)	Life expectancy for dogs in the age interval (x. x + 1) e(x)
0 - 1	83970	655	0,01	1.00	99612	948462	9.48 (9.13 – 9.84)
1 – 2	83315	1174	0,01	0.99	98529	848850	8.55 (8.10 – 9.01)
2 – 3	82141	3032	0,04	0.98	96062	750321	7.67 (6.98 – 8.36)
3 - 4	79109	5516	0,07	0.94	91112	654259	6.94 (6.04 – 7.83)
4 – 5	73593	6026	0,08	0.88	84477	856706	6.40 (5.48 – 7.33)
5 – 6	67567	5900	0,08	0.81	77630	478670	5.91 (5.00 – 6.82)
6 – 7	61667	5899	0,09	0.74	70852	401040	5.40 (4.50 – 6.31)
7 – 8	55768	5979	0,10	0.67	64031	892326	4.89 (3.99 – 5.80)
8 – 9	49789	6348	0,12	0.61	56967	266158	4.39 (3.47 – 5.31)
9 - 10	43441	6582	0,14	0.53	49579	911567	3.92 (2.99 – 4.86)
10 – 11	36859	6941	0,17	0.46	41880	159612	3.48 (2.51 – 4.45)
11 – 12	29918	6946	0,21	0.38	33991	927650	3.10 (2.10 – 4.10)
12 – 13	22972	6235	0,24	0.30	26455	83741	2.79 (1.78 – 3.79)
13 - 14	16737	5456	0,28	0.23	19661	57286	2.51 (1.48 - 3.53)
14 – 15	11281	4171	0,31	0.16	13889	37625	2.29 (1.26 – 3.32)
15 – 16	7110	3077	0,36	0.11	9307	23737	2.10 (1.04 – 3.15)
16 – 17	4033	1916	0,38	0.07	5894	14429	1.98 (0.91 – 3.04)
17 – 18	2117	1051	0,40	0.04	3600	8536	1.90 (0.84 – 2.96)
18 - 19	1066	511	0,39	0.03	2184	4935	1.82 (0.83 – 2.82)
19 – 20	555	289	0,41	0.02	1318	2752	1.66 (0.69 – 2.62)
20 – 21	266	149	0,44	0.01	762	1434	1.47 (0.57 -2.37)
21 - 22	117	82	0,52	0.01	407	672	1.22 (0.37 -2.08)
22 - 23	35	35	1,00	0.00	265	265	1.00 (0.02 -1.98)

Table S4: Current life table of Portuguese Podengos registered in SIAC.

Age interval in years (x. x + 1)	Number living at age x (lx)	Number dying in (x.x+1) (dx)	Conditional Probability of death (qx)	Proportion surviving to age x	Number of dog-years lived at age x L(x)	Total number of dog-years lived from year x T(x)	Life expectancy for dogs in the age interval (x. x + 1) e(x)
0 - 1	77683	752	0.01	1.00	99518	796052	7.96 (7.60 - 8.32)
1 – 2	76931	3922	0.05	0.99	96575	696534	7.03 (6.26 - 7.80)
2 – 3	73009	6191	0.08	0.94	90285	599959	6.37 (5.43 - 7.31)
3 - 4	66818	6542	0.09	0.86	82422	509674	5.90 (4.93 - 6.86)
4 – 5	60276	6603	0.10	0.78	74317	427251	5.45 (4.48 - 6.43)
5 – 6	53673	6588	0.12	0.70	66184	352935	5.02 (4.04 - 6.01)
6 – 7	47085	6347	0.13	0.62	58200	286750	4.62 (3.64 - 5.59)
7 – 8	40738	6216	0.14	0.54	50430	228550	4.21 (3.23 - 5.19)
8 – 9	34522	6124	0.16	0.47	42787	178120	3.82 (2.82 - 4.82)
9 - 10	28398	6007	0.19	0.39	35263	135333	3.47 (2.44 - 4.50)
10 – 11	22391	5539	0.22	0.32	28062	100070	3.17 (2.12 - 4.22)
11 – 12	16852	4769	0.25	0.25	21543	72008	2.93 (1.86 - 4.00)
12 – 13	12083	3912	0.28	0.18	15918	50465	2.73 (1.64 - 3.82)
13 - 14	8171	2948	0.31	0.13	11302	34547	2.59 (1.47 - 3.71)
14 – 15	5223	1915	0.31	0.09	7828	23245	2.51 (1.41 - 3.61)
15 – 16	3308	1174	0.30	0.06	5430	15417	2.41 (1.36 - 3.46)
16 – 17	2134	814	0.32	0.04	3751	9987	2.24 (1.21 - 3.27)
17 – 18	1320	504	0.32	0.03	2549	6236	2.05 (1.09 - 3.02)
18 - 19	816	367	0.37	0.02	1684	3687	1.79 (0.85 - 2.73)
19 – 20	449	232	0.41	0.01	1037	2004	1.54 (0.65 - 2.42)
20 – 21	217	143	0.50	0.01	579	966	1.26 (0.41 - 2.10)
21 - 22	74	74	1.00	0.00	388	388	1.00 (0.02 - 1.98)

Table S5: Current life table of Labradors Retriever registered in SIAC.

Age interval in years (x. x + 1)	Number living at age x (lx)	Number dying in (x.x+1) (dx)	Conditional Probability of death (qx)	Proportion surviving to age x	Number of dog-years lived at age x L(x)	Total number of dog-years lived from year x T(x)	Life expectancy for dogs in the age interval (x. x + 1) e(x)
0 - 1	13263	427	0.03	1.00	98415	976523	9.77 (9.03 - 10.50)
1 – 2	12836	496	0.04	0.97	94994	878108	9.07 (8.29 - 9.84)
2 – 3	12339	412	0.03	0.93	91626	783115	8.41 (7.72 - 9.10)
3 - 4	11927	451	0.04	0.90	88424	691489	7.68 (6.98 - 8.37)
4 – 5	11476	483	0.04	0.87	84964	603065	6.95 (6.26 - 7.65)
5 – 6	10993	530	0.05	0.83	81216	518101	6.23 (5.53 - 6.93)
6 – 7	10463	593	0.06	0.79	77073	436885	5.51 (4.81 - 6.22)
7 – 8	9870	712	0.07	0.75	72282	359812	4.80 (4.07 - 5.53)
8 – 9	9158	882	0.09	0.70	66477	287529	4.13 (3.36 - 4.89)
9 - 10	8276	1079	0.12	0.63	59404	221053	3.49 (2.69 - 4.30)
10 – 11	7197	1316	0.17	0.56	50878	161649	2.91 (2.07 - 3.75)
11 – 12	5881	1538	0.23	0.46	40880	110771	2.40 (1.52 - 3.28)
12 – 13	4343	1627	0.32	0.36	29928	69891	1.97 (1.05 - 2.88)
13 - 14	2716	1365	0.40	0.24	19438	39963	1.64 (0.71 - 2.58)
14 – 15	1351	862	0.48	0.15	11032	20525	1.41 (0.47 - 2.35)
15 – 16	489	373	0.55	0.08	5439	9493	1.26 (0.30 - 2.23)
16 – 17	116	94	0.58	0.03	2393	4054	1.20 (0.24 - 2.17)
17 – 18	22	17	0.57	0.01	1017	1661	1.17 (0.26 - 2.07)
18 - 19	5	4	0.63	0.01	419	644	1.05 (0.14 - 1.96)
19 – 20	1	1	1.00	0.00	225	225	1.00 (0.12 - 1.88)

Table S6: Current life table of German Shepherds registered in SIAC.

Age interval in years (x. x + 1)	Number living at age x (lx)	Number dying in (x.x+1) (dx)	Conditional Probability of death (qx)	Proportion surviving to age x	Number of dog-years lived at age x L(x)	Total number of dog-years lived from year x T(x)	Life expectancy for dogs in the age interval (x. x + 1) e(x)
0 - 1	11542	481	0.04	1.00	97960	831139	8.31 (7.55 - 9.08)
1 – 2	11061	563	0.05	0.96	93537	733180	7.64 (6.84 - 8.45)
2 – 3	10498	569	0.05	0.91	88750	639643	7.02 (6.22 - 7.81)
3 - 4	9929	592	0.06	0.86	83846	550893	6.38 (5.59 - 7.17)
4 – 5	9337	664	0.07	0.81	78552	467047	5.74 (4.93 - 6.55)
5 – 6	8673	666	0.07	0.76	72956	388495	5.13 (4.34 - 5.91)
6 – 7	8007	732	0.09	0.70	67089	315539	4.50 (3.71 - 5.29)
7 – 8	7275	796	0.10	0.64	60701	248451	3.88 (3.09 - 4.67)
8 – 9	6479	997	0.14	0.57	53282	187749	3.27 (2.44 - 4.11)
9 - 10	5482	1179	0.19	0.49	44407	134468	2.73 (1.86 - 3.61)
10 – 11	4303	1327	0.27	0.40	34336	90060	2.27 (1.35 - 3.20)
11 – 12	2976	1180	0.33	0.29	24237	55724	1.92 (0.99 - 2.85)
12 – 13	1796	958	0.42	0.19	15340	31488	1.62 (0.66 - 2.58)
13 - 14	838	552	0.50	0.11	8462	16147	1.44 (0.45 - 2.42)
14 – 15	286	207	0.53	0.06	4166	7686	1.35 (0.36 - 2.35)
15 – 16	79	57	0.53	0.03	1953	3519	1.32 (0.36 - 2.29)
16 – 17	22	16	0.53	0.01	916	1566	1.25 (0.34 - 2.17)
17 – 18	6	5	0.59	0.01	411	650	1.12 (0.22 - 2.01)
18 - 19	1	1	1.00	0.00	239	239	1.00 (0.02 - 1.98)

Table S7: Current life table of Brittany Spaniel dogs registered in SIAC.

Age interval in years (x. x + 1)	Number living at age x (lx)	Number dying in (x.x+1) (dx)	Conditional Probability of death (qx)	Proportion surviving to age x	Number of dog-years lived at age x L(x)	Total number of dog-years lived from year x T(x)	Life expectancy for dogs in the age interval (x. x + 1) e(x)
0 - 1	7903	18	0.00	1.00	99888	1024730	10.25 (10.05-10.45)
1 – 2	7885	51	0.01	1.00	99454	924842	9.27 (8.95 - 9.59)
2 – 3	7834	110	0.01	0.99	98441	827013	8.34 (7.90 - 8.79)
3 - 4	7724	227	0.03	0.98	96332	729528	7.46 (6.86 - 8.07)
4 – 5	7497	427	0.06	0.95	92286	633682	6.68 (5.89 - 7.47)
5 – 6	7070	547	0.07	0.90	86320	541696	6.04 (5.17 - 6.91)
6 – 7	6523	603	0.09	0.83	79318	455376	5.49 (4.59 - 6.39)
7 – 8	5920	587	0.09	0.76	72079	376059	4.97 (4.10 - 5.85)
8 – 9	5333	659	0.12	0.69	64520	303979	4.44 (3.52 - 5.35)
9 - 10	4674	641	0.13	0.61	56650	239459	3.96 (3.06 - 4.85)
10 – 11	4033	745	0.17	0.53	48305	182809	3.46 (2.51 - 4.42)
11 – 12	3288	751	0.20	0.44	39350	134504	3.07 (2.09 - 4.05)
12 – 13	2537	697	0.24	0.35	30647	95154	2.73 (1.73 - 3.73)
13 - 14	1840	670	0.31	0.26	22367	64506	2.44 (1.37 - 3.51)
14 – 15	1170	461	0.33	0.18	15285	42140	2.30 (1.23 - 3.38)
15 – 16	709	305	0.35	0.12	10103	26855	2.19 (1.10 - 3.27)
16 – 17	404	170	0.35	0.08	6553	16752	2.11 (1.07 - 3.15)
17 – 18	234	108	0.37	0.05	4207	10199	1.97 (0.93 - 3.01)
18 - 19	126	59	0.38	0.03	2625	5992	1.85 (0.86 - 2.84)
19 – 20	67	32	0.38	0.02	1626	3368	1.67 (0.76 - 2.59)
20 – 21	35	21	0.46	0.01	956	1742	1.41 (0.51 - 2.30)
21 - 22	14	11	0.55	0.01	486	786	1.17 (0.29 - 2.05)
22 -23	3	3	1.00	0.00	300	300	1.00 (0.04 - 2.04)

Table S8: Current life table of Beagles registered in SIAC.

Age interval in years (x. x + 1)	Number living at age x (lx)	Number dying in (x.x+1) (dx)	Conditional Probability of death (qx)	Proportion surviving to age x	Number of dog-years lived at age x L(x)	Total number of dog-years lived from year x T(x)	Life expectancy for dogs in the age interval (x. x + 1) e(x)
0 - 1	4064	7	0,00	1,00	99914	908769	9,09 (8,92 - 9,25)
1 – 2	4057	21	0,01	1,00	99570	808856	8,10 (7,84 - 8,37)
2 – 3	4036	71	0,02	0,99	98447	709285	7,14 (6,69 - 7,60)
3 - 4	3965	198	0,05	0,98	95204	610839	6,26 (5,55 - 6,97)
4 – 5	3767	360	0,09	0,93	88593	515635	5,55 (4,63 - 6,47)
5 – 6	3407	405	0,11	0,84	79627	427042	5,06 (4,09 - 6,03)
6 – 7	3002	409	0,13	0,75	70118	347415	4,64 (3,65 - 5,63)
7 – 8	2593	394	0,14	0,65	60728	277297	4,24 (3,26 - 5,23)
8 – 9	2199	356	0,15	0,56	51912	216569	3,86 (2,90 - 4,82)
9 - 10	1843	367	0,18	0,48	43390	164657	3,45 (2,46 - 4,44)
10 – 11	1476	388	0,23	0,39	34531	121268	3,10 (2,04 - 4,17)
11 – 12	1088	321	0,26	0,30	26137	86737	2,89 (1,81 - 3,97)
12 – 13	767	259	0,29	0,22	19063	60600	2,72 (1,60 - 3,84)
13 - 14	508	176	0,30	0,16	13505	41537	2,62 (1,52 - 3,72)
14 – 15	332	124	0,31	0,11	9408	28033	2,51 (1,40 - 3,62)
15 – 16	208	75	0,31	0,08	6483	18625	2,43 (1,37 - 3,50)
16 – 17	133	55	0,34	0,05	4403	12142	2,28 (1,19 - 3,38)
17 – 18	78	30	0,32	0,03	2930	7739	2,22 (1,19 - 3,24)
18 - 19	48	15	0,27	0,02	2046	4809	2,03 (1,18 - 2,88)
19 – 20	33	14	0,35	0,02	1424	2763	1,60 (0,79 - 2,41)
20 – 21	19	14	0,54	0,01	820	1338	1,19 (0,32 - 2,06)
21 - 22	5	5	1,00	0,01	518	518	1,00 (0,02 - 1,98)

Table S9: Current life table of German Shorthaired Pointers registered in SIAC.

Age interval in years (x. x + 1)	Number living at age x (lx)	Number dying in (x.x+1) (dx)	Conditional Probability of death (qx)	Proportion surviving to age x	Number of dog-years lived at age x L(x)	Total number of dog-years lived from year x T(x)	Life expectancy for dogs in the age interval (x. x + 1) e(x)
0 - 1	4852	68	0.01	1.00	99304	883454	8.83 (8.38 - 9.29)
1 – 2	4784	220	0.04	0.99	96392	784150	7.95 (7.17 - 8.74)
2 – 3	4564	309	0.07	0.94	91092	688688	7.31 (6.40 - 8.22)
3 - 4	4255	304	0.07	0.88	84973	598085	6.80 (5.90 - 7.69)
4 – 5	3951	293	0.07	0.82	79008	513365	6.27 (5.40 - 7.14)
5 – 6	3658	264	0.07	0.76	73429	434525	5.71 (4.90 - 6.52)
6 – 7	3394	322	0.09	0.71	67573	361097	5.10 (4.23 - 5.97)
7 – 8	3072	355	0.11	0.64	60852	293523	4.56 (3.66 - 5.46)
8 – 9	2717	371	0.13	0.57	53672	232671	4.06 (3.15 - 4.97)
9 - 10	2346	389	0.15	0.50	46179	179000	3.58 (2.66 - 4.50)
10 – 11	1957	403	0.19	0.42	38397	132821	3.14 (2.19 - 4.08)
11 – 12	1554	440	0.25	0.34	30172	94424	2.74 (1.72 - 3.76)
12 – 13	1114	399	0.30	0.26	21966	64253	2.48 (1.40 - 3.56)
13 - 14	715	273	0.32	0.18	15142	42286	2.34 (1.27 - 3.42)
14 – 15	442	194	0.36	0.12	10046	27144	2.22 (1.10 - 3.33)
15 – 16	248	104	0.35	0.08	6482	17098	2.18 (1.11 - 3.25)
16 – 17	144	56	0.33	0.05	4289	10615	2.07 (1.09 - 3.05)
17 – 18	88	41	0.38	0.03	2802	6326	1.83 (0.85 - 2.81)
18 - 19	47	26	0.43	0.02	1684	3524	1.64 (0.65 - 2.63)
19 – 20	21	13	0.47	0.01	930	1840	1.51 (0.52 - 2.50)
20 – 21	8	5	0.48	0.01	489	910	1.42 (0.48 - 2.35)
21 - 22	3	2	0.50	0.00	252	421	1.25 (0.40 - 2.10)
22 -23	1	1	1.00	0.00	168	168	1.00 (0.02 - 1.98)

Table S10: Current life table of Poodles registered in SIAC.

Age interval in years (x. x + 1)	Number living at age x (lx)	Number dying in (x.x+1) (dx)	Conditional Probability of death (qx)	Proportion surviving to age x	Number of dog-years lived at age x L(x)	Total number of dog-years lived from year x T(x)	Life expectancy for dogs in the age interval (x. x + 1) e(x)
0 - 1	4116	79	0.02	1.00	99049	1084827	10.85 (10.25 - 11.45)
1 – 2	4037	121	0.03	0.98	96650	985777	10.05 (9.33 - 10.77)
2 – 3	3916	135	0.03	0.95	93589	889127	9.34 (8.60 - 10.08)
3 - 4	3781	135	0.04	0.92	90362	795538	8.65 (7.92 - 9.37)
4 – 5	3646	152	0.04	0.89	86937	705176	7.95 (7.20 - 8.69)
5 – 6	3494	180	0.05	0.85	82987	618239	7.26 (6.47 - 8.05)
6 – 7	3314	191	0.06	0.81	78585	535251	6.62 (5.83 - 7.41)
7 – 8	3123	190	0.06	0.76	74067	456666	5.98 (5.22 - 6.75)
8 – 9	2933	201	0.07	0.72	69435	382599	5.33 (4.57 - 6.09)
9 - 10	2732	253	0.09	0.67	64088	313164	4.67 (3.86 - 5.48)
10 – 11	2479	319	0.12	0.61	57426	249075	4.08 (3.19 - 4.96)
11 – 12	2160	358	0.15	0.54	49619	191649	3.57 (2.65 - 4.49)
12 – 13	1802	358	0.18	0.46	41395	142030	3.12 (2.20 - 4.04)
13 - 14	1444	340	0.21	0.37	33356	100635	2.70 (1.79 - 3.61)
14 – 15	1104	343	0.27	0.29	25472	67278	2.29 (1.35 - 3.22)
15 – 16	761	330	0.36	0.22	17682	41806	1.94 (0.95 - 2.93)
16 – 17	431	225	0.41	0.14	10982	24124	1.74 (0.73 - 2.75)
17 – 18	206	129	0.48	0.08	6180	13143	1.62 (0.55 - 2.69)
18 - 19	77	47	0.47	0.04	3252	6963	1.64 (0.58 - 2.70)
19 – 20	30	16	0.42	0.02	1784	3710	1.64 (0.67 - 2.61)
20 – 21	14	8	0.44	0.01	1018	1926	1.47 (0.56 - 2.38)
21 - 22	6	4	0.50	0.01	545	909	1.25 (0.40 - 2.10)
22 -23	2	2	1.00	0.00	363	363	1.00 (0.02 - 1.98)

Table S11: Current life table of Estrela Mountain Dogs registered in SIAC.

Age interval in years (x. x + 1)	Number living at age x (lx)	Number dying in (x.x+1) (dx)	Conditional Probability of death (qx)	Proportion surviving to age x	Number of dog-years lived at age x L(x)	Total number of dog-years lived from year x T(x)	Life expectancy for dogs in the age interval (x. x + 1) e(x)
0 - 1	3536	197	0,05	1.00	100000	1,00	7,50 (6,66 - 8,33)
1 – 2	3339	247	0,07	0.95	94580	0,95	6,90 (5,98 - 7,82)
2 – 3	3091	254	0,08	0.88	87833	0,88	6,39 (5,46 - 7,32)
3 - 4	2837	242	0,08	0.81	80900	0,81	5,90 (5,00 - 6,80)
4 – 5	2595	244	0,09	0.74	74281	0,74	5,38 (4,48 - 6,27)
5 – 6	2350	235	0,10	0.68	67611	0,68	4,86 (3,99 - 5,73)
6 – 7	2115	261	0,12	0.61	61172	0,61	4,32 (3,42 - 5,21)
7 – 8	1854	216	0,11	0.54	54061	0,54	3,82 (3,02 - 4,62)
8 – 9	1638	255	0,14	0.48	48110	0,48	3,23 (2,40 - 4,06)
9 - 10	1383	299	0,20	0.41	41161	0,41	2,69 (1,82 - 3,56)
10 – 11	1084	317	0,26	0.33	33130	0,33	2,22 (1,34 - 3,10)
11 – 12	766	326	0,35	0.25	24678	0,25	1,81 (0,89 - 2,73)
12 – 13	441	251	0,44	0.16	16018	0,16	1,52 (0,58 - 2,46)
13 - 14	190	131	0,51	0.09	8921	0,09	1,33 (0,39 - 2,27)
14 – 15	59	46	0,56	0.04	4347	0,04	1,21 (0,28 - 2,14)
15 – 16	12	10	0,59	0.02	1908	0,02	1,12 (0,22 - 2,01)
16 – 17	2	2	1,00	0.01	786	0,01	1,00 (0,02 - 1,98)

Table S12: Current life table of Yorkshires Terrier registered in SIAC.

Age interval in years (x. x + 1)	Number living at age x (lx)	Number dying in (x.x+1) (dx)	Conditional Probability of death (qx)	Proportion surviving to age x	Number of dog-years lived at age x L(x)	Total number of dog-years lived from year x T(x)	Life expectancy for dogs in the age interval (x. x + 1) e(x)
0 - 1	3533	4	0.02	1.00	99942	1170142	11.70 (11.55 - 11.86)
1 – 2	3529	6	0.03	1.00	99798	1070200	10.71 (10.53 - 10.89)
2 – 3	3523	10	0.03	1.00	99576	970402	9.73 (9.52 - 9.95)
3 - 4	3513	21	0.04	0.99	99143	870826	8.76 (8.46 - 9.06)
4 – 5	3492	42	0.04	0.99	98260	771683	7.81 (7.41 - 8.20)
5 – 6	3451	105	0.05	0.98	96218	673423	6.89 (6.31 - 7.48)
6 – 7	3346	196	0.06	0.95	92064	577205	6.09 (5.33 - 6.85)
7 – 8	3150	223	0.06	0.89	86315	485141	5.43 (4.65 - 6.21)
8 – 9	2927	299	0.07	0.83	79219	398825	4.79 (3.92 - 5.66)
9 - 10	2628	299	0.09	0.75	71125	319606	4.25 (3.40 - 5.10)
10 – 11	2329	348	0.12	0.67	62412	248481	3.70 (2.81 - 4.60)
11 – 12	1981	361	0.15	0.58	52928	186069	3.22 (2.32 - 4.12)
12 – 13	1620	398	0.18	0.48	42843	133141	2.77 (1.82 - 3.72)
13 - 14	1222	349	0.21	0.38	32885	90298	2.40 (1.48 - 3.33)
14 – 15	873	340	0.27	0.28	23595	57413	2.04 (1.07 - 3.00)
15 – 16	533	278	0.36	0.19	15071	33818	1.78 (0.75 - 2.81)
16 – 17	255	150	0.41	0.11	8610	18747	1.68 (0.62 - 2.74)
17 – 18	105	69	0.48	0.06	4576	10137	1.67 (0.53 - 2.81)
18 - 19	36	20	0.47	0.03	2406	5561	1.81 (0.72 - 2.90)
19 – 20	16	6	0.42	0.02	1466	3155	1.81 (0.96 - 2.66)
20 – 21	10	6	0.44	0.01	919	1689	1.42 (0.52 - 2.32)
21 - 22	4	3	0.50	0.01	472	770	1.19 (0.32 - 2.06)
22 -23	1	1	1.00	0.00	298	298	1.00 (0.02 - 2.02)