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Results of a Web-Based Health Survey of Retired Racing Greyhounds

Linda K. Lord, Jill E. Yaissle, Liliana Marin, and C. Guillermo Couto

Background: Adoption of retired racing Greyhounds has become increasingly popular during the past decade. To date, research has focused on the physiologic and clinicopathologic peculiarities of Greyhounds but there is little published information on disease prevalence in the breed.

Objective: The objective of this study is to determine the prevalence of disease in retired racing Greyhounds.

Animals: In this study, 747 Greyhounds were used.

Methods: A standardized survey method was used, and survey responses were collected by an Internet survey. Owners could answer a survey for every Greyhound that they had owned since January 1, 2005.

Results: Of the 692 eligible participants, 441 (63.7% response rate) completed surveys for 747 Greyhounds. The mortality rate for Greyhounds within the 2-year period was 15% (113 of 747 died). The most common cause of death reported was cancer (66 dogs, 58%), and the most common type of cancer listed as the cause of death was osteosarcoma (28 dogs, 25%). The most commonly reported groups of diseases or disorders were skeletal (232 dogs, 33%), skin (197 dogs, 28%), digestive (132 dogs, 18%), cancer (94 dogs, 13%), and endocrine (85 dogs, 11.9%). Forty-five percent of Greyhounds diagnosed with cancer and 6% of the overall population had osteosarcoma.

Conclusions and Clinical Importance: The results of this study can be used by veterinary researchers to continue to investigate the most common diseases in this population. As more retired racing Greyhounds enter the pet population, the results of this study will help educate veterinarians and owners about the most prevalent diseases in the breed.

Key words: Cancer; Disease prevalence; Dog; Epidemiology.

Adoption of retired racing Greyhounds has become increasingly popular during the past decade. It is estimated that approximately 120,000 Greyhounds live in homes as pets as compared to 55,000 Greyhounds in racetracks. In the past few years, private Greyhound adoptions ranged from 15,000 to 18,000/year (Guccione, National Greyhound Association, personal communication). Research has demonstrated that Greyhounds have hematologic and biochemical differences from other breeds, some of which are not widely known in the veterinary field.[1–3] Greyhounds have physiologic differences including a larger heart size,[4,5] a higher vertebral heart score,[6] high glomerular filtration rate,[7] high arterial blood pressure,[4,5] and relative aortic stenosis.[8]

To date, research has focused mainly on the physiologic and clinicopathologic peculiarities of Greyhounds, but there is little published data for disease prevalence in the breed. Some diseases, such as tick-borne illnesses and hypothyroidism, are thought to be common in the breed,[9,10] but no scientific data have ever been used to confirm their prevalence. Furthermore, most of the Greyhounds that have been evaluated are located at referral institutions or racetracks in limited areas throughout the United States. Thus, these Greyhounds may not be representative of the general population of retired racers in the United States.

Breed health surveys are one method used to study disease prevalence in a subpopulation of dogs. Several comprehensive health surveys that fully investigate health conditions of certain breeds[11,12] have been conducted. These surveys were convenience-based and do not represent a random sample of the general breed populations.

The primary objective of this study was to conduct a random sample survey to evaluate the type and prevalence of diseases in retired racing Greyhounds in the United States. A secondary objective was to determine the major causes of death for these Greyhounds.

Materials and Methods

Sampling Frame

The sampling frame consisted of a cohort of current subscribers to the national magazine *Celebrating Greyhounds*.[a] It was felt that this sampling frame represented the most comprehensive national list from which a random sample of Greyhound owners could be chosen and provided a reasonable representation of the target population of retired racing Greyhounds in the United States. A list of the names and addresses for the subscribers was provided by the magazine publisher.

Sample Design

The sample design was a stratified random sample using proportional allocation. The strata were defined as the 4 regions of the country, as defined by the US Census Bureau (Northeast, Midwest, South, and West).[13] The proportional allocation was based on the Census-estimated population figures for each region and the number of subscribers in each region for 2005. A random number generator, using standard computer software,[b] was used to select a simple random sample from each stratum. The sample size was calculated based on an estimated prevalence for osteosarcoma (OSA) of 10%, a margin of error of 3%, and a confidence interval of 95%. Any subscriber identified as a business or institution was removed from the list. Each individual selected in the sample was

From the Department of Veterinary Preventive Medicine (Lord) and the Department of Veterinary Clinical Sciences (Yaissle, Marin, and Couto), College of Veterinary Medicine, and the OSU Comprehensive Cancer Center (Couto), The Ohio State University, Columbus, OH. All research was performed at The Ohio State University College of Veterinary Medicine.

Reprint requests: Linda K. Lord, DVM, PhD, Department of Veterinary Preventive Medicine, College of Veterinary Medicine, The Ohio State University, 1920 Coffey Road, A100N Sisson Hall, Columbus, OH, 43210; e-mail: lord.19@osu.edu.

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Table 1. Summary of the geographical regions across the United States for the 441 survey respondents.

Region	Surveyed	Ineligible	Eligible	Responded	Percent Response	Greyhounds	Total Percent
Northeast	202	4	198	122	61.6	180	24.1
Midwest	170	5	165	97	58.8	155	20.6
South	210	10	200	135	67.5	256	34.2
West	132	3	129	87	67.4	156	20.9
Total	714	22	692	441	63.7	747	100

assigned a unique identification (ID) number that was used for tracking survey responses.

Study Design

A standardized survey method was used,[14] and survey responses were collected primarily by an Internet survey. The initial and follow-up contacts were sent by mail because e-mail addresses for the subscribers were unavailable. An introductory letter explaining the purpose of the survey was sent to all selected individuals in the survey on September 25, 2006. The individuals were asked to access a unique web address that included their unique ID number. They were asked to complete the survey for every Greyhound they owned since January 1, 2005, including dogs that were alive at the time or had died during the study time frame. Individuals were asked to contact the authors by phone or email if they did not own a Greyhound or did not have access to a computer. Individuals that were eligible for the study but who did not have a computer were sent a mail version of the survey. Respondents could be tracked on the survey website through the use of their unique ID number. A postcard reminder was sent 2 weeks after the initial mailing, and a final reminder letter was sent 5 weeks after the initial mailing. Survey responses were accepted on the website through November 27, 2006.

Survey Instrument

Using a standard Internet survey program,[15] owners were asked a series of questions primarily related to disease and behavioral conditions.[c] Disease conditions were grouped by organ system or discipline, and owners could select more than 1 disease, if applicable. Major categories for disease conditions included skeletal, cancer, skin, allergy, digestive, liver/spleen, neurologic, respiratory, heart/circulatory, blood, endocrine, tick-borne, and behavioral. Because of a technical error, questions on renal disease and dental health were erroneously omitted from the final version of the Internet survey. In addition, the following general information was included: sex, age, years owned, spay/neuter status, activities, and racing history for those Greyhounds that had competed. For any Greyhound that had died during the study time frame, the owner was asked for the age of their dog at the time of death and the cause of death by category (cancer, heart disease, kidney disease, trauma, infectious disease, bleeding disorder, and other).

In each major disease category and for cause of death, the owner could select the category "Other" and write in a specific disease condition. Each Other category response was reviewed by the 2 primary authors and, if appropriate, reassigned to one of the previously defined categories.

All data were tracked with standard software.[b] The survey was given exempt approval status by The Ohio State University Institutional Review Board.

Pilot Study

A pilot study was implemented to test access to the web address and survey question design. A sample of 24 individuals, 6 from each stratum, was selected for the pilot study. They were sent an initial mailing on September 11, 2006, and a postcard reminder 10 days later. Owners were asked to provide feedback on the clarity of individual questions in the comment section of the survey. Of the 24 individuals, 13 responded. Based on this response rate, a conservative 50% response rate was used to adjust the sample size calculation (sample size adjusted = sample size/0.50).

Statistical Analysis

Medians and ranges were calculated for responses that consisted of continuous data, and proportions were calculated for responses that consisted of categorical data. The denominator for each categorical response was determined based on the number of respondents answering the particular question (ie, not every respondent answered every question). The overall mortality rate was calculated as the number of Greyhounds that died during the study period divided by the total number of Greyhounds in the study. Confidence intervals for all prevalence estimates were calculated with survey methodology that accounted for the stratified sample and single-stage clustering at the owner level. Comparisons were made among the prevalence of different diseases among regions using a χ^2 test. The Fisher's exact test was used for categorical variables when the expected value of a given cell in the comparison was <5. For all analyses, values of $P \leq .05$ were considered significant. Standard statistical software was used.[d]

Results

Survey Respondents

There were 4,999 current subscribers to *Celebrating Greyhounds*; 714 were randomly selected for the study, and 692 were considered to be eligible participants (14 did not have eligible dogs, 4 were businesses, and 4 were invalid). Of the 692 eligible participants, 441 (63.7% response rate) completed surveys for 747 Greyhounds. Table 1 provides a summary of survey response by region.

Signalment Characteristics

In the study, 362 (49%, 95% CI 45.5–52.0) Greyhounds were male and 380 (51%, 95% CI 48.0–54.5) were female. Only 5 (1%, 95% CI 0.2–1.3) of the dogs were intact. Thirty-two of the Greyhounds (4%, 95% CI 2.8–5.7) were 1 to 3 years of age; 169 (23%, 95% CI 19.6–25.7) were 3 to 6 years of age; 255 (34%, 95% CI 30.5–37.8) were 6 to 9 years of age; 208 (28%, 95% CI 24.4–31.2) were 9 to 12 years of age; and 83 (11%, 95% CI 8.8–13.5) were 12 years of age or older. The median number of Greyhounds per household was 2 (range 1 to 6). The length of time Greyhounds lived in a household was as follows: 258 (35%, 95% CI 30.8–38.4) Greyhounds resided in the

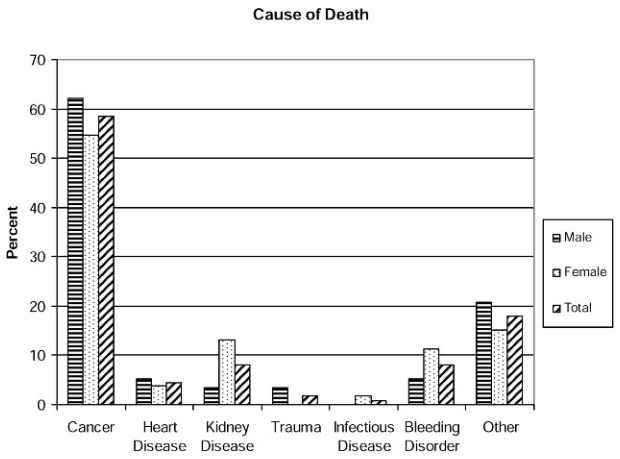

Fig 1. Cause of death listed as percent of the 111 reported as deceased and divided by sex. Two Greyhounds that died are not included because sex was not reported.

house for 1 to 3 years; 280 (38%, 95% CI 33.8–41.3) for 3 to 6 years; 149 (20%, 95% CI 17.0–23.0) for 6 to 9 years; 49 (7%, 95% CI 4.5–8.7) for 10 to 12 years; and 9 (1%, 95% CI 0.4–2.0) for 12 years or longer.

The owners reported that 677 (91%, 95% CI 88.8–93.2) of the Greyhounds had a prior racing history, with a median number of races of 43 (range, 2 to 400 races). Approximately half (291; 52%, 95% CI 47.0–56.0) of the dogs raced for 1–2 years, 221 (39%, 95% CI 34.9–43.3) raced for 2–4 years, and 53 (9%, 95% CI 7.0–11.8) raced for more than 4 years.

Owners were asked to indicate the types of activities in which their Greyhounds participated and could select more than 1 answer. Of the 717 Greyhounds for which an activity was reported, 715 (100%, 95% CI 99.3–100.0) were considered to be pets, 70 (10%, 95% CI 7.0–12.4) were used as a therapy dogs, 51 (7%, 95% CI 4.4–9.9) were used in obedience, and 11 (2%, 95% CI 0.3–2.7) were used in agility.

Causes of Death

The mortality rate for Greyhounds within the 2-year period was 15% (113 of 747 [95% CI 12.4–17.8] died or were euthanized). For those 113 deaths, the 4 most prevalent causes of death reported were cancer (66 dogs, 58%, 95% CI 49.5–67.4); other causes (21 dogs, 18%, 95% CI 11.6–25.6) were mainly orthopedic, kidney disease (9 dogs, 8%, 95% CI 3.0–13.0), and bleeding disorders (9 dogs, 8%, 95% CI 2.9–13.1). Of the 66 dogs that died of cancer, 28 owners reported OSA as the primary type of cancer (4 additional dogs had multiple forms of cancer, including OSA). Figure 1 illustrates the cause of death divided by sex.

Disease Prevalence

The disease prevalences were reported individually and grouped either by major organ system or, when multiple systems were involved, by discipline (Table 2). Because the survey was a stratified sample, regional differences in diseases also were evaluated, with significant differences reported in Table 3. The most commonly reported groups of diseases/disorders were skeletal (232 dogs, 33%, 95% CI 29.1–35.9), skin (197 dogs, 28%, 95% CI 24.1–31.0), digestive (132 dogs, 18% [95% CI 15.4–21.5]), cancer (95 dogs, 13%, 95% CI 11.0–16.9), and endocrine (85 dogs, 11.9%, 95% CI 9.3–14.5).

OSA was the most prevalent form of cancer reported, with a prevalence of 45% (95% CI 34.2–54.2) for dogs with cancer and 6% (95% CI 4.3–7.6) for the overall population. Osteoarthritis (OA) was the most commonly reported condition, with a prevalence of 54% (95% CI 46.9–60.9) for dogs with a non-neoplastic skeletal problem and a prevalence of 18% (95% CI 14.6–20.4) for the overall population. Bald thighs were reported as the most prevalent skin disorder (59%, 95% CI 51.3–61.4), with a prevalence of 16% (95% CI 13.3–18.8) for the overall population. Fifty-five percent (95% CI 45.7–63.4) of dogs with reported digestive diseases had diarrhea (10%, 95% CI 7.6–12.5 for the overall population). Hypothyroidism was reported as the most prevalent endocrine disease (93%, 95% CI 87.2–98.7), with a prevalence of 11% (95% CI 8.5–13.6) for the total population.

Regarding OSA, owners were asked specific questions concerning the location of the primary tumor using scientific and lay terminology (ie, proximal humerus, shoulder area). For 41 of the 42 Greyhounds with OSA, 24 (59%, 95% CI 42.6–74.5) were male and 17 (41%, 95% CI 25.5–57.4) were female. For 40 of the 42 Greyhounds, the owners identified the location as 20 (50%, 95% CI 34.9–65.2) in the proximal humerus (shoulder area), 8 (20%, 95% CI 6.8–33.2) in the distal radius (wrist area), 1 (2.5%, 95% CI 0–7.6) in the proximal femur (hip area), 3 (7.5%, 95% CI 0–15.7) in the distal femur (knee area, just above it), 4 (10%, 95% CI 0.1–19.9) in the proximal tibia (knee area, just below it), 1 (2.5%, 95% CI 0–7.5) in the distal tibia (ankle area), and 3 (7.5%, 95% CI 0–15.8) in other locations. For 36 of the 42 Greyhounds, the owners identified the affected leg as 18 (50%, 95% CI 32.1–68.0) in the right front leg, 9 (25%, 95% CI 9.9–40.1) in the left front leg, 3 (8%, 95% CI 0–18.2) in the right back leg, and 6 (17%, 95% CI 4.3–28.9) in the left back leg.

Behavior Problems

Greyhound owners were asked a series of yes/no questions on common behavior problems. They reported that 12 Greyhounds (2%, 95% CI 0.8–2.7) showed aggression toward people, 60 (9%, 95% CI 6.5–10.6) showed aggression toward other dogs, and 40 (6%, 95% CI 4.0–7.4) showed fear aggression. One-hundred forty-three dogs (20%, 95% CI 17.4–23.2) had a noise phobia, and 188 (27%, 95% CI 23.5–29.6) had storm phobia. Separation anxiety was reported for 133 (19%, 95% CI 16.0–22.0) Greyhounds. Fifty additional dogs (7%, 95% CI 4.9–8.4) were listed having a behavioral problem not included in the above categories.

Table 2. Diseases reported by owners for 747 Greyhounds across the United States.

Organ System or Discipline	Disease	Number of Greyhounds	Percent of Group (95% CI)	Percent of All Greyhounds (95% CI)	Number Reported
Skeletal		232		32.5 (29.1–35.9)	714
	Arthritis	125	53.9 (46.9–60.9)	17.5 (14.6–20.4)	
	Hip dysplasia	4	1.7 (0.9–3.4)	0.6 (0–1.1)	
	Polyarthritis	2	0.9 (0–2.0)	0.3 (0–0.6)	
	Racing injury	101	43.5 (37.2–49.9)	14.1 (11.6–16.7)	
	Ruptured CCL	8	3.4 (1.2–5.7)	1.1 (0.4–1.9)	
	Other	56	24.1 (18.3–29.1)	7.8 (5.9–9.7)	
Cancer		94		13.3 (11.0–16.9)	707
	Brain/CNS	3	3.2 (0–6.7)	0.4 (0–0.9)	
	Hemangiosarcoma	8	8.5 (2.4–14.5)	1.1 (0.3–1.9)	
	Lung	3	3.2 (0–6.6)	0.4 (0–0.9)	
	Lymphoma	8	8.5 (3.0–13.8)	1.1 (0.4–1.9)	
	Mammary	0	0.0	0.0	
	Mast cell	6	6.4 (1.5–11.1)	0.8 (0.2–1.5)	
	Melanoma	2	2.1 (0–5.1)	0.3 (0–0.6)	
	Osteosarcoma	42	44.7 (34.2–54.2)	5.9 (4.3–7.6)	
	Perianal	0	0.0	0.0	
	Prostate	0	0.0	0.0	
	Soft tissue sarcoma	6	6.4 (1.5–11.2)	0.8 (0.2–1.5)	
	Hemangiopericytoma	0	0.0	0.0	
	Neurofibroma/sarcoma	0	0.0	0.0	
	Nerve sheath	2	2.1 (0–5.1)	0.3 (0–0.7)	
	Fibrosarcoma	0	0.0	0.0	
	Squamous cell carcinoma	4	4.3 (0.1–8.3)	0.6 (0–1.1)	
	Other	21	22.3 (13.3–30.9)	3.0 (1.7–4.3)	
Skin		197		27.5 (24.1–31.0)	716
	Bald thighs	115	58.4 (51.3–65.4)	16.3 (13.3–18.8)	
	Skin allergy	31	15.7 (10.7–20.8)	4.4 (2.9–5.7)	
	Chronic ear infection	18	9.1 (5.2–13.1)	2.5 (1.4–3.6)	
	Onychodystrophy	13	6.6 (2.9–9.3)	1.8 (0.9–2.7)	
	Corns	42	21.3 (15.5–27.1)	5.9 (4.2–7.5)	
	Other	29	14.7 (9.5–18.9)	4.1 (2.7–5.4)	
Allergy		80		11.2 (8.8–13.7)	715
	Flea	8	10.0 (3.3–16.7)	1.1 (0.4–1.9)	
	Food	39	48.8 (37.1–60.4)	5.5 (3.7–7.2)	
	Inhalant (atopy)	10	12.5 (5.0–19.9)	1.4 (0.6–2.2)	
	Contact	9	11.3 (4.6–17.9)	1.3 (0.5–2.0)	
	Drug	14	14.9 (6.9–23.1)	2.0 (0.9–3.1)	
	Other	10	12.5 (4.9–20.1)	1.4 (0.6–2.2)	
Digestive		132		18.4 (15.4–21.5)	716
	Anal sac disease	15	11.4 (5.7–17.0)	2.1 (1.0–3.2)	
	Diarrhea	72	54.5 (45.7–63.4)	10.1 (7.6–12.5)	
	Vomiting	19	14.4 (7.8–21.0)	2.7 (1.4–3.9)	
	Clostridial diarrhea	4	3.0 (0–6.6)	0.6 (0–1.2)	
	Giardiasis	5	3.8 (0.6–7.0)	0.7 (0.1–1.3)	
	GDV	3	2.3 (0–4.8)	0.4 (0–0.9)	
	Inflammatory bowel disease	17	12.9 (7.0–18.8)	2.4 (1.3–3.4)	
	Irritable bowel disease	21	15.9 (9.4–22.4)	2.9 (1.8–4.1)	
	Pancreatic disease	10	7.6 (3.1–12.1)	1.4 (0.6–2.2)	
	Other	18	13.6 (7.9–19.4)	2.5 (1.4–3.6)	
Liver/spleen		18		2.5 (1.4–3.7)	712
	Cirrhosis	1	5.6 (0–17.7)	0.1 (0–0.4)	
	Hepatitis	0	0.0	0.0	
	Portosystemic shunt	0	0.0	0.0	
	Enlarged spleen	9	50.0 (26.3–73.8)	1.3 (0.5–2.0)	
	Hypersplenism	1	5.6 (0–17.5)	0.1 (0–0.4)	
	Other	8	44.4 (22.1–66.6)	1.1 (0.4–1.9)	

Table 2. Continued

Organ System or Discipline	Disease	Number of Greyhounds	Percent of Group (95% CI)	Percent of All Greyhounds (95% CI)	Number Reported
Neurologic		52		7.3 (5.4–9.2)	717
	Epilepsy/seizures	17	32.7 (19.7–45.7)	2.4 (1.3–3.4)	
	Lumbosacral stenosis	14	26.9 (14.1–39.7)	2.0 (1.0–2.9)	
	Disc disease	14	26.9 (13.7–40.1)	2.0 (0.9–3.0)	
	Cognitive dysfunction	5	9.6 (1.3–18.0)	0.7 (0.1–1.3)	
	Other	10	19.2 (7.8–30.7)	1.4 (0.6–2.2)	
Respiratory		17		2.4 (1.4–3.5)	715
	Laryngeal paralysis	2	11.8 (0–29.6)	0.3 (0–0.6)	
	Pneumonia	3	17.6 (0–37.8)	0.4 (0–0.9)	
	Chronic kennel cough	2	11.8 (0–26.4)	0.3 (0–0.6)	
	Other	10	58.8 (30.9–86.7)	1.4 (0.6–2.2)	
Heart/circulatory		47		6.5 (4.6–8.5)	718
	Cardiomyopathy	3	6.4 (0–13.4)	0.4 (0–0.9)	
	Congenital heart defect	0	0.0	0.0	
	Congestive heart failure	8	17.0 (4.1–29.9)	1.1 (0.3–1.9)	
	Heart murmur	38	80.9 (67.9–93.9)	5.3 (3.5–7.1)	
	Hypertension	5	10.6 (1.5–19.8)	0.7 (0.1–1.3)	
	Pulmonic stenosis	0	0.0	0.0	
	Subaortic stenosis	1	2.1 (0–6.4)	0.1 (0–0.4)	
	Persistent right aortic arch	0	0.0	0.0	
	Other	3	6.4 (0–13.7)	0.4 (0–0.9)	
Blood		24		3.3 (2.1–4.7)	718
	Spontaneous bleeding	1	4.2 (0–12.9)	0.1 (0–0.4)	
	Postoperative bleeding	3	12.5 (0–27.6)	0.4 (0–0.9)	
	Swollen leg syndrome	0	0.0	0.0	
	Stroke	7	29.2 (9.1–49.3)	1.0 (0.3–1.7)	
	Von Willebrand's disease	6	25.0 (5.9–44.0)	0.8 (0–1.6)	
	IMHA	0	0.0	0.0	
	ITP	2	8.3 (0–20.7)	0.3 (0–0.7)	
	Other	5	20.8 (1.6–40.1)	0.7 (0.1–1.3)	
Endocrine		85		11.9 (9.3–14.5)	717
	Addison's disease	0	0.0	0.0	
	Cushing's disease	3	3.5 (0–7.6)	0.4 (0–0.9)	
	Diabetes mellitus	0	0.0	0.0	
	Hypothyroidism	79	92.9 (87.2–98.7)	11.0 (8.5–13.6)	
	Other	5	5.9 (0.7–11.1)	0.7 (0.1–1.3)	
Tick borne		47		6.5 (4.7–8.4)	719
	Babesia canis infection	19	40.4 (25.5–55.4)	2.6 (1.5–3.8)	
	Babesia gibsonii infection	1	2.1 (0–6.4)	0.1 (0–0.4)	
	Ehrlichia canis infection	5	10.6 (1.5–19.8)	0.7 (0.1–1.3)	
	Lyme disease	17	36.2 (20.8–51.5)	2.4 (1.1–3.6)	
	Other	10	21.3 (10.2–32.4)	1.4 (0.6–2.2)	

Discussion

The present study was designed to obtain epidemiologic information about the most common diseases in retired racing Greyhounds. The results of this study can be used by veterinary researchers to investigate the most common diseases reported for this population. In addition, as more retired racing Greyhounds enter the pet population, the results of this study will help educate veterinarians and owners about the most prevalent diseases in the breed.

Craig[16] reported on common causes of death for Golden Retrievers, Labrador Retrievers, Rottweilers, Boxers, and German Shepherd Dogs. For all of these breeds neoplasia was the most common cause of death or euthanasia. In the present study, similar results were reported for Greyhounds; neoplasia accounted for 58% of the deaths reported. The results of the present study also support findings of a nonscientific Greyhound mortality survey[17] conducted in the United Kingdom in 2000; there were 142 respondents and the most commonly reported cause of death was neoplasia.

OSA was the most common neoplasm in former racing Greyhounds in this survey. Forty-five percent of Greyhounds diagnosed with cancer and 6% of the overall population had OSA. These results are in agreement with those of Crawford et al,[18] who investigated the risk for OSA in dogs presented to the

Table 3. Regional differences for reported diseases, behaviors, and training among the 4 national regions: Northeast, Midwest, South, and West.

Category	Response	Region				Total	*P* Value
		Northeast	Midwest	South	West		
Obedience training	Yes	16	8	9	18	51	.009
	No	157	140	236	133	666	
Lymphoma	Yes	6	1	0	1	8	.006
	No	158	147	244	150	699	
Digestive problems	Yes	42	24	29	37	132	.001
	No	127	124	216	117	584	
Diarrhea	Yes	24	11	14	23	72	.003
	No	145	137	231	131	644	
Von Willebrand disease	Yes	4	1	0	1	6	.046
	No	166	147	246	153	712	
Endocrine disease	Yes	24	13	19	29	85	.005
	No	145	136	226	125	632	
Hypothyroidism	Yes	22	12	18	27	79	.008
	No	147	137	227	127	638	
Tick borne illness	Yes	20	4	13	10	47	.01
	No	150	145	233	144	672	
Lyme disease	Yes	10	2	4	1	17	.013
	No	160	147	242	153	702	
Other tick borne diseases	Yes	5	0	1	4	10	.025
	No	165	115	178	121	520	
Storm phobia	Yes	60	30	67	31	188	.004
	No	106	115	178	121	520	

University of Florida Veterinary Medical Center. The authors reported that Greyhounds had the highest risk for OSA, followed by Rottweilers and Great Danes. OSA also was more common in a front limb (75%) than a rear limb (25%). Considering that 60% of total body weight is supported by the front limbs, this finding supports the hypothesis of an association between minor trauma due to excess weight and increasing occurrence of the disease.[19]

The most commonly reported non-neoplastic skeletal problem in the present study was OA, but no specific joint localization was provided. In addition to OA, racing injuries (14.1%) and other skeletal problems (7.8%) such as fractures were reported. Previous studies have indicated that Greyhounds are not predisposed to hip dysplasia[20] but have been reported as commonly having fractures of lower extremities associated with racing[21] and remodeling changes,[22] which could lead to the development of OA. OA may have been overdiagnosed in patients with other musculoskeletal diseases on the basis of physical examination findings alone; it is also possible that OSA or old racing injuries were underdiagnosed if no radiographic evaluation of the affected areas was done.

Other diseases considered to be problems in Greyhounds, such as diarrhea, tick-borne diseases, and hypothyroidism, were reported frequently in the current study. Eleven percent of the overall population was reported as having hypothyroidism. However, studies have demonstrated that canine reference ranges for basal serum T4 and fT4 concentrations may not be appropriate for evaluating Greyhounds.[23] Most Greyhounds with low resting T4 and fT4 concentrations are not hypothyroid.[24] Therefore, hypothyroidism may have been overdiagnosed in this study population.

Acute diarrhea is a common problem in Greyhounds. It is commonly stated that the diarrhea is due to the raw meat diets many of the Greyhounds are fed at racetracks. In 1993, 66% of 106 samples of commercial raw meat fed to Greyhounds tested positive for Salmonella by DNA probe.[25] These same researchers were able to correlate the Salmonella strains found in the diet to those found in the feces.[26] Recently, another study tested various samples from feces, food, and equipment at a breeding facility and found that 66% of all samples and 93% of fecal samples tested were positive for Salmonella.[27] Racing Greyhounds with or without diarrhea also have a high fecal load of *Escherichia coli* Shiga toxins 1 and 2.[28] However, the cause or mechanism of the diarrhea has yet to be clearly identified.

Tick-borne diseases previously were common in Greyhounds.[29] A study in 1983 reported that 181/393 Greyhounds (46%) at a Florida racetrack were seropositive for *Babesia canis*.[30] However, it is the experience of one of the authors (GC) that the prevalence has decreased. Fifteen years ago, at The Ohio State Veterinary Teaching Hospital, approximately half of the retired racing Greyhounds evaluated as potential blood donors tested positive for *Babesia canis* or *Ehrlichia canis* by immunofluorescent assay (Couto, personal communication, 2002). Currently, only 1–3% of the dogs are positive for tick-borne diseases. A recent report on the distribution of

babesiosis in the United Statems found that only 10/673 blood samples submitted for Babesia-specific polymerase chain reaction were positive for *Babesia canis vogeli*. Six of these 10 dogs were Greyhounds.[31] In the current study, 6.5% of the Greyhounds were reported as having a tick-borne disease. *Babesia canis* (2.6%) infection and Lyme disease (2.5%) were the most commonly reported tick-borne diseases.

One limitation of this study is that the list frame used for the mailing may not be representative of the entire retired racing Greyhound population. However, the use of mailing addresses from a national Greyhound magazine was the largest database of Greyhound owners readily available and included owners from throughout the United States. The selection of the participants was randomized to limit selection bias. The owners were self-selected to participate, but no incentives were used that could have biased participation. Despite these attempts to select a random, representative population, some bias in the selected population and subsequent reported disease distribution still may exist.

Another limitation of the present study is that the interpretation of the findings may have had some responder bias. The owners of Greyhounds that had been diagnosed with a disease may have been more willing to participate in the survey than the owners of healthy dogs.[32] In addition, these results are based on the owner responses and not the medical records of the patients, and some misinterpretation and incorrect reporting of the original diagnosis may have occurred.

In the present study, questions on renal disease and dental health were erroneously omitted from the final version of the Internet survey. Therefore, additional research is needed to evaluate the prevalence of these diseases. We also detected regional differences for some of the diseases, activities, and behavioral problems. In some instances (eg, Lyme disease) the differences observed are most likely due to the higher distribution of the *Ixodes* tick in the Northeast. However, for hypothyroidism there is no clear reason for the differences observed. These observations and others should further be investigated.

Despite the limitations discussed above, the current study generated a list of common diseases and causes of death in retired racing Greyhounds in North America. These results will enable veterinarians to become familiar with these diseases and anticipate future problems for their Greyhound patients. Future research to more clearly determine the prevalence of diseases could include a comparison of the present results to veterinary medical records. Finally, research to investigate possible differences in the diseases affecting retired racing Greyhounds as compared to those diseases affecting American Kennel Club–registered Greyhounds could be conducted.

Footnotes

[a] *Celebrating Greyhounds* Magazine, published by Greyhound, Inc, Framingham, MA

[b] Microsoft Office Excel 2003, Microsoft Corporation, Redmond, WA

[c] A copy of the survey is available from the primary author upon request

[d] Stata Version 9.1, StataCorp, College Station, TX

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