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# Osteosarcoma: Prevalence and influences

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## The Nationwide® Osteosarcoma Study

# Osteosarcoma: Prevalence and influences

Nationwide® analyzed its proprietary pet insurance claims data, revealing groundbreaking results, including: breeds of dogs more likely to be diagnosed, age of diagnosis and geographical influencers.

### Executive Summary

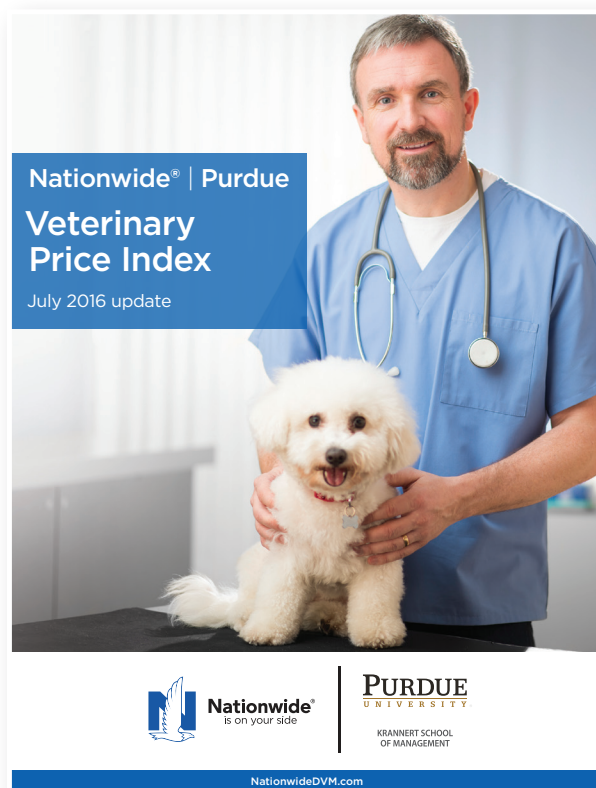
Pet insurance claims reveal osteosarcoma to be relatively common in dogs. When the data from Nationwide's pet insurance unit is more closely analyzed, however, clear trends emerge based on size, breed and other factors. Osteosarcoma diagnoses are significantly more common among the largest dogs, a trend more pronounced in a number of extra-large breeds. The disease prevalence starts to climb in late middle age, peaking from age 8-11, after which prevalence declines in step with the typical lifespan for large and extra-large dogs. Gender does not appear a significant risk, although male dogs are slightly more affected than females. Population density (rural, urban, and suburban) and region show differences in prevalence.

### Background

As part of its commitment to its members, to pet owners and to the veterinary community, the pet insurance division of Nationwide launched an aggressive program of data analysis in 2013. Using its peerless database of more than 30 years' worth of pet health insurance claims and working with industry and academic partners, Nationwide's pet insurance unit (founded and formerly known as Veterinary Pet Insurance®, or VPI®) laid out plans for a series of studies, both financial and medical, to provide greater understanding of the issues in veterinary medicine. These studies are intended to bring data into the discussions that aid in greater understanding - and that can lead to solutions.

This osteosarcoma data analysis is the first of Nationwide's veterinary medical studies. The two previous studies in the initiative focused on the financial self-perceptions of veterinarians (The VPI®-Veterinary Economics Financial Health Study, 2014) followed by ongoing semi-annual analysis of veterinary pricing trends (the Nationwide® | Purdue Veterinary Price Index, initial release in January of 2015).

Nationwide will continue to work with economists at the Krannert School of Management at Purdue University on the semi-annual refresh of the Veterinary Price Index, which has quickly become a benchmark for the veterinary community.



In addition, Nationwide has a robust publication schedule of veterinary medical data analysis, drawn from the largest and longest-term claims database in the pet health insurance industry.

A library of all studies in the data initiative is maintained for free downloading in the "Studies and Research" section of Nationwide's website for the veterinary community, Nationwide®DVM (NationwideDVM.com).

## The dataset

### Dog size distribution

Dog Size	Freq.	Percent
Tiny (0-10 lbs.)	169,954	16.62
Small (11-30 lbs.)	265,356	25.95
Medium (31-50 lbs.)	205,753	20.12
Large (51-110 lbs.)	353,886	34.60
Extra Large (>111 lbs.)	27,730	2.71
Total	1,022,679	100.00

The osteosarcoma analysis is drawn from 2007-2013 claims data, inclusive, for a total of 1.02 million canine policies. The analysis includes 355 breeds and mixes, including all American Kennel Club-recognized “pure” breeds as well as breeds recognized by other clubs and registries, some of the breeds quite rare in the United States (e.g., Appenzeller Sennenhunde, Pyrenean Mastiff). The dataset of breeds and mixes also includes purpose-bred so-called “designer dogs”

(e.g., Puggles, Labradoodles). Finally, the dataset of defined breeds and mixes also includes dogs identified only as “mixed,” and further divided by size (e.g., Large, 51-110 pounds, Tiny, 0-10 pounds).

Identification of breed or mix of a given dog is self-reported by the owner, entering the database at the time the policy is underwritten.

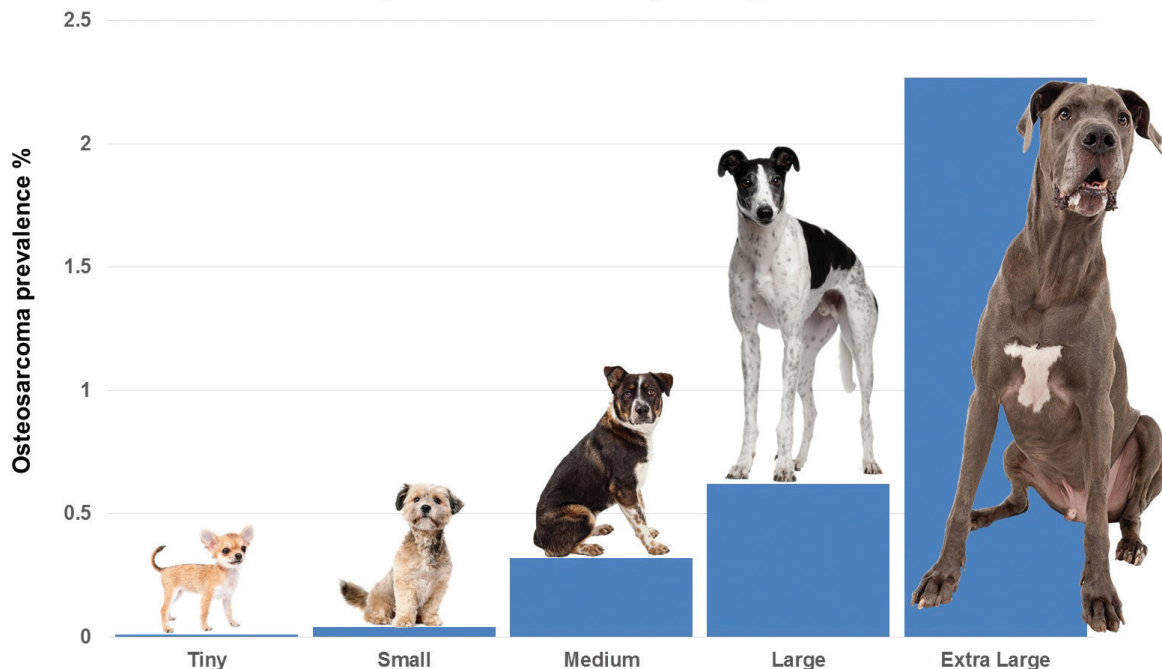
The size of dogs in the dataset is spread in sufficient numbers for analysis, with large dogs representing the largest population of insured canines (34.60%).

The prevalence of osteosarcoma in the described database is 0.35% (3,612 cases from 1,022,679 policies in force during 2007-2013 inclusive).

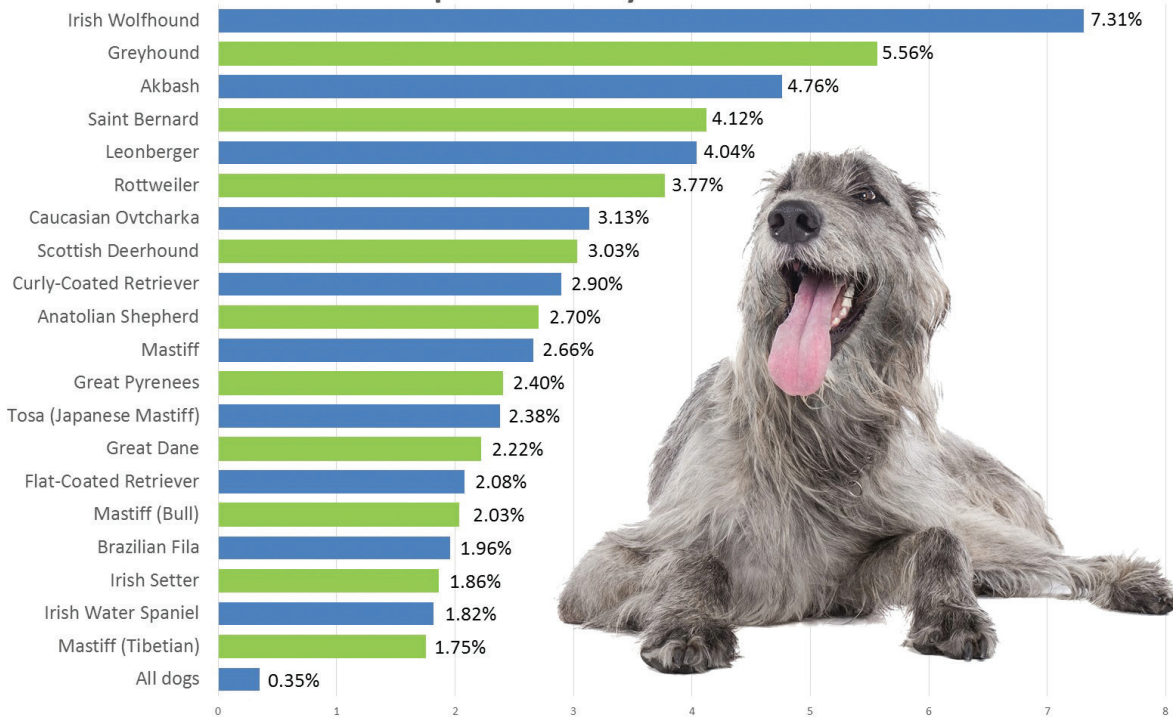
### Prevalence by size

As anticipated based on general experience in the veterinary community as well as from journal scans, the extra-large dogs had the highest risk of osteosarcoma (2.27%). Diagnosis of osteosarcoma is extremely rare in dogs defined as tiny (less than 10 pounds, 0.01%) and small (11-30 pounds, 0.04%). Nationwide claims data also showed that as the size of a dog increases, the risk of osteosarcoma does as well.

## Osteosarcoma prevalence by dog size



## Osteosarcoma prevalence by breed



While it's true that the larger a dog is, the more likely the diagnosis of osteosarcoma, the risk is not borne evenly across the class of the largest dogs. Some breeds in the class of dogs defined in the data set as “extra large” (more commonly known as a “giant” breed) are more likely to be diagnosed with osteosarcoma (e.g., Irish Wolfhound, Saint Bernard) than other extra-large breeds (e.g., Newfoundland). Some of the breeds at high risk are in the next size class down, “large” (e.g., Greyhound, Curly and Flat-Coated Retrievers).

In the Nationwide analysis, the breeds most likely to be diagnosed with osteosarcoma, in order of disease prevalence, are shown in the chart above.

All of the above are large or extra-large breeds of dogs. The risk to have osteosarcoma of the five largest breeds of dogs in existence—the Akbash, Anatolian Shepherd, Great Dane, Irish Wolfhound and Scottish Deerhound—is found to be 696% higher than all other dogs.

## Age of disease onset, and gender influence

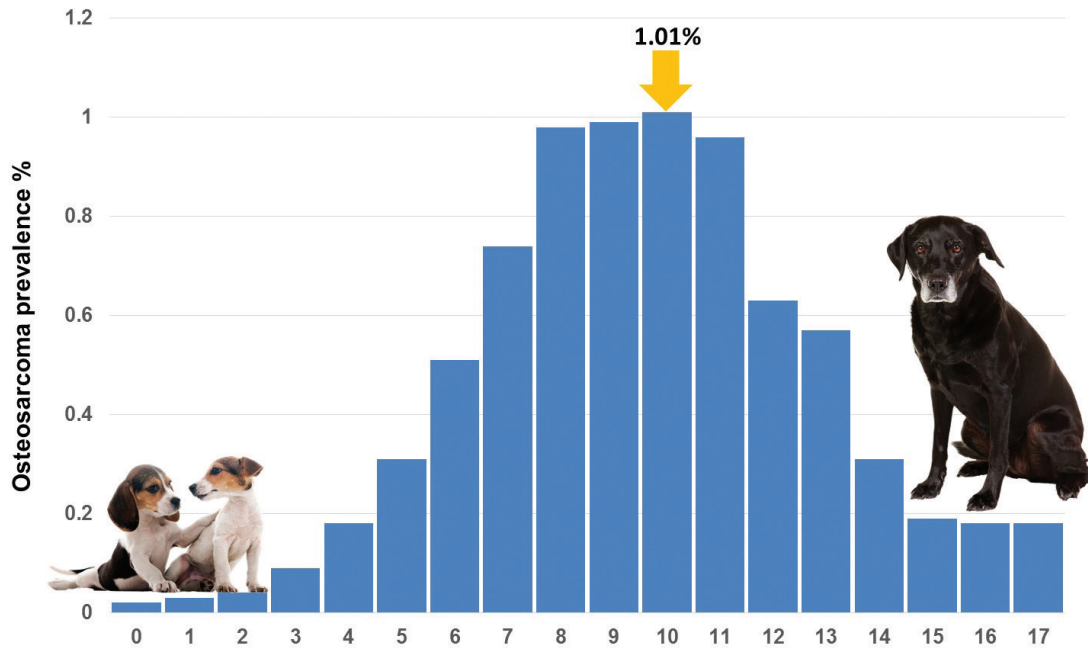
Early-onset osteosarcoma is not unheard of; in the dataset were dogs diagnosed under the age of two, and even under the age of 12 months. However, osteosarcoma is primarily of disease of late middle-age to senior dogs, with the majority of cases diagnosed from ages 7 to 12, inclusive. The average age of disease onset is 7.9 years. The average age of disease onset for extra large dogs is 8.3 years, and it is statistically significantly higher than other breeds.

In looking at three breeds prone to the disease—Greyhound (osteosarcoma prevalence 5.56%), Great Dane (2.22%), and Rottweiler (3.77%)—the Great Dane was more likely to be diagnosed at an earlier age.

## Mean age of diagnoses

Breed	Mean Age
Greyhound	8.68
Great Dane	6.28
Rottweiler	7.66

## Osteosarcoma prevalence by dog age (years)



When examining the Nationwide dataset for disease prevalence by gender—0.36% male to 0.34% female—it was found that this is not statistically relevant. Therefore, gender doesn't play as much a role in disease prevalence as much as size or breed.

### The role of geography, population density, and socioeconomics

While analyzing the prevalence data, we examined whether region, population density, and socioeconomics had any statistically relevant

bearing. In fact, they do. The prevalence of an osteosarcoma diagnosis is statistically more likely in the West region and in areas designated by population density as rural.

The degree of prevalence stayed roughly the same by region for extra-large breeds as compared to all dogs. Additionally, the dataset showed that among the extra-large breeds, the prevalence of osteosarcoma in rural/suburban/urban settings varied little, a finding not shown in the general population.

## Osteosarcoma prevalence by region

*All dogs*



## Osteosarcoma prevalence by population density

All dogs



Socioeconomics is also statistically associated with the osteosarcoma diagnosis. The higher the socioeconomics score of the owners, the higher the osteosarcoma prevalence. At the highest SES level (cutpoint of 90), the prevalence of osteosarcoma was 0.42% vs. 0.34% for the remainder.

### Summary

While data analysis shows statistically significant differences in osteosarcoma prevalence based on region, population density, and socioeconomics status, the most reliable predictor of a higher prevalence of osteosarcoma is the size and/or breed of a dog.

In analyzing the data set, Nationwide hopes to assist the veterinary community in educating pet owners about the prevalence of osteosarcoma, a disease with a generally poor prognosis.

Sharing this information may lead pet owners to choose a different breed of dog. Additionally, a general knowledge of osteosarcoma prevalence allows those with the most affected breeds to be aware of the higher risks, so that affected dogs can be diagnosed as early as possible, when prognosis and treatment options are greatest.

*This study is the first in a series of reports on pet health drawn from anonymized claims data from Nationwide's pet insurance unit. All releases will be available on Nationwide Chief Veterinary Officer Dr. Carol McConnell's blog for the veterinary community, NationwideDVM.com. The next medical data analysis is planned for early 2017 at the North American Veterinary Community conference.*



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Rosenberger JA, Pablo NV, Crawford PC. "Prevalence of and intrinsic risk factors for appendicular osteosarcoma in dogs: 179 cases (1996-2005)." *J Am Vet Med Assoc.* 2007 Oct 1;231(7):1076-80. Veterinary Pet Insurance and VPI are service marks of Veterinary Pet Insurance Company. Nationwide, the Nationwide N and Eagle, and Nationwide Is On Your Side are service marks of Nationwide Mutual Insurance Company. ©2016 Veterinary Pet Insurance Company and Nationwide. 16VET4200

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