Aging Well: Old dogs, new data (Part 1)

For this analysis into diseases that affect senior pets, the Nationwide® Pet Health Analytics and Insights Team used data representing more than 4 million years of canine and feline policies and claims. In this publication, the leading U.S. pet health insurer identifies insights into the diseases of older pets, and identifies actions that could significantly impact senior pet health. July 2022

Executive summary

With graying muzzles and slower strides, pets move ever-deeper into our hearts as they age. Growing old is unavoidable, but the maladies associated with aging are not always inevitable – and some that are can be minimized with early intervention and good veterinary care.

As Aristotle said, "Education is the best provision for old age," and this is just as true when it comes to our companion animals. Knowing the most likely diseases for an individual aging pet provides a framework for ensuring the best possible life for these special family members. But what diseases should veterinary healthcare teams and pet families be aware of, and when? Is it possible to be more targeted around prevention, awareness, and optimal management of senior diseases?

This analysis shows:

- **The impact of the law of large numbers.** With relatively few exceptions, peer-reviewed studies are considered useful with cohorts numbering in the hundreds of dogs or cats (or even less), and focusing on a single breed or a handful of breeds. As the largest U.S. pet health insurer, Nationwide is able to access millions of health records for hundreds of breeds. These massive cohorts allow for a depth of risk analysis at a level of statistical credibility that is incomparable to existing published data.
- **The value of incorporating American Animal Hospital Association (AAHA) Life Stage Guidelines into data studies.** Inclusion of AAHA Life Stage Guidelines into analyses allows for the creation of more dynamic studies that are more applicable and accessible to pet families and veterinary healthcare teams.
- **The role that a better understanding of senior pet risks by breed and dog type can have in driving key health interventions.** Pet families and veterinary healthcare teams can best partner together for informed prevention, early diagnosis, and optimal disease management along a spectrum of care with targeted, personalized education throughout the life of companion animals.

In 2021, Nationwide's pet insurance division created a dedicated Pet Health Analytics and Insights Team comprised of veterinarians, data scientists, and breed experts working in collaboration with Nationwide actuaries, analytics experts, and technology partners. The goal: providing pet owners, veterinary healthcare teams and the veterinary industry with information that contributes to informed, data-driven decisions for the care of companion animals.

In this study, Nationwide's Pet Health Analytics and Insights Team analyzed the policy and claims data from 3,464,566 dog years at risk (DYAR) and 626,137 cat years at risk (CYAR). ("Years at risk" are the number of years for which Nationwide has provided insurance coverage – a pet insured for five years provides data for five years at risk.) These data represented Nationwide-insured dogs and cats over a six-year period (2016-2021). Using the 2019 American Animal Hospital Association (AAHA) Canine Life Stage Guidelines[1] and the 2021 AAHA/American Association of Feline Practitioners (AAFP) Feline Life Stage Guidelines,[2] species- and breed-specific life stage classifications were applied to these data. Per AAHA, this simplified grouping of puppy/kitten, young adult, mature adult, and senior "is consistent with how pet owners generally perceive their dog's maturation and aging process and provides a readily understood basis for an evolving, lifelong healthcare strategy."

Combining this volume of high-quality insured pet data with a life stage classification framework allowed Nationwide to make accurate assessments of disease risk across our canine and feline populations and deliver insights that are meaningful and approachable for pet families and veterinary healthcare teams. A more detailed explanation of how Nationwide approached the application of these life stage data can be found in the methodology document associated with this analysis.[3]

Nationwide pet health data publications

There are three previous white papers from Nationwide, all with a focus on cancer in dogs:

- **"Oodles of Doodles: Popularity and Health,"** on the popularity of poodle crosses and their lower rates of cancer claims compared to their contributing breeds – Poodles, Golden Retrievers and Labrador Retrievers.
- **"Diversity of Risk: Purebred Dogs and Cancer,"** on the relative risk of claims for common cancers in popular purebred dogs.
- **"About the Size of It: Scaling Canine Cancer Risk,"** on the effect dog size has on the relative risk of cancer, how it differs across body systems, and what effect size and body system has on age of initial cancer claim.

All these studies are available at the Nationwide Pet website, address below. An expanded explanation of methodology of the three analyses of cancer claims is also available at the same location. These studies and others in process are part of a larger effort by Nationwide in pioneering positive change in veterinary medicine, in part through greater use of "big data" by industry players, shared for the benefit of all.

www.petinsurance.com/petdata

[1] https://www.aaha.org/aaha-guidelines/life-stage-canine-2019/life-stage-canine-2019/
[2] https://www.aaha.org/aaha-guidelines/life-stage-feline-2021/feline-life-stage-home/
[3] https://www.petinsurance.com/veterinarians/research/

Aging Well: Old dogs, new data (Part 1)

About AAHA Life Stage Guidelines

When is a dog old? While the "seven dog years to one human year" has long been debunked[4], nothing quite as simple can take its place. The most cursory of observations reveal that small dogs age more slowly than large ones do: While a Chihuahua is still an active adult at 8, a Chesapeake Bay Retriever is showing signs of aging at the same age, while the aging process starts even earlier for a massive dog such as the Bullmastiff.

Knowing how dogs age is neither trivial nor merely academic. As in human medicine, a life-stage approach to pet care provides the best outcomes for good health. Such guidelines provide veterinary healthcare teams and pet families alike with a framework for making choices that will keep pets healthy and active as long as possible.

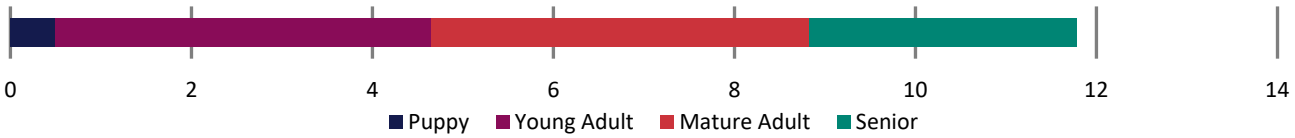
For a decade now, the American Animal Hospital Association (AAHA) has provided a peer-reviewed guideline on canine l feline life stages, most recently updated in 2019 (dogs) and 2021 (cats, in conjunction with the American Association of Feline Practitioners) and featuring the work of top veterinary professionals from the United States and Canada.

In analyzing our policy and claims data to track diseases across life stages, we used the AAHA/AAFP guidelines not only because we didn't wish to "re-invent the wheel," but also out of respect for the outstanding work of our colleagues and in the interest of advancing standards in the industry

AAHA Canine Life Stage Definitions[5]

Puppy	Young adult	Mature adult	Senior
From birth to cessation of rapid growth	From puppy to completion of physical and social maturation	From young adult to until the last 25% of estimated lifespan	From mature adult through end-of-life

The example of a Dachshund is used below; moving from puppy to young adult life stage at 6 months, young adult to mature adult at 4 years 7 months, mature adult to senior at 8 years 7 months.



[4] "The Seven-Year Glitch: Looking for a Better Man-to-Dog Lifespan Ratio," Wall Street Journal, Aug. 29, 2008.
[5] https://www.aaha.org/aaha-guidelines/life-stage-canine-2019/canine-life-stage-definitions/

Old dogs, new data: analyzing senior diseases

When choosing which conditions to examine in which species, the Nationwide team started from a place of guided intuition. Our veterinarians and medical professionals helped create classification structures where they gathered insurance diagnostic codes into groups that would be inclusive of senior pet diseases but that would not exclude inherited or early life stage diseases so as not to artificially skew results. For example, the cardiac disease classification included diagnostic codes for diseases that could intuitively be thought of as older pet diseases such as "valvular heart disease" and "congestive heart failure" as well those that may be likely to occur earlier than senior years such as "inherited cardiomyopathy".

This approach allowed for a holistic view of the data for high-level evaluation while maintaining the ability to dig deeper to examine how different disease processes might affect breeds, sizes, and genetic pools differently across their lives. Multiple disease systems were evaluated for the applicability to senior pets, their overall incidence rate in the population and, somewhat as a function of these, the availability of data for more granular analysis. As a result, this analysis focuses on the following disease processes / body systems and will be delivered in two parts:

- **Part 1 (this document)**
  - Canine diabetes and pancreatitis
  - Canine arthritis
  - Canine cardiac disease
  - Canine kidney disease
- **Part 2 (to be released in Fall, 2022)**
  - Canine intervertebral disc disease
  - Canine hepatic disease
  - Feline kidney disease
  - Feline cardiac disease
  - Feline hyperthyroidism

(Several other conditions were examined in detail and will be featured in future studies. Specifically, preliminary analyses associated with canine adrenal diseases (Cushing's and Addison's) and feline urinary disease have sparked early interest from the team.)

When identifying whether a pet should be counted, and which life stage a claimed condition should fall into, the team followed simple rules:

1) Within any classification, if a claim had been submitted for a pet prior to the study period, that pet was eliminated from that analysis. For example, given that the analysis period is 2016 through 2021, if an insured pet had an arthritis claim in 2014 and maintained coverage through 2021, this pet would be excluded from the arthritis analysis. Subsequent claims would not be included in the analysis, and they would not be included in any count of "at risk years".
2) The first incident date for any condition within the classification is the one that counts. For example, if a dog in the puppy life stage had an initial claim for a cardiac condition and then subsequent claims through the young adult life stage, they would be counted as having the disease as a puppy, and thereafter be eliminated from the analysis.

In order to remind ourselves how pet families are living with these senior diseases, each of the following chapters will start with a real-world scenario featuring a severely affected breed, a short breed profile, and a depiction of the AAHA life stages for that breed.

Aging Well: Old dogs, new data (Part 1)

Canine diabetes and pancreatitis

> No dogs have enjoyed a work-from-home policy more than Salt and Pepper. The two girls spend their days hard at work, too, barking at squirrel hijinks and delivery drivers. Salt, a 9-year-old Miniature Schnauzer, is larger than Pepper, a 12-year-old Miniature Pincher, but there's no doubt the older dog's the boss.

While neither seems to be slowing down much, everything changed two years ago when Pepper was hospitalized for several days. She had always had a sensitive stomach, so her family figured she'd eaten something that didn't agree with her. They were shocked when their feisty little dog was diagnosed with diabetes, pancreatitis, and diabetic ketosis, a life-threatening complication. The veterinarian thought Pepper's lifelong "sensitive stomach" had more likely been chronic pancreatitis. Pepper is now doing well with insulin shots and monitoring.

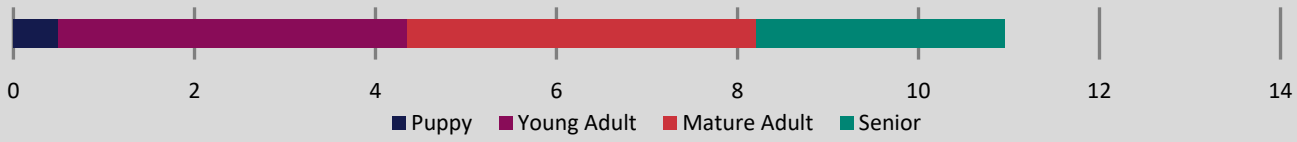
The family started worrying about Salt, since their veterinarian told them Miniature Schnauzers are also at higher risk for pancreatitis. Both dogs went on a low-fat diet at their veterinarian's suggestion, and when Salt recently began drinking and urinating more, her family didn't delay taking her in. Salt, too, was diagnosed with diabetes.

Did they miss something? Could they have prevented this? Their veterinarian assured them that diabetes cannot be prevented, but the family's swift action may have helped Salt avoid the hospital stay Pepper had. ”

Miniature Schnauzer

Europe has long favored the all-around working dog over the specialist, and few breeds illustrate this better than the Schnauzer, a versatile dog in three sizes: Giant, Standard and the most popular of all, the Miniature, which weighs in at under 20 pounds. In fact, the Miniature Schnauzer is among the most popular of all breeds, 11th in our database.

Their traditional usefulness in keeping rodent infestations at bay has them grouped at dog shows as a variety of terrier. Miniature Schnauzers, however, are typically more accepting of strangers and eager to please than other dogs developed with rat-control in mind. They do share a similar appearance and a wiry coat that needs professional grooming and are likewise happy to sound an alarm over almost anything, anytime.

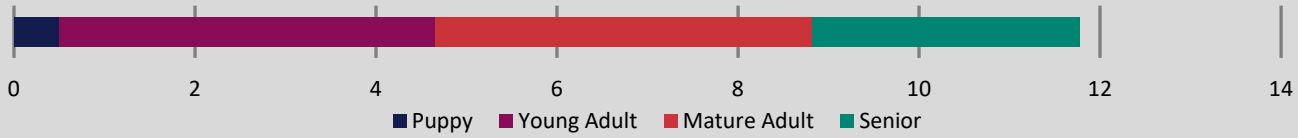


Aging Well: Old dogs, new data (Part 1)

Miniature Pinscher

Smoother of coat but just as lively, the Miniature Pincher (41st most popular breed in our database) is another fearless German breed. Like Schnauzers, Pinschers come in different sizes, with the MinPin the smallest of a very old family of dogs. The MinPin is often misidentified as a “miniature Doberman” (which they are not), and the breed has a very distinctive trait no other dog shares: A high-stepping “hackney” gait that matches a “look at me” personality.

Like many small dogs, MinPins can be barky, and they consider themselves to be far larger than their 10-pound weight. Because of their big-dog attitude, they need to be protected from their worst impulses when it comes to leaping off furniture or trying to pick fights with other dogs



Aging Well: Old dogs, new data (Part 1)

Canine pancreatic disease profile (diabetes mellitus and pancreatitis)

The pancreas is a glandular organ with two main functions, exocrine (releasing the enzymes that digest food into the intestines), and endocrine (releasing substances like insulin into the blood to regulate nutrients from that food). Pancreatitis is the most common disease of the pancreas in dogs, with prevalence across life stages reported as high as 34%[6] in some studies. It is an inflammatory disease with clinical signs that include vomiting, diarrhea, and abdominal pain. While many cases are thought to be idiopathic (no known underlying cause), risk factors include obesity, hyperlipidemia, eating things like trash or table scraps[7], and genetics. The Miniature Schnauzer is well established as a breed with high risk for pancreatitis. Possible causes include a predisposition for high hypertriglyceridemia (a type of lipid) and genetic mutations.[8]

Diabetes mellitus is a known disease of aging dogs with a higher risk seen in females and dogs with other health conditions.[9] Most dogs develop insulin-dependent diabetes, and top clinical signs seen by pet families include increased urination, drinking, and hunger, with or without weight loss. Pets without their diabetes well controlled may develop diabetic ketoacidosis, a life-threatening condition characterized by fluid and electrolyte imbalances.[10] A high mortality rate has been observed in the first six months, suspected secondary to concurrent serious illnesses (e.g., diabetic ketoacidosis, kidney failure, acute pancreatitis).[9]

Several studies have correlated diagnosis of both pancreatitis and diabetes, and questions remain whether one disease causes the other.[11] Prevailing theories lean toward pancreatitis causing the development of diabetes mellitus with estimates of around 30% developing this way. Nationwide data provide compelling breed-specific evidence that the opposite pathway may be more common.[12]

A note on relative risk

People read studies with varying levels of comfort when it comes to statistics, so we've worked to make the information here as easy to understand as possible for everyone. To that end, we've provided the risk ratio ("half as likely," "three times as likely") with the combined claims relative risk for all dogs, and, where appropriate, have also provide the relative percentages.

For example, if breed A has a 163.5% risk of having a diabetes claim when compared to the mean (average) rate for other dogs, this is equivalent to noting that breed A is 1.63 times more likely to have had a claim submitted than the average dog, or, said another way, that breed A had a 63.5% greater risk of a claim.

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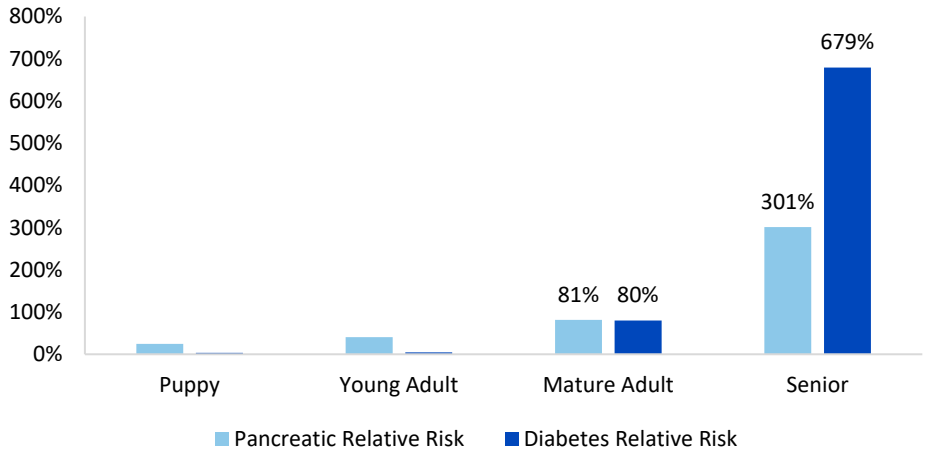
[6] Watson PJ, Roulois AJ, Scase T, Johnston PE, Thompson H, Herrtage ME. Prevalence and breed distribution of chronic pancreatitis at post-mortem examination in first-opinion dogs. J Small Anim Pract. 2007 Nov;48(11):609-18. doi: 10.1111/j.1748-5827.2007.00448.x. Epub 2007 Aug 13. PMID: 17696987.
[7] Lem KY, et al. Associations between dietary factors and pancreatitis in dogs. J Am Vet Med Assoc. 2008;233:1425–1431.
[8] Bishop MA, Xenoulis PG, Levinski MD, Suchodolski JS, Steiner JM. Identification of variants of the SPINK1 gene and their association with pancreatitis in Miniature Schnauzers. Am J Vet Res. 2010 May;71(5):527-33. doi: 10.2460/ajvr.71.5.527. PMID: 20433378.
[9] Fall T, Hamlin HH, Hedhammar A, Kämpe O, Egenvall A. Diabetes mellitus in a population of 180,000 insured dogs: incidence, survival, and breed distribution. J Vet Intern Med. 2007 Nov-Dec;21(6):1209-16. doi: 10.1892/07-021.1. PMID: 18196728.
[10] Ettinger, S. J., Feldman, E. C., Coˆté Etienne, & Stephen, D. B. P. (2017). Canine Diabetes Mellitus. In Textbook of Veterinary Internal Medicine: Diseases of the dog and the cat (seventh, Vol. 2, pp. 1782–1796). essay, Elsevier.
[11] Davison, L.J. (2015), Diabetes mellitus and pancreatitis – cause or effect?. J Small Anim Pract, 56: 50-59. https://doi.org/10.1111/jsap.12295
[12] Kumar, Pankaj & Kumari, Rashmi & Kumar, Manish & KUMAR, SANJIV & Chakrabarti, Asit. (2014). Current practices and research updates on diabetes mellitus in canine. Veterinary World. 7. 952-959. 10.14202/vetworld.2014.952-959.

Aging Well: Old dogs, new data (Part 1)

Canine diabetes and pancreatitis data insights

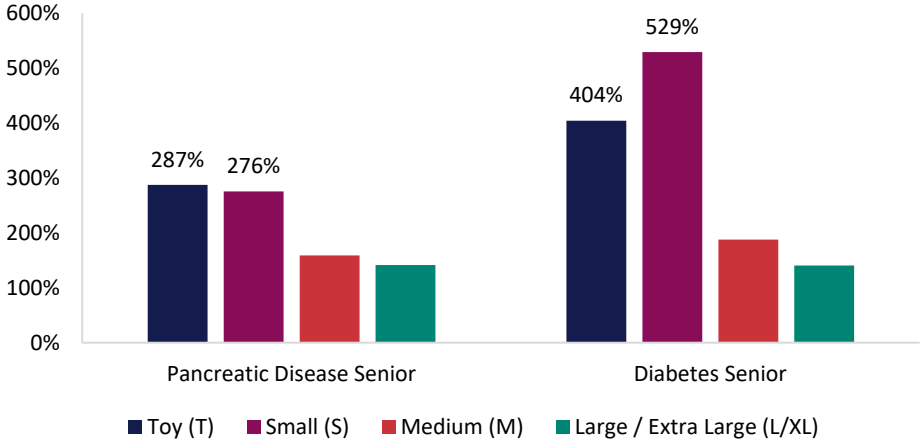
Diabetes and pancreatitis both peak in senior pets – Chart 1. While both are diseases that pose a significantly greater risk in senior pets, diabetes risk increases by nearly 8.5 times between mature adult and senior life stages, whereas pancreatitis shows a (still very significant) 3.5 multiplier. As a point of clarity, this is not to say that diabetes is more common than pancreatitis. There are fewer overall cases of diabetes than pancreatitis, but a greater proportion of diabetes cases occur in senior years, therefore the relative risk is greater.

Chart 1 - Relative risk for pancreatitis increased by 3.5x from mature adulthood into senior life stage, diabetes by 8.5x



Toy and small senior dogs are at greater risk for both diseases – Chart 2. Looking at both diseases by dog size, while the higher relative risk for diabetes is maintained, both diseases show significantly higher relative risk in toy and small breeds.

Chart 2 - Diabetes and pancreatitis both disproportionately affect relative risk in toy and small senior dogs



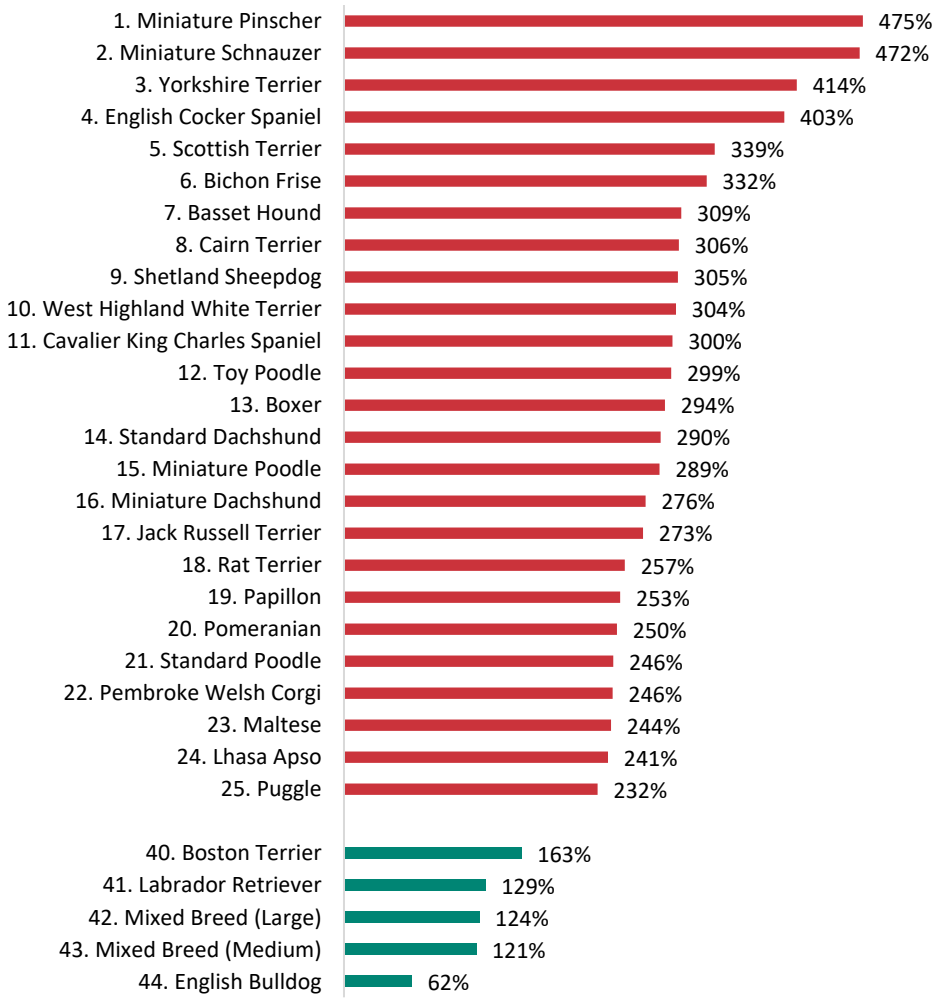
Small, spirited dogs dominate pancreatitis risk ranking – Chart 3

Looking just at breed relative risk for pancreatitis, two miniature breeds stand out - the Pinscher and the Schnauzer. Corresponding with what we saw in Chart 2, the upper echelons of the list are full of toy and small dogs - so much so, in fact, that the medium and large breeds (English Cocker at 4, Basset at 7, and Boxer at 13) really do stand out.

Of the breeds at the lower end of the list, perhaps it's not surprising to see the genetically diverse medium and large mixed breeds, and it's certainly pleasant to see English Bulldogs at the lower end of a disease risk table, given their other health challenges.

Note: Reviewing the literature, a published table of pancreatitis incidence rates[13] (single geographic location, not differentiated by life stage, 1994 to 2004,) placed Miniature Schnauzers, Shetland Sheepdogs, and Yorkshire Terriers on the top three steps, while Miniature Pinschers came in significantly lower. This referenced published study drew from around 2,500 affected dogs; Chart 3 draws from tens of thousands of pancreatitis-affected dogs (all of these listed breeds are P<0.000007862). It is immensely valuable to have a published comparison to be able to reference against, and our goal would be to add to this store of knowledge with these publications.

Chart 3 - Senior life stage pancreatitis relative risk for 25 highest-risk and 5 lowest-risk breeds



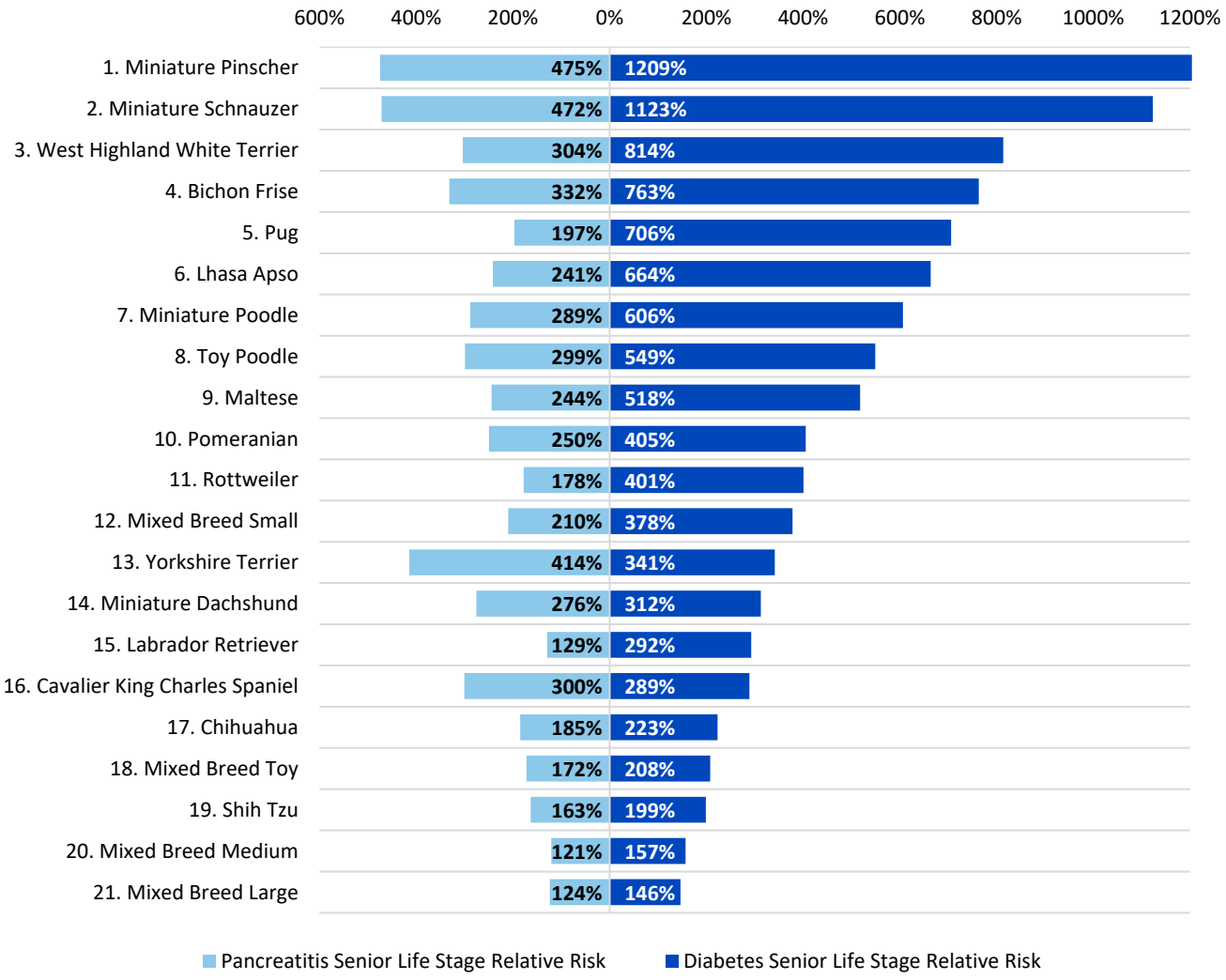
[13] Ettinger, S. J., Feldman, E. C., Coté, E & Stephen, D. B. P. (2017). Canine Pancreatic Disease. In Textbook of Veterinary Internal Medicine: Diseases of the dog and the cat (seventh, Vol. 2, pp. 1696). essay, Elsevier.

Aging Well: Old dogs, new data (Part 1)

Strong correlations between risk for pancreatitis and risk for diabetes in key breeds – Chart 4

Charting the data for diabetes relative risk (dark blue in Chart 4) against pancreatitis risk data from Chart 3 (light blue), there are several startling correlations. Most obvious, perhaps is that the top two positions do not change: Miniature Pinscher and Miniature Schnauzer are even further removed from the pack when it comes to diabetes than they were with pancreatitis. Of the other highly ranked pancreatitis breeds, Bichon Frise and Yorkshire Terrier, also feature. (Neither English Cocker Spaniel nor Scottish Terrier had sufficient diabetic data to be included in this chart - a function of a less frequent disease and a less common breed.)

Chart 4 - Many breeds show a high correlation between relative risks for diabetes and pancreatitis

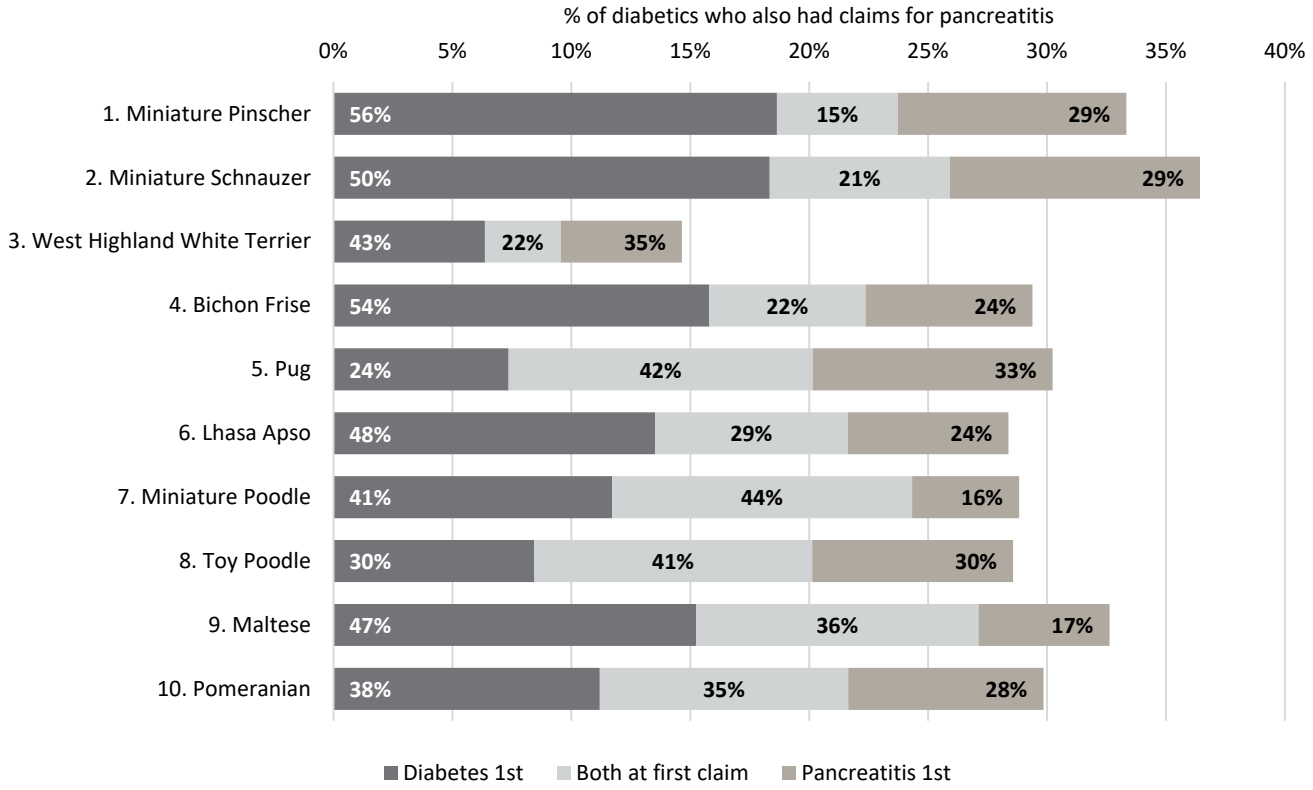


Comorbidity abounds for key breeds – Chart 5

For the top breeds, we were able to dig a level deeper and examine how many diabetics had also had claims submitted for pancreatitis. We were then able to assess the sequence in which the diseases had been claimed for.

For example, reading the top entry of Chart 5: The overall length of the stacked bar indicates that 33% of diabetic Miniature Pinschers have also had claims for pancreatitis. Looking at the segments within the bar, of those dogs 56% had claims for diabetes first, 15% presented with both diabetes and pancreatitis in the same claim, and 29% initially presented with pancreatitis.

Chart 5 - Many breeds have a considerable proportion of pets who have had both diabetes and pancreatitis. Most breeds appear to present with either diabetes first, or diabetes and pancreatitis together



Looking at the overall shape of these data, we see that the majority of dogs with diabetes/pancreatitis comorbidity either presented first with diabetes, or with diabetes and contemporaneous pancreatitis. To call out our disease ambassadors, the Miniature Pinscher and Miniature Schnauzer have the highest levels of comorbidity, and the highest proportion of those dogs who present as diabetes-first cases. While the startlingly parallel disease data that we have charted across these two breeds is an interesting finding, it triggers a larger question. Much has been written on potential causes in Miniature Schnauzers (genetic mutations, hyperlipidemia), but the authors could find no reference of these abnormalities in Miniature Pinschers. Are there entirely different hereditary processes in MinPins that happen to generate the same data, or do they share more with Schnauzers than has so far been discovered?

Canine diabetes and pancreatitis data - Clinical significance for at-risk dogs

Both pancreatitis and diabetes mellitus are complicated diseases that cannot be entirely prevented. However, through timely and specific communication and education, pet families and veterinary healthcare teams can work together on awareness of key risks, and on ways to aid early detection

Which pets?

According to the data above, small and toy breed senior dogs are at increased risk for both diseases. Key breeds are listed in Charts 4 and 5, with Miniature Schnauzers and Miniature Pinchers at highest risk for each disease alone, as well as comorbidity with both.

What actions?

Pet families –

- Prevention: Understand the increased importance of a healthy body condition score and avoid high-fat table scraps[14,15]
- Early detection: Monitor food and water intake, urination habits and talk to your veterinary healthcare team about changes

Veterinary healthcare teams –

- Awareness of risks: The high death rate of new diabetic patients in the first 6 months may indicate complications from late diagnosis or a diabetic management learning curve, focus education efforts on early detection for senior dogs less than 30 lb, especially breeds most at risk
- Awareness of risks: Knowing that diabetes and pancreatitis are risk factors for each other, discuss early detection with families that have the first diagnosis

[14] Lem KY, et al. Associations between dietary factors and pancreatitis in dogs. J Am Vet Med Assoc. 2008;233:1425–1431.
[15] Mansfield C. Acute pancreatitis in dogs: advances in understanding, diagnostics, and treatment. Top Companion Anim Med. 2012 Aug;27(3):123-32. doi: 10.1053/j.tcam.2012.04.003. Epub 2012 May 30. PMID: 23148853.

Aging Well: Old dogs, new data (Part 1)

Canine Arthritis

Keely is a 10-year-old Rough Collie with markings that have children calling her "Lassie" whenever they see her. While it annoys her family, it doesn't bother Keely: she adores children, and could not care less what they call her as long as they pay her attention.

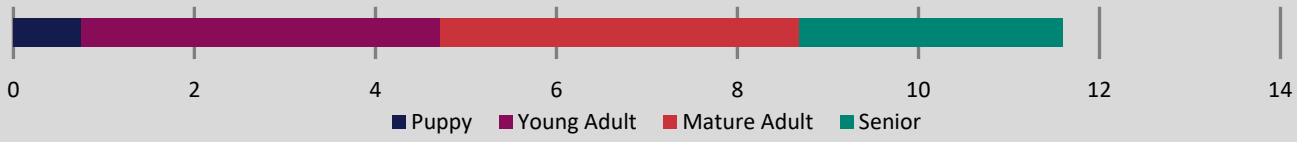
Her family have noticed her "slowing down" in the last year or so. While she used to dance at the very sight of a leash for a long walk or the promise of a car ride to the dog park, now she doesn't want to play for as long or as hard as she used to. Keely's family took her to her veterinarian, and her healthcare team told them she had some painful joints. At her veterinarian's advice, Keely's family started her on a home-care plan that included swimming in the family pool, physical therapy exercises and non-steroidal anti-inflammatories for bad days.

Keely's diagnosis is not surprising: Nationwide's data indicate her breed is at highest risk for developing arthritis as a senior.

Rough Collie

Collies may be the original "influencer" breed, thanks to England's Queen Victoria, one of the breed's earliest fans. Today Collies are best known for the "Lassie" TV shows, which made the breed so well known in the United States that Lassie was issued the first pet health insurance policy by Veterinary Pet Insurance, now part of Nationwide. While Collies remain one of the most recognizable of breeds, they're not as popular as they once were: The Rough Collie is the 79th most popular breed in our database.

The Collie is a large dog, ranging from 50 to 75 pounds, with a long, thick, and relatively high-maintenance double coat. The breed is moderately active, easy to train, affectionate towards family (especially children) and is known to have a great deal to say when it comes to barking.



Aging Well: Old dogs, new data (Part 1)

Canine arthritis disease profile

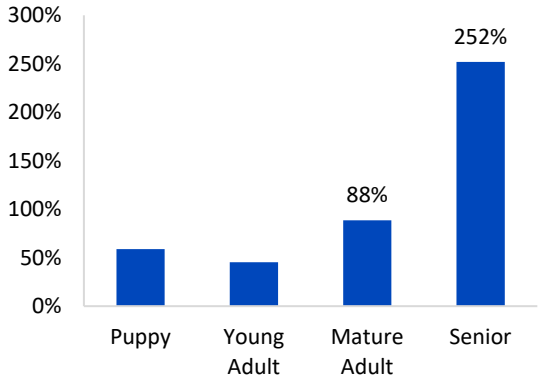
When considering which diagnostic codes to include in this classification, the authors focused on primary osteoarthritis (OA) and medically managed causes of secondary OA.

Primary OA is considered idiopathic (a disease that arises spontaneously), with identified risk factors that include age and obesity.[16]

Secondary OA is the most common cause of osteoarthritis in dogs and occurs because of an identifiable primary cause (e.g. trauma, cruciate ligament injury, hip or elbow dysplasia, patellar luxation).[17] There are six well described risk factors: genetics, breed, conformation, age, sex/neuter status, and body weight (body size as well as body condition score).[18]

Canine arthritis data insights

Chart 6 - Relative risk of claims for arthritis increases by almost 3x from mature adulthood into senior life stage

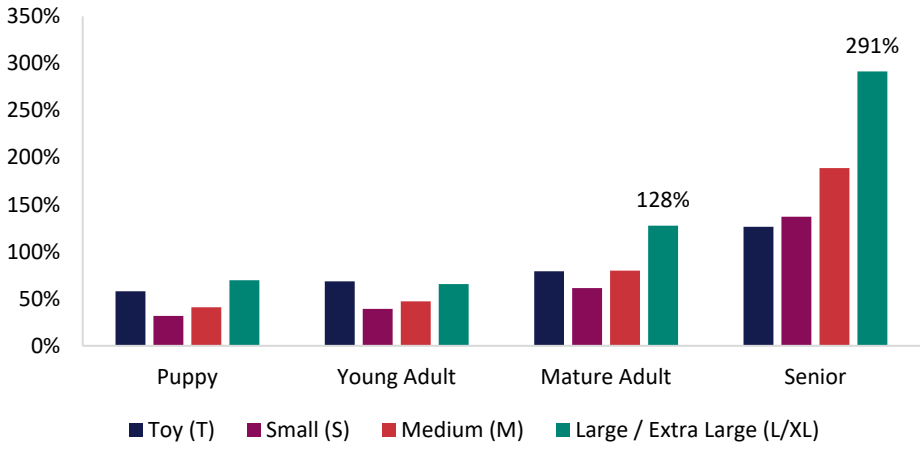


Senior pets at increased risk – Chart 6. Of the diseases studied in this analysis, arthritis was the most common disease affecting senior canines. From a relative risk perspective, the increase in relative risk between mature adulthood to senior years is significant, jumping by a factor of almost three, from 88% to 252%.

[16] Martel-Pelletier J, Barr AJ, Cicuttini FM, Conaghan PG, Cooper C, Goldring MB, Goldring SR, Jones G, Teichtahl AJ, Pelletier JP. Osteoarthritis. Nat Rev Dis Primers. 2016 Oct 13;2:16072. doi: 10.1038/nrdp.2016.72. PMID: 27734845.
[17] Pettitt RA, German AJ. Investigation and management of canine osteoarthritis. Practice. (2015) 37:1–8. 10.1136/inp.h5763
[18] Anderson KL, Zulch H, O'Neill DG, Meeson RL, Collins LM. Risk Factors for Canine Osteoarthritis and Its Predisposing Arthropathies: A Systematic Review. Front Vet Sci. 2020 Apr 28;7:220. doi: 10.3389/fvets.2020.00220

Aging Well: Old dogs, new data (Part 1)

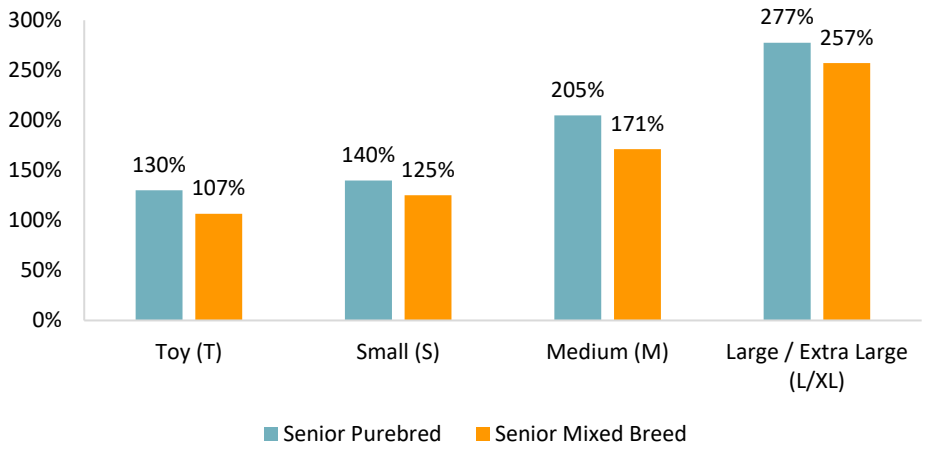
Chart 7 - Relative risk of claims for arthritis is higher for large and extra large mature and senior dogs



Large and extra-large dogs most at risk – Chart 7. As might be expected for a biomechanical disease where size can be a factor, we can see in Chart 7 that large and extra-large dogs are significantly more at risk across mature adulthood and senior life stages.

Senior purebred dogs are more likely to submit arthritis claims – Chart 8. Focusing on the senior life stage, Chart 8 splits the data by dog size as well as purebred versus mixed breed status. At every dog size across the senior years, purebred dogs are just slightly higher at risk, although not near as significantly as we saw in our previous studies on cancer.[19]

Chart 8 - Relative risk of claims for arthritis is higher in purebred dogs



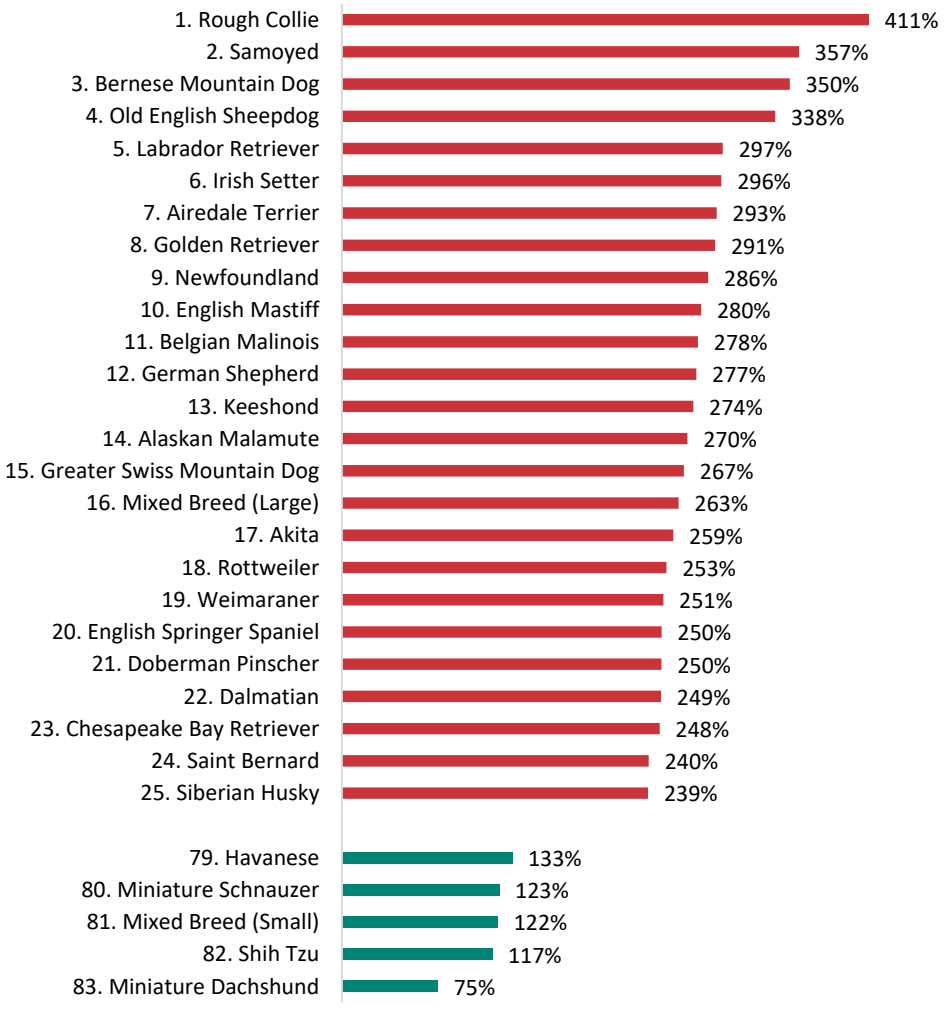
[19] https://www.petinsurance.com/veterinarians/research/

Aging Well: Old dogs, new data (Part 1)

Featured breeds: The usual suspects, some guest stars, and the least at risk – Chart 9

The usual suspects: based on their own personal clinical experiences, the veterinarian authors of this study were certainly expecting to find some of these top 25 breeds: Labrador Retriever placed at No. 5, Golden Retriever at 8, and German Shepherd at 12. For several of the larger breeds, the surprise was not their presence, but that they did not place higher: Bernese Mountain Dog at 3, Newfoundland at 9, and Rottweiler at 18. However, looking deeper at the data, all six of these "usual suspects" also showed significantly higher risk in the mature adult life stage. A fine but important distinction: if this were a study of how many senior dogs were affected by arthritis rather than a measure of how many developed it specifically during their senior life stage, these breeds would likely chart much higher, in line with our clinical expectations.

Chart 9 - Senior life stage arthritis relative risk for 25 highest-risk and 5 lowest-risk breeds



An interesting inclusion, but not necessarily unexpected, is large mixed-breed dogs at 16. Looking at the small difference between the purebred and mixed breed risks in the large and extra-large dog category of Chart 8 supports the theory that biomechanics play a greater role in risk than genetics.

Our guest stars: It may be worth noting here that the only way that breed popularity affects any breed's entry into this table is whether there were a sufficient number of affected senior dogs to ensure statistical credibility (see methodology for details[20]). For the arthritis portion of this study, more than 80 dog breeds qualified (accounting for more than 99.5% of the dog years at risk). The authors are not aware of any prior studies that have had access to this volume of data across such a variety of breeds. In short, breeds that have very low risk of senior arthritis (i.e., very small number of dogs

[20] https://www.petinsurance.com/veterinarians/research/

affected) or those with small insured populations will not show in this breed-specific list, but the breeds that are included have convincing volumes of data available.

Finding the Rough Collie convincingly atop this chart, the authors went back to the data multiple times, to see if there could be a mistake. While the veterinarians on the team had certainly seen arthritic Collies, it wasn't something that had stuck out. Similarly, literature review did not yield any significant results. However, looking at the data multiple different ways, this breed remained the undisputed king of the hill.

While the Alaskan Malamute may not be a surprising entry given the breed's large body size, the other arctic breeds listed here, Siberian Husky, Samoyed and Keeshond – three medium-sized breeds – might not be expected to rank so high.

For these more surprising breeds, the Nationwide team looks forward to digging further into better understanding risk factors and comorbidities. For example, do they suffer from higher rates of obesity, are ages of sterilization markedly different, etc.

The least at risk: Given the data in Chart 7, there should be no real surprises in this list of toy and small breeds, (Although we do see some of these names crop up as high risk in other disease chapters.)

Canine arthritis data - Clinical significance for at-risk dogs

There is a general consensus that arthritis is underdiagnosed in dogs, resulting in poor animal welfare. As indicated in our story above about Keely, many pet families see the slow down as something natural, not as a disease process that can be successfully addressed. The data in this study present an opportunity for a targeted approach to prevention, early detection and optimal disease management.

Which pets?

According to the data, the populations at increased risk are mature adult and senior dogs, particularly large and extra-large dogs. Purebred dogs at highest risk are shown in Chart 9, with Rough Collies, Samoyeds, and Bernese Mountain dogs at the pinnacle.

What actions?

Pet families –

- Prevention: Obesity is a known risk factor - understand the increased importance of maintaining healthy lifelong weight
- Prevention: Especially for large and extra-large breeds, understand how proportioned feeding and low impact exercise are important while joints are developing[21,22]
- Early detection: Identify signs of pain through changes in behavior, posture and mobility (e.g., stiff gait, limping after rest)[23]
- Optimal management: Awareness of the benefits of weight management, home environment adaptations, modified exercise routines, diet and supplements, complementary therapies; pharmaceutical medications[24]

Veterinary healthcare teams –

- Optimal management: A multimodal approach to arthritis education, detection and management that empowers pet families and creates opportunities along a spectrum of care[25]

[21] Krontveit RI, Nodtvedt A, Saevik BK, Ropstad E, Trangerud C. Housing- and exercise-related risk factors associated with the development of hip dysplasia as determined by radiographic evaluation in a prospective cohort of Newfoundlands, Labrador Retrievers, Leonbergers, and Irish Wolfhounds in Norway. Am J Vet Res. (2012) 73:838–46. 10.2460/ajvr.73.6.838
[22] Leppanen M, Maki K, Juga J, Saloniemi H. Factors affecting hip dysplasia in German shepherd dogs in Finland: efficacy of the current improvement programme. J Small Anim Pract. (2000) 41:19–23. 10.1111/j.1748-5827.2000.tb03130.x
[23] https://caninearthritis.co.uk/managing-arthritis/owner-identification-of-pain/
[24] https://caninearthritis.co.uk/managing-arthritis/what-can-be-done/
[25] https://caninearthritis.co.uk/cam-for-professionals/vets-veterinary-practices/

Aging Well: Old dogs, new data (Part 1)

Canine cardiac disease

Rupert is an 8-year-old Cavalier King Charles Spaniel. Rupert's family, a retired couple who love to travel, take him almost everywhere they go. From the cafes of Paris to a condo on the coast of Oregon to a mile-high dog-friendly hotel in downtown Denver, Rupert is a merry travel companion just as comfortable in his carrier under a plane seat as in his crate in the family's car.

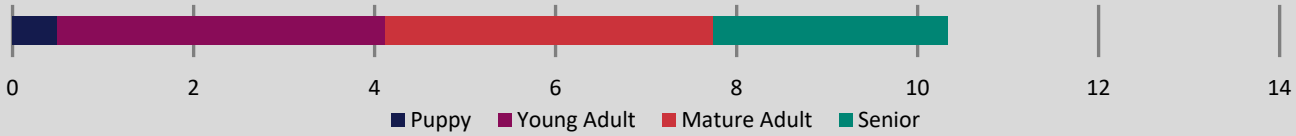
Rupert's family knows that Cavaliers are prone to heart problems, so they ensure his veterinarian sees him for a physical exam every year. This year, a heart murmur is diagnosed. After consultation, his veterinarian refers Rupert to a veterinary cardiologist. His dad jokes that it's easier to see Rupert's cardiologist than his own, but the humor hides his worry. While Rupert is still his happy self, and is eating just fine, their last Cavalier died after struggling with congestive heart failure.

Rupert's veterinary cardiologist informs the couple that after an ultrasound of his heart, she can confirm that he has heart disease. While the news isn't what they had hoped, Rupert's healthcare team gives them some good information: Advances in veterinary care will help keep jet-setting Rupert living his best life for a long time yet.

Cavalier King Charles Spaniel

Small spaniels have been favored for their companionship (and warmth in those cold castles) for centuries, and today the Cavalier King Charles Spaniel is the most popular of the toy spaniels, ranked at No. 20 among all breeds in our database. Despite an appearance similar to the dogs in old paintings, the CKCS is in fact a relatively new breed, developed to look like the companions of many an ancient noble European home.

Eager to please and friendly with most anyone, the lively Cavalier is one of the larger toy breeds at around 15 pounds. While the reddish brown-and-white Blenheim variety of the breed's silky, medium-length coat is most commonly seen, Cavaliers also come in three other coat color combinations. Known as very sweet-tempered and cheerful, they can sometimes also be stubborn. As companions, they're up for anything from a brisk walk to a day of binge-watching as long as they're with their people.



Canine cardiac disease profile

While canine cardiac disease has a variety of categorizations, the simplest breakdown is to divide them into congenital (those that are present at birth) and acquired (those that develop after birth). Since pet insurance does not cover conditions where there were signs of disease prior to the policy (i.e., pre-existing conditions), we should make the assumption that congenital disease (which some studies estimate as high as 20% of cardiac cases[26]) is mostly excluded from these data. Since the focus of this analysis is on diseases of senior pets, this does not present any significant obstacles, but is worth mentioning for clarity.

Speaking, then, of acquired cardiac disease, the broadest definitions split cases into valvular diseases and cardiomyopathies (diseases of the heart muscle). Of the heart valves, the mitral valve is the one most commonly associated with disease: Myxomatous mitral valve disease (MMVD) is estimated to account for 75-80% of heart disease in the dog, and for around 75% of congestive heart failure cases.[27,28] For cardiomyopathies, the most common forms are dilated cardiomyopathy (DCM), hypertrophic cardiomyopathy (HCM) and arrhythmogenic cardiomyopathy (commonly called Boxer cardiomyopathy).

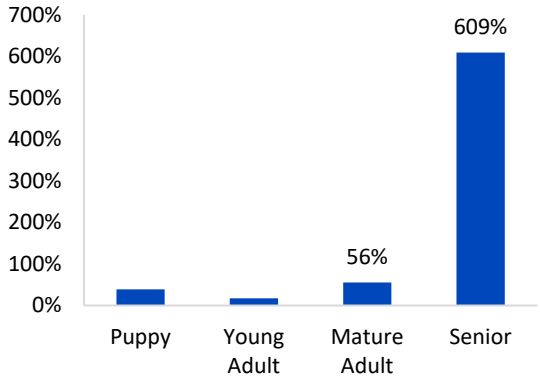
The most common outcome of cardiac disease is congestive heart failure (CHF). A diagnosis of CHF is made when the severity of cardiac disease is significant enough that the heart cannot meet the body's needs, causing fluid to accumulate in the lungs, and resulting in clinical signs like coughing, exercise intolerance, and difficulty breathing.[29]

[26] Oliveira, P., Domenech, O., Silva, J., Vannini, S., Bussadori, R. and Bussadori, C. (2011), Retrospective Review of Congenital Heart Disease in 976 Dogs. Journal of Veterinary Internal Medicine, 25: 477-483. https://doi.org/10.1111/j.1939-1676.2011.0711.x
[27] Bagardi, M.; Zamboni, V.; Locatelli, C.; Galizzi, A.; Ghilardi, S.; Brambilla, P.G. Management of Chronic Congestive Heart Failure Caused by Myxomatous Mitral Valve Disease in Dogs: A Narrative Review from 1970 to 2020. Animals 2022, 12, 209. https://doi.org/10.3390/ ani12020209
[28] Atkins, C.; Bonagura, J.; Ettinger, S.; Fox, P.; Gordon, S.; Haggstrom, J.; Stepien, R. Guidelines for the Diagnosis and Treatment of Canine Chronic Valvular Heart Disease. J. Vet. Intern. Med. 2009, 23, 1142–1150
[29] Keene, BW, Atkins, CE, Bonagura, JD, et al. ACVIM consensus guidelines for the diagnosis and treatment of myxomatous mitral valve disease in dogs. J Vet Intern Med. 2019; 33: 1127– 1140. https://doi.org/10.1111/jvim.15488

Aging Well: Old dogs, new data (Part 1)

Canine cardiac disease data insights

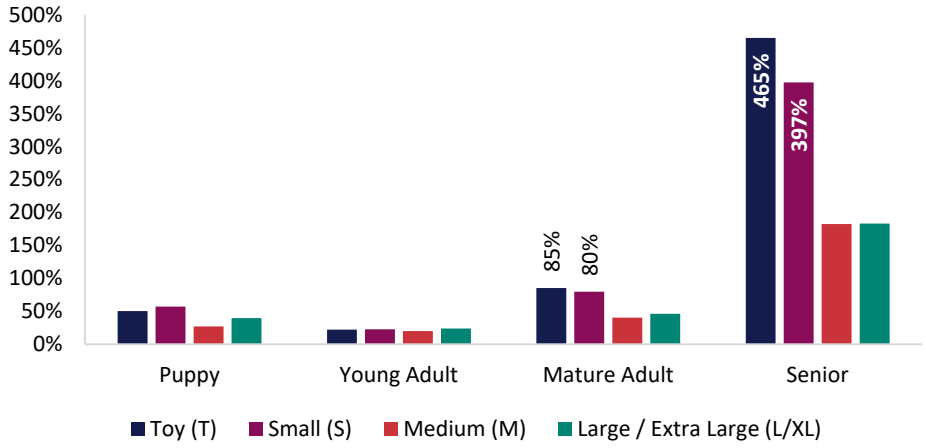
Chart 10 - Relative risk of claims for cardiac disease increases by more than 10x from mature adulthood into senior life stage



Senior pets at significantly increased risk – Chart 10. From a relative risk perspective, Chart 10 shows that the increase in relative risk between mature adulthood to senior years is significant, jumping by a factor of more than 10 times, from 56% to 609%.

Toy- and small-breed dogs are most at risk – Chart 11. Despite some specific diseases being linked to large-breed dogs, clinicians will likely not be surprised to see that toy- and small-breed dogs are at much higher risk, especially through mature adulthood and senior years. Chart 11 shows an approximate five-fold increase in risk for both toy and small dogs between these life stages.

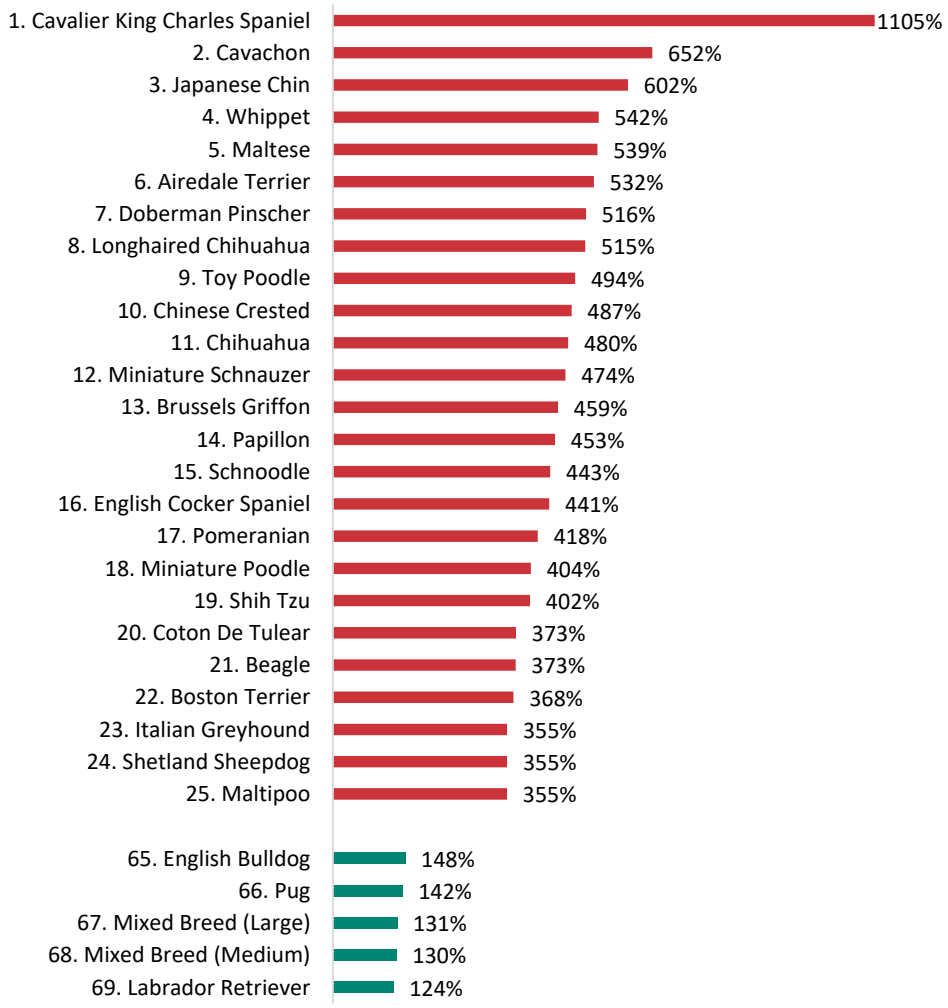
Chart 11 - Relative risk of claims for cardiac disease is higher for toy and small dogs across most life stages



Featured breeds – a predictable poster child, and some more surprising charting breeds – Chart 12

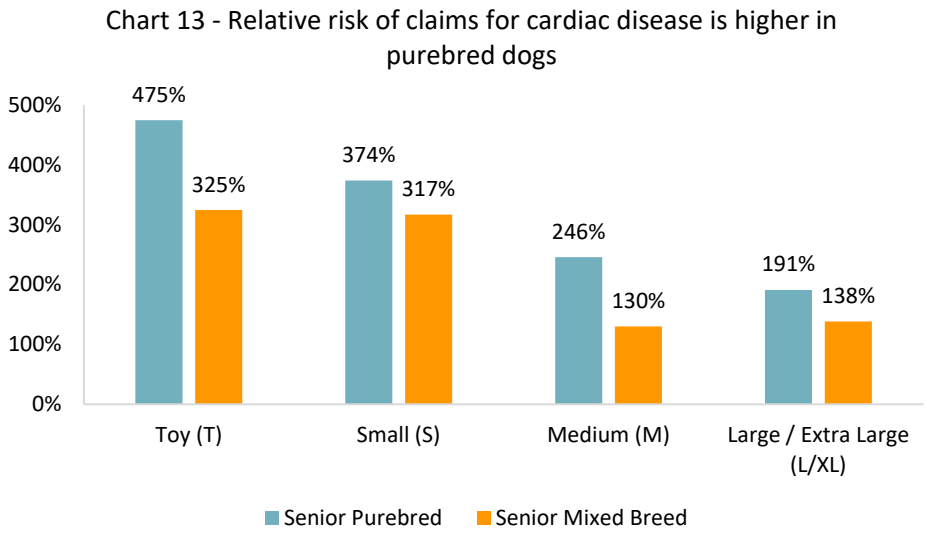
As suggested in the title, not many readers will be shocked to see the Cavalier King Charles Spaniel (CKCS) convincingly atop this chart. However, the inclusion of a CKCS mixed-breed, the Cavachon[30], at 2 was moderately surprising given the dilution effect between purebreds and mixed breeds that we saw for many forms of cancer in an earlier white paper.[31] Literature review indicated that a dominant genetic trait has been identified in the development of MMVD in the CKCS[32], so this could be at least part of the explanation for this entry. Otherwise, the list delivers on much of what was inferred in the prior graphs: many toy and small breed dogs with the inclusion of some medium and large breeds dogs that we might expect (Doberman at 7 and Beagle at 21) as well as some more named mixed breeds that might raise an eyebrow (Schnoodle at 15 and Maltipoo at 25).

Chart 12 - Senior life stage cardiac disease relative risk for 25 highest-risk and 5 lowest-risk breeds



Of the breeds with the lowest risk for developing cardiac disease as seniors, Labradors (placed highly for some forms of cancer in our previous white papers[33]) and the brachycephalic breeds English Bulldog and Pug, both of whom have their share of other health challenges, have some positive news here.

[30] Although Cavachon is not a recognized "breed", popular mixed breeds (e.g., Labradoodle, Golden Doodle, etc) as well as breed coat variants (e.g., Rough Collie and Smooth Collie) have been included in Nationwide's listings for many years.
[31] Oodles of Doodles
[32] Madsen MB, Olsen LH, Häggstrom J, et al. Identification of 2 loci associated with the development of myxomatous mitral valve disease in Cavalier King Charles spaniels. J Hered 2011;102(S1):S62–S67.
[33] Diversity of Risk



Purebred dogs face higher risks – Chart 13. Regarding the low placement of medium and large mixed breeds in Chart 12, we can see in Chart 13 that risk is lower for senior mixed breeds across all dog sizes for mixed-breed dogs compared to purebreds

Canine cardiac disease data - Clinical significance for at-risk dogs

The risk for cardiac disease increases by over 10-fold once dogs enter the senior life stage. While cardiac disease may be an inevitability for some dogs, long-term outcomes for at-risk dogs can be vastly improved through good lifelong habits, early detection, and optimal disease management.

Which pets?

According to Nationwide's analysis, senior dogs are at increased risk, particularly toy and small purebred dogs. Chart 12 shows the top-ranked breeds, with Cavalier King Charles Spaniels, Cavachons, Japanese Chins, and Whippets at highest risk.

What actions?

Pet families –

- Prevention: Understand the increased importance of a healthy body condition score and a balanced diet
- Early detection: Understand that early disease is subtle and identify key changes in behavior (tiring easily, progressive cough, anorexia) and physiology (e.g., resting respiratory rate) that could indicate advancing disease

Veterinary healthcare teams –

- Awareness of risks: Teach lifelong habits for at-risk dogs and prepare them for "next steps"; importance of regular checkups, weight management, early detection, role of diagnostics and treatment in absence of clinical disease[34]

[34] Keene BW, Atkins CE, Bonagura JD, Fox PR, Häggström J, Fuentes VL, Oyama MA, Rush JE, Stepien R, Uechi M. ACVIM consensus guidelines for the diagnosis and treatment of myxomatous mitral valve disease in dogs. J Vet Intern Med. 2019 May;33(3):1127-1140. doi: 10.1111/jvim.15488. Epub 2019 Apr 11. PMID: 30974015; PMCID: PMC6524084.

Aging Well: Old dogs, new data (Part 1)

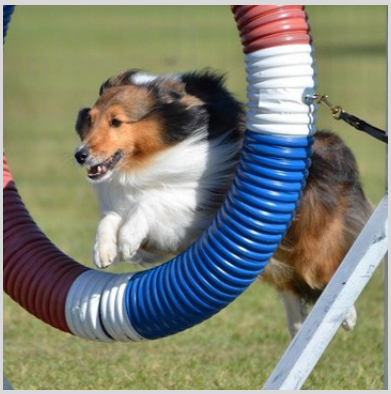
Canine kidney disease

Tilly is a 9-year-old Shetland Sheepdog who loves playfully herding her family's kids around their fenced back yard, jumping over obstacles the kids set up for her. She loves showing off the tricks her family has taught her, and if she weren't so shy around strangers, they think she'd be wonderful on TV.

Recently, she has been drinking more water than usual and has had a few accidents in the house, which she hasn't done since her puppy days. Worried, they make an appointment with her veterinarian.

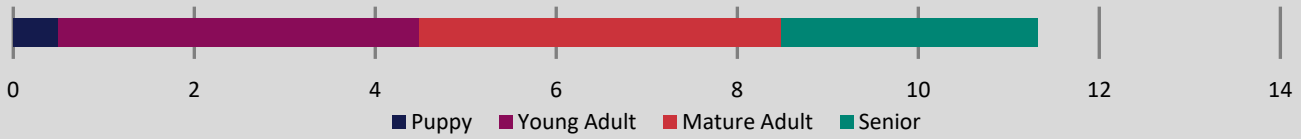
After a workup by her veterinary team -- bloodwork, urinalysis, and an ultrasound -- Tilly's veterinarian tells the family she is worried about the dog's kidneys. After other issues are ruled out, Tilly is diagnosed with chronic kidney disease. Tilly's veterinarian is optimistic that with a special diet and regular veterinary care, Tilly will be herding her children and showing off her tricks for a good while yet.

Shetland Sheepdog



Active and athletic, the Shetland Sheepdog, commonly known as a Sheltie, is a bright, eager to please dog who picks up tricks effortlessly and is known as a top performer in the sport of canine agility. The breed is not a Collie in miniature, although Shelties do share their larger relative's enthusiasm for barking, along with origins in Scotland and a thick double coat. Shelties are more common than Collies, ranked 58th among breeds in our database.

The Sheltie is one of the smallest of the herding breeds, no taller than 16 inches at the shoulder and weighing from 15-25 pounds. They are playful with family and tend to be shy with people they don't know. Although most are generations removed from their traditional farm work, many Shetland Sheepdogs retain some herding instinct.



Aging Well: Old dogs, new data (Part 1)

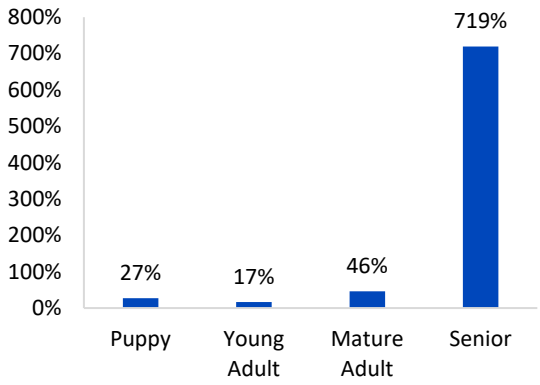
Canine kidney disease profile

The kidneys serve multiple critical roles, although they are most commonly known for filtering the blood to remove waste products. Kidney failure is diagnosed when the kidneys have lost more than 75% of their ability to function, and clinical signs (e.g., vomiting, diarrhea, weight loss) begin. This can happen suddenly (acute kidney failure) or over time (chronic kidney failure) and may include loss of protein (glomerular disease)[35]. Chronic kidney disease is a known disease of aging pets with an estimated prevalence of up to 7% in dogs.[36] Acute kidney disease is often secondary to toxin ingestion or infection and may be more common throughout earlier life stages.

Outcomes for acute[37] and chronic[38] kidney disease can be significantly impacted by medical management, although only acute kidney disease is potentially reversible.

Canine kidney disease data insights

Chart 14 - Relative risk of claims for kidney disease increases by more than 15x from mature adulthood into senior life stage

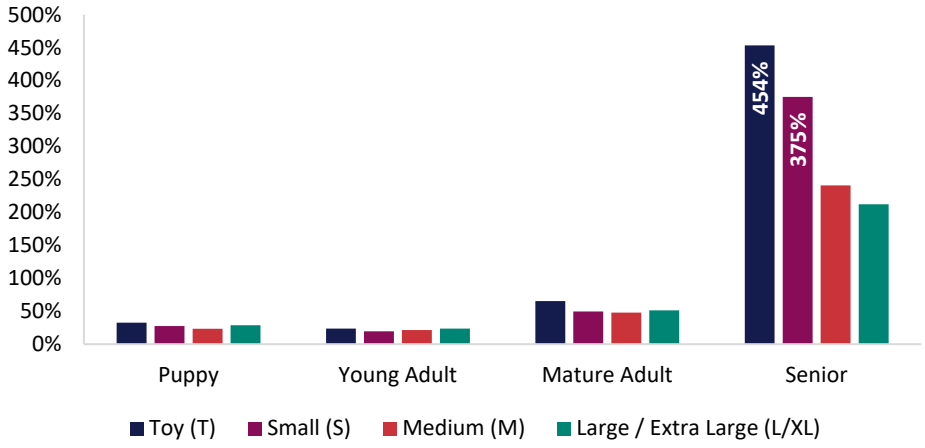


Chronic kidney failure is overwhelmingly a disease of senior dogs – Chart 14. While puppyhood through mature adult years saw submission of some claims for kidney disease, the vast majority of claims for kidney disease is in senior dogs. Chart 14 shows that the risk increases by more than 15 times between mature adult and senior life stages.

[35] Ettinger, S. J., Feldman, E. C., Coté, E & Stephen, D. B. P. (2017). Urinary System. In Textbook of Veterinary Internal Medicine: Diseases of the dog and the cat (seventh, Vol. 2, pp. 1955–1957). essay, Elsevier.
[36] Lund EM, Armstrong PJ, Kirk CA, et al. Health status and population characteristics of dogs and cats examined at private veterinary practices in the United States. J Am Vet Med Assoc. 1999;214:1336-1341.
[37] Dunaevich A, Chen H, Musseri D, Kuzi S, Mazaki-Tovi M, Aroch I, Segev G. Acute on chronic kidney disease in dogs: Etiology, clinical and clinicopathologic findings, prognostic markers, and survival. J Vet Intern Med. 2020 Nov;34(6):2507-2515. doi: 10.1111/jvim.15931. Epub 2020 Oct 12. PMID: 33044036; PMCID: PMC7694831.
[38] Polzin DJ. Chronic kidney disease in small animals. Vet Clin North Am Small Anim Pract. 2011 Jan;41(1):15-30. doi: 10.1016/j.cvsm.2010.09.004. Epub 2010 Dec 4. PMID: 21251509.

Aging Well: Old dogs, new data (Part 1)

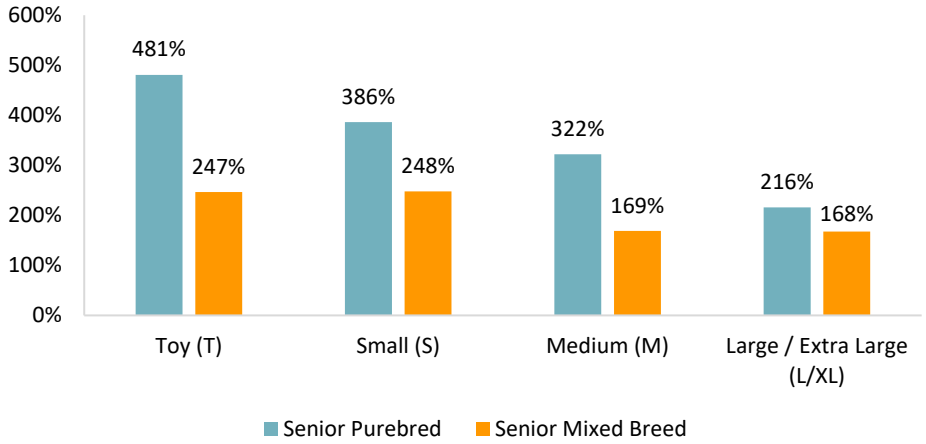
Chart 15 - Relative risk of claims for kidney disease is higher for toy and small senior dogs



Toy and small dogs most at risk – Chart 15. The data show a clearly increased risk for toy and small dogs in Chart 15. Similar to our commentary around mammary cancer in our Diversity of Risk white paper, are toy and small dogs so much less prone to other common senior diseases (like cancer and orthopedic disease) that kidneys (and hearts) are the organs that most often fail?

Purebred senior dogs more likely to have claims submitted for kidney disease – Chart 16. For senior dogs of all sizes, purebred dogs are much more likely to develop kidney disease. This is most pronounced for toy, small and medium purebred dogs, with toy and medium purebred dogs at almost twice the risk of their mixed-breed counterparts.

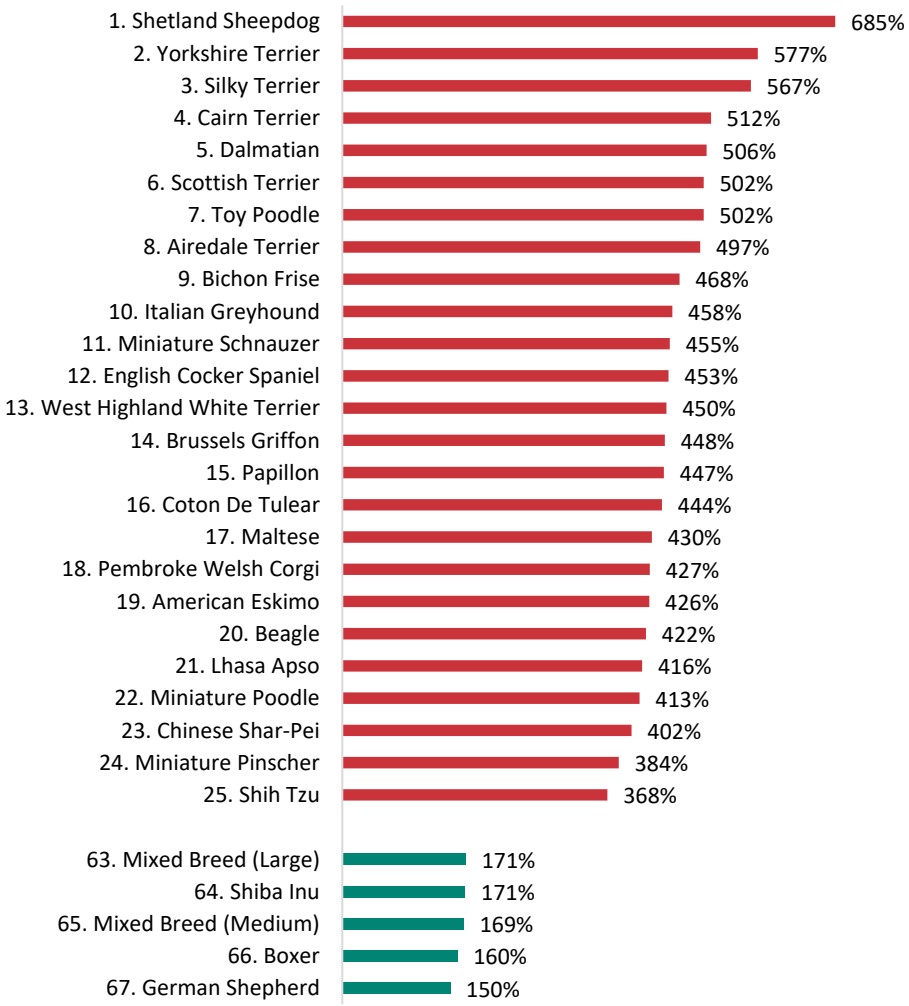
Chart 16 - Relative risk of claims for kidney disease is higher in senior purebred dogs of all sizes



Are there any "usual suspects" for canine senior kidney disease? – Chart 17

Shelties occupy the top spot with a differentiated value for relative risk. The same difference in risk is spread between the Yorkie at number 2 and the Bichon Frise at number 9. When searching the published literature for senior-onset kidney disease, breed predilections are relatively focused on familial diseases[39] that occur at relatively low rates in the general population. While kidney dysplasia of Lhasa Apso may be a recognized pathology, it seems unlikely that a congenital or developmental disease would be the driver of these first-time diagnosis senior cases.

Chart 17 - Senior life stage kidney disease relative risk for 25 highest-risk and 5 lowest-risk breeds



As mentioned in previous chapters, these disease-specific rankings include only those breeds that meet the statistical requirements for significance (see methodology). They are driven by breed popularity only insofar as enough dogs have had claims submitted for kidney disease. The data across senior dogs for the "significant" kidney breeds from the Sheltie at number 1 to the German Shepherd at number 67 are drawn from more than 800,000 dog years at risk. The authors would suggest that these data offer the most comprehensive breed-specific review of risk for the development of kidney disease in senior dogs.

[39] http://www.iris-kidney.com/education/risk_factors.html

Canine kidney disease data - Clinical significance for at-risk dogs

With an increased relative risk of more than 15-fold as dogs reach the senior life stage, kidney disease offers the opportunity for targeted education and partnership between pet families and veterinary healthcare teams to improve pet outcomes. Except for toxic or infectious causes, kidney failure cannot be prevented. However, early detection and proactivity in helping pet families engage with diagnostics and treatments can extend longevity and improve quality of life.[40]

Which pets?

The data indicate that toy and small breed dogs, especially purebreds are at increased risk. Chart 17 indicates Shetland Sheepdogs, Yorkshire Terriers and Silky Terriers are at highest risk.

What actions?

Pet families –

- Early detection: Monitor water intake and urination habits; awareness of other clinical signs (e.g., poor hair coat, weight loss, vomiting or poor appetite)
- Optimal management: Awareness of the benefits of dietary modification,[41] home treatments (e.g., increasing moisture content of the diet)

Veterinary healthcare teams –

- Awareness of risks: Opportunities to emphasize benefits of routine diagnostics for at-risk senior pets

[40] Iris staging of CKD. IRIS Kidney - Guidelines. (n.d.). Retrieved July 15, 2022, from http://www.iris-kidney.com/education/guidelines/staging.html
[41] http://www.iris-kidney.com/pdf/IRIS-DOG-Treatment_Recommendations_2019.pdf

Final note

This is the first of two white papers analyzing senior diseases in dogs and cats, and the continuation of a larger series of analyses on companion animal health and veterinary industry trends. While most will be conducted by Nationwide's Pet Health Analytics and Insights Team, others will be created with input from academic partners. As the leading U.S. pet health insurer with more than 1 million pets actively protected, Nationwide believes these studies to be of use to veterinary professionals and pet families alike while helping to advance the use of industry data sources in developing guidance on pet selection and care to the benefit of all.

We believe this model of relative risk analysis will act as a foundation for Nationwide to provide evidence-based, clinically actionable tools to veterinary healthcare teams and pet families. Personalizing pet health education will drive more effective preventive care, prolong healthy lifespan, and improve pet health outcomes.

Authors: Jules Benson, BVSc MRCVS, Chief Veterinary Officer; Stacey Neff, MS, Biostatistician; Sarah Peterson, BS, Data Analyst; Emily M. Tincher, DVM, Director of Veterinary Relations; Gina Spadafori, BA, Veterinary Communications.

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