

# Purebred vs Mixed Breed Dogs: Various Disorders

## The 2013 UC Davis Study

*by Carol Beuchat PhD*

Data from -

- Bellumori TP, TR Famula, DL Bannasch, JM Belanger, & AM Oberbauer 2013 Prevalence of inherited disorders among mixed-breed and purebred dogs: 27,254 cases (1995-2010). J Am Vet Med Assoc 242: 1549-1555.

Researchers looked at data for 24 genetic disorders. For 13 of these, incidence in purebreds was not different from that in mixed breed dogs. For 10 of the disorders (42%), purebreds were significantly more likely to be affected. Only for the incidence of ruptured cranial cruciate ligament were mixed breed dogs more affected than purebreds.

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**Objective**—To determine the proportion of mixed-breed and purebred dogs with common genetic disorders.

**Design**—Case-control study.

**Animals**—27,254 dogs with an inherited disorder.

**Procedures**—Electronic medical records were reviewed for 24 genetic disorders: hemangiosarcoma, lymphoma, mast cell tumor, osteosarcoma, aortic stenosis, dilated cardiomyopathy, hypertrophic cardiomyopathy, mitral valve dysplasia, patent ductus arteriosus, ventricular septal defect, hyperadrenocorticism, hypoadrenocorticism, hypothyroidism, elbow dysplasia, hip dysplasia, intervertebral disk disease, patellar luxation, ruptured cranial cruciate ligament, atopy or allergic dermatitis, bloat, cataracts, epilepsy, lens luxation, and portosystemic shunt. For each disorder, healthy controls matched for age, body weight, and sex to each affected dog were identified.

**Results**—Genetic disorders differed in expression. No differences in expression of 13 genetic disorders were detected between purebred dogs and mixed-breed dogs (ie, hip dysplasia, hypo- and hyperadrenocorticism, cancers, lens luxation, and patellar luxation). Purebred dogs were more likely to have 10 genetic disorders, including dilated cardiomyopathy, elbow dysplasia, cataracts, and hypothyroidism. Mixed-breed dogs had a greater probability of ruptured cranial cruciate ligament.

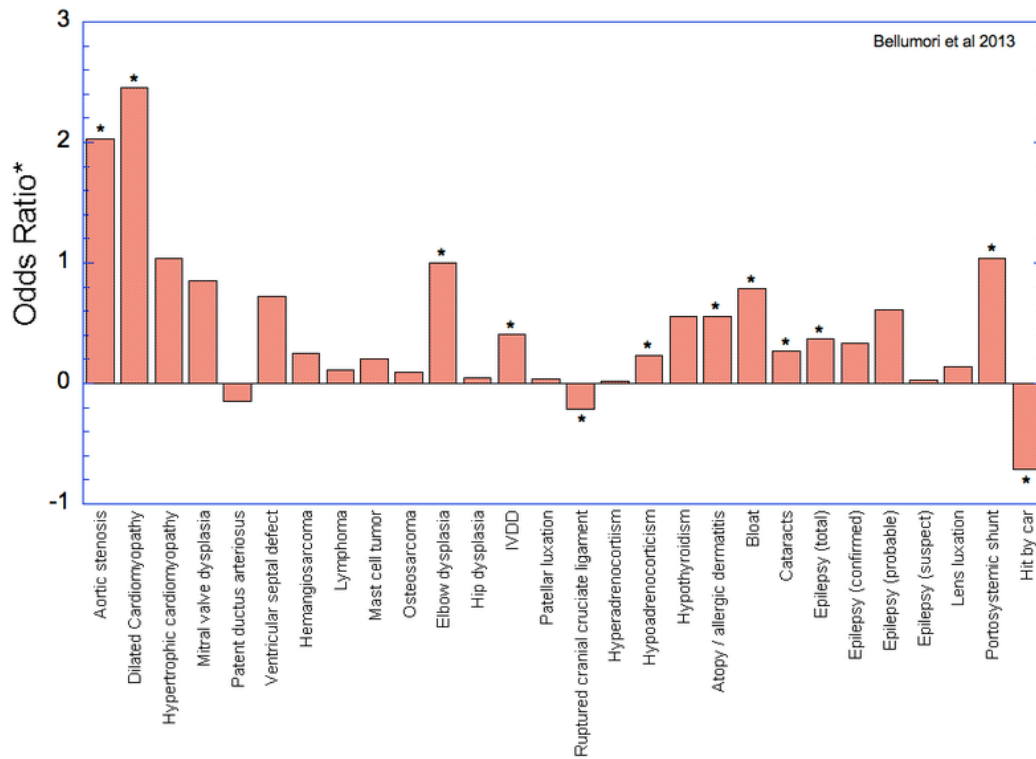
**Conclusions and Clinical Relevance**—Prevalence of genetic disorders in both populations was related to the specific disorder. Recently derived breeds or those from similar lineages appeared to be more susceptible to certain disorders that affect all closely related purebred dogs, whereas disorders with equal prevalence in the 2 populations suggested that those disorders represented more ancient mutations that are widely spread through the dog population. Results provided insight on how breeding practices may reduce prevalence of a disorder. (*J Am Vet Med Assoc* 2013;242:1549–1555)

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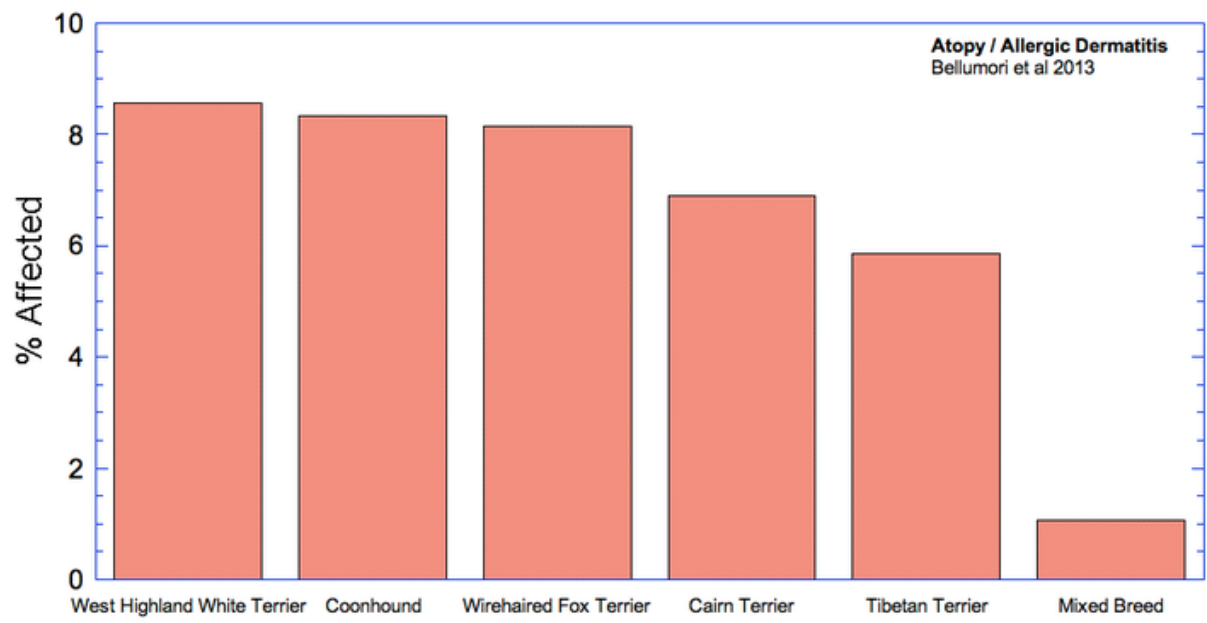
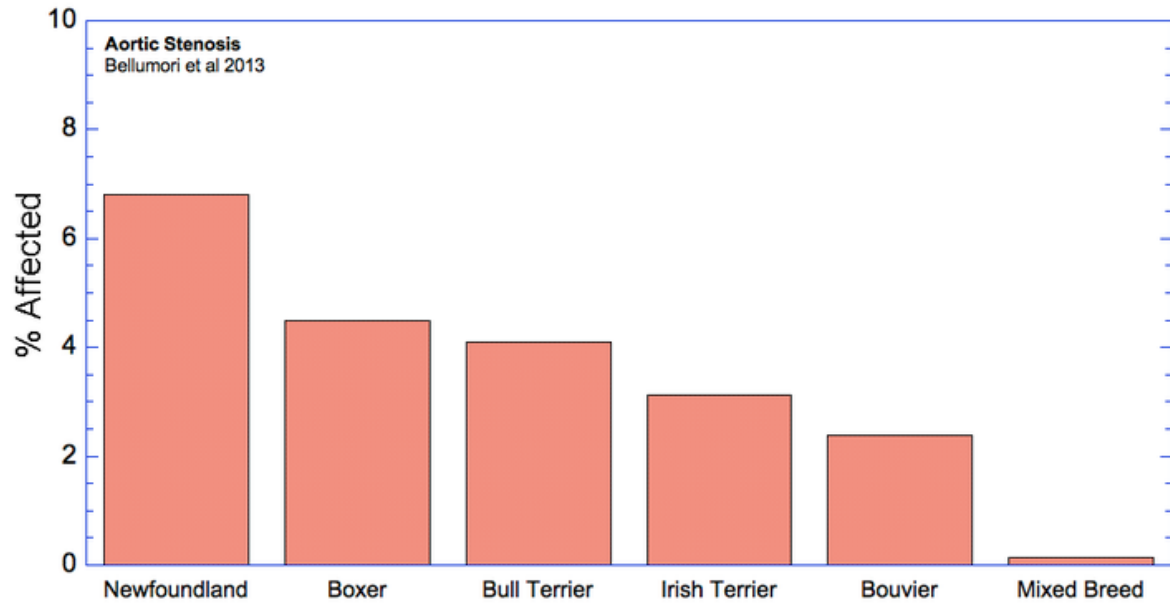
NOTE\* - In the publication (above), data are presented as a mean odds ratio (OR) comparing purebred dogs relative to mixed breed dogs, in which equal risk for a disorder in purebred and mixed breed dogs would have an OR = 1. To make the data easier to view as a graph, I have computed (OR\* = 1-OR), for which equal risk in purebred and mixed breeds dogs would have a value of 0, and higher odds for purebreds would have OR\* > 0, and higher odds for mixed breeds would have OR\* < 0. Therefore, in the graph below, higher risk for purebreds are bars going upwards, and higher risk for mixed breeds are bars going down.

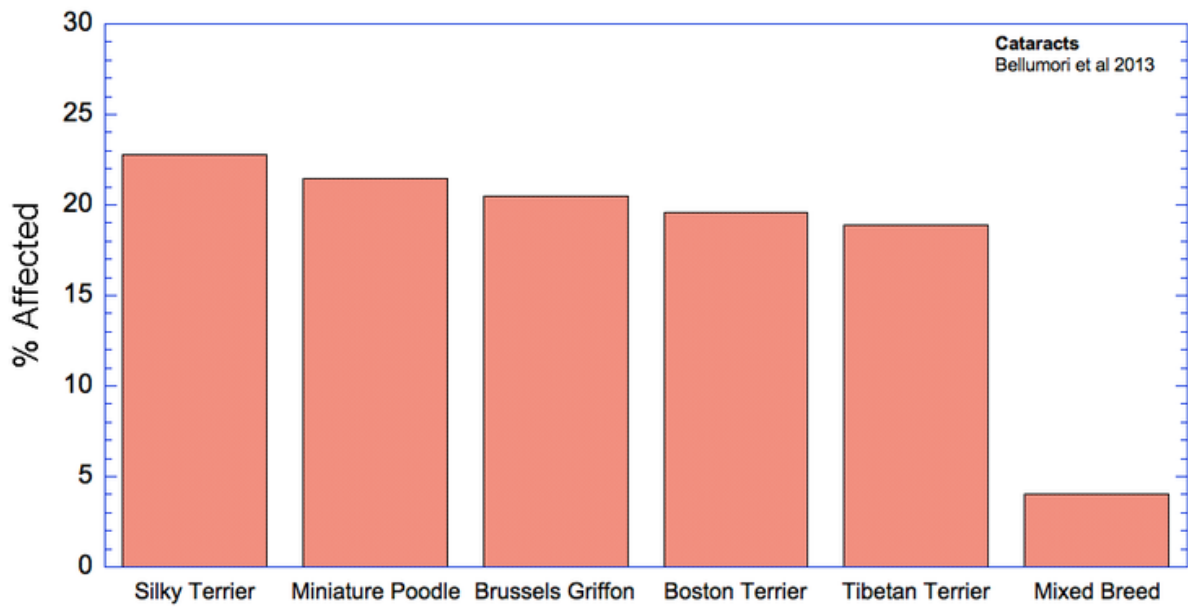
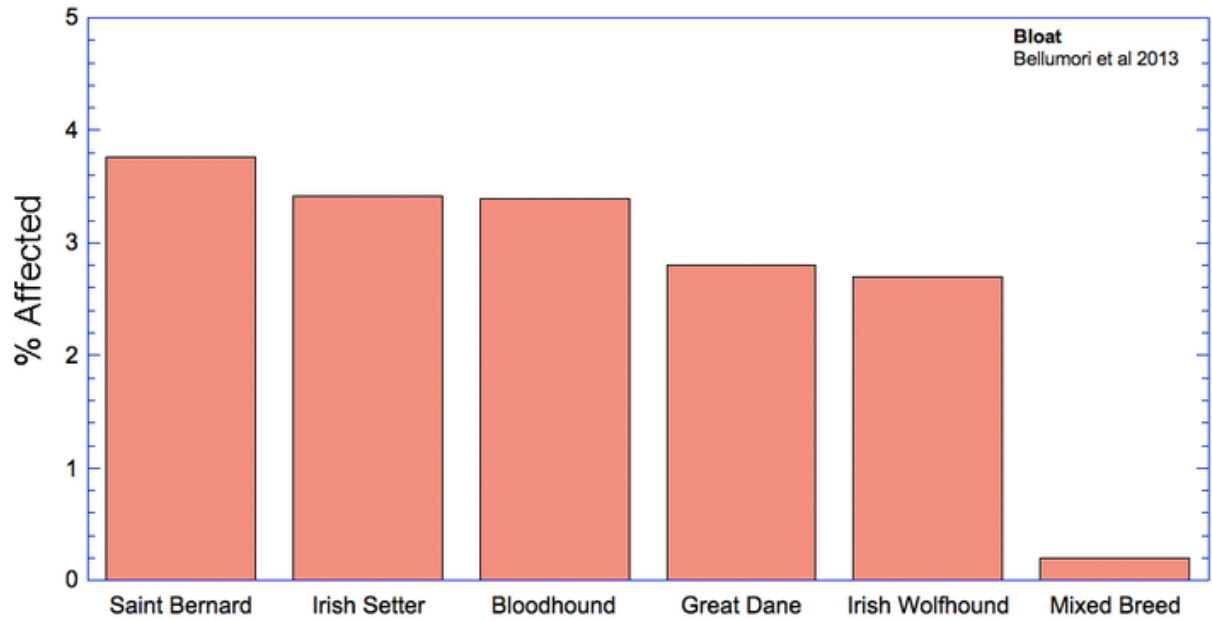
Asterisks (\*) on bars indicate that in 50 comparisons of affected dogs with matched control sampling sets, there was a significant probability (P<0.05) that pure and mixed breed dogs differed in expression of the condition. (See Methods and Materials: Statistical Analysis in Bellumori et al 2013 for details.) Consequently, for the traits in which the comparison of purebred and mixed breed was

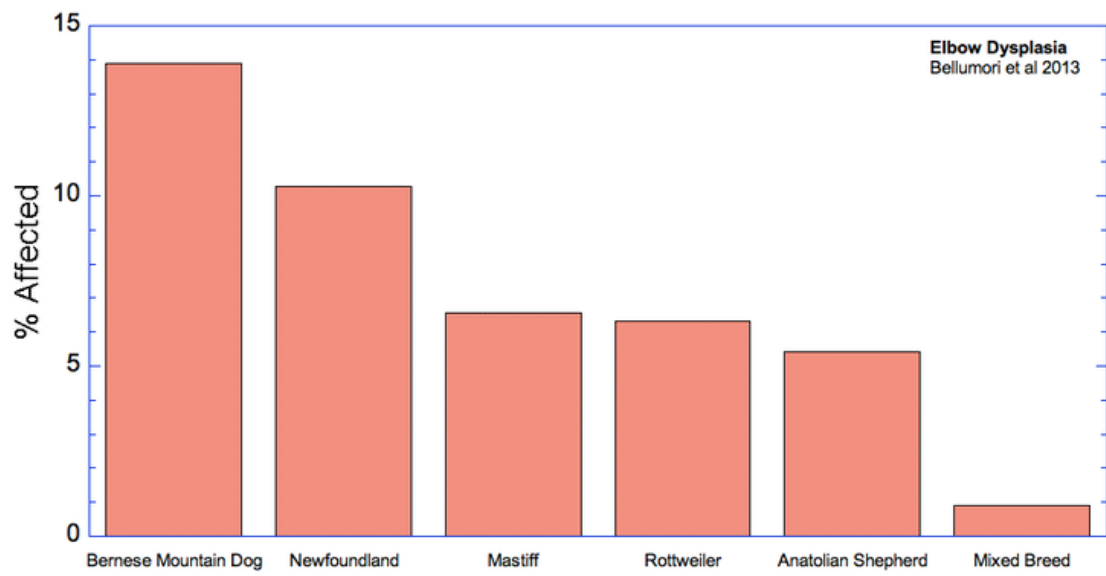
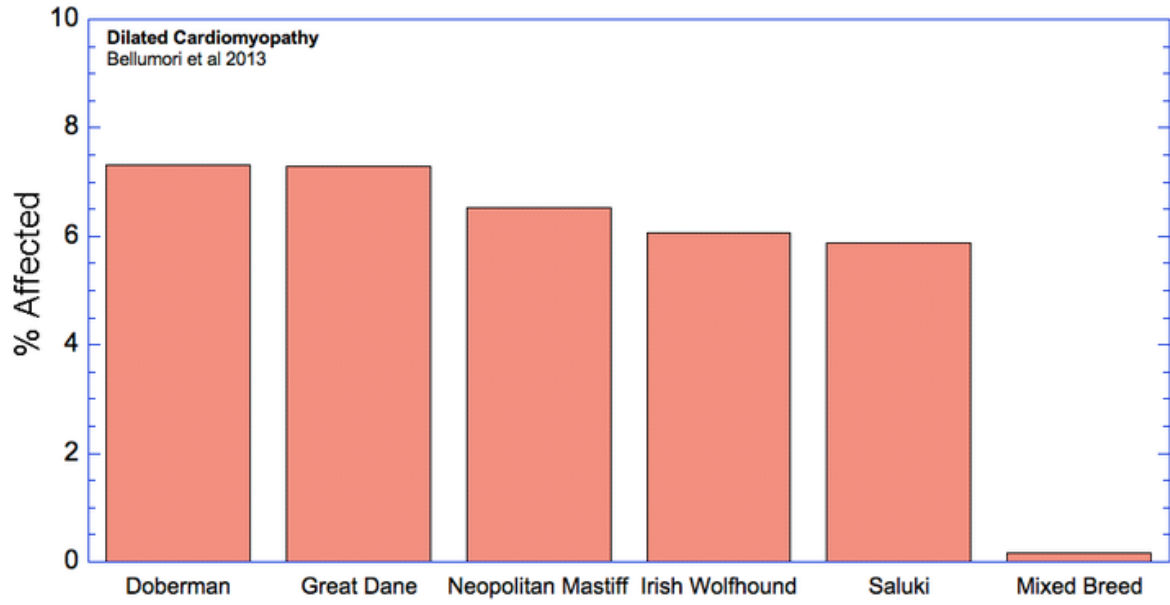
significant (indicated by \* above the bar), purebred dogs were at greater risk of having the disorder when OR\* is positive (bars going up). For the disorders in which mixed breed dogs had higher risk than purebreds (represented by negative values in the graph below), only two of the comparisons were significant - for ruptured cruciate ligament and "hit by car". That is, for only one of the health traits (vs accident) examined were mixed breed dogs at higher risk than purebreds. For 10 of the traits, purebred dogs had significantly ( $P < 0.05$ ) higher risk of being affected than mixed breed dogs.

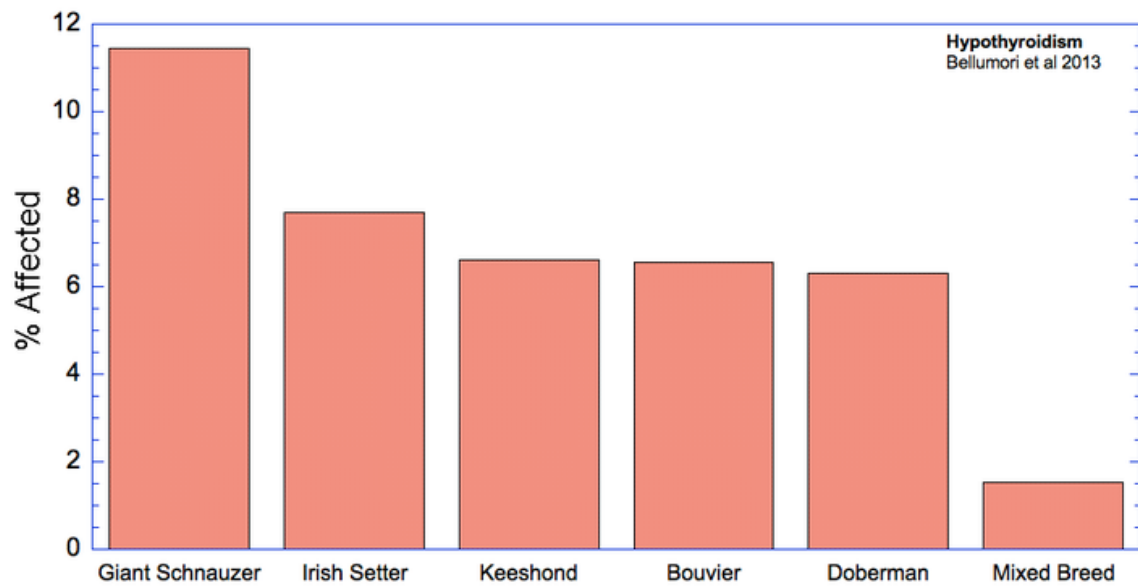
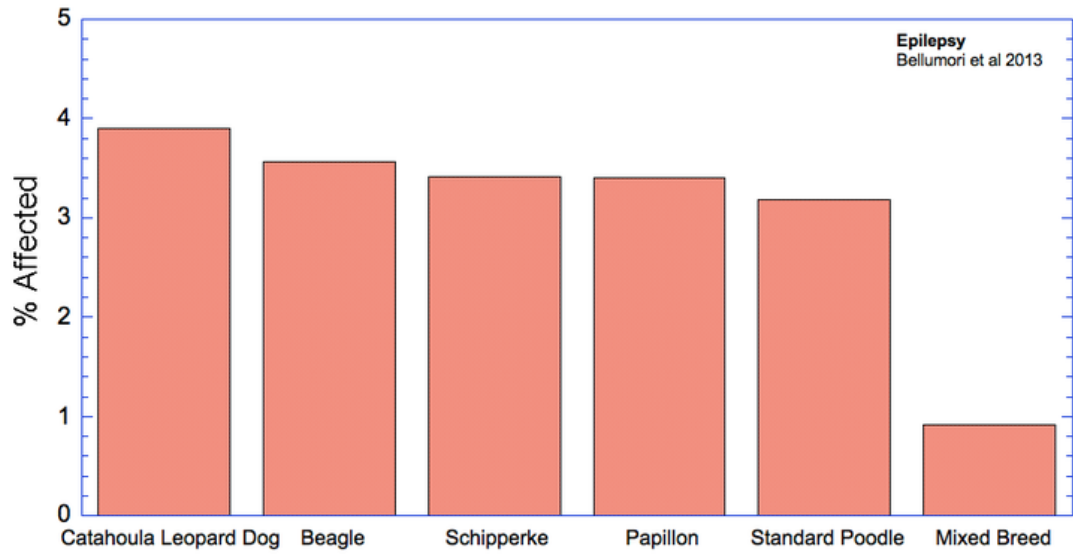


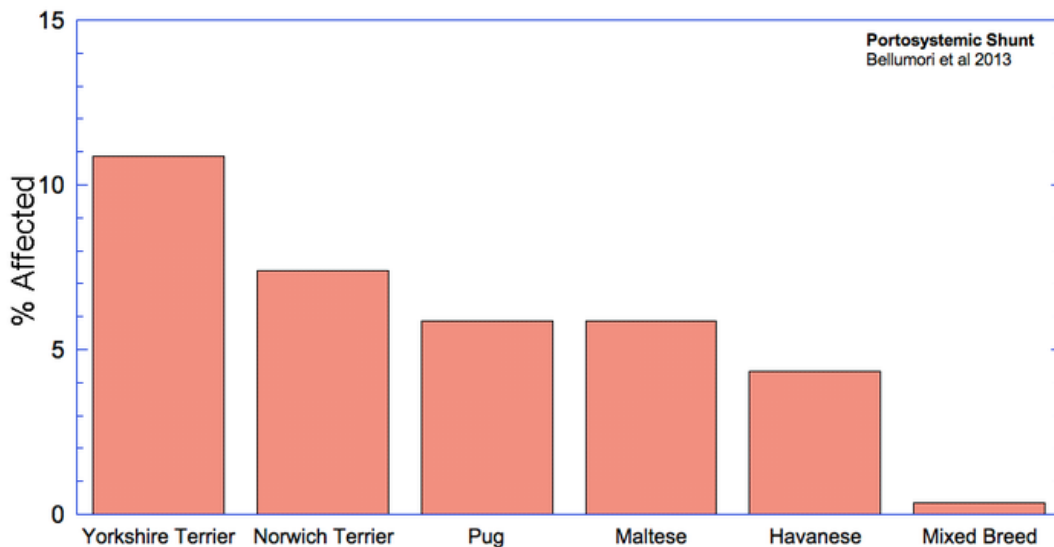
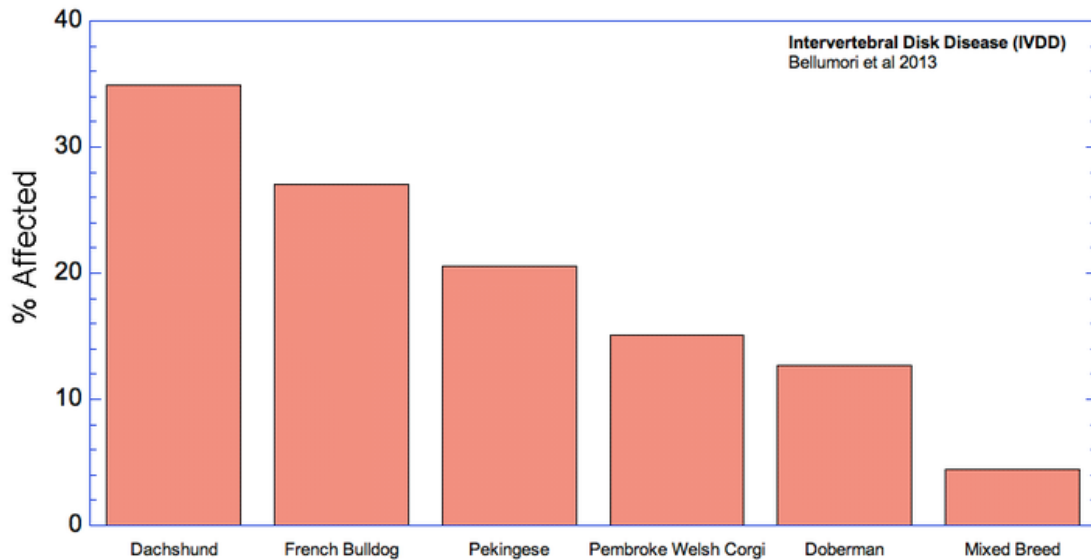
For the 10 genetic disorders which were significantly more prevalent in purebred dogs, data are presented for the 5 breeds with the highest rates of affected dogs plus the value for mixed breeds. The data for each of these are graphed below.











NOTE - This study received considerable press because of controversy among breeders and the public about whether purebred dogs are more afflicted with genetic disorders than mixed breed dogs. The study demonstrated that for 10 of the 27 disorders examined, purebred dogs were significantly more likely to be affected than mixed breed dogs (see the first graph above). For one disorder, ruptured cranial cruciate ligament, mixed breed dogs were more likely to be afflicted, and they were also more likely to be hit by a car. For the remaining 17 disorders, the study failed to find a difference



between mixed and purebred dogs in the probability of being affected. The statistical statement of failure to find a significant difference between mixed and purebred dog populations is not the same as saying that a particular disease is "equally common" in mixed and purebred dogs, which is how it was generally interpreted by the press and also apparently many breeders.

- "A new study by researchers at the University of California, Davis, indicates that mixed breeds don't necessarily have an advantage when it comes to inherited canine disorders." UC Davis press release
- "A new study on the prevalence of inherited disorders among American mixed breed and purebred dogs has negated the common assumption that a mixed breed dog is always healthier than a purebred dog." (Quickfall 2013)
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- "It has been publicly discussed for years that hereditary disorders would be a direct consequence of the strict selective breeding of pedigree dogs and that for this reason the purebreds would have a much greater risk of developing hereditary disorders than mixed breed dogs. According to the latest research by Bellumori and his group, this assumption does not seem to hold. Indeed many diseases seem to be as common in mixed breed as in pedigree dogs" (Moller)
- "A new study on the prevalence of inherited disorders among American mixed breed and purebred dogs has negated the common assumption that a mixed breed dog is always healthier than a purebred dog" (Quickfall 2013).

It is true - a mixed breed dog is not "always healthier than a purebred dog". But it is the case - as this study showed - that purebred dogs have a greater risk of developing some of the hereditary disorders examined in this study than mixed breed dogs. And certainly in the case of genetic disorders caused by a single recessive mutation, purebred dogs should be far more likely to be afflicted because they are also more likely to inherit two copies of the defective allele as a consequence of inbreeding. Most of the disorders examined here are

likely polygenic (i.e., involve complex effects of multiple genes). For the dozens of genetic disorders afflicting dogs that are caused by single recessive mutations, purebreds will surely exceed mixed breed dogs in frequency.

The authors of this study tackled a very important question that is very difficult to address because collecting the "perfect" data set is impossible. Using data on clinical occurrence of disease is fraught with difficulty because of many sources of potential complication - perhaps purebred dogs are more likely to receive veterinary treatment than mixed breeds, comparisons among groups (e.g., afflicted vs not, purebred vs mixed) are confounded by unequal sample sizes or differences among groups in the age, sex, etc of animals, and many other things that are a statistician's nightmare. In fact, the "perfect" comparison will never be done. But this study presents a large compilation of data and thorough analysis that is the first (and might be the only) attempt to explore differences in predisposition to disease in purebred and mixed breed dogs.

Moller F Mixed breed dogs are not protected from breed disease heritage. MyDogDNA website. ([pdf](#))

Quickfall L 2013 Kennel Club welcomes study looking at health of all dogs. Dog News, Vol 29(30): 134, July 26, 2013. <http://issuu.com/dognews/docs/072613/134>

UC Davis press release (4/2/2014) Purebred dogs not always at higher risk for genetic disorders, study finds. ([pdf](#))

Wood R 2013 Prevalence of genetic disorders compared in purebred and mixed-breed dogs. CABI VetMed Resource. <http://www.cabi.org/VetMedResource/news/23088>