



In the know about noses: Methodology



Introduction

The white papers associated with this methodology are a continuation of a larger series of studies 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 1.1 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.

Data sources

Breed and condition data were directly sourced from Nationwide policy and claims data. Dog years at risk (DYAR) represents the number of years for which Nationwide has provided insurance coverage – a dog insured for five years provides data for five dog years at risk. For this analysis, we focused on DYAR from select Nationwide pet insurance products to ensure continuity of coverage type for the analysis. If a pet had a claim submitted for any of the conditions under review that fell prior to the period of dates selected for the analysis, that pet's data were eliminated from the study population.

For the disease categories used in the study, Nationwide's proprietary condition codes were mapped to the brachycephalic disease classifications described in the white papers. For example, data specifically for brachycephalic obstructive airway syndrome (BOAS) was derived from claims with conditions codes that include: "brachycephalic syndrome", "stenotic nares", "everted laryngeal sacculles" and "elongated soft palate".

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Table 1

Breed name	Included in the analysis	Referenced as brachycephalic													
		Krainer 2022 ¹	Freiche 2021 ²	Packer/Hendricks 2015 ³	Packer/Tivers 2015 ⁴	Riecks 2007 ⁵	Gruenheid 2018 ⁶	O'Neill 2015 ⁷	Colverde 2021 ⁸	Fawcett 2019 ⁹	Regier 2020 ¹⁰	Wagner 2020 ¹¹	Erjavec 2021 ¹²	Eivers 2019 ¹³	Ekenstedt 2020 ¹⁴
French Bulldog	●	●	●	●	●	●	●	●	○	●	●	●	●	●	●
Shih Tzu	●	●	●	●	●	○	●	○	○	●	○	○	○	○	○
English Bulldog	●	●	●	●	●	●	●	●	○	●	●	○	●	●	● *
Boxer	●	●	●	●	●	○	●	○	○	●	○	○	○	○	●
Pug	●	●	●	●	●	●	●	●	○	●	●	●	○	●	●
Boston Terrier	●	●	●	●	●	●	●	○	○	●	●	○	●	●	●
Cavalier King Charles Spaniel	●	●	●	●	●	○	○	○	●	●	○	●	○	○	○
Bull Mastiff	●	●	●	○	●	●	●	○	○	●	○	○	○	○	○
Pekingese	●	●	●	●	●	●	●	○	○	●	○	●	○	○	○
Dogue De Bordeaux	●	●	●	●	○	○	●	○	○	●	○	○	○	○	○
Brussels Griffon	●	●	○	●	○	○	●	○	●	●	○	○	○	○	○
Japanese Chin	●	○	○	●	○	○	○	○	○	○	●	●	●	○	○
Lhasa Apso	●	●	○	○	●	○	●	○	○	●	○	○	○	○	○
Shar Pei	●	○	●	○	●	●	●	○	○	○	○	○	○	●	○
Chow Chow	●	○	○	○	●	●	○	○	○	○	○	○	○	●	○
Olde English Bulldogge	○	○	○	○	○	○	○	○	○	○	○	○	○	○	● *
Victorian Bulldog	○	○	○	○	○	○	○	○	○	○	○	○	○	○	● *
Tibetan Spaniel	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Alapaha Blue Blood Bulldog	○	○	○	○	○	○	○	○	○	○	○	○	○	○	● *
Affenpinscher	○	○	○	●	○	○	○	○	○	●	○	○	○	○	○
English Toy Spaniel	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○

*- references "bulldogs," but not specific bulldog breeds

Brachycephalic breed selection

Working from an initial list sourced from Nationwide's breed list and in-house subject matter experts, the Nationwide team reviewed subject-specific peer-reviewed publications, recording references to specific breeds (see Table 1). Breeds with at least three publication mentions were included in the analysis. (The breeds excluded from the analysis represented a very small portion of Nationwide's insured brachycephalic population.)

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Table 2

Breed name	Included in extreme brachycephalic group	Referenced as extreme brachycephalic													
		Krainer 2022 ¹	Freiche 2021 ²	Packer/Hendricks 2015 ³	Packer/Tivers 2015 ⁴	Riecks 2007 ⁵	Gruenheid 2018 ⁶	O'Neill 2015 ⁷	Colverde 2021 ⁸	Fawcett 2019 ⁹	Regier 2020 ¹⁰	Wagner 2020 ¹¹	Erjavec 2021 ¹²	Eivers 2019 ¹³	Ekenstedt 2020 ¹⁴
French Bulldog	●	●	○	○	○	○	○	●	○	●	○	○	● *	○	●
English Bulldog	●	●	○	○	○	○	○	●	○	●	○	○	● *	○	● *
Pug	●	●	○	○	○	○	○	●	○	●	○	○	●	○	●
Boston Terrier	○	○	○	○	○	○	○	○	○	○	○	○	●	○	○

*- references "bulldogs," but not specific bulldog breeds

"Extreme brachycephalic" breed selection

Using the same source publications and the same criterion as above, breeds that were referred to as extreme brachycephalic or as having extreme morphology were sub-grouped as "extreme brachycephalic" breeds (Table 2).



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Analysis

Relative risk was used to compare the incidence rate of brachycephalic breeds to the incidence rate of non-brachycephalic breeds. Relative risk was calculated by dividing the incidence rate of brachycephalic breeds by the incidence rate of non-brachycephalic breeds.

When examining an individual breed's relative risk for a condition, only those with statistically significant representation were included. Two-sided one sample z tests of proportions were used to compare proportions.¹⁵ Unless stated otherwise, for all analyses in the paper, the Bonferroni correction was used to adjust for multiple comparisons.¹⁶

Calculation of relative risk

Unless otherwise specified, relative risk is in relation to non-brachycephalic dogs in the study population. By way of example, if a given breed (breed X) has 300 claims for a respiratory condition out of a sample size of 10,000 DYAR, the analysis focuses on the comparison between that rate and the rate of respiratory condition in non-brachycephalic dogs. Incidence and relative risk for breed X vs. non-brachycephalic dogs is calculated as in the example below:

Total number of breed X with at least one claim for a respiratory condition = 300

Total number of DYAR for breed X = 10,000

Total number of non-brachycephalic dogs with at least one claim for a respiratory condition = 1,500

Total DYAR of non-brachycephalic dogs = 100,000

Incidence within breed X:

$$\frac{\text{Number of dogs in breed X with respiratory condition}}{\text{DYAR for breed X}} = \frac{300}{10,000} = 3.00\%$$

Incidence in non-brachycephalic dogs:

$$\frac{\text{Number of non-brachycephalic dogs with respiratory condition}}{\text{DYAR of non-brachycephalic dogs}} = \frac{1,500}{100,000} = 1.50\%$$

Respiratory condition relative risk, or risk ratio, in breed X compared to non-brachycephalic dogs:

$$\frac{\text{Incidence within breed X}}{\text{Incidence in non-brachycephalic dogs}} = \frac{3.00\%}{1.50\%} = 2.00\% (200\%)$$

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