Final Report:
Standard Schnauzer Club of America Health Survey of 2015

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Background The Standard Schnauzer is generally considered a healthy breed. To insure the accuracy of this statement and more importantly, to protect the future health of the breed, it is imperative that breeders and owners have accurate knowledge of the incidence of health problems that may exist in the breed. Thus, the Standard Schnauzer Club of America conducted a survey to document the health status of the breed in 2015. The health survey sought information on **all** Standard Schnauzers born in the U.S. or Canada who were alive at any time between January 1, 2008 and December 31, 2014.

This was the 4th health survey conducted by the Club, collecting information on dogs alive at some point over the last 26 years. The health surveys of 1998, 2004 and 2007 enrolled dogs alive at different intervals during the period of 1/1/92- 12/31/07.

The goals of the 2015 health survey were four-fold:

(1) Enroll a sufficient number of dogs so that reliable estimates of the incidence of diseases/conditions (% of all dogs in the breed that may be affected) could be ascertained. These data would allow for development of a quantitative picture of the current disease incidence (or absence thereof) in our breed and thus the current health of our breed. Generating a simple catalog of diseases existing in the breed and/or the health status of individual dogs were NOT foci.

(2) Enroll a large number of the dogs who died during this period - this is important as they provide data regarding disease/health over a lifespan.

(3) Obtain sufficient data to identify diseases/conditions that may exist at low frequency in the breed;

(4) To the extent feasible, confirm that some/many diseases probably do not currently exist in Standard Schnauzers

The Benchmark for the 2015 SSCA Health Survey was to enroll 2,200 of the estimated 13,000 dogs alive at any point in the January 1, 2008 to December 31, 2014 time window (7 years) and thus eligible to be enrolled. This included collecting data on the estimated 5,500 dogs who died during the enrollment eligibility period.

Summary of Results from 2015 Health Survey

The conclusions from analyses of the collected data can be summarized as follows:

1. Data collected for 1398 or approximately 11% of enrollment eligible dogs
2. Half of the dogs who died during the enrollment period lived to be over 13.1 years; BUT it must be noted that data were collected on only 254 dogs or less than 5% of the 5,500 dogs that died in the 2008-2014 time window (including 12 dying of accidental causes).
3. Few serious diseases were noted to occur in the breed.
4. (potentially) serious conditions affect only a very few of the dogs enrolled.

Conclusion: Most of the diseases reported in the survey are those expected for dogs that live to an older age. Overall, the health status of our breed, including our older dogs, is good.

A. Collection of Health Survey Data.

The goal of the 2015 SSCA Health Survey was to obtain an accurate and complete picture of the health of our breed. To achieve the survey goals, the health survey was designed to obtain information for a large number of dogs, not just dogs showing in conformation, participating in performance events, registered dogs, dogs in breeding programs **or** dogs with health issues. To obtain maximum participation, the Health Survey Taskforce worked closely with breeders, fanciers and pet owners in gathering information and emphasized the **importance of having data on ALL Standard Schnauzers, this included healthy dogs** as well as dogs with health problems. Having a broad base for enrollment is critical for having sufficient and representative data needed to estimate the incidence of disease (% of all dogs alive at any point in the enrollment window affected) and thus the health of our breed.

The Health Survey Taskforce initiated distribution of information regarding the importance of conducting a health survey (advertising) 6 months prior to distribution of the survey forms. Information regarding the health survey was distributed as widely as possible, using publications and websites of the national club as well as local clubs, presentations at specialties, direct mail to members of the national or local clubs and the relevant chat sites. A substantial effort was made to have breeders contact the folks to whom they had sold puppies (or to gather and submit the information themselves). The data were submitted by the breeders/owners to an Independent party (someone not associated with the SSCA or Standard Schnauzers) for removal of any and all personal identifiers; this process insured confidentiality and that no data could be linked to a dog or breeder/owner. No list of names of individuals providing data was retained. Only de-identified survey forms were transferred to the Taskforce for analysis of the data; only aggregate information for any disease/trait is being reported.

The health survey sought information on **all** Standard Schnauzers born in the U.S. or Canada who were alive at any time (be that one day or the entire period) during the period of January 1, 2008 through December 31, 2014. Dogs enrolled in the 2008 Health Survey were eligible to be enrolled in the 2015 survey (if they were alive at any point in the enrollment window) as they would/could provide additional years of health data. The collection of data was initiated on January 1, 2015 and completed on October 31, 2015.

Results of the Standard Schnauzer 2015 Health Survey

B. Demographic data

B.1. AKC registration data for Standard Schnauzers

The data for AKC registrations of Standard Schnauzers for the last 48 years (35 years for litters) are in Table 1. It is clear that the number of Standard Schnauzers registered, both dogs and litters, has been quite constant for the last 25 years.

Table 1. AKC registrations per year (averaged over 5 year intervals)					
years	**dogs / year**	**litters /year**	**puppies/litter**	**% P'NS**	**% Black**
1960-64	342				
1965-69	865				
1970-74	1014				
1975-79	764	208	3.7		
1980-84	652	162	4.0		
1985-89	548	139	3.9		
1990-94	549	121	4.5	82	18
1995-99	492	116	4.2	80	20
2000-04	582	137	4.2	82	18
2005-09	563	130	4.3	74	26
2010-14	549	135	4.1	59	41

B.2. Number of Standard Schnauzers eligible for enrollment in 2015 health survey

Employing data for AKC registrations during the relevant time period and the life expectancy as calculated from the date provided by the 2008 and 2015 health surveys, it is possible to estimate the number of AKC registered dogs alive at any point during the 2008-2014 time period and thus, the number of Standard Schnauzers eligible for enrollment.

The average number of puppies registered per year from 1995-2014, the period when most dogs alive on January 1, 2008 (the start of the eligibility window for data collection) were born, is 550. Given the data that the average age of death for all dogs enrolled in the 2008 and 2015 surveys is 12.5 years, it can be calculated that 5,300 AKC registered dogs were alive at the start of the enrollment period. In addition, 3,850 puppies were registered with the AKC during the 2008-2014 time period. (*see discussion of litter size in Section F.*) Thus, it can be calculated that ~9,000 AKC registered dogs were eligible for inclusion in the health survey.

You will note that the above discussion refers to AKC registrations, but not all Standard Schnauzer puppies are registered. Employing the data on litter size collected during the 2008 health survey and this survey (See Section F), only 65% of the live-born Standard Schnauzer puppies in litter registrations are converted to completed registrations. Thus, an additional 5,250 Standard Schnauzers – a total of ~12-14,000 dogs- were eligible for enrollment in the 2015 health survey. Registration status was not a question included in the survey and it was not required that dogs be AKC registered to be enrolled in the survey.

Thus, a total of approximately 13,000 Standard Schnauzers were estimated to be alive at some point during that 2008-2014 time window and eligible for enrollment in the 2015 Health Survey. Given the stability of the number of Standard Schnauzers registered (and assuming this reflects stability in the number of dog whelped), it can be estimated that 5,500 dogs died during the 2008-2014 time period and were therefore eligible to be enrolled. These dogs provide a treasure-trove of information as it includes all aspects of their entire/complete lifespan.

Although the number of AKC registration for Standard Schnauzers has been very stable for over 35 years, the distribution between P'NS and Black dogs has changed substantially over the last 10-12 years. In the 20 years prior to 2004, Black dogs accounted for 18-20% of the Standard Schnauzers registered. In the last 5 year period, 2011-2015, Black dogs accounted for 40% of all Standard Schnauzers registered with the AKC (Table 1). Given this changing distribution during the period of interest for the 2015 health survey (dogs alive at any time in the 2008-2014

timeframe), it was assumed for data quality control purposes that 30% of the dogs eligible to be enrolled were Black.

B.3. Demographics of individuals submitting information for 2015 survey

Data were provided by an estimated 465 individuals. As everyone is aware, the forms were submitted to a 3rd party who removed all identifying information before forwarding the forms to me, thus, the submitter demographics can only be roughly estimated. It appeared that many individuals submitted data on more than a single form (data for more than 4 dogs), so it is only possible to have a very rough estimate of the number of individuals submitting data. Also, it appeared that a substantial portion of the data was provided by breeders (as the data submitted were for a number of dogs from the same litter), rather than individual owners, thus it is not possible to estimate the number of different (or individual) owners for the dogs enrolled in the survey. Table 2 provides some general insight into the membership of individuals submitting data (again – not necessarily the owner of the enrolled dog).

As can be seen in Table 2, about 280 SSCA members (approximately 60% of the 450 SSCA household member units) provided data for the survey (it is important to note that the individuals submitting the data may be the breeder rather than the current owner of a the dog); these individuals supplied about 65% of the data collected. Another 7% of the dogs were enrolled by members of one of our six Local Clubs but who were not SSCA members.

Table 2. Membership of individuals submitting data

membership	number of submitters	number of dogs enrolled [a]
SSCA only	130	371
Local Club only	61	102
SSCA+Local	91	320
SSCA+ all-breed	62	258
All-breed (only)	7	13
None or unknown	114	361
Total	465	1425

[a] Total dogs enrolled, including foreign born dogs.

Although the participation by SSCA and Local Club members was very substantial and very important, these individuals supplied information on only 6-8% of the estimated 13,000 dogs that were eligible to be enrolled in the survey. These numbers emphasize one of the major challenges for conducting successful health surveys; most of our dogs are owned by people without significant connection with the SSCA. These dogs are a substantial resource for tracking the health status of our breed, although it is very difficult to maintain contact with these individuals.

Breeders are critical in connecting with non-member owners and are central to the success of health survey initiatives. It is expected that many of the individuals submitting data for a large number of dogs were breeders who were submitting data for the individual owners. As seen in Table 3, almost 40% of the dogs were enrolled by only 6.5% of the individuals enrolling dogs. The data, and therefore the conclusions, are very dependent upon the degree to which the health of dogs from these kennels are representative of the health of the breed.

As at least some of the submitters were breeders rather than individual owners, it is not possible to estimate (even guesstimate) the average number of Standard Schnauzers per househol

Table 3. Dogs enrolled per individual submitting data		
Dogs entered	number of individuals	number of dogs enrolled
One (1)	195	195
2-3	163	362
4-5	76	319
6 or >	30 (6.5%)	547 (38%)
Total	464	1426

With regard to participation in AKC events, 75 submitters indicated participation only in conformation, 75 participated in only companion and/or performance events and 135 indicated participation in conformation plus companion/performance events. 175 submitters (38% of submitters - accounting for 30% of dogs enrolled) did not indicate participation in any events.

As you read through this report, you may note small differences in the numbers of dogs in various sections. This reflects the absence of data with regard to a specific question but a generally complete survey form for a dog.

B.4. Dogs enrolled in the 2015 health survey – General data

Data were provided for enrollment in the health survey for 1,426 dogs. Four dogs were not enrolled in the survey because of insufficient data or obvious errors in the submitted data. Twenty four additional dogs for which data were submitted were not born in the US or Canada. This included 8 bitches and 5 dogs who were in breeding programs. No outstanding health/disease issues were observed in these imported dogs. But because of the small number and suspected heterogeneity of country of origin of these foreign-born dogs, these dogs were not included in the data set analyzed for the health of the breed. The data set analyzed for health/disease status included 1,398 dogs.

Thus, approximately 11% of all (registered and unregistered) Standard Schnauzers estimated to be alive in the U.S./Canada at any point between Jan 1 2008 and Oct 31, 2014 (1,398 of 13,000 dogs) were enrolled in the survey. This is 65% of the 2015 Health Survey goal of collecting data for 2,200 dogs.

972 enrolled dogs (69%) were P'NS; 424 (30%) were Black; 2 were of unspecified coat color. As discussed above, this distribution of dogs by coat color is consistent with the coat color distribution of dogs registered during the last 15 years. The health survey data has been analyzed without separation by coat color as P'NSs and Blacks are (sometimes) interbred in the U.S. – i.e. they do not constitute distinct or separate gene pools. Inspection of the incidence of the more common diseases/conditions does not suggest any association of a disease/condition with coat color, an observation consistent with a generally related gene pool between dogs of the two coat colors. The one exception may be median age of death (see details in Section D.2.)

Bitches are over-represented in the survey with 765 bitches (56%) and 626 (44%) dogs enrolled; sex was unspecified for 7 individuals.

B.5. Age distribution and health status of dogs enrolled in survey

The distribution of dogs enrolled by age of enrollment (or death) for all dogs, for dogs alive at enrollment or age at death is presented in Table 4. The average age at enrollment (or age at death, including dogs dying of accidental causes) for all dogs enrolled in the survey was 6.5 years, while the median age at enrollment for these same dogs was 6.9 years (50% of dogs enrolled were over 6.9 years of age). The median age for dogs alive at enrollment is 5.8 years. 30% of the alive-at-enrollment dogs were over 10 years of age.

Table 4. Dogs enrolled in survey segregated by age at enrollment (or age at death).

Age (years)	all dogs # (%)	Not alive at enrollment # non-accidental / # accidental	# alive at enrollment (% of dogs enrolled)
-2.0	143 (10.2)	8 / 3	132 (11.5)
2.1-4.0	238 (17.0)	7 / 2	229 (20.0)
4.1-6.0	249 (17.8)	4 / 3	242 (21.1)
6.1-8.0	161 (11.5)	11 / 1	149 (13.0)
8.1-10.0	172 (12.3)	27 / 2	143 (12.5)
10.1-12.0	177 (12.7)	30 / 0	147 (12.8)
12.1-14.0	137 (9.8)	72 / 1	65 (5.7)
14.1-15.0	58 (4.1)	37 / 0	21 (1.8)
15.1-16.0	35 (2.5)	31 / 0	4 (0.3)
16.1-	15 (1.1)	14 / 0	1 (0.1)
unknown	13 (1.0)	0	13 (1.1)
Total	1398	240 / 12	1146

These data are analyzed further in Section D.1. (Table 9), where health status includes a measure of disease severity.

B.6. Spay/neuter status of dogs enrolled in the survey

Table 5 presents the age of spay/neuter of dogs enrolled in the survey. Spay/neuter status was unknown for 14 dogs/bitches.

Table 5. Age of spay/neutering of dogs/bitches in the survey.

Bitches age (years)	Spayed (number)	% of spayed bitches	Un-spayed [a] (number)
0.5 or younger	50	9.2	6
0.6-1.0	140	26.0	23
1.1-2.0	63	11.7	19
2.1-5.0	103	19.1	96
>5.0	131	24.3	64
age unknown	50	9.3	3
unspayed at death			14
TOTAL	538 (70%)		222 (30%)
Dogs age (years)	Neutered (number)	% of neutered Dogs	Un-neutered [a] (number)
0.5 or younger	74	18.6	1
0.6-1.0	124	31.1	18
1.1-2.0	47	11.8	23
2.1-5.0	39	9.8	51
>5.0	59	14.8	102
age unknown	54	13.6	3
unneutered at death			29
TOTAL	398 (63%)		227 (37%)

[a]The age for unneutered dogs/unsprayed bitches is their age at enrollment in the survey. Note: the age spans are not uniform across age groups

Seventy percent of all bitches enrolled were spayed, while 63 percent of all dogs were neutered. Nine percent of bitches and 19% of dogs were spayed/neutered before six months of age. Another 26% of bitches and 31% of dogs were spayed/neutered in the 6-12 months of age window. In summary, 35% of bitches and 50% of dogs were spayed/neutered before they were 12 months of age. For comparison, 31% of bitches and 38% of dogs were spayed/neutered prior to one year of age in the 2008 survey.

The potential relationship of spay/neuter to the risk of specific diseases or conditions is discussed in Section E.2.

C. Results of Clinical and Diagnostic Tests

Additional details of outcomes from clinical and diagnostic or predictive tests associated with a disease state are discussed further in Section D.

C.1. Orthopedic Foundation for Animals (OFA) Hip Evaluation

OFA tests (radiologic evaluation of hips) were completed for 204 dogs and 322 bitches enrolled in the survey (37% of enrolled dogs) (Table 6). Results of the OFA examine were not specified for 7 dogs, although it was indicated that the examination had been conducted. “OFA” in this report refers specifically to the evaluation of hips.

Table 6. Hip evaluation results reported in 2015 Health Survey						
Rating	**# of Dogs**	**% of screened**	**# of Bitches**	**% of screened**	**Total**	**% of screened**
Excellent	11	5.3	40	12.4	51	9.7
Good	166	81.3	249	77.3	415	78.9
Fair	24	11.8	28	8.7	52	9.9
Poor	2	0.9	4	1.2	6	1.1
Dysplastic	2	0.9	1	0.3	3	0.6
Total	204		322		526	
Not screened	424		441		865	

The OFA hip evaluation data for dogs in breeding programs are included in the above data but are also summarized separately in the section on Reproductive Performance (Section F, Table 10).

Eight dogs (0.5% of dogs enrolled) were reported by the individual completing the survey to have hip dysplasia. Two of these dogs were graded by OFA as "dysplastic" and one as "fair", while the remaining 5 did not report an OFA evaluation grade. Employing OFA criteria, only the 6 dogs graded as poor would be considered as potentially dysplastic at the time of OFA evaluation. It was not clear from the data submitted if the dogs indicated as being dysplastic, but without OFA evaluations were clinically diagnosed, if the dog was assumed to be dysplastic based on a preliminary evaluation of the X-ray or if mobility issues were assumed to be associated with hip dysplasia.

CHIC-OFA maintains a database that reports Breed summaries of results of OFA evaluation data for dogs undergoing hip examination. Films for some 100-110 Standard Schnauzers have been submitted to OFA for evaluation each year for the 1990-2010 timeframe. For the 2011-2015 period, the number of submitted films dropped to about 60 per year. Given that approximately 550 Standard Schnauzers were born and registered each year since about 1990, it can be estimated that approximately 20% of AKC registered Standard Schnauzers are undergoing OFA evaluation for hip dysplasia, except for the most recent 5 year period when only 10% of dogs were evaluated. It should be noted that these OFA data are from films submitted by owners. The data could be biased if owners of dogs with poor hips as observed in an initial review of the X-ray film are less likely to submit films for OFA evaluation than are owners of dogs with good hips. The data reported in the database of OFA reviewed films submitted for Standard Schnauzers is presented in Table 7.

Table 7. Hip evaluation results for Standard Schnauzers in OFA database							
Time Period	**before 1980**	**Before 1990**	**1991-95**	**1996-00**	**2001-05**	**2006-10**	**2011-15**
OFA grade							
Excellent (% of dogs)	7.1	7.0	5.8	11.7	8.7	11.2	11.1
Dysplastic (% of dogs)	22.8	10.5	8.1	7.2	7.9	6.5	5.9
Total dogs	743	1838	616	600	647	596	307

Individual dogs graded Excellent, Good or Fair are graded "normal" in the OFA breed summary database, Poor is graded borderline and dysplastic is graded Mild, Moderate or Severe. The summarized OFA analysis (Table 7) only provides the data above. It would appear that dogs with hip dysplasia might be under-represented in the 2015 Health Survey (only 1% of dogs enrolled in the survey were reported as dysplastic, while approximately 5% of dogs with films evaluated by OFA were noted as dysplastic). On a positive note, it is clear that the incidence of hip dysplasia is relatively low in Standard Schnauzers, being ranked 95-100 among AKC breeds in the OFA database (#1 has highest incidence) in terms of incidence of hip dysplasia. More importantly, the reported incidence of hip dysplasia has declined substantially (from 22.8% prior to 1980 to 5.9% in the last 5 year reporting period) over the last 35 years and has been stable for the last 15 years. Note that the "before 1990" data does include the data in the "before 1980" column. Note that the dogs with data in Table 6 are a subset of the dogs in Table 7, primarily the dogs in the 2006-2015 columns.

Note that the data in Tables 6 and 7 only include data submitted to OFA by Standard Schnauzer owners. Obviously, it is possible that the decline in hip dysplasia since 1980 reflects selective submission of X-ray films for evaluation rather than a real decline. It should be noted that the number of submissions is quite constant over the 30 year time period of 1980-2010 (approximately 100/year). The 50% decline in the number of films evaluated is the 2010-2015 time period is worrisome.

C.2. Eye Evaluation: Eye examinations by Board Certified Ophthalmologists, historically (and commonly) referred to as CERF (Canine Eye Registration Foundation) exams were reported for 191 dogs and 286 bitches. Two bitches and 4 dogs reported Abnormal results. 463 dogs were reported to be "Clear", while 8 did not report results (although indicated an eye exam was completed). As will be noted later, 6 dogs were reported to have a disease/condition of the eye but 4 had normal evaluations. It should be noted that eye evaluations, which are usually conducted beginning at several years of age, do not predict later in life events. A number of dogs had multiple eye exams.

It will be noted in the "Disease Summary" table that a number of older dogs were reported to have cataracts and four dogs were reported with PRA. The results from the "later in life" diagnosis of cataracts, for example, did not alter a previous eye result – all eye evaluation data are reported as provided, with the last result being tabulated in the event of several examinations for any dog.

Additional details of results from eye evaluations for the dogs/bitches in breeding programs are presented in Section F.

It should be noted that the OFA has recently established a database for results of eye examinations conducted by Board Certified Ophthalmologists. This eye examination results database is parallel to the CERF database and should be a source of data in the future.

C.3. Thyroid: Results of clinical tests for thyroid status were reported for 57 dogs and 92 bitches. 15 dogs (25%) and 21 bitches (22%) reported low/hypo or "abnormal" (presumably hypo) results. Dogs with both a normal and a later "low" result were classified as "low".

Hypothyroidism (disease code 1103) was indicated for 35 dogs/bitches. Among these 35 dogs, 25 reported a "low/hypo" thyroid test result, 2 reported only a "normal" thyroid test result and 8 dogs did not have a reported thyroid test result. Presumably, the cases of "hypothyroidism" that were not supported by a clinical test were based upon an assumption that certain visual traits are indicative of and/or associated with hypothyroidism. Approximately 25% of the reported cases of hypothyroidism were in dogs/bitches under 5 years of age, while an additional 25%% of the reported cases of hypothyroidism were in dogs/bitches in the 5 to 7.5 years of age range (Appendix Table 2).

It is not possible from the data provided to differentiate between results from thyroid tests that were conducted for diagnostic reasons in dogs suspected to have low thyroid levels and results that were a component of a routine examination; that is, it is not clear how many of the 149 dogs tested were suspected of being hypothyroid prior to conducting the test. The extent to which the data represent a biased (non-random) sampling of the dogs of the breed is unknown and thus the true incidence of hypothyroidism is unknown.

C.4. Genotyping for risk of Dilated Cardiomyopathy

A molecular (genotyping) based test for risk of Dilated Cardiomyopathy (DCM) became available in the period of the enrollment eligibility window. The uptake of this test has been rapid, with 230 dogs tested and an additional 93 dogs being reported as the offspring of parents testing homozygous normal (and thus, these latter dogs are homozygous normal by decent). The DCM genotype was reported for approximately 20% of all dogs enrolled. The DCM genotype results are in Table 8.

Table 8. DCM genotype

Genotype	# of Dogs	# of Bitches
normal	111	153
heterozygote	28	41
affected	3	4
parents clear	27	56

C.5. Other tests: Only a small number of dogs reported results from other tests, for example- elbows and cardiac. The data sets for these test results are too limited for any meaningful analysis.

D. Cause of Death / Incidence of Disease

D.1. Frequency of disease diagnosis segregated by severity and age at diagnosis

In Table 9, the diseases/conditions are separated by severity and age at diagnosis for dogs alive at the time of enrollment. The classification of the severity of a disease/condition is somewhat (very) arbitrary but generally is as follows: very severe – life threatening in the short term (cancer, heart attack), moderately severe – requires long term treatment / significant decrease in quality of life (progressive retinal atrophy, allergy over extended time), low severity – no significant impact on quality of life (undescended testicle, single incidence of food allergy). The age of onset was included in the assignment of severity, for example, arthritis in a 12-14 year old dog is less severe than a similar condition in a 5 year old dog.

Table 9. Dogs enrolled in survey segregated by age at enrollment and severity of disease (only dogs alive at enrollment).

Age (years)	all dogs	# w/o health problems	# with health problems	Low severity	Moderate severity	Very severe
-2.0	146	131	15 (11%)	12	0	3
2.1-4.0	220	184	36 (16%)	21	9	6
4.1-6.0	242	181	61 (25%)	36	17	8
6.1-8.0	149	96	53 (35%)	30	16	7
8.1-10.0	143	88	55 (38%)	25	14	16
10.1-12.0	145	71	74 (51%)	39	15	20
12.1-14.0	65	33	32 (49%)	9	13	10
14.1-15.0	20	4	16 (80%)	6	6	4
15.1-16.0	4	0	4 (100%)	1	2	1
16.1-	2	0	2 (100%)	0	1	1
Unknown	10	9	1 (10%)	0	1	0
Total	1146	797 (70%)	349 (30%)	179 (16%)	94 (8%)	75 (7%)

As can be observed in Table 9, almost 50% of the "health problems" reported in the survey would be expected to have minimal impact on either life expectancy or quality of life for the affected dog. Also, it is noteworthy that most of the cases of disease classified as "very severe" were generally diagnosed later in life, with 50% of the initial diagnosis for very severe diseases/conditions occurring after 10 years of age.

The median age for enrolled dogs without a health issue is 5.0 years. For dogs with an indicated health issue (not separated by degree of severity), the median age is 8.3 years of age.

Of the 1146 dogs alive at enrollment, 642 were bitches, 498 were dogs and 6 were of unknown gender. Of the 797 dogs alive and without health problems at the time of enrollment, 473 were bitches, 390 were dogs and 4 were of unstated sex. 70% of the dogs enrolled reported no health problems. 9.5% of the dogs (108) over 10 years of age that were alive at the time of enrollment were without any reported health problems. Even our older dogs are generally in good health.

D.2. Age at and Cause of Death

The complete data set on cause of death for 254 dogs (including 12 dying of accidental causes), tabulated by age, is presented in **Appendix Table 1 (Cause of death segregated by age at death).**

In Table 1, it can be seen that registration numbers (litters whelped/puppies registered) have not changed substantially over the last 20 years (~130 litters and 550 puppies registered per year or 4.2 registered puppies per litter). The data on reproductive performance in the 2015 health survey, as well as the 2008 survey (combining estimates from puppies sired per litter and live puppies per litter whelped) indicates an average of 6.5 live-born puppies per litter. Thus, it can be estimated that about 5,500 puppies (of which 3,850 were registered) were born in the 2008-2014 window and, in the absence of a major change in the average lifespan for our dogs, it would be expected that a similar number of dogs (5,500) died during the 2008-2014 time period. Thus, the survey data base for age/cause of death represents only about 4.3% of all deaths expected to have occurred during the survey period.

Excluding the 12 dogs dying of accidental causes or euthanized for an apparent non-life threatening disease related cause, the average age of death for the remaining 240 dogs is 11.8 years. The few dogs dying at a young age skew the distribution and have a large impact on the average age of death.

The median age at death is a more meaningful measure of the lifespan of our population of dogs. The median age of death for the 240 dogs dying of non-accidental causes (50% of dogs are older at time of death) is 13.0 years. The median age for 119 dogs was 13.0 years; the median age for 119 bitches was 13.0 years. 80% of dogs live to be at least 10.0 years of age and only 7% die (non-accidentally) at less than 6.0 years of age.

Although the data set for analysis is small, and the difference may not be significant, the median age of death for the 42 Black dogs was 11.0 years, while it was 13.7 years for the 197 P'NS dogs enrolled in the survey. This difference in age at death does not appear to be attributable to any specific cause of death, but again, given the small data set for Black dogs, it would be very difficult to identify causes, even if the median age of death difference is significant.

Old age was the most common (single) cause of death (52 dogs/21%), with 44 of these dogs being older than 14 years of age at the time of death; 14 dogs (6%) died of unknown (unreported) causes (with 9 over the age of 12 years).

Cancer as a general classification was the cause of death for 95 (40%) dogs, with 17 of the cases involving an unknown or unspecified site. Hemangiosarcoma (12 cases/12% of all cancers) being the most common specific cancers identified as a cause of death. The next most common sites for cancers causing death were lung, liver and brain, all of which are common sites for metastatic disease, as well as primary tumors. Only 10 of 95 cases of cancer caused death were reported in dogs less than 8 years, with 14 additional cases in 8-10 year old dogs. Most cancer caused deaths (50%) occur in older dogs (over 12 years of age).

Stroke (14 cases/6%), heart attack (9 cases/4%) and congestive heart failure (4 cases/2%) contribute significantly to mortality in older dogs (over 14 years of age). Cardiomyopathy was indicated as the cause of death for 6 dogs, 5 who were 1.5-3.1 years of age at death and one dog who was over the age of 12 years. This latter case of indicated cardiomyopathy is likely to be a miss-diagnosis rather than the same disease as observed in young dogs.

Although the cause of death database is small (only 4.5% of eligible dogs), the absence of either bloat or epilepsy as a cause of death is noteworthy. Not unexpectedly, no deaths were reported for four disease categories, dermatology, ophthalmology, female reproduction and male reproduction. These 4 specific disease categories, as well as specific diseases for which no events were reported, are not listed in Appendix Table 1 (but are listed in Appendix Table 2, the disease frequency table, even when no cases were reported).

D.3. Frequency of disease diagnosis segregated by age of diagnosis.

The following analyses include all dogs enrolled in the survey, independent of alive/non-alive status at the time of enrollment. Note that a dog dying of accidental causes could be included in the "no disease" or a specific disease category. Disease issues were reported for 596 of the 1398 dogs enrolled in the survey. Some dogs exhibited more than a single disease/condition; each disease indicated in the submitted data was counted as an independent event. Thus, more than 596 events were noted and included in the analyses.

The complete data set on disease incidence is tabulated by age in **Appendix Table 2 (Incidence of disease/condition segregated by age at diagnosis).**

1. Cancer

The most common disease group was cancer with 180 cases reported. These cases occurred in 165 different dogs as several dogs reported multiple independent tumors. The most common tumor site was the mammary gland, with 25 cases. It should be noted that mammary cancer was indicated as the cause of death for only 6 of the 25 bitches diagnosed with mammary cancer (with 4 being over the age of 12 years). This suggests that the mammary tumors, which account for almost 20% of the tumors identified in bitches under 10 years of age, observed in Standard Schnauzers are not particularly aggressive. These data also emphasizes the importance of early detection. The second/third most common cancers, with 16 cases each, were hemangiosarcoma and (likely squamous cell) tumors of the toe.

It is very noteworthy that almost 80% of the tumors/cancers are being identified in dogs over 10 years of age. This age of diagnosis is as expected for cancers without a strong genetic component/contribution to risk of disease. That is, irrespective of tumor type/site, cancers with a strong genetic contribution to risk are generally characterized by an early age of diagnosis, ***which is not what is observed in our breed***.

2. Cardiovascular

Heart murmurs were detected at some time in the life of 15 dogs, with approximately 40% of the cases being identified in young dogs.

Six cases of dilated cardiomyopathy (DCM) were reported as being diagnosed in dogs at the age of 18-28 months of age. One additional case was indicated as being identified in a dog over 14 years of age; but, it is unlikely that this is an accurate diagnosis. Two of the six reported cases of early onset cardiomyopathy would appear to be dogs from the same litter (assuming dogs with same date of birth and submitted on the same form are littermates). In addition, one dog diagnosed with DCM appears to be a littermate to a dog reported to have been diagnosed with sudden cardiac arrest. An additional 5 cases of sudden cardiac arrest were reported, with 4 being diagnosed in dogs in the 0.2-3.1 years of age interval. The etiology of sudden cardiac arrest is unknown, as is any possible relationship to DCM. None of the dogs identified as exhibiting sudden cardiac arrest reported a genotype for risk of DCM.

Twelve cases of stroke were reported, all in dogs over 12 years of age. Seven cases of heart attack were reported, with only one case in a dog less than 10 years of age. Congestive heart failure was reported for 6 dogs, 5 being over 12 years of age at diagnosis. Thus, except for DCM and sudden cardiac arrest, most cardiovascular events are occurring in our older dogs.

3. Dermatology

Dermatology issues were reported in a number of dogs, with 47 dogs reporting sebaceous cysts. The 33 reported cases of allergy were a diverse collection, with the most common being indicated as a food allergy. Although specific questions regarding the potential causes of allergies were not asked, the comments added by the submitter suggest that the causes of both food and seasonal allergic reactions are very varied.

4. Orthopedic

Arthritis was reported in 43 dogs, with most cases observed in dogs over 12 years of age. Eight cases of hip dysplasia were noted. Twenty eight cases of ruptured anterior cruciate ligaments (torn ACL) were reported, predominately in middle-age dogs, with a couple of dogs reporting multiple events. It is not possible, with available data, as the questions were not asked, to associate ACL issues with participation in performance events, level of exercise, strenuous activity, etc.

5. Gastroenterology

Chronic gastric conditions were most often seen in young dogs (less than 2 years), with irritable bowel syndrome being the most commonly reported condition. No specific cause or reaction to a specific food was apparent in most cases and none of these were noted to be life threatening. It was generally observed in younger dogs. It is noteworthy that no cases of bloat were reported.

6. Hematology

Five cases of autoimmune hemolytic anemia were reported, with age of diagnosis being over 10 years for three of the cases. Two cases of unspecified platelet dysfunction in 10-12 year old dogs were reported.

7. Nephrology

A range of kidney/urinary tract diseases were reported, with the most common being bladder/kidney stones (8 cases). There was no evidence of any clustering of disease or age at diagnosis.

8. Neurology/neuromuscular

Five cases of epilepsy were reported, with 3 of the cases being diagnosed in dogs in the 4-6 year age range. The other two cases were diagnosed in older dogs – one being 10-12 years of age and one over 14 years of age. These latter two cases are well beyond the normal age of diagnosis for any of the subtypes of epilepsy and are more likely to be a seizure as a consequence of another condition, e.g. brain tumor. Seizures (non-specific) were reported in 8 dogs, with only 2 cases diagnosed in dogs under 6 years of age and 2 occurring in dogs over 14 years of age. Degenerative myelopathy and vestibular disorder were each reported in three dogs, all other 10 years of age.

9. Ophthalmology

Cataracts were noted in 26 dogs, with all but 5 of these cases being diagnosed in dogs over 8 years of age. Four cases of progressive retinal atrophy (PRA) were reported (two in dogs 4-6 years of age and two in dogs 8-10 years of age). One case of retinal dysplasia and one case of retinal disease were each reported.

Five cases of conjunctival dermoid were report, 4 in dogs less than 2 years of age and one in a 2-4 year old dog. Dermoid cysts include a range of different conditions; the submitted data are

insufficient to ascertain if these 5 cases are similar in characteristics or are a collection of different conditions. No evidence was provided that these dogs were negatively impacted by the condition(s).

10. Endocrinology

Only one cases of diabetes mellitus (insulin dependent) (age of diagnosis - 9 years) and 3 cases of diabetes insipidus (age of diagnosis being 3 and over 14 years, with the age of 3rd case being unspecified) were reported. ***This is very much in conflict with a report*** *(where it is possible that Miniature Schnauzers (which are known to have a high incidence of endocrine diseases) and Standard Schnauzers were not always correctly identified)* ***suggesting Standard Schnauzers have a high incidence of diabetes.***

About 2.5% of dogs were reported to be hypothyroid. The cases are generally uniformly distributed within age groups, beginning at 5 years of age. Also, no significant gender difference in incidence was observed with 21 of 92 tested bitches and 15 of 59 tested dogs being indicated as hypo-thyroid. As previously described in Section C.3., only about one third of these cases were confirmed by a laboratory test. Note that about 10% of dogs clinically tested were reported as hypo-thyroid, but is not possible from the available data to differentiate between results that were for diagnostic reasons (suspected hypothyroidism and thus a non-random sampling) and the results that were a component of a routine examination. Thus, it is difficult to evaluate the real incidence of this condition in the breed.

Addison's disease was reported for 8 dogs, clustering in dogs less than 4 years of age. Cushing's disease was diagnosed in 6 dogs, all over 8 years of age. As the results of a laboratory test for adrenal function was not included in the survey, it can only be assumed that these diagnoses are based on clinical tests and thus confirmed.

11. Female reproduction

Although only three bitches are indicated as "infertile" on the health status data form submitted, it is noted in the data regarding Reproductive Performance that 5 bitches were bred at least twice but did not whelp a litter. Two additional bitches were indicated as being bred once but did not whelp a litter. Infertility does not appear to be a major issue in the breed. No female reproduction or gynecological issue affected more than a couple of dogs.

12. Male reproduction

Cryptorchidism was identified in 27 dogs (monochidism in 15 dogs; bilateral in 12 dogs). Five dogs were reported as not producing sperm. In the Reproductive Performance data, one dog was used in 3 breedings and 2 dogs were used in single breeding without producing litters. Only one of these latter three dogs was indicated as being sterile.

13. Temperament

Two dogs (both male) were noted as aggressive to people, 4 bitches and one dog were noted to be aggressive to other dogs. An additional 5 dogs and 4 bitches were judged to be overly protective of the owner. Eleven bitches and 5 dogs were indicated to be fearful while 6 bitches were stated to exhibit shyness.

14. Nonmalignant cysts

One hundred and eight cases of nonmalignant cysts were reported, most commonly in middle-aged dogs. The most common (67 cases or 62%) were classed as lipomas. It would appear that these cysts are more of a nuisance than a serious or life threatening medical condition.

Although these cysts were generally not well described, it was obvious that some were a chronic problem requiring repeated treatment, while they were apparently more isolated cases/single events in other dogs.

15. Infectious Disease

Infectious diseases, and especially tick-borne infections, have become an increasing health concern over the last decade. Many of these are emerging diseases and/or regionally localized diseases, thus, the incidence is dependent upon the geographical distribution of the specific tick or organism. Lyme disease was the most common infectious disease, seen in 13 dogs. No cases of Chagas Disease (Tryp. Cruzi infection), which is increasingly an issue in the South central U.S. or Brucellosis, which is being increasingly identified in several sections of the country in translocated shelter dogs, were reported.

CONCLUSION: ***Overall, the "typical" Standard Schnauzer has a long life span, and is generally healthy, even as an older dog.***

E. Relation of Spay/Neuter Status to disease/condition

E.1. Orthopedic conditions and potential relation to age of spay/neuter.

The potential that age of spay/neuter is associated with increased risk of ACL injury was addressed in the analysis of the data collected in this survey, as it was in the 2008 survey. Twenty eight cases (17 bitches; 11 dogs) of ruptured anterior cruciate ligaments (torn ACLs) were reported. At least 2 of these animals reported multiple occurrences. Ages of occurrence were: less than 2 year (1 dog); 2-4 years (4 dogs) 4-6 years (8 dogs); 6-8 years (2 dogs); 8-10 years (5 dogs); with 2 dogs over 10 years of age and 6 of age unknown. Five of the affected dogs were spayed/neutered at less than 6 months of age, with another 5 dogs spayed/neutered before reaching one year of age. Seven of the affected dogs were not spayed/neutered at the time of the injury.

Although more cases of ACL injury were reported in this survey than in the 2008 survey, the high correlation between early spay/neuter and risk of ACL injury (8 of 9 cases ACL injury were in dog spayed/neutered at less than 6 months of age in the 2008 survey) was not observed in the 2015 data set. The possible reasons for the difference in conclusions between the two data sets could be many. Among the reasons **could** be: (1) the larger 2015 data set is more representative of the population of affected dogs; (2) the injury occurred in more older dogs enrolled in the 2015 survey; (3) owners are changing exercise/training practices; etc.

Thirteen of the 28 dogs reporting ACL injury also reported results from an OFA hip evaluation. Among these 13 dogs, 9 were graded as Good and 2 graded as Excellent, while another 2 graded as fair. Thus, in this very small data set, OFA hip evaluation grade is not predictive of ACL injury risk.

The data collected in the survey do not provide any information regarding other potential risk

factors for ACL damage- for example, were these dogs participating in performance events or strenuous exercise/activity associated with potential stress to the muscle/ligaments of the dogs when the incident occurred.

Eight dogs in the survey were reported with hip dysplasia. Early spay/neuter does not appear to be associated with risk of hip dysplasia in this small data set.

E.2. Potential relationship of (early) spaying to the risk of mammary cancer.

Questions have arisen regarding a potential relationship of (early) spaying to the decreased risk of mammary cancer. Twenty five cases of mammary cancer were reported in 762 bitches enrolled. Two of the bitches with mammary cancer were spayed at less than one year of age, 4 were not spayed at the time of enrollment, while the remaining 19 were spayed at age 6 years or older. Coincidence of age of cancer diagnosis and age of spaying was commonly observed, suggesting that spaying was a component of the treatment regime. Eighteen of the 25 bitches (72%) diagnosed with mammary cancer whelped litters.

F. Reproductive Performance

F.1 Reproduction performance and characteristics of "breeding stock"

Data were provided for 236 bitches that were bred; 462 breedings resulted in the whelping of 423 litters and 2668 live-born puppies. 179 of these bitches were P'NS, and whelped 320 litters and 1941 puppies. 56 bitches were Black and whelped 103 litters and 711 puppies. 5 bitches were bred multiple times but did not whelp a litter, while 3 bitches were bred once and did not conceive. Birth defects, most appearing to be incompatible with normal survival, were reported for 129 puppies in approximately 75 litters. The average litter size was 6.3 puppies without reported birth defects. 119 bitches whelped only 1 litter, 65 whelped 2 litters, 27 whelped 3 litters, 20 whelped 4 litters and 4 bitches whelped 5-6 litters.

Data were provided for 118 dogs that were used for breeding (368 matings); they sired 346 litters and 2485 puppies. 90 of the dogs were P'NS, used in 279 breedings, resulting in 261 litters and 1722 puppies. 28 of the dogs were Black, employed in 109 breedings resulting in 107 litters and 765 puppies. Three dogs reportedly used for breeding (each multiple times) did not sire a litter. Although male infertility does not appear to be a major issue in the breed, this very low number could be influenced by fertility testing prior to utilization as a stud or simply underreporting. The average litter size sired was 6.7 "normal" puppies per litter. Only 20 puppies with birth defects were reported to have been sired. If the number of birth defects reported for bitches (76 puppies after adjustment for the number of litters sired) is employed (as it is probably a more accurate estimate), the number of normal puppies per litter sired is reduced to 6.5 per litter, consistent with the size of litters whelped. 43 dogs sired only a single litter, 36 dogs sired 2-3 litters, 14 dogs sired 4-5 litters, and 22 dogs sired 6 or more litters (45% of litters reported).

It should be noted that not all of the litters in the health survey were necessarily whelped during the 2008-2014 time frame, only that the dog or bitch was alive during that period. Inspection of the age of dogs/bitches in this data suggests that probably 10% of the litters were likely to have been whelped prior to 2008. This does not impact the data collected, but does impact the estimate of the percent of litters for which data were collected.

AKC records indicate that 1150 litters were registered in the 2007-2015 period. Thus, data were reported in the health survey for an estimated 30-40% of the litters born during the period. During this period, registration data indicates an average of 4.2 AKC registered puppies per litter. The difference between AKC registration data and the Survey litter size data suggests

that about 2 puppies per litter (or 35% of puppies in a litter) are not being registered. This rate of conversion of litter registrations to individual registrations of about 65% for Standard Schnauzers is about 20 percentage points above the average registration rate for all breeds.

The OFA grade was provided for most of the dogs and bitches included in breeding programs (Table 10). Note that litter size was not reported for several dogs and bitches, although OFA data were provided, thus the differences in numbers.

Obviously, the "not tested" group could include some dogs that were evaluated with a preliminary review but with films not submitted to OFA for formal evaluation. In either case, it is clear from the sample of individuals participating in the survey, most breeders are complying with the Standard Schnauzer Club of America code of ethics with regard to having dogs/bitches hips evaluated prior to breeding. This is especially encouraging, as the litters in Table 10 account for a substantial fraction of the litters whelped.

Table 10: Hip evaluation results for 233 bitches and 113 dogs in breeding programs

Rating	# of bitches	# of litters	# of dogs	# of liters
Excellent	26	46	4	22
Good	170	316	85	260
Fair	20	34	16	45
Poor	1	3	0	0
Not tested	16	25	7	19

Ophthalmologist Eye Exam Data: 190 bitches whelping litters were reported as "clear" following the ophthalmology examination ("CERFed"), while 61 bitches whelping 71 litters and 438 puppies were apparently not evaluated. 95 dogs siring 348 litters were reported to be "clear" when evaluated, while 21 dogs siring 51 litters and 348 puppies were apparently not evaluated by a certified ophthalmologist.

DCM genotyping: It should be noted that the molecular based test for risk of DCM only became available during the enrollment eligibility window. Thus, the test was not available for many of the dogs siring/whelping litters enrolled in this health survey. Among the 233 bitches reported as whelping litters, 96 tested as clear, while 23 tested as heterozygous and 2 were offspring of parents testing as clear. For 113 dogs siring litters, 56 were genotyped as clear while 13 were tested as heterozygous.

Foreign born dogs/bitches in breeding stock.

Although foreign born dogs were not included in the health/disease component of the health survey, they were included in the Reproductive Performance component of the survey. They will be contributing to the gene pool of our breed and these offspring will be included in the next SSCA health survey.

Data were submitted for 8 foreign-born bitches (6 P'NS, 2 BL) who whelped litters. They all were scored as Good for hips by OFA and clear following an ophthalmological examination. They whelped 14 litters and 94 live-born puppies. Six were "clear" for DCM genotype, while 2 were not genotyped.

Data were submitted for 5 foreign born dogs (1 P'NS, 4 BL) who sired 20 litters and 161 puppies They were all evaluated for hip dysplasia, with 2 being scored as Excellent and 3 scored as Good by OFA. They were all clear following an ophthalmological examination. All of these dogs were "clear" for DCM genotype.

G. Comparison of results from data collected in 2008 and 2015 health surveys.

The SSCA conducted two health surveys prior to the 2008 health survey. The health survey of 1998, which enrolled dogs alive during the period of 1/1/92- 12/31/96, obtained information on 574 dogs (450 alive at time of reporting). The health survey of 2004, which enrolled dogs alive between 1/1/97 and 12/31/2003 (7 year period), obtained data on 120 dogs. These surveys employed quite different survey instruments than the 2008 and 2015 health surveys. These survey instrument differences not withstanding, the 1998 and 2004 surveys did not identify a high incidence of any disease within the breed and the conclusions of these surveys (where comparible) are generally similar to the results of the 2008 and 2015 surveys.

As the 2008 and 2015 health surveys utilized very similar survey instruments and had similar levels of enrollment, it is possible to compare the data for possible trends in disease incidence in our breed over the last 15 years. ***When reviewing the data suggesting possible trends, it is critical to remember that, on the scale of population based epidemiology studies, these are small data sets. Thus, any and all conclusions are assuming that the 10-14% of eligible dogs enrolled are representative of the other 85-90% of dogs that were eligible but not enrolled in either the 2008 or 2015 health survey.***

The health survey of 2008 collected data on 1455 dogs, 14% of an estimated 11,000 dogs who were alive at any time during the period of January 1, 2002 through December 31, 2007, and thus eligible to be enrolled. The health survey of 2015 collected data on 1398 or approximately 11% of the 13,000 enrollment eligible dogs. (Note the difference in potential enrollment reflects that the 2015 survey had a 7 year enrollment eligibility window while the window for the 2008 survey was only 6 years.) The estimated number of individuals submitting data in 2015 was 10% less than the number of individuals submitting data in 2008.

Appendix Table 3 includes data on the causes of death, comparing the results from the 2008 and 2015 surveys. Appendix Table 4 includes data on the total incidence of diseases, comparing the data from the 2008 and 2015 surveys. In these tables, an incidence of (x) indicates a question not included in that survey, while a (0) indicates a question asked, but with no cases reported.

It is critical to understand that the differences between the incidence data for any disease/condition in the two surveys is based on very small numbers. These observed (potential) differences could be real or they may simply reflect the non-representative sampling of dogs eligible to be enrolled in one or both of the surveys.

The potentially significant differences (as well as differences in the survey instruments) include:

The increase in the number of cancer cases seen in the 2015 survey relative to the 2008 data reflects increases in the incidence of cases of hemangiosarcoma and mast cell, lung and toe tumors.

The decreased incidence of dilated cardiomyopathy in 2015 relative to the 2008 survey may reflect the addition of the "sudden cardiac arrest" as a specific condition (a disease category not asked in 2008). The etiology of "sudden cardiac arrest" is currently unknown as is any potential relationship to DCM.

Note “allergies” was a single entry in the 2008 survey, while they were segregated in to 3 allergy subtypes in the 2015 survey.

The increased incidence of cruciate ACL injury in the 2015 survey is noteworthy. The survey does not provide the information necessary to identify any risk factors for the condition/injury.

In contrast to the 2008 survey where eight cases of persistent hyaloid artery were reported, all diagnosed in dogs undergoing CERF evaluation at less than a year of age; no such cases were reported in the 2015 survey.

The reverse is observed for conjunctival dermoid growths, where 5 cases were reported in the 2015 survey, while no cases were reported in 2008.

The number of stillborn puppies in the 2015 survey was less than reported in 2008. The 2008 survey data included two large litters of stillborn puppies. No such complete litters of stillborn puppies were reported in the 2015 survey, thus explaining part of any potential difference.

With the exception of a possible increased number of deaths due to lung or brain cancer in the 2015 survey, it would not seem that any differences are likely to exist between the 2 surveys with regard to the cause of death.

H. The Standard Schnauzer Health Survey: The Future

As the analysis of the 2015 health survey data approaches closure, it is important to consider **“what next”.** The collection and analysis of survey data is only the beginning. The important goal of a health survey is to provide guidance for research that could lead to reductions in the incidence of the more common conditions/diseases identified in the breed.

It is very clear from both the 2008 and 2015 health surveys that the major causes of death in our breed are old age and old age related diseases. The vast majority of our dogs are healthy during most of their life. Thus, research directed toward these more common causes of disease/death is unlikely to positively impact the overall health and life expectancy of our breed.

Thus, we are now challenged to use this collected data most productively to develop a better understanding of the less frequent / low incidence diseases in our breed. It is especially important to focus on diseases that affect our younger dogs and diseases that may include a significant genetic contribution to risk. Our goal must be to insure that the incidence of these less common diseases do not increase in our breed.

Maintaining the health of our breed is a mission for all the folks owned by Standard Schnauzers. The good work needs to continue!

Appendix Table 1. Cause of death segregated by age at death

Deaths (Cause/age-yrs)	0-1.9	2.0-3.9	4.0-5.9	6.0-7.9	8.0 - 9.9	10.0-11.9	12.0-13.9	14.0-15.9	16.0-	Total
Cancer										
Hemangiosarcoma (blood)					3	5	1	3		12
Lymphosarcoma		1		1	1	1	1	1		6
mast cell tumors (skin)				1		1		1		3
Melanoma							3			3
Osteosarcoma (bone)					2	1		2		5
Squamous cell tumors (skin)						1				1
Mammary					1	1	2	2		6
ovarian										0
Testicular										0
Stomach						2				2
Kidney							1			1
Liver					2	3	3	1		9
Leukemia										0
Bladder							2	3		5
Brain				2	2	1	3			8
Thyroid								1		1
Lung			1	1	3	2	4			11
Toe							1			1
Nasal						1	3			4
other										0
unknown site				3		6	4	3	1	17
Total cancer	0	1	1	8	14	25	28	17	1	95
Cardiovascular										
Cardiomyopathy	1	4					1			6
Sudden Cardiac arrest	2	3		1						6
Congestive Heart Failure							2	2		4
Stroke							3	9	2	14
Heart failure/heart attack					1	1	2	3	2	9
other					1	1		1		3
Orthopedic										
spine/back injury						1	1			2
other										0
Gastroenterology (GI)										
Bloat										0
Diarrhea - chronic						1				1
other							1			1
Hematology (blood)										
Platelet disfunction							1			1
Autoimmune anemia					1	3				4
other							1			1

Appendix Table 1. Cause of death segregated by age at death (cont)										
Deaths (Cause/age-yrs)	**0-1.9**	**2.0-3.9**	**4.0-5.9**	**6.0-7.9**	**8.0 - 9.9**	**10.0-11.9**	**12.0-13.9**	**14.0-15.9**	**16.0-**	**Total**
Nephrology (kidney/urinary)										
Bladder disease							1			1
Bladder/kidney stones		1								1
Urinary tract disorder						1				1
other					1		1	2		4
Neurology / Muscular										
Epilepsy										0
Seizures				1	1			1		3
muscle weakness								2		2
nerve degeneration								1		1
degenerative myelopathy						1	2			3
Vestibular disorder							1	1		2
other				1				1		2
Endocrinology										
Pancreatic insuffiency					1					1
Addison's disease										0
Cushing's disease									1	1
other										0
Temperament										
Unstable	1									1
Nonmalignant cysts										
Lipomas								1		1
Infectious disease										
other	1							1		2
Old age							8	33	11	52
Unknown/other	1			1	2	1	3	6		14
TOTAL										242
Accidental	3	1	2	2	2	1	1			12
TOTAL										254

Appendix Table 2. Disease/condition segregated by age at diagnosis

"unkn" means that age of diagnosis is unknown

disease / age (years)	0-1.9	2.0-3.9	4.0-5.9	6.0-7.9	8.0-9.9	10.0-11.9	12.0 - 13.9	14.0-	unkn	total
Cancer										
Hemangiosarcoma (blood)					3	6	1	4	2	16
Lymphosarcoma		1		1	1	1	1	1		6
Mast cell tumors (skin)	1	1	1	1	4	5		1		14
Melanoma						2	3			5
Osteosarcoma (bone)			1		5	2	1	1		10
Squamous cell tumors -skin			2		3	4		1		10
Mammary			2	8	4	6	2	1	2	25
Ovarian (none)										0
Testicular (none)										0
Stomach						2				2
Kidney			1							1
Liver					2	3	2	2		9
Leukemia (none)										0
Bladder						1	2	2		5
Brain				2	3	1	2			8
Thyroid			1				1			2
lung			2	2	4	1	5			14
toe		1	1	2	4	2	4	1	1	16
nasal						1	3			4
other										0
cancer unknown	1		2	4	3	12	4	6	1	33
total cancer	*2*	3	13	20	36	49	31	20	6	180
Cardiovascular										
Cardiomyopathy	2	4						1		7
Sudden Cardic Arrest	2	3		1						6
Restrictive Cardiomyopathy	none									0
Heart murmur	2	1	3		5	1	2		1	15
Valve dysfunct-structual	1	2								3
Congestive Heart Failure						1	3	2		6
Stroke							3	9		12
Heart attack/failure					1	1	2	3		7
other				1		1				2

Appendix Table 2. Disease/condition segregated by age at diagnosis (cont)										
disease / age (years)	**-1.9**	**2.0-3.9**	**4.0-5.9**	**6.0-7.9**	**8.0-9.9**	**10.0-11.9**	**12.0 - 13.9**	**14.0-**	**unkn**	**total**
Dermatology										
Allergies	3	1	2	1	1				1	9
Pigment abnormalities			1							1
Allergies (seasonal)	1	5		1					1	8
Allergies (food)	6	6		1						13
Allergies (common)			3							3
Seborrhea (extreme dandruff)										0
Sebaceous cysts	1	8	14	9	6	7	1		1	47
Mange		2							1	3
other	2	3	1	1	1				1	9
Orthopedic										
Arthritis			3		6	8	21	4	1	43
Hip dysplasia	1	1	1	1	1	2	1			8
Elbow dysplasia	1									1
cruciate ACL	1	4	8	2	5	1	1		6	28
spine/back injury										0
other							1			1
Gastroenterology (GI)										
Irritable bowel syndrome	9	1	2			1				13
Chronic colitis						1				1
Gastritis - chronic	1	1	1			1				4
Vomiting - chronic	2			2		1				5
Diarrhea - chronic	1			1	1					3
other	1		5	1			1		1	9
Hematology (blood)										
Platelet dysfunction						2				2
autoimmune anemia			1		1	1	2			5
other							1		1	2
Nephrology (kidney/urinary)										
Bladder disease					1		1	1		3
Bladder/Kidney stones		2		3		1			2	8
Familial renal disease									1	1
Urinary tract disorder				1		1			1	3
Cystitis (bladder inflammation)	1	1		1	1					4
other		1		1		1	1	3		7

Appendix Table 2. Disease/condition segregated by age at diagnosis (cont)										
disease / age (years)	**-1.9**	**2.0-3.9**	**4.0-5.9**	**6.0-7.9**	**8.0-9.9**	**10.0-11.9**	**12.0 - 13.9**	**14.0-**	**unkn**	**total**
Neurology / Muscular										
Epilepsy			3			1		1		5
Seizures (non-specific)	1	1		1	1	1		2	1	8
Trembling/tremors	1	1	2	4	1	1		3	2	15
Muscle weakness						1		1		2
Nerve degeneration								1		1
Degenerative myelopathy						2	1			3
Vestibular disorder							2	1		3
other	1			1			2	3		7
Ophthalmology										
Cataracts		1	1	3	5	9	6		1	26
Progressive retinal atrophy			2		2					4
Retinal dysplasia		1								1
Retinal disease						1				1
Persistent hyaloid artery										0
Corneonjunctival dermoid	4	1								5
other	2	2	2	1		3	1		2	13
Endocrinology										
Diabetes mellitus (insul depend)					1					1
Diabetes insipidus		1						1	1	3
Hypothyroidism	1	3	7	8	5	4	5	2	2	39
Thyroiditis (inflammation)										0
Pancreatic insufficiency										0
Addison's disease	2	4	1				1			8
Cushing's disease					2	1	1	1	1	6
other										
Female reproduction										
Anestrus										0
Pyrometria				1	1					2
Vaginitis (inflammation)	1				1				2	4
Abnormal estrus cycle	1	4								5
Primary uterine inertia			1						1	2
Infertile		2		1						3
other	1			1						2

Appendix Table 2. Disease/condition segregated by age at diagnosis (cont)										
disease / age (years)	**-1.9**	**2.0-3.9**	**4.0-5.9**	**6.0-7.9**	**8.0-9.9**	**10.0-11.9**	**12.0 - 13.9**	**14.0-**	**unkn**	**total**
Male reproduction										
Cryptorchidism	12									12
Monochidism	15									15
Testicular atrophy	1				1					2
Lack of semen/sperm	2	1				2				5
Prostatitis (inflammation)			1	1			1			3
Prostatic hypertrophy			1	1	1					3
other	4								1	5
Temperament										
Aggressive (to people)	2									2
Aggressive (to dogs)	2	1							2	5
Overly protective	3	2	1						3	9
Fearful	11	1	1						3	16
Shyness	4	1							1	6
Unstable	1									1
other	4								1	5
Nonmalignant cysts										
Hemangiomia				1						1
Histiocytoma	2			1		4				7
Mammary adenomas				2	5	5			2	14
other		1	5	4	2	2			5	19
Infectious Disease										
Brucellosis										0
Leptospirosis										0
Lyme Disease	2	5		1	1	2			2	13
Coronavirus										0
Canine Parovirus		1				1				2
Parainfluenza		1		1		1				3
Tryp. cruzi (Chagas disease)										0
Other	1				1	2				4
Birth defects in puppies										
Cleft palate	8									
Failure to walk (swimmers)	2									
Incomplete abdomin closure	3									
Hydrocephalus	0									
Failure to thrive	8									
Stillborn	33									
Other	4									

Appendix Table 3. Cause of death - 2015 vs 2008

Cause of death - 2015		Cause of death - 2008	
Cancer		**Cancer**	
Hemangiosarcoma (blood)	12	Hemangiosarcoma (blood)	8
Lymphosarcoma	6	Lymphosarcoma	4
mast cell tumors (skin)	3	mast cell tumors (skin)	0
Melanoma	3	Melanoma	1
Osteosarcoma (bone)	5	Osteosarcoma (bone)	8
Squamous cell tumors (skin)	1	Squamous cell tumors (skin)	1
Mammary	6	Mammary	5
ovarian	0	ovarian	0
Testicular	0	Testicular	2
Stomach	2	Stomach	5
Kidney	1	Kidney	1
Liver	9	Liver	10
Leukemia	0	Leukemia	2
Bladder	5	Bladder	4
Brain	8	Brain	2
Thyroid	1	Thyroid	1
Lung	11	Lung	4
Toe	1	Toe	0
Nasal	4	Nasal	2
other	0	other	9
unknown site	17	unknown site	16
Total cancer	95	***Total cancer***	*85*
Cardiovascular		**Cardiovascular**	
Cardiomyopathy	6	Cardiomyopathy	10
Sudden Cardiac arrest	6	Sudden Cardiac arrest	x
Congestive Heart Failure	4	Congestive Heart Failure	x
Stroke	14	Stroke	16
Heart failure/heart attack	9	Heart failure/heart attack	11
other	3	other	0
Orthopedic		**Orthopedic**	
Spine/back injury	2	Spine/back injury	x
other	0	other	2
Gastroenterology (GI)		**Gastroenterology (GI)**	
Bloat	0	Bloat	3
Diarrhea - chronic	1	Diarrhea - chronic	
other	1	other	2
Hematology (blood)		**Hematology (blood)**	
Platelet disfunction	1	Platelet disfunction	0
von Willebrand's disease	x	von Willebrand's disease	1
Autoimmune anemia	4	Autoimmune anemia	3
other	1	other	0

Appendix Table 3. Cause of death - 2015 vs 2008 (cont)

Nephrology (kidney/urinary)		**Nephrology (kidney/urinary)**	
Bladder disease	1	Bladder disease	0
Bladder/kidney stones	1	Bladder/kidney stones	0
Urinary tract disorder	1	Urinary tract disorder	0
other	4	other	2
Neurology / Muscular		**Neurology / Muscular**	
Epilepsy	0	Epilepsy	1
Seizures	3	Seizures	1
Muscle weakness	2	Muscle weakness	
Nerve degeneration	1	Nerve degeneration	x
Degenerative myelopathy	3	Degenerative myelopathy	x
Vestibular disorder	2	Vestibular disorder	x
other	2	other	1
Endocrinology		**Endocrinology**	
Pancreatic insuffiency	1	Pancreatic insuffiency	
Addison's disease	0	Addison's disease	1
Cushing's disease	1	Cushing's disease	1
other	0	other	2
Temperament		**Temperament**	
Aggressive	0	Aggressive	1
Unstable	1	Unstable	1
Nonmalignant cysts		**Nonmalignant cysts**	
Lipomas	1	Lipomas	0
Infectious disease		**Infectious disease**	
other	2	other	x
Old age	52	**Old Age**	48
Unknown/other	14	**Unknown/other**	29/5
TOTAL	240	**TOTAL**	238
Accidental	12	**Accidental**	11
TOTAL	252	**TOTAL**	249

Appendix Table 4. Disease/condition - 2015 vs 2008			
number of cases 2015		**number of cases 2008**	
Cancer		**Cancer**	
Hemangiosarcoma (blood)	16	Hemangiosarcoma (blood)	7
Lymphosarcoma	6	Lymphosarcoma	6
Mast cell tumors (skin)	14	Mast cell tumors (skin)	5
Melanoma	5	Melanoma	4
Osteosarcoma (bone)	10	Osteosarcoma (bone)	9
Squamous cell tumors (skin)	10	Squamous cell tumors (skin)	9
Mammary	25	Mammary	25
Ovarian	0	Ovarian	0
Testicular	0	Testicular	5
Stomach	2	Stomach	8
Kidney	1	Kidney	1
Liver	9	Liver	10
Leukemia	0	Leukemia	3
Bladder	5	Bladder	5
Brain	8	Brain	3
Thyroid	2	Thyroid	1
Lung	14	Lung	6
Toe	16	Toe	5
Nasal	4	Nasal	3
other	0	other	11
cancer unknown	33	cancer unknown	16
total cancer	***180***	***total cancer***	***142***
Cardiovascular		**Cardiovascular**	
Cardiomyopathy	7	Cardiomyopathy	15
Sudden Cardic Arrest	6	Sudden Cardiac Arrest	x
Restrictive Cardiomyopathy	0	Restrictive Cardiomyopathy	x
Heart murmur	15	Heart murmur	29
Valve dysfunct-structual	3	Valve dysfunction	4
Patent ductus arterious	x	Patent ductus arterious	1
Pulmonary valve stenosis	x	Pulmonary valve stenosis	0
Congestive Heart Failure	6	Congestive Heart Failure	x
Ventricular septal defects	x	Ventricular septal defects	0
Stroke	12	Stroke	9
Heart attack/failure	7	Heart attack/failure	5
other	2	other	3
Dermatology		**Dermatology**	
Allergies	9	Allergies	19
Allergies (seasonal)	8	Allergies (seasonal)	8
Allergies (food)	13	Allergies (food)	13
Allergies (common)	3	Allergies (common)	3
Sebaceous adenitis	x	Sebaceous adenitis	1
Pigment abnormalities	1	Pigment abnormalities	3
Seborrhea (extrem dandruff)	0	Seborrhea (extrem dandruff)	1
Sebaceous cysts	47	Sebaceous cysts	39
Mange	3	Mange	3
other	9	other	19

Appendix Table 4. Disease/condition - 2015 vs 2008 (cont)			
Orthopedic		**Orthopedic**	
Arthritis	43	Arthritis	65
Hip dysplasia	8	Hip dysplasia	16
Elbow dysplasia	1	Elbow dysplasia	2
Cruciate ACL	28	Cruciate ACL	9
Spine/back injury	0	Spine/back injury	x
other	1	other	7
Gastroenterology (GI)		**Gastroenterology (GI)**	
Bloat	**0**	Bloat	5
Irritable bowel syndrome	13	Irritable bowel syndrome	6
Chronic colitis	1	Chronic colitis	4
Gastritis - chronic	4	Gastritis - chronic	3
Vomiting - chronic	5	Vomiting - chronic	2
Diarrhea - chronic	3	Diarrhea - chronic	2
other	9	other	9
Hematology (blood)		**Hematology (blood)**	
Hemophilia A	x	Hemophilia A	0
Hemophilia B	x	Hemophilia B	0
Inherited hemolytic anemias	x	Inherited hemolytic anemias	1
autoimmune anemia	5	autoimmune anemia	x
Platelet dysfunction	2	Platelet dysfunction	1
von Willebrand's disease	x	von Willebrand's disease	1
other	2	other	6
Nephrology (kidney/urinary)		**Nephrology (kidney/urinary)**	
Bladder disease	3	Bladder disease	1
Bladder/Kidney stones	8	Bladder/Kidney stones	3
Familial renal disease	1	Familial renal disease	2
Urinary tract disorder	3	Urinary tract disorder	4
Cystitis (bladder inflammation)	4	Cystitis (bladder inflammation)	1
other	7	other	10
Neurology / Muscular		**Neurology / Muscular**	
Epilepsy	5	Epilepsy	4
Seizures (non-specific)	8	Seizures	3
Trembling/tremors	15	Trembling/tremors	7
Muscle weakness	2	Muscle weakness	4
Nerve degeneration	1	Nerve degeneration	3
Degenerative myelopathy	3	Degenerative myelopathy	x
Vestibular disorder	3	Vestibular disorder	x
other	7	other	5

Appendix Table 4. Disease/condition - 2015 vs 2008 (cont)			
Ophthalmology		**Ophthalmology**	
Cataracts	26	Cataracts	29
Progressive retinal atrophy	4	Progressive retinal atrophy	2
Retinal dysplasia	1	Retinal dysplasia	3
Retinal disease	1	Retinal disease	1
Persistent hyaloid artery	0	Persistent hyaloid artery	8
Conjunctival dermoid	5	Conjunctival dermoid	x
other	13	other	16
Endocrinology		**Endocrinology**	
Diabetes mellitus (insul depend)	1	Diabetes mellitus (insul depend)	2
Diabetes insipidus	3	Diabetes insipidus	5
Hypothyroidism	39	Hypothyroidism	39
Thyroiditis (inflammation)	0	Thyroiditis (inflammation)	7
Pancreatic insufficiency	0	Pancreatic insufficiency	3
Addison's disease	8	Addison's disease	5
Cushing's disease	6	Cushing's disease	10
other		other	7
Female reproduction		**Female reproduction**	
Anestrus	0	Anestrus	3
Pyrometria	2	Pyrometria	10
Vaginitis (inflammation)	4	Vaginitis (inflammation)	3
Abnormal estrus cycle	5	Abnormal estrus cycle	10
Primary uterine inertia	2	Primary uterine inertia	4
Infertile	3	Infertile	3
other	2	other	3
Male reproduction		**Male reproduction**	
Cryptorchidism	12	Cryptorchidism	11
Monochidism	15	Monochidism	9
Testicular atrophy	2	Testicular atrophy	2
Lack of semen/sperm	5	Lack of semen/sperm	5
Abnormal sperm	x	Abnormal sperm	0
Congential defects	x	Congential defects	0
Prostatitis (inflammation)	3	Prostatitis (inflammation)	3
Prostatic hypertrophy	3	Prostatic hypertrophy	1
other	5	other	2

Appendix Table 4. Disease/condition - 2015 vs 2008 (cont)			
Infectious Disease		**Temperament**	
Aggressive	**x**	Aggressive	9
Aggressive (to people)	2	Aggressive (to people)	x
Aggressive (to dogs)	5	Aggressive (to dogs)	x
Overly protective	9	Overly protective	x
Fearful	16	Fearful	18
Shyness	6	Shyness	16
Unstable	0	Unstable	2
other	5	other	3
Nonmalignant cysts		**Nonmalignant cysts**	
Hemangiomia	1	Hemangiomia	3
Histiocytoma	7	Histiocytoma	5
Lipomas	67	Lipomas	44
Mammary adenomas	14	Mammary adenomas	11
undefined	x	undefined	4
other	19	other	17
Infectious Disease		**Infectious Disease**	
Brucellosis	0	Brucellosis	x
Leptospirosis	0	Leptospirosis	x
Lyme Disease	13	Lyme Disease	x
Coronavirus	0	Coronavirus	x
Canine Parovirus	2	Canine Parovirus	x
Parainfluenza	3	Parainfluenza	x
Tryp. cruzi (Chagas disease)	0	Tryp. cruzi (Chagas disease)	x
Other	4	Other	x
Birth defects in puppies		**Birth defects in puppies**	
Cleft palate	8	Cleft palate	7
Failure to walk (swimmers)	2	Failure to walk (swimmers)	3
Incomplete abdomin closure	3	Incomplete abdomin closure	8
Hydrocephalus	0	Hydrocephalus	0
Failure to thrive	8	Failure to thrive	20
Stillborn	33	Stillborn	73
Other	4	Other	9