

# Long-term Effects of Early Environments on the Behavior and Welfare of Dogs

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# Why Study Canine Behavioral Development?

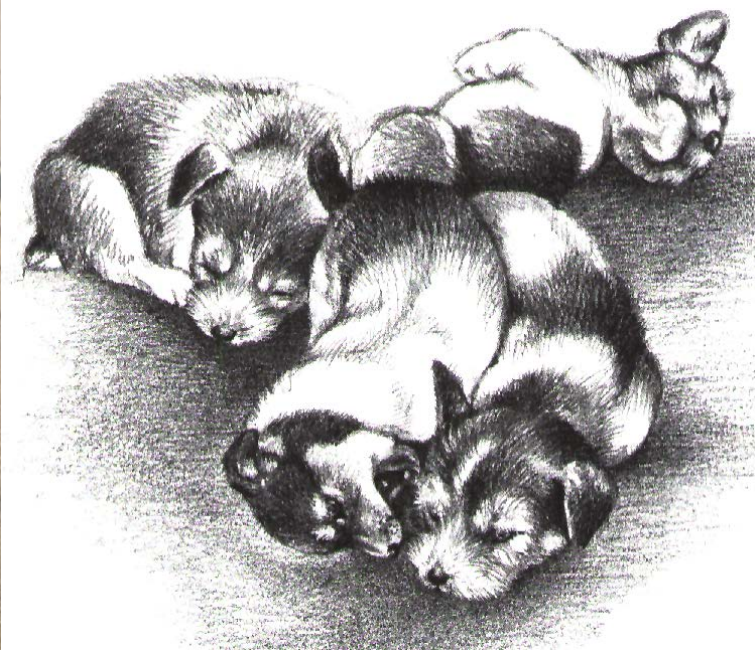


- *Animal Welfare:* Behavior problems disrupt the human-animal bond. Primary reason why dogs are abused, abandoned, or disowned; contributory factor in 40-50% of all shelter relinquishments. Making them the #1 cause of premature death in American dogs
- *Public Health:* 4.5 million Americans are bitten by dogs every year and  $\pm$  800,000 require medical treatment. Dog attacks cause 20-30 human deaths /year in the USA.
- *Public Service:* Behavior problems are the primary reason why working dogs (guide dogs, search & rescue dogs, detector dogs, etc.) are released from breeding and training programs.
- *Little known:* Current guidelines on puppy care and husbandry based on a few studies conducted in the 1950s & 60s.



# Scott & Fuller (1965)

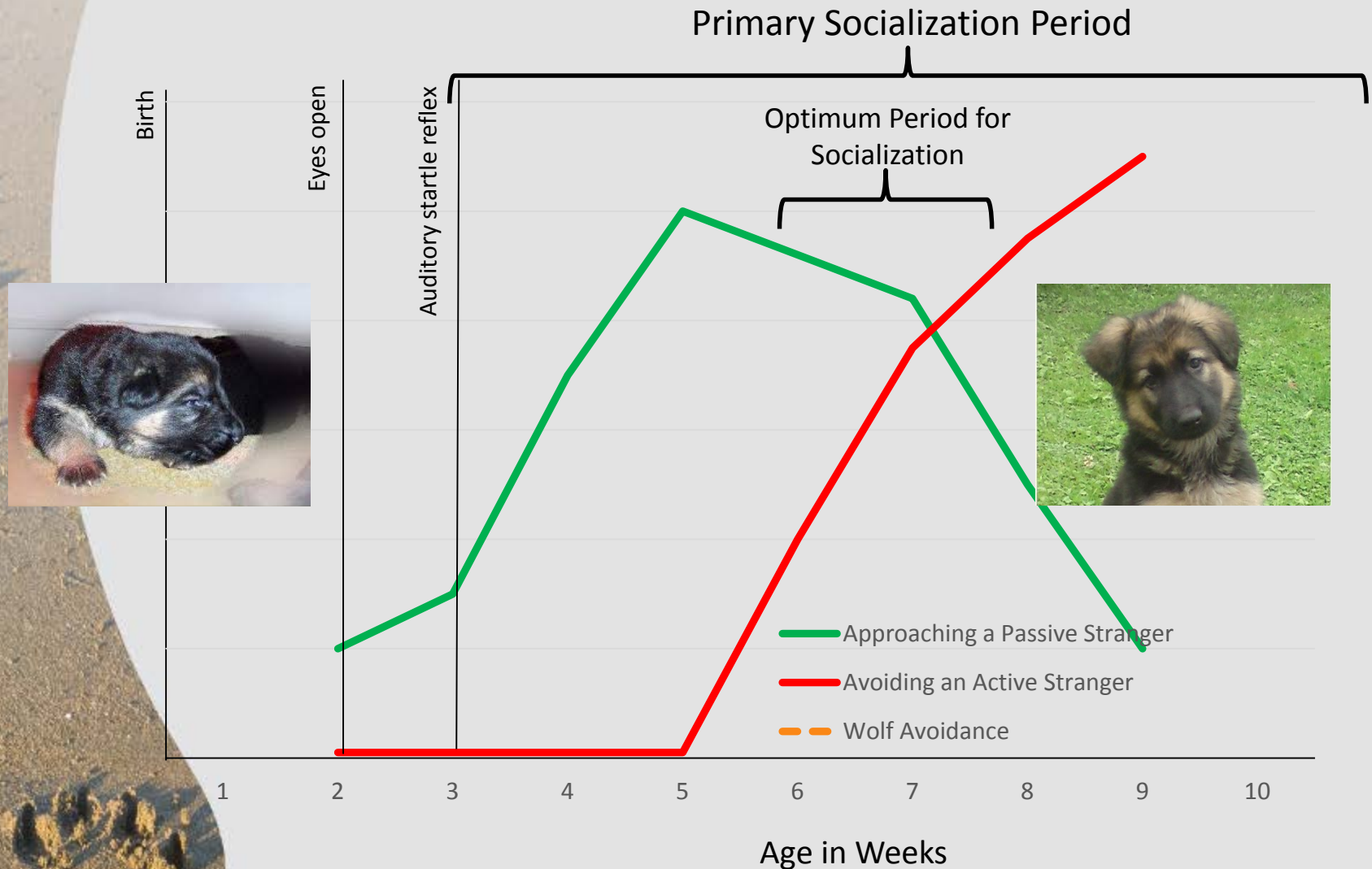
## *Genetics and Social Behavior of the Dog.*



“The young dog should be introduced, at least in a preliminary way, to the circumstances in which it will live as an adult, preferably by 8 weeks, and certainly no later than 12 weeks of age.”

“The ideal time to produce a close social relationship between a puppy and his master occurs between 6 and 8 weeks of age. This is the optimal time to remove a puppy from the litter and make it into a house pet.”

# The Classic Model of Puppy Socialization (Scott & Fuller, 1965)



# Canine Development Research at Penn Vet







## Canine Behavioral Assessment & Research Questionnaire



Dog owners/puppy-raisers/handlers asked to rate their dogs' behavioral responses to a 100 different everyday situations or stimuli.

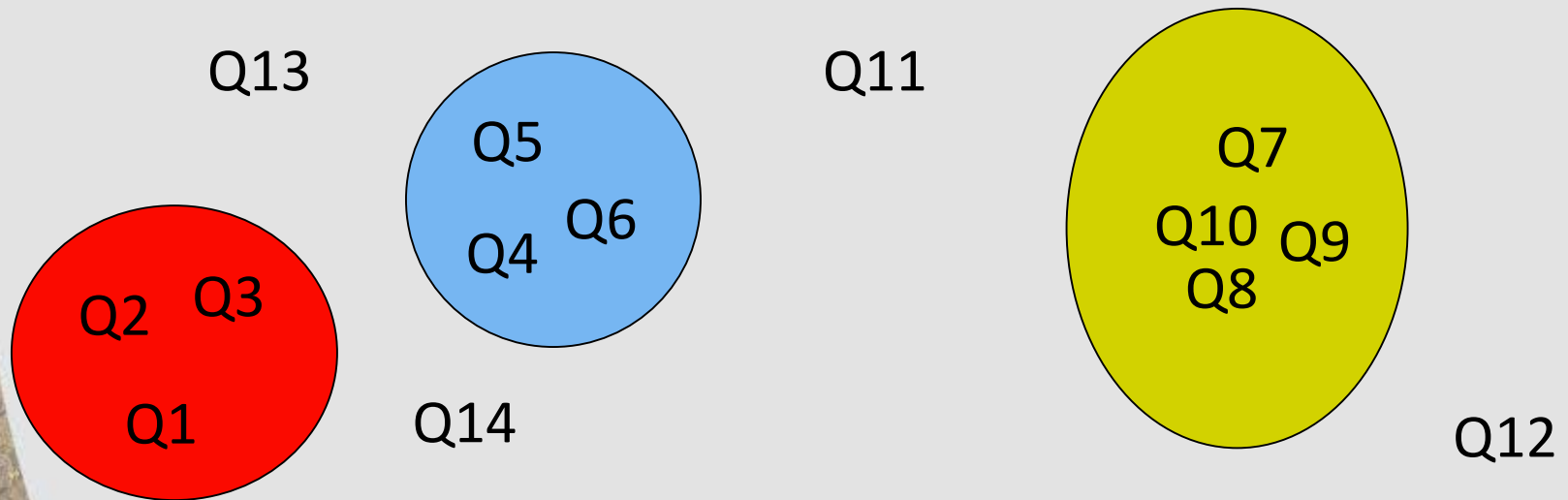


Principal Components Factor Analysis used to extract 14 distinct behavioral subscales, and 22 miscellaneous behaviors.



Validity and reliability of most of these subscales and items have now been confirmed.

# Factor Analysis



Factor analysis is a statistical technique for condensing information by grouping related items into separate factors or subscales.

# 14 C-BARQ Subscales Extracted by Factor Analysis

*Stranger-directed aggression* (10 items)  
*Owner-directed aggression* (8 items)  
*Dog-directed aggression* (4 items)  
*Familiar dog aggression* (4 items)

*Stranger-directed fear* (4 items)  
*Dog-directed fear* (4 items)  
*Nonsocial fear* (4 items)  
*Attachment/attention-seeking* (6 items)  
*Separation-related behavior* (8 items)  
*Touch sensitivity* (4 items)

*Excitability* (6 items)  
*Energy* (2 items)  
*Chasing* (4 items)  
*Trainability* (8 items)

Hsu, Y. & Serpell, J.A. *Journal of the American Veterinary Medical Association*, 223(9): 1293-1300, 2003.



# 22 Miscellaneous C-BARQ Items

Escaping/roaming

Rolling in scent

Coprophagia

Chewing objects

Mounting

Food begging

Food stealing

Fear of stairs

Pulling on leash

Marking with urine

Submissive/emotional urination

Separation urination

Separation defecation

Hyperactivity

Staring (compulsive)

Snapping at flies (compulsive)

Tail-chasing/spinning

Shadow/light-chasing (compulsive)

Persistent barking

Autogrooming (self)

Allogrooming (others)

Other abnormal /stereotypic



# Canine Behavioral Assessment & Research Questionnaire

The C-BARQ is designed to provide dog owners and professionals with standardized evaluations of canine temperament and behavior.



*Photo credit: Crevko*

## New to C-BARQ?

Sign up to enter a dog and complete the C-BARQ.

[Sign Up Now](#)

## Returning Users

Welcome back! Enter your user name and password below.

User Name

jserpell

Password

.....

[Sign In](#)

[Forget your password?](#)

## What is the C-BARQ?

[Learn more](#) about the C-BARQ and what it measures.

### CAT OWNERS:

Participate in the **Feline Behavioral Assessment & Research Questionnaire**

**[febarq.org](http://febarq.org)**



Help support the C-BARQ and the University of Pennsylvania's Center for Interaction of Animals & Society by [donating to this project](#).

Working dog organizations, veterinarians, researchers, trainers, shelters, breeders, and breed groups can [register with us to participate in the C-BARQ project](#).

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PennVet



## Canine Behavioral Assessment & Research Questionnaire

Deborah Duffy

### Section 1: Training and obedience

Some dogs are more obedient and trainable than others. By clicking on the appropriate choices, please indicate how trainable or obedient your dog has been in each of the following situations in the recent past.

Selected dog: **TEST DOG**

	← NEVER	SELDOM	SOMETIMES	USUALLY	ALWAYS →	NOT OBSERVED/ NOT APPLICABLE
1. When off the leash, returns immediately when called.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2. Obeys the "sit" command immediately.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3. Obeys the "stay" command immediately.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4. Seems to attend/listen closely to everything you say or do.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
5. Slow to respond to correction or punishment; "thick-skinned".	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
6. Slow to learn new tricks or tasks.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
7. Easily distracted by interesting sights, sounds, or smells.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
8. Will "fetch" or attempt to fetch sticks, balls, or objects.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Reset Scores

Continue -->





## Section 2: Aggression

Some dogs display aggressive behavior from time to time. Typical signs of moderate aggression in dogs include barking, growling and baring teeth. More serious aggression generally includes snapping, lunging, biting, or attempting to bite. By clicking on the following scales, please indicate your own dog's recent tendency to display aggressive behavior in each of the following contexts:

Selected dog: **Ralph**



9. When verbally corrected or punished (scolded, shouted at, etc.) by you or a household member.

☐ ☐ ☐ ☐ ☐ ☐

10. When approached directly by an unfamiliar **adult** while being walked/exercised on a leash.

☐ ☐ ☐ ☐ ☐ ☐

0 1 2 3 4 -

<http://www.cbarq.org>



# C-BARQ Background Questions

1. Dog's age (in years/months)
2. Breed
3. Sex
4. Weight (approximately)
5. Whether spayed/neutered
6. Age spayed/neutered (weeks/months)
7. Primary reason for spaying/neutering
9. Where dog was acquired (source)
10. Its age when acquired (weeks/months)
11. Whether dog involved in work/sports/recreational activities, and what kinds?
12. First dog owned?
13. If not, number owned previously?
14. Did owner grow up with dogs as a child?
15. Number of other dogs in household
16. Relative ages of other dogs in household.



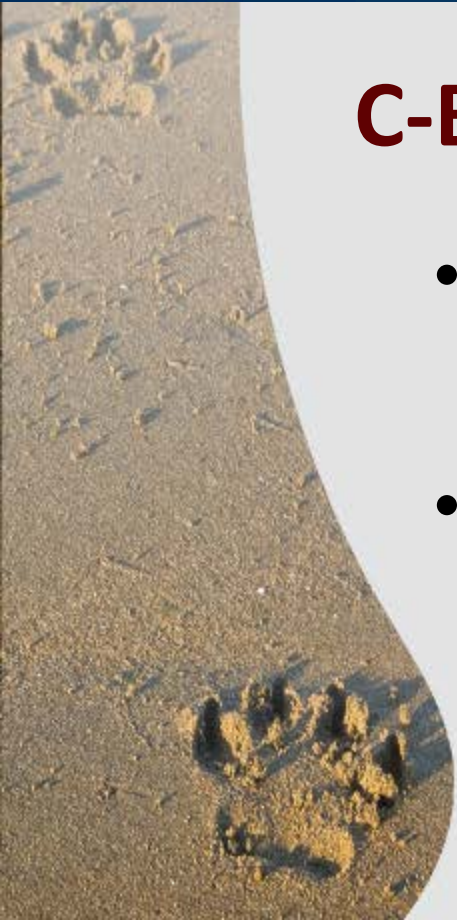
# Canine Behavioral Assessment & Research Questionnaire

The C-BARQ is designed to provide dog owners and professionals with standardized evaluations of canine temperament and behavior.



## **C-BARQ website went live in 2005**

- Database now contains behavioral profiles on approximately 40,000 pet dogs, and 30,000 working guide /service dogs.
- Allows us to generate highly reliable normative behavioral data on these dog populations, both as a whole and according to breed.





# What Can the C-BARQ Tell Us About Puppy Development?



# How Does a Puppy's Early Experience Influence It's Behavioral Development?

Common belief among veterinarians, behaviorists and trainers that puppies obtained from pet stores are more susceptible to developing health and behavioral problems.

**CBE**





# Effects of Early Environment:

## Pet Stores vs. Noncommercial Breeders



- ❖ We compared the C-BARQ scores of adult dogs whose owners acquired them as puppies from either pet stores (N=413) or noncommercial breeders (N=5657).
- ❖ Dogs from these two sources are comparable because they are usually purebred and acquired at similar ages.



# Differences in behavioral characteristics between dogs obtained as puppies from pet stores and those obtained from noncommercial breeders

Franklin D. McMillan, DVM, DACVIM; James A. Serpell, PhD;  
Deborah L. Duffy, PhD; Elmabrok Masaoud, PhD; Ian R. Dohoo, DVM, PhD

**Objective**—To compare the owner-reported prevalence of behavioral characteristics in dogs obtained as puppies from pet stores with that of dogs obtained as puppies from noncommercial breeders.

**Design**—Cross-sectional study.

**Animals**—Dogs obtained as puppies from pet stores ( $n = 413$ ) and breeder-obtained dogs (5,657).

**Procedures**—Behavioral evaluations were obtained from a large convenience sample of current dog owners with the online version of the Canine Behavioral Assessment and Research Questionnaire, which uses ordinal scales to rate either the intensity or frequency of the dogs' behavior. Hierarchic linear and logistic regression models were used to analyze the effects of source of acquisition on behavioral outcomes when various confounding and intervening variables were controlled for.

**Results**—Pet store-derived dogs received significantly less favorable scores than did breeder-obtained dogs on 12 of 14 of the behavioral variables measured; pet store dogs did not score more favorably than breeder dogs in any behavioral category. Compared with dogs obtained as puppies from noncommercial breeders, dogs obtained as puppies from pet stores had significantly greater aggression toward human family members, unfamiliar people, and other dogs; greater fear of other dogs and nonsocial stimuli; and greater separation-related problems and house soiling.

**Conclusions and Clinical Relevance**—Obtaining dogs from pet stores versus noncommercial breeders represented a significant risk factor for the development of a wide range of undesirable behavioral characteristics. Until the causes of the unfavorable differences detected in this group of dogs can be specifically identified and remedied, the authors cannot recommend that puppies be obtained from pet stores. (*J Am Vet Med Assoc* 2013;242:1359–1363)

It has long been an article of faith among veterinarians and canine professionals that dogs obtained as puppies from pet stores have a higher prevalence of health and behavioral problems.<sup>1</sup> However, there has been a dearth of empirical studies to support this notion. In a retrospective survey of the owners of 737 adult dogs, Jagoe<sup>a</sup> found that dogs obtained from pet shops had a significantly higher

## ABBREVIATIONS

C-BARQ	Canine Behavioral Assessment and Research Questionnaire
CBE	Commercial breeding establishment
NCB	Noncommercial breeder

# Results (Logistic Mixed Model)

Acquisition from a pet store predicted greater prevalence of:

Outcome	Direction	Odds Ratio	P-value	95% CI
Separation-related behavior	Increase in pet store dogs	1.58	0.002	(1.19, 2.11)
Owner-directed aggression	Increase in pet store dogs - intact	3.13	<0.001	(1.87, 5.23)
	Increase in pet store dogs- neutered	1.44	0.006	(1.11, 1.87)
Stranger-directed aggression	Increase in pet store dogs	1.59	0.003	(1.18, 2.16)
Non-social fear	Increase in pet store dogs	1.44	0.047	(1.01, 2.07)
Familiar dog aggression	Increase in pet store dogs	1.35	0.021	(1.05, 1.74)
Dog-directed fear	Increase in pet store dogs	1.33	0.030	(1.03, 1.71)
Dog-directed aggression	Increase in pet store dogs	1.96	<0.001	(1.44, 2.67)
Touch sensitivity	Increase in pet store dogs	1.58	0.002	(1.18, 2.11)

McMillan, F.D., Serpell, J.A., Duffy, D.L., Masaoud, E. & Dohoo, J.R. Differences in behavioral and psychological characteristics between dogs obtained as puppies from pet stores and those obtained from noncommercial breeders. JAVMA, 2013.

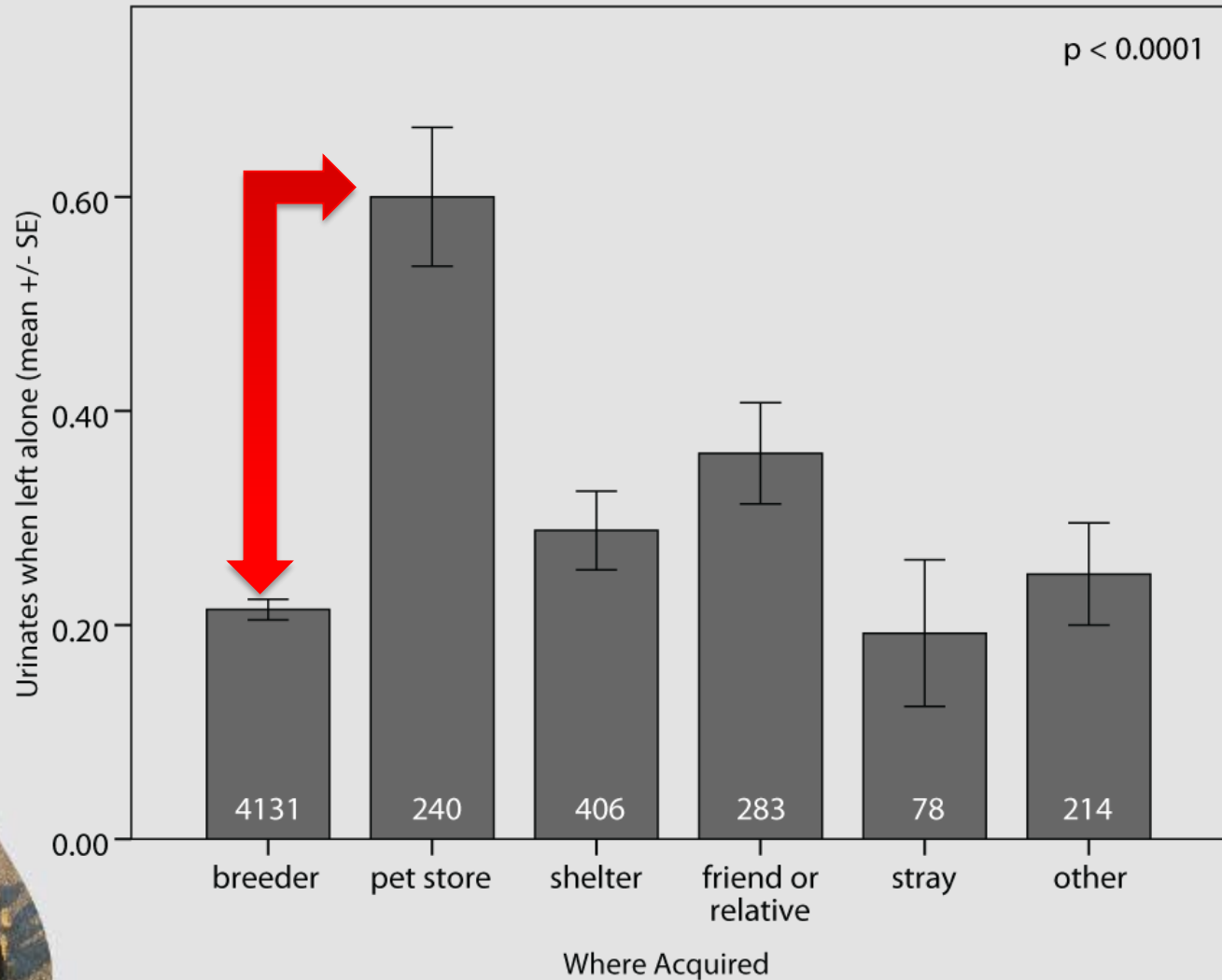
\* Possible effects of breed, sex, age, body weight, whether neutered, presence of other dogs in household, and training all taken into account in the analyses.

## C-BARQ Data: Persistent barking





## C-BARQ Data: House soiling (urination)



# Possible sources of observed differences

No information

No information

\*

\*

\*

Pet store	Noncommercial breeder
<b>Genetics:</b> Little or no selection for temperament.	<b>Genetics:</b> Positive selection for temperament.
<b>Early socialization:</b> Commercial breeding operations give little attention to appropriate socialization.	<b>Early socialization:</b> Most NCBs devote some effort toward socializing puppies prior to sale.
<b>Epigenetics:</b> Parents more likely to be stressed prior to breeding / during gestation.	<b>Epigenetics:</b> Parents less likely to be stressed prior to breeding / during gestation.
<b>Early life adversity (ELA):</b> Stressful early environment: Early weaning and separation from mother/littermates; multiple episodes of transport to the “broker”, the pet stores, and final homes; mixing with unfamiliar puppies; handling by strangers, etc.	<b>ELA:</b> Less stressful early environment: Appropriate age of weaning and separation from mother/littermates; only single episode of transport from breeder to final home.
<b>Owner differences:</b> Pet store acquisitions more likely to be spontaneous ‘spur of the moment’, rather than carefully considered. Owners of this type may be less experienced and / or less committed.	<b>Owner differences:</b> Breeder acquisitions tend to be made by people who have given relatively careful thought to owning a puppy. Owners likely to be more experienced and committed.

# Epigenetics: Do the Breeding Dogs from CBEs Exhibit Higher than Normal Rates of Stress / Anxiety?



Contents lists available at SciVerse ScienceDirect

Applied Animal Behaviour Science

journal homepage: [www.elsevier.com/locate/applanim](http://www.elsevier.com/locate/applanim)



## Mental health of dogs formerly used as 'breeding stock' in commercial breeding establishments

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### ABSTRACT

Canine commercial breeding establishments (CBEs) are kennel facilities where puppies are produced in large numbers for commercial sale. In the popular media, CBEs are commonly referred to as "puppy mills" or "puppy farms." Conditions in CBEs vary widely in quality. Dogs in these facilities are routinely housed for their entire reproductive lives in cages or runs, and provided with minimal to no positive human interaction or other forms of environmental enrichment. Numerous anecdotal reports have suggested that after removal from CBEs many of the former breeding dogs display persistent behavioural and psychological abnormalities when compared with the general pet dog population. The purpose of this study was to determine if this anecdotal evidence could be confirmed empirically.

Behavioural evaluations of the dogs were obtained from current owners/fosterers using the Canine Behavioural Assessment and Research Questionnaire (C-BARQ), which utilizes ordinal scales to rate either the intensity or frequency of the dog's behaviours. A total of 1169 former CBE dogs were included in the study.

Among the CBE ex-breeding dogs, 76 different breeds were represented. With the exception of the Bichon Frise (31.5%), all other breeds comprised <5% of the dogs. The sex ratio



# Methods



1. Solicitation of adopters of ex-breeder Commercial Breeding Establishment (CBE) dogs
2. Participants completed C-BARQs on 332 former CBE dogs
3. Results from CBE dog adopters were compared to results from a convenience sample of C-BARQ evaluations of 332 pet dogs from the C-BARQ database matched for breed, sex, age and neuter status.

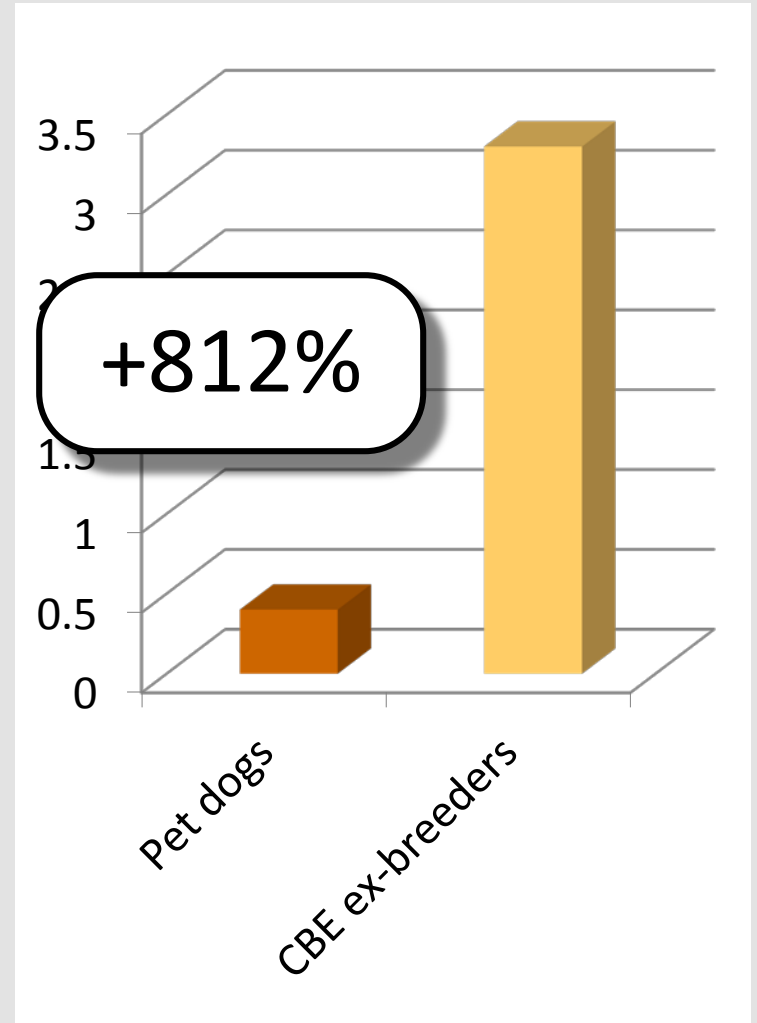
# Results (Generalized Linear Models)

CBE ex-breeder dogs displayed unusually high levels of fear/anxiety and house-soiling

Outcome	Direction	Odds Ratio	P-value	95% CI
Stranger-directed fear	Increase in CBE ex-breeders	8.12	< 0.0001	(1.73, 2.48)
Non-social fear	Increase in CBE ex-breeders	6.62	< 0.0001	(1.51, 2.27)
Fearful on stairs	Increase in CBE ex-breeders	5.98	< 0.0001	(1.35, 2.23)
Touch sensitivity	Increase in CBE ex-breeders	3.19	< 0.0001	(0.8, 1.52)
House soiling (urination)	Increase in CBE ex-breeders	2.81	< 0.0001	(0.65, 1.42)
House soiling (defecation)	Increase in CBE ex-breeders	2.07	0.0003	(0.33, 1.12)
Urine marking (in home)	Increase in CBE ex-breeders	2.06	0.001	(0.29, 1.16)

\* CBE ex-breeders and convenience sample of pet dogs matched for breed, sex, age, and neuter status.

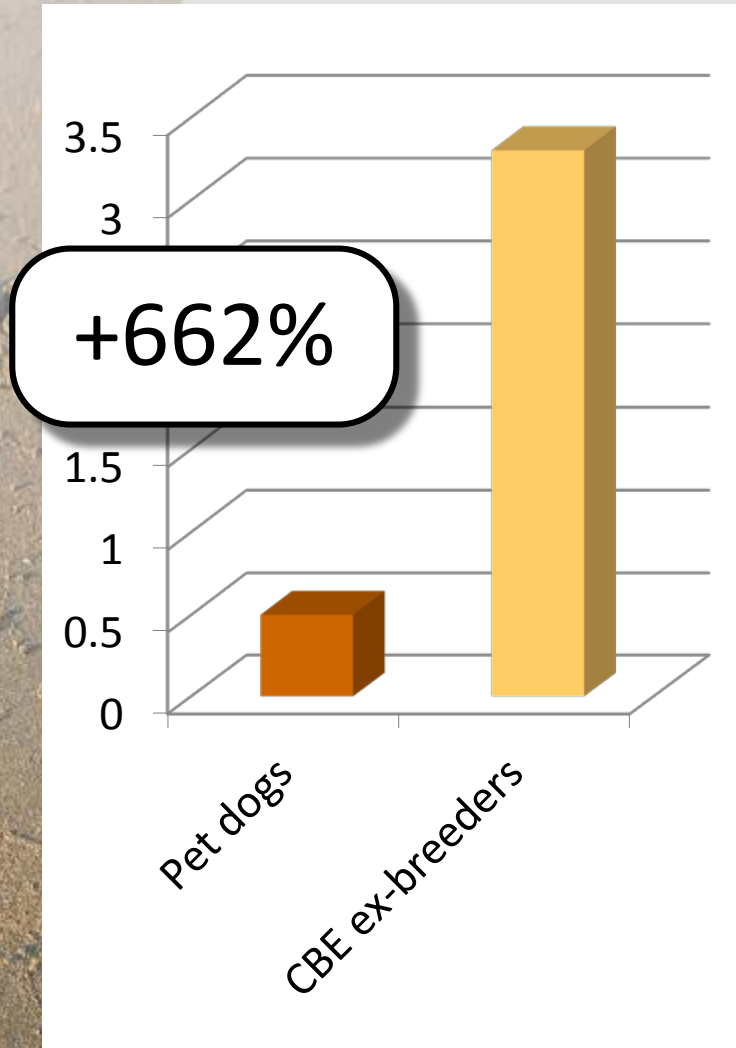
# Stranger-directed Fear





# Non-social fear

Fear of novel objects, sounds, movements, etc.



# FEAR-RELATED TERMS PEOPLE USED IN DESCRIBING THEIR DOGS

- “skittish” (44)
- “startles easily” (10)
- “always on alert, on edge, on guard, and hyper-alert” (5)
- “overly reactive, jumpy, or easily unnerved, frightened, scared, spooked, or panicked” (27)
- “frightened by sudden or quick movements or sounds” (33)
- “frightened of everything or almost everything” (24)
- “frightened all the time under any circumstances” (12)

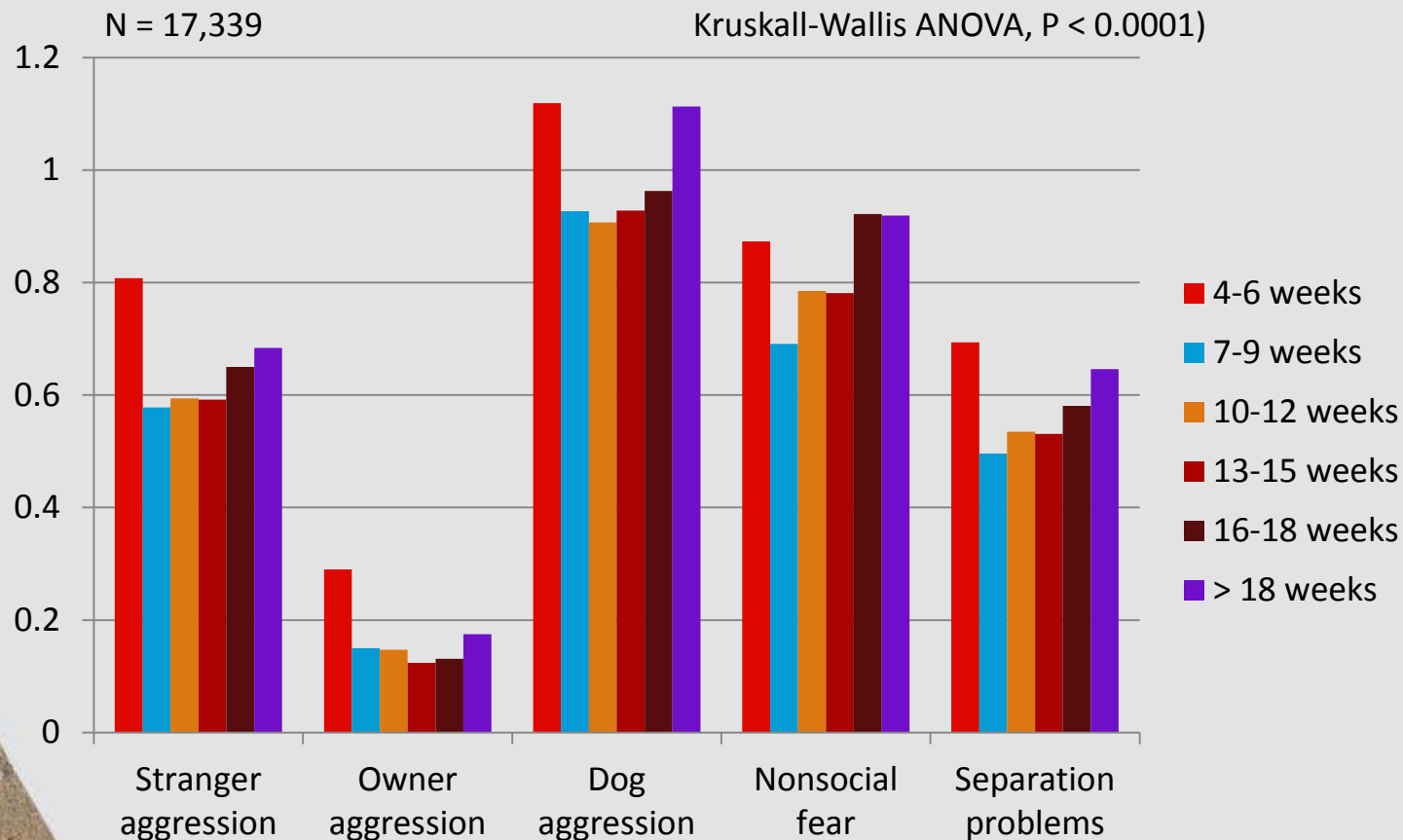
# ELA: Do Adverse Early Experiences Affect the Development of Behavior in Dogs (the Influence of Re-homing)?



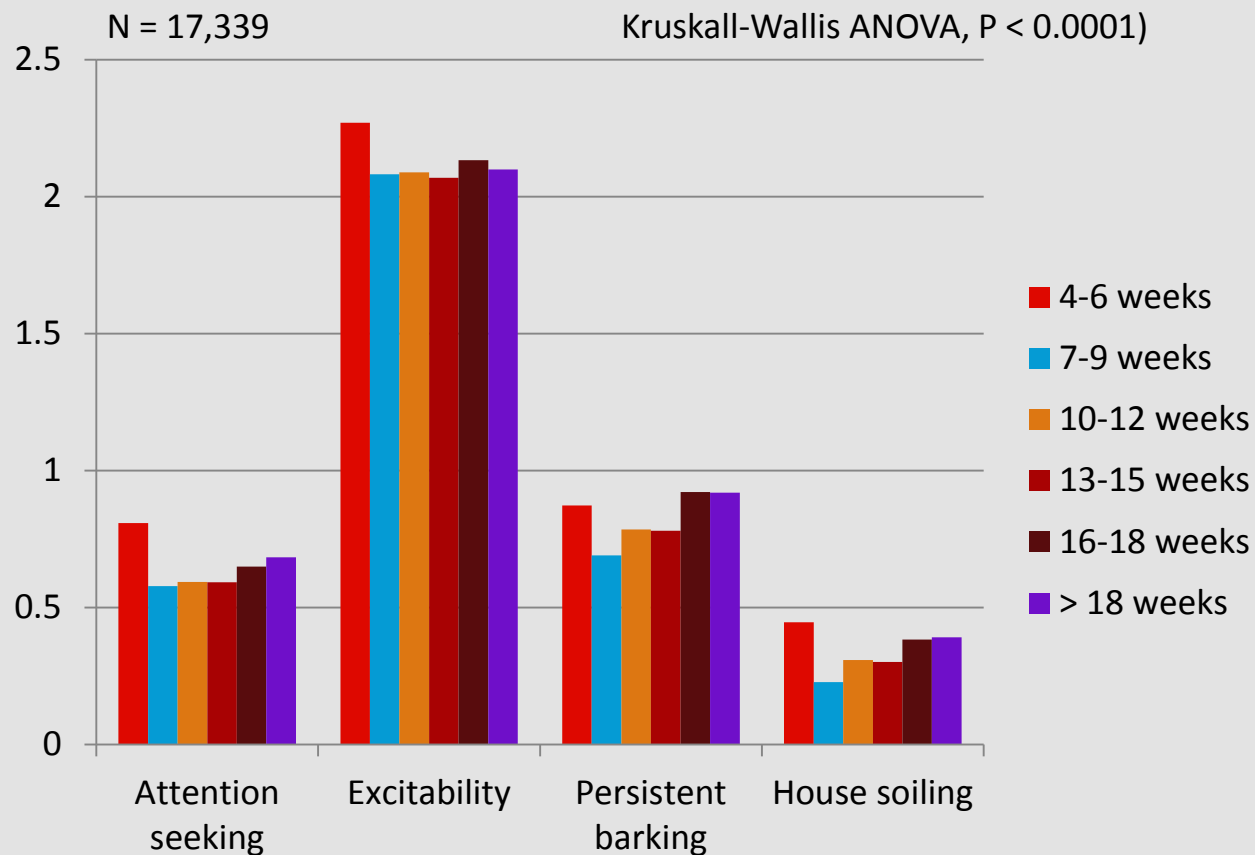
Methods: Used the C-BARQ database to analyze the association between 'age acquired' and the severity/prevalence of behavior problems in dogs.



# Effects of Early Adversity: Age When Acquired

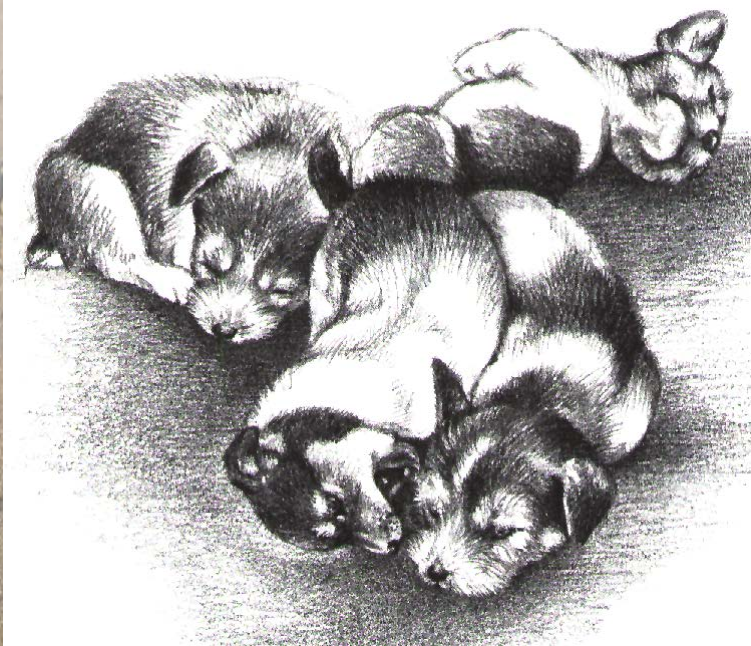


# Effects of Early Adversity: Age When Acquired



# Scott & Fuller (1965)

## *Genetics and Social Behavior of the Dog.*



“The young dog should be introduced, at least in a preliminary way, to the circumstances in which it will live as an adult, preferably by 8 weeks, and certainly no later than 12 weeks of age.”

“The ideal time to produce a close social relationship between a puppy and his master occurs between **7 and 9 weeks** of age. This is the optimal time to remove a puppy from the litter and make it into a house pet.”

### Effect of Early Weaning?



# Owner Differences: Lessons from Guide Dogs



- All guide dog puppies are reared in the same kennel environment and receive the same level of early socialization.
- All puppies are re-homed with puppy-raisers at 7-9 weeks, and C-BARQed at 12 months of age.
- Additional information collected from puppy raisers regarding characteristics of puppies' rearing environment.
- Analyzed associations between these environmental variables and C-BARQ scores at 12 months of age.



# Aspects of Juvenile and Adolescent Environment Predict Aggression and Fear in 12-Month-Old Guide Dogs

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Maturational changes in behavior, and the possible influence of the puppy-raising environment on behavioral development, were investigated in a total sample of 978 prospective guide dogs belonging to four different breeds/crosses. All dogs belonged to the same guide dog organization, and had been exposed to similar early environmental influences prior to being assigned to puppy-raising households at 7–8 weeks of age. Behavioral data were collected from puppy raisers when the dogs were 6 and 12 months old using the C-BARQ®, a standardized, validated, and widely used survey instrument that measures the frequency and/or severity of most common behavior problems in dogs. Information about the puppy-raising environment was obtained from puppy raisers using a standardized questionnaire shortly before the dogs were returned to the guide dog organization for training. Data were analyzed using both univariate and multivariate statistics (binary logistic generalized estimating equations modeling and generalized linear modeling). The findings demonstrated specific maturational changes in behavior between 6 and 12 months of age. In particular, German Shepherd dogs displayed an increase in stranger-directed aggression compared with the other breeds/crosses between 6 and 12 months of age. Several aspects of the puppy-raising environment were associated with puppies' C-BARQ scores at 12 months of age. In particular, growing up in households with more experienced puppy raisers, and in the company of at least one other dog, were both associated with positive effects on a number of puppy behaviors. By contrast, puppies that had been frightened by a person or threatened by

Birth



Placement with  
Volunteer Puppy Raiser  
(7-9 weeks old)



Return to Center  
For Training  
(15-18 months old)



Field Service  
(18-24 months old)



C-BARQ

6 mos

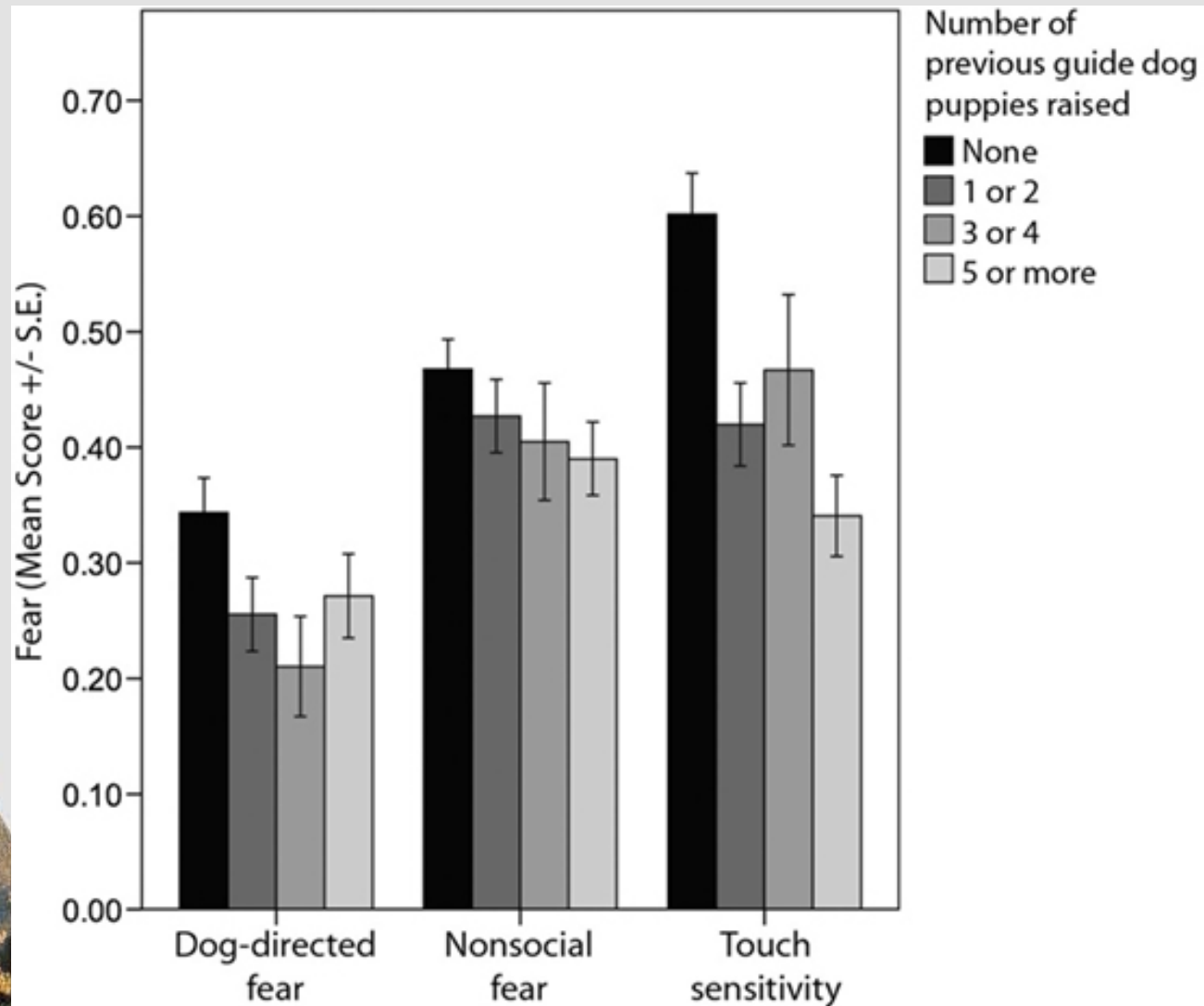
12 mos

Released  
& Adopted

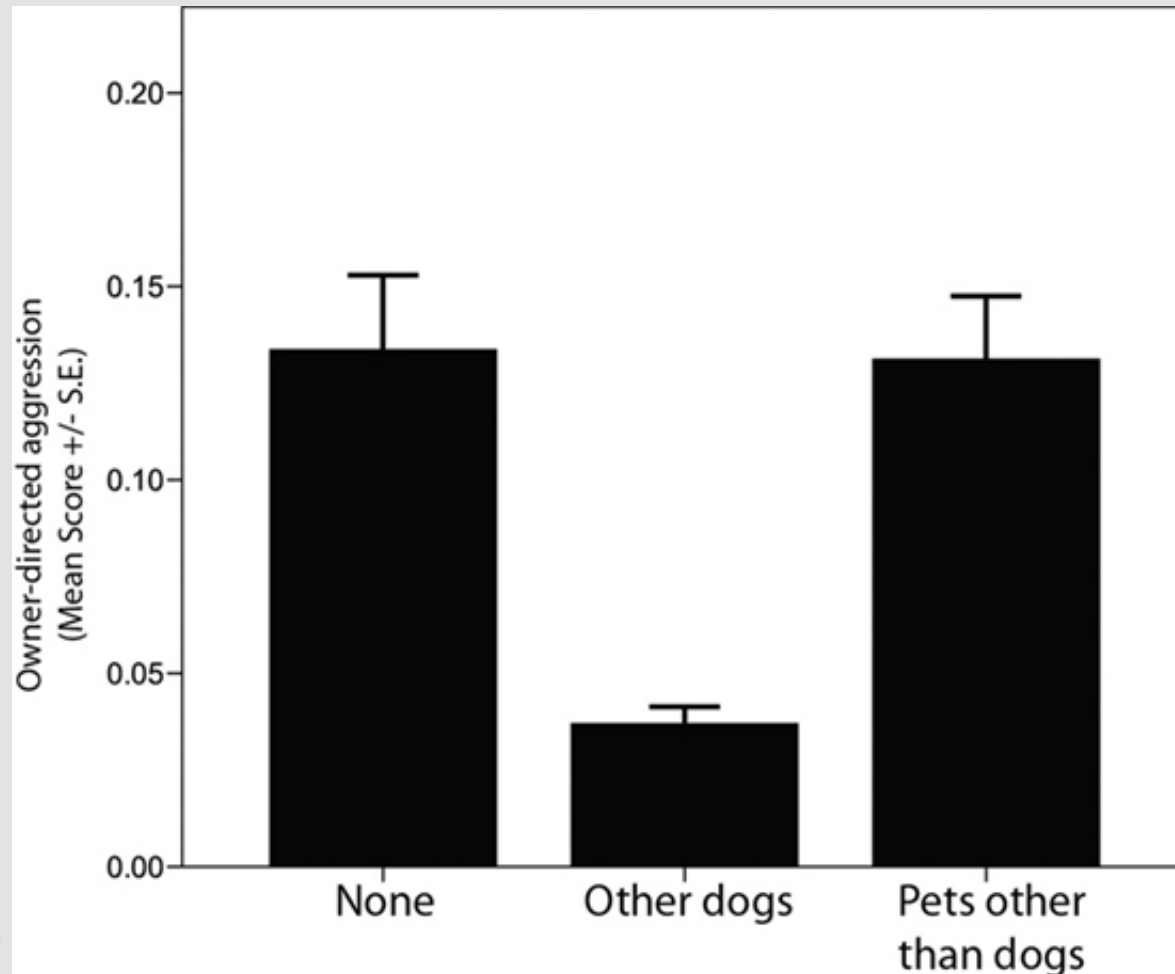




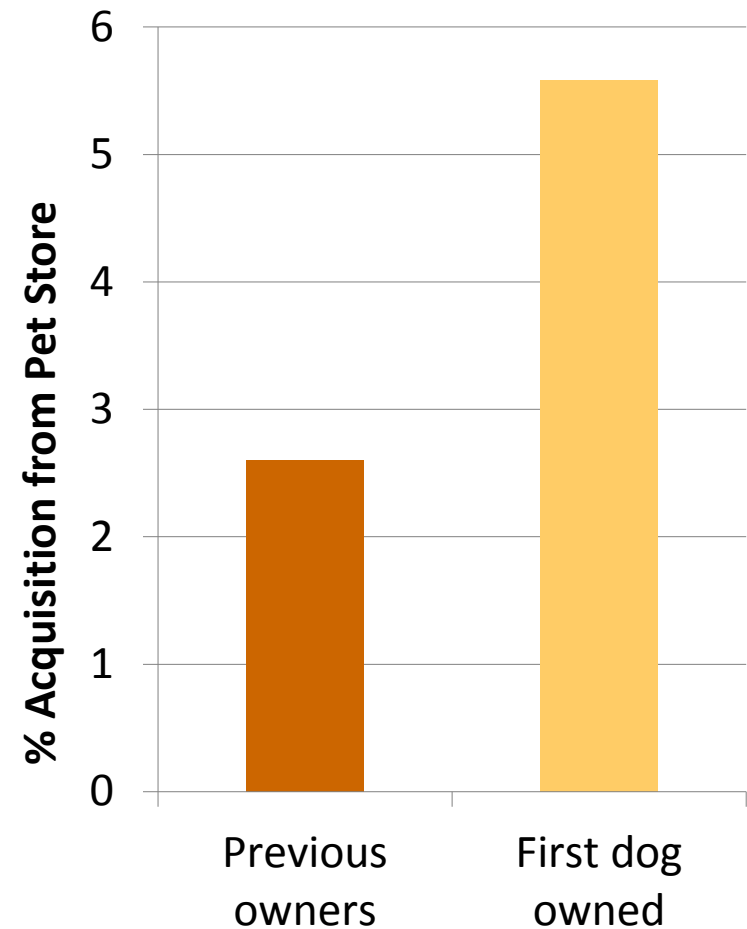
## Dogs Reared By More Experienced Puppy-Raisers Tend to Have Fewer Problems with Fear & Anxiety



# Puppies raised with other dogs in the household display lower levels of owner-directed aggression



# Less Experienced Owners Are More Likely to Acquire Puppies from Pet Stores





# Conclusions



- Aspects of early environment exert profound, long-term effects on the behavior of dogs.
- Acquisition of puppies from pet stores is associated with higher prevalence of almost all major behavior problems.
- Causal mechanism(s) for this association remain unclear, but epigenetic influence of maternal stress, adverse effects of early weaning, and inexperienced owners may all be contributory factors.
- Additional studies needed to identify main causal factors.
- The current recommended re-homing age for puppies should be amended to 7-9 weeks pending further study of the effects of early weaning / re-homing.
- The sensitive period for socialization doesn't end at 12 weeks. It continues for at least the first year of life.



Thank You!