Behavioral rehabilitation of extremely fearful dogs: Report on the efficacy of a treatment protocol

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ABSTRACT

Some dogs entering shelters exhibit extreme fearfulness, often after experiencing cruelty or neglect. Dogs displaying extreme fearfulness are difficult to assess and treat using the tools and protocols available in most shelters. Without effective treatment, these dogs have an unacceptably poor quality of life and are unlikely to be successfully adopted. Treatment protocols using behavior modification techniques such as desensitization, counterconditioning and operant conditioning were developed to reduce fear of stimuli that pet dogs typically experience in adoptive homes. From 2013–2020, outcomes were recorded for dogs that went through this behavioral rehabilitation program. The graduation rate from the program was 86 % (380/441). Graduated dogs spent an average of 96 (SD=55) days in the program, experiencing an average of 78 specific treatment sessions. They showed a significant improvement in behavior in a standardized behavior assessment (df=440, t = 28.3836, p = 0.001) before meeting criteria for placement. Once offered for adoption, they had a 99 % adoption rate and a 96 % adopter satisfaction rate. These results indicate that an appropriately designed behavioral rehabilitation program for dogs displaying extreme fear in a shelter setting can prove highly successful, resulting in improved quality of life and reduced need for behavioral euthanasia.

1. Introduction

Fearfulness appears to be a common behavior problem in dogs. Studies have reported varying prevalence rates among dogs in or recently adopted from shelters (Poulsen et al., 2010; Wells and Hepper, 2000) and dogs in pet homes (Kobelt et al., 2003; Martínez et al., 2011; Salonen et al., 2020; Tiira et al., 2016), with rates are as high as 30-53%. . Although both genetic (Ilska et al., 2017) and environmental factors (Goddard and Beilharz, 1985) contribute to the development of this problem, early life experiences can have a profound impact. Compromised maternal care and inadequate socialization can both contribute to the development of fearful behavior (Pierantoni et al., 2011; Demirbas et al., 2014). Stimuli that are not encountered regularly in a positive or neutral situation during a dog's early sensitive developmental period, between three weeks and three to four months of age, can elicit fear later in life (Serpell et al., 2016).

Undersocialized dogs are likely to exhibit fear when exposed to novel environments (Stephen and Ledger, 2005), and entering an animal shelter may prove especially stressful (Barrera et al., 2010; Vitulová

et al., 2018). If experiencing mild fear, they may exhibit behaviors and body language such as a lowered body posture, flattened ears, tucked tail, wide eyes, inhibition, trembling, and/or panting—but most maintain the ability to recover from a frightening experience and resume normal activities (Stellato et al., 2017). When people approach these dogs, they do not show signs of severe fear, such as panicked escape behavior or catatonic responses, and they may be willing to approach people. The ability to interact with dogs with mild fear provides opportunities to apply a range of interventions designed to improve quality of life in the shelter and increase the likelihood of adoption. In addition to providing environmental enrichment to reduce stress, animal welfare staff and volunteers can help reduce dogs' fear through petting, play, and training activities (e.g., Bergamasco et al., 2010; Normando, 2009; Shiverdecker, 2013).

Dogs who experience moderate to severe fear in the shelter pose a significant animal welfare problem. This sub-population of dogs cannot tolerate participation in a standardized behavior evaluation (Valsecchi et al., 2011) and may even show increased fearfulness after attempted treatment (Martínez et al., 2011; Salonen et al., 2020). Dogs who have

experienced cruelty or neglect, particularly from a young age, often fall into this category, displaying extreme fear of people, handling, leashing, leash walking, and a wide variety of novel objects and environments (Pfaffenberger and Scott, 1959; Panksepp et al., 1983; Puurunen, 2018). There is a typological difference between normal, adaptive fear, as might be displayed by the average, socialized dog in a shelter or home setting, the mild to moderate fear seen in some dogs affected by genetic and/or experiential factors, and the moderate to extreme, maladaptive fear displayed by severely undersocialized dogs. The third category of fear is debilitating, significantly compromises a dog's quality of life, and makes functioning as a companion animal impossible.

The proportion of dogs in a shelter displaying moderate to extreme fear varies depending on the population and evaluation method used but has been found to range between 6 % and 15 % (Demirbas et al., 2014). Rehabilitating these behaviorally compromised animals in shelters can prove challenging because shelters are typically highly stimulating, often unpredictable environments and controlled exposure to frightening stimuli is difficult or impossible to achieve. The combination stressful housing and the tendency of fearful animals to avoid interacting with people may contribute to extremely fearful dogs' inability to respond to treatment (Panksepp et al., 1983). The consequences of unresolved extreme fear in shelter dogs can include a poor quality of life, impaired physiological health, and, ultimately, euthanasia to end suffering or simply due to lack of interested adopters (Marston et al., 2004; Mornement et al., 2010). Several studies suggest that potential adopters show a preference for animals that orient towards them and approach in a "friendly" manner (Protopopova and Wynne, 2014; Weiss et al., 2012).

In an effort to learn how to best help this at-risk population, The American Society for the Prevention of Cruelty to Animals (ASPCA®) Behavioral Rehabilitation Center (BRC) conducted a pilot study, providing treatment for dogs exhibiting moderate to extreme fear. The goal was to determine if a standardized behavior modification and enrichment plan could significantly reduce fear of people and everyday activities, enabling dogs to live successful lives as companion animals. Most of the dogs accepted into the program originated from situations where they experienced cruelty or neglect. Although ASPCA® cruelty and neglect cases catalyzed this study, and many dogs treated came from those cases, dogs were also accepted from shelters and rescue groups across the United States, where they had been deemed unplaceable as companion animals due to their extreme fear, resulting poor quality of life and inability to function as pets.

This report describes the development and outcome of the BRC's work to rehabilitate moderately to extremely fearful dogs in a controlled shelter environment (Reid and Collins, 2015). The treatment program included multiple desensitization and counterconditioning protocols and operant conditioning protocols designed to reduce dogs' fear of stimuli that typify life in a home environment and teach skills needed for success as pets. From 2013–2020, the BRC recorded treatment progress outcomes including periodic behavior evaluations, graduation rates, and adoption rates of "graduates," and adopter follow-up data to assess the efficacy of the program. The objectives of this study were to determine what proportion of shelter dogs displaying moderate to extreme fear could be rehabilitated to the point of meeting a set of graduation assessment criteria ("Adoptability Guidelines," See Appendix 3"), how long, on average, it took for successful dogs to meet those criteria, and whether graduates could succeed in adoptive homes. Despite the severity of the dogs' fearfulness, we optimistically predicted that reducing typically stressful shelter stimuli (e.g. Taylor and Mills, 2007), and implementing consistent, standardized treatment protocols would result in at least half of dogs meeting Adoptability Guidelines.

From 2013–2016, the program took place on the grounds of St. Hubert's Animal Welfare Center in Madison, NJ. In 2018, the program moved to Weaverville, NC, where a larger staff care for and treat dogs in a new, purpose-built facility. The facility and staff in New Jersey had the capacity to treat 30 dogs at a time; the expanded program in North

Carolina can accommodate up to 65.

## 2. Materials and methods

2.1. Study participants

As summarized in Fig. 1, dogs were admitted into the study from ASPCA cruelty and neglect cases, as well as from partner animal shelters and foster-based rescue groups. Source shelters applied for a dog to be transferred into the program by filling out a customized behavior survey based on C-BARQ (Hsu and Serpell, 2003) and submitting medical records. Candidacy for the program was assessed according to the following criteria (intake forms shown in Appendix 1): (1) the dog was rescued from a cruel or neglectful situation or staff suspected such a background (this was not required if a dog met all other criteria); (2) the dog was physically healthy according to a review of medical records and a veterinary exam performed within 10 days of transport; (3) the dog was spayed or neutered; (4) the dog had been given standard preventatives, diagnostics and vaccinations per the Association of Shelter Veterinarians Guidelines (Newbury et al., 2010); (5) the dog's fearful behavior was severe enough to prevent placement in an adoptive home and impair the dog's ability to function comfortably as a companion animal; (6) the dog exhibited fearful body language and behavior (see Appendix 1); (7) the dog did not have other behavior problems (e.g., resource guarding, aggression toward other dogs, separation anxiety); (8) the dog did not show offensive aggression (see Appendix 1). Once accepted, dogs were transported to the BRC via the sending shelters' vehicles, private vehicles, and regularly scheduled regional shelter animal relocation vehicles.

2.2. Intake, housing and enrichment

After arrival on Day 0, all dogs were given three full days with minimal exposure to humans or other stimuli to acclimate to their new housing environment (per Hennessy et al., 1997). On intake, all dogs were pseudo-randomly assigned to one of two treatment groups: immediate treatment onset or delayed onset. This was done to verify that the behavioral rehabilitation protocols, and not simply time to settle into the new environment or the provision of enrichment, reduced successful dogs' fearfulness over time.

Dogs participating in the program at the New Jersey facility were housed in a separate shelter wing, with traditional animal shelter features: 2 rows of kennels, 15 per side, with a kitchen and a storage space in between the rows. With this design, 38 enclosures faced a blank wall, while 2 enclosures faced each other (approximately 10–12 feet apart). Dogs moved down a narrow aisle, past each other's enclosures, when entering or exiting the kennel area. In the North Carolina facility, kennels were arranged in a unique shape, with 13 kennels per housing area and only 3–4 kennels adjacent to each other, arranged like 3 sides of a square. Staff areas (e.g., bathroom, kitchen, small office area) were positioned in the middle, preventing visual access to other dogs for some and allowing it for others. Exiting and entering the housing area did not require dogs to walk past several enclosures.

Dogs at both facilities were singly housed in kennels with guillotine doors that gave them periodic access to an outdoor portion of their enclosures. Each morning, outdoor kennels were cleaned first. Then staff trained in low-stress handling techniques moved any dogs too fearful to pass through open guillotine doors by carrying them or transporting them in rolling crates to the outdoor portion of the runs so that the inside could be cleaned. Throughout the remainder of the day, dogs' guillotine doors were opened periodically, at scheduled times, to allow them outdoor access—and the opportunity to exercise choice over their location. The indoor portion of each run included the bottom half of a plastic airline crate, turned to create a short barrier that dogs could choose to hide behind. Soft bedding was provided for dogs who did not ingest it. The outdoor portion of each run included a platform bed
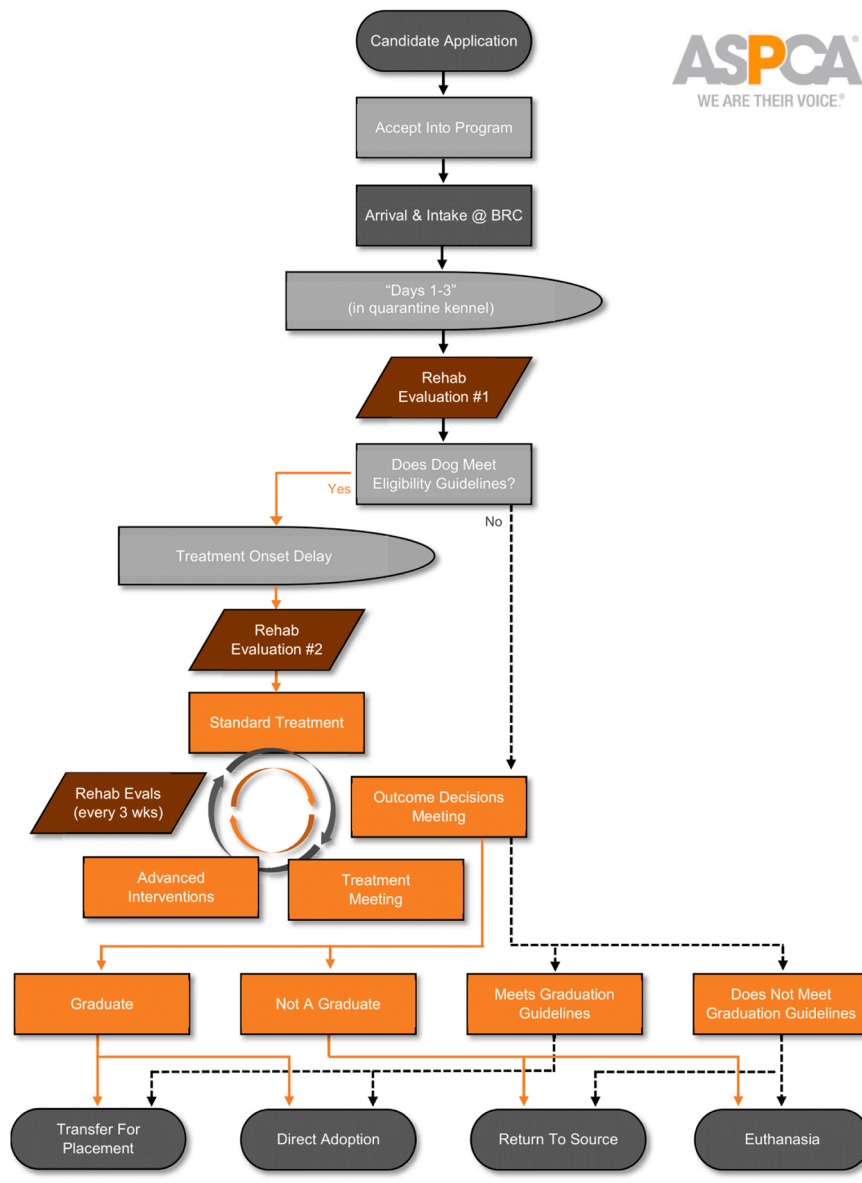
Fig. 1. Dog intake, treatment, and disposition flowchart.

(Kuranda®).

Dogs received in-kennel environmental enrichment four times per day on a rotating schedule to provide variety. Enrichments included toys (e.g., stuffed animals, tug ropes), food puzzle toys, edible and inedible chew items, objects scented with calming smells such as lavender and chamomile (Graham et al., 2005), and objects sprayed with synthetic prey scents. At "Zen Time," which occurred during the daily staff lunch break, staff or volunteers turned on a recording of household sounds at a low volume before handing out chews and edible enrichment items. This simple counterconditioning routine was performed to help dogs gradually acclimate to sounds they would hear in a home environment. After all items were handed out, household sounds stopped and music was played at a low volume (Kogan et al., 2012; Wells et al., 2002), the indoor lights were dimmed, and all people left the area. During the Zen Time hour, no one entered the dogs' housing area, a strategy intended to provide a predictable period of rest in the middle of the day.

2.3. Ethical note

The protocols described were developed for therapeutic reasons, as part of the mission of the Behavioral Rehabilitation Center, and data were used for case management and ongoing program assessment. Prior approval from an IACUC or equivalent oversight body was not sought. A decision to publish results was made as a part of the ASPCA's behavior research plan and research review process. This decision was informed by ethical considerations, including acknowledgement of the Center's robust and welfare-focused inclusion, treatment, and outcome decision-making processes, as well as the potential for publication to encourage lifesaving treatment for fearful shelter dogs.

2.4. Behavior modification

The goal of the behavior modification treatment program was to decrease fear of people and of stimuli and events dogs commonly encounter in adoptive homes. Such stimuli included having a leash

attached to their collar and going on a walk; interacting with staff who became familiar, which included approach, praise, petting, handling and husbandry, play, and gentle restraint; experiencing unfamiliar substrates, objects, sights, and sounds; greeting and interacting with unfamiliar people; and being confined to crates and cars. Treatment protocols fell into three main behavior modification categories: Socialization with People, Leash Application and Walking, and Handling. Exposure to novelty was incorporated into the final stages of all treatment categories. Dogs also received training to prepare them for confinement to a crate and riding in a vehicle while in a crate or wearing a seatbelt. (Many pet dogs experience both as part of everyday life, but acclimation to both experiences was also necessary to facilitate lower-stress transport to shelter partners for adoption and, finally, from the shelters to adopters' homes.) See Appendix 6 for further information.

Each dog in treatment received one fifteen-minute session a day, five days a week. On the two other days of the week, dogs received only in-kennel enrichment. These "rest days" were scheduled so as to avoid two days without behavior modification in a row for any dog. During each treatment session, staff employed multiple protocols to make steady progress in each behavior modification category. For example, the dog might participate in leashing practice (Leash Application), then a walk to a training room (Leash Walk), then perform a hand-targeting behavior (Socialization/Handling), and finally experience petting of non-sensitive body areas (Handling), all within the same treatment session. Protocol-introduction order generally followed a flowchart (Fig. 1), with some necessary variation according to dogs' specific fears and behaviors as they progressed through the program. Protocols incorporated both respondent and operant conditioning techniques.

BRC staff employed several tools to reinforce desired behavior and to achieve desensitization and counterconditioning goals. Social interaction with other dogs, including play, was reserved for behavior modification treatment sessions, where it was used to encourage socially facilitated exploration and interaction with people and to teach dogs to associate exposure to people with pleasurable access to conspecifics. In fact, all treatment sessions were conducted with at least one other dog—a less fearful "helper dog"—until the final stages of the program, when dogs learned to engage in sessions with only people present. Favored in-kennel enrichment items were also incorporated into sessions to stimulate investigatory behavior (e.g., scents planted along walking routes), encourage interactive object play (toys), and create positive associations (e.g., edible chews and food puzzle toys during time in a crate). All meals, which consisted of kibble mixed with canned food and/or high-value treats, were rationed out at the beginning of the day and then provided to each dog during his or her treatment session. (On rest days, dogs received plain kibble in a food puzzle toy.).

To keep treatment as consistent as possible, staff who implemented the behavior modification protocols used a database to review information about dogs' previous sessions before conducting a new session. The team also met on a weekly basis to review treatment progress and discuss troubleshooting strategies when individual dogs showed slow or no behavior change. Communication using these two primary channels facilitated alignment throughout the extensive rehabilitation process for each animal. The use of objective benchmarks and goals, outlined in the program's Adoptability Guidelines, ensured consistent treatment and outcome decision-making across the population.

2.5. Psychopharmaceuticals

In an effort to reduce fear and help accelerate progress through the program, dogs received psychotropic medication in addition to behavior modification and enrichment. Working in close collaboration with the staff in New Jersey, a veterinary behaviorist prescribed a few different medications when the program launched in 2013. After monitoring and extensive discussion, it was decided that the generic selective serotonin reuptake inhibitor (SSRI) fluoxetine, in combination with gabapentin (antiseizure, anxiolytic, analgesic), seemed most effective and very

rarely caused any observable side effects. In 2014, the decision was made to use only this medication combination when psychopharmaceuticals were a component of treatment.

In New Jersey, staff behavior experts reviewed each dog's progress each week and, starting at eight weeks of behavior modification treatment, decided whether to add psychotropic medication to the dog's treatment plan. If medication was determined necessary, the veterinary behaviorist started the dog on medication. His or her progress was reassessed each week, and the decision was made to stay at the same dosages, increase dosages, or decrease dosages. This protocol continued until the dog made enough progress for the behavior experts to estimate that he or she needed only two to three more weeks of treatment before graduation. At that point, the veterinary behaviorist provided a two- to three-week medication weaning schedule, during which staff continued to closely monitor the dog's behavior. The purpose of weaning all dogs off medication was to ensure that they maintained a good quality of life without psychopharmaceuticals, given the inability to ensure that adopters would choose to continue to give them. Very few dogs showed behavioral regression during the weaning phase. In the rare event that a dog did, the staff reviewed that case and decided whether to continue behavior modification or humanely euthanize the dog.

When the program moved to North Carolina, the team decided to revisit the protocol used in New Jersey. Because almost every dog in the program required psychotropic medication at eight weeks in treatment, the team decided to begin the medication for all dogs when they started behavior modification treatments and rapidly increase the dosages to the maximum recommended amounts, as determined by a veterinary behaviorist (fluoxetine: 2 mg/kg by mouth once daily; gabapentin: 15 mg/kg by mouth twice daily). Other aspects of the psychopharmacology protocol remained the same.

2.6. Behavior evaluations

Each dog received an initial standardized behavior evaluation on Day 4 after intake and every 21 ($+/-3$) days thereafter to track behavior change over time, up to a maximum of five evaluations. If the dog was still in treatment after five behavior evaluations, evaluations ceased until staff determined that the dog was ready for graduation and placement. At that point, a sixth and final behavior evaluation was conducted.

Handlers who were relatively unfamiliar to the dog (three or fewer prior interactions with the dog) conducted each evaluation. Evaluations included several subtests performed in multiple contexts and aimed to replicate experiences that a dog would normally have in shelter and home settings. Behavior was observed and recorded while the dog was (1) in a kennel, (2) on a walk indoors and (3) a walk outdoors, (4) in an outdoor exercise pen, and (5) in an unfamiliar room—a "Real Life Room" designed to mimic a room in an adoptive home. A room not used for treatment sessions served as the Real Life Room for evaluations. To make this room seem as unfamiliar as possible to the dogs, a different configuration of furniture, different lighting, and novel air freshener scents were used each time the evaluation was repeated for each dog. In the five behavior evaluation environments, handlers performed a series of behaviors, which included applying a leash, sitting quietly, calling the dog, attempting to solicit play with a toy, attempting to pet the dog, and leaving the dog alone for a few minutes while hidden observers watched via camera.

For each subtest, the assessor rated the dog on multiple rating scales, including a boldness-fearfulness scale, a sociability/proximity scale, and an aggression scale. A scribe entered data into a database. All evaluations were video recorded and reviewed if needed to complete the ratings. The handler and scribe conferred to summarize the results for each of the following: Leashing; Walking on Leash; Handling; Socialization with a Familiar Person; Socialization with an Unfamiliar Person; In-Kennel Behavior toward a Familiar Person; and In-Kennel Behavior toward an Unfamiliar Person. A final, overarching single description grade

was assigned according to the descriptions provided in Appendix 2. Changes in behavior over the series of evaluations served as one indicator of within-individual behavior change during the dogs' time in the treatment program.

2.7. Animal outcomes

An Outcome Decisions Panel met each week to track animal progress and make decisions about dogs' status in the program [see Appendix 4]. Panel members included staff leads responsible for behavior modification, behavior evaluation, animal sheltering and daily care, medical health, and animal placement. To construct as complete an assessment picture as possible, the committee reviewed information gathered in multiple contexts: daily care and enrichment provision, behavior evaluations, any necessary medical examinations or procedures, and treatment sessions. (Data on the contribution of treatment variables on individual outcomes will be addressed in a future publication.) To ensure consistent outcome decisions, the committee used (1) Adoptability Guidelines, which objectively described acceptable and unacceptable levels of fear and aggression in multiple contexts [see Appendix 2], and (2) a Quality-of-Life Assessment Tool [see Appendix 5]. These two guides required the Panel to consider both important aspects of behavioral assessment—a dog's ability to function as a companion animal (behaviors the dog can perform or tolerate) and the dog's ability to enjoy a good quality of life in an adoptive home.

During weekly meetings, the panel sorted dogs into status categories: In Treatment Delay, In Treatment, 2–3 Weeks Pre-Graduation (meaning staff estimated that the remaining treatment time required for graduation was two to three weeks, and the processes of finding placement with a shelter partner and weaning off psychotropic medication began), and Graduate. If a dog did not show positive behavior change in response to treatment to meet Adoptability Guidelines and/or continued to suffer from a poor quality of life for behavioral reasons, medical problems that arose while the dog was in treatment, or both, the Panel made the decision to humanely euthanize the dog. Humane euthanasia was performed on-site, using familiar handlers and low-stress handling techniques. In rare cases, if the Panel had difficulty deciding whether a dog was eligible for graduation from the program, the dog spent two weeks in a foster home as a "test drive". During this period, a trained foster person attempted to behave like a "normal" adopter, recorded behavior observations using a standardized form, and collected video footage. At the end of the two-week period, the committee assessed the dog's ability to function as a companion animal and quality of life in the home and made an outcome decision.

2.8. Data standards

Program data were collected in Filemaker (Claris International, Filemaker Pro. Santa Clara, CA: Claris International Inc.). The data were collected as part of the program carried out according to internal ASPCA ethical standards, which conform to the International Guiding Principles for Biomedical Research Involving Animals as issued by the Council for the International Organizations of Medical Sciences. For analysis, data for animals enrolled between program initiation (3/18/2013) and January 9th 2020 were exported into Microsoft Excel (version 16), which was used to calculate descriptive statistics. Statistical analysis was performed using Stata (StataCorp. 2019. *Stata Statistical Software: Release 16*. College Station, TX: StataCorp LLC).

2.9. Statistical analysis

Descriptive statistics were generated with ordinal categories (age group, behavior evaluation) coded numerically from 1 to N. Assessments of frequencies were carried out using a Fishers exact test with the exception of sex distribution, which employed a goodness of fit Chi^2 test. Further analysis employed a combination of traditional ANOVA and t-

tests. Two sample t-tests were used to compare dogs in the NC versus NJ facilities and dogs provided immediate versus delayed treatment. Within-subjects assessments relating to behavioral evaluation scores employed the paired t-test and repeated measures ANOVA. A linear regression was performed to quantify the influence of initial behavioral evaluation grade on improvement during treatment.

3. Results

In total, 441 dogs were enrolled in the BRC program, with an over-representation of females (M=188, F=253; Chi^2 =9.58, p = 0.0020). Each dog's age was estimated based on physical indicators; ages were grouped into three categories. Fifty-two (12 %) of the dogs were juveniles aged 5–11 months, 368 (83 %) were adults aged 1–7 years, and 21 (5 %) were seniors over 7 years of age. The histories of the dogs included animal hoarding cases (159/36 %), stray (76/17 %), puppy mills (66/ 15 %), cruelty or neglect cases other than dogfighting, hoarding, or puppy mills (53/12 %), owner surrender to a shelter (28/6 %), dogfighting cases (21/5 %), and "other" (38/9 %) (e.g., shelter transfer, abandoned, rescued after a natural disaster, unknown) [Fig. 2].

Each dog was identified as belonging to a dog breed, to a type (e.g., pit bull), or to a breed group (e.g., hound, retriever, terrier) based on the dog's phenotypic characteristics, with the understanding that visual identification of breed is potentially unreliable (Voith et al., 2013). The sample included 48 different known or assigned breed designations with representation across breed groups (see Fig. 3). The pit bull types were included under "terrier; pit bull types and their mixes" and made up 10 % (N = 44) of the population in total.

The factors of age, sex, breed, and history did not predict the outcomes of behavior grade improvement, graduation, or adoption [Table 1].

In the North Carolina facility, the average length of stay increased somewhat, from 93 (New Jersey) to 108 days in treatment (t = −2.94, p = 0.004). However, graduation rate was not significantly different at 233/273 85 % (NC) and 140/161 87 % (NJ) (Fisher's exact test p = 0.671); therefore, the data were pooled for analysis to represent the performance level of the program overall since inception. The following results investigate population-level outcomes. A report on demographic and treatment variables as predictors of graduation for individual dogs is forthcoming.

Treatment was provided after a 0-, 2- or 4-week delay after intake, a factor that will be further investigated in later reports. Treatment delay was not salient to the current report as there were no statistically significant differences between delay groups in relation to duration of treatment (ANOVA ($F(2/2) = 0.93$, $p = 0.0.3964$) or successful graduation (LR $Chi^2(1) = 0.21$, p = 0.6431). This variable will be discussed more extensively in a future report.

The outcome of treatment was assessed using 1) behavior evaluation scores in the first versus the final behavior evaluation, 2) the proportion of animals meeting graduation guidelines, 3) the proportion of dogs adopted, and, where available, 4) adopter satisfaction. Overall outcomes for the 441 dogs who were accepted for treatment between 7/27/2013 and 1/9/2020 are shown below.

3.1. Behavior evaluations

Overall, with the grades of A–D corresponding to no fear, mild fear, moderate fear, and severe fear equated to scores of 1–4, dogs in the treatment program showed a significant improvement in behavior evaluation (paired t = 28.3836, p = 0.001, df=440, see Fig. 4) with the mode moving from 1 (Grade D) to 3 (Grade B) (paired t = 28.3836, p = 0.001, df=440). Dogs in the immediate onset treatment group achieved significantly higher evaluation scores at Evaluation 2 than dogs in the delayed onset group, who received no behavior modification sessions before Evaluation 2 (T[294]=4.4271, p = 0.0001).

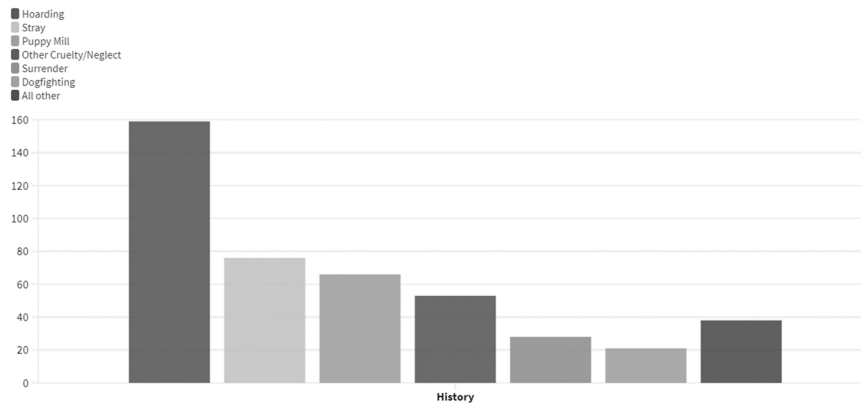When only graduating dogs are considered, their average initial
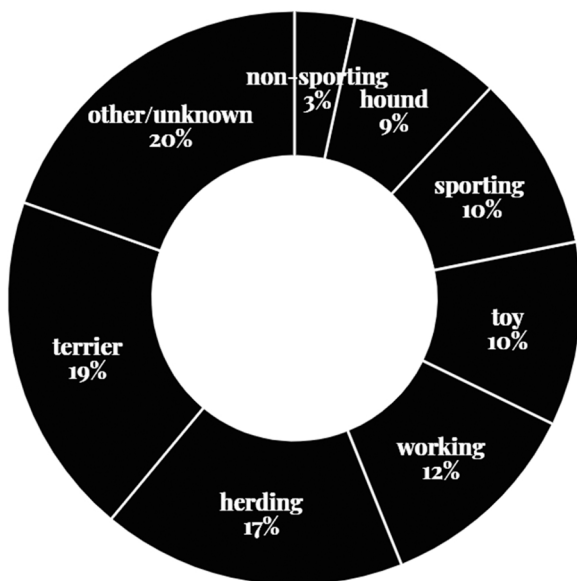
Fig. 2. History of dogs at intake.

Fig. 3. Breeds represented in the treatment population.

Table 1

Relationship between demographic values or age, breed, sex and history and outcome variables of behavior evaluation improvement, graduation and adoption – Fishers exact test (two-sided).

	age	breed	sex	history
Behavior evaluation	0.680	.649	.818	.515
Graduation	1.000	.849	.407	.264
Adoption	0.924	.749	.888	.326

behavioral evaluation was 1.64 (SD=0.76; Grade C) and the average score on the final evaluation was 2.88 (SD=0.75; Grade B) resulting in an average improvement of 1.24 grades (paired t = 29.522, p = 0.001, df=378). Non-graduates also showed improvement (t = 5.9071, p = 0.001, df=60), but their starting and final grades were lower (1.27 SD=0.50 – 1.98 SD=1.05), with an improvement of less than one grade (0.93): see Fig. 5.

Grade at first evaluation significantly predicted behavior improvement during treatment, linear regression F= (1. 440) 102.54, Prob > F = 0.001, R-squared = 0.1890. Dogs with higher initial grades, indicating less fearfulness, showed less improvement during their treatment, potentially due to a ceiling effect.

3.2. Graduation

The graduation rate from the program was 86.17 % (380/441). Graduating dogs spent an average of 96 (SD=54.70) days in the treatment program, experiencing an average of 78 (SD=46.73) individual treatment sessions, with non-graduates receiving an average of 86 (SD=34.06) treatments over 125 (SD=47.05) days.

3.3. Adoption

Most dogs were transferred to a partner shelter or rescue group for placement in homes; a minority were adopted directly from the program. Disposition outcome was reported for 301 (79 %) of the dogs who graduated. Among graduate dogs with known disposition, 297 (99 %) were adopted: 262 after transfer, 30 directly from the program, and 5 from foster homes or by the fosterers themselves. The remainder were still in temporary foster (2) or were euthanized (2). A small number of non-graduating dogs were requested by their shelter of origin to be returned to their shelter of origin and they were ultimately adopted; See Fig. 6.

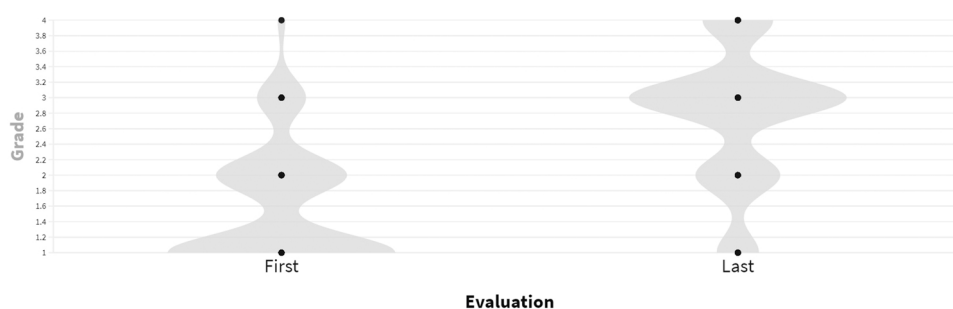Post-adoption surveys were sent to all adopters of graduate dogs and

Fig. 4. Violin plot showing behavior evaluations for the entire population at first and final evaluation. With the points marking scores equivalent to the letter grades ascending from D to A.,.
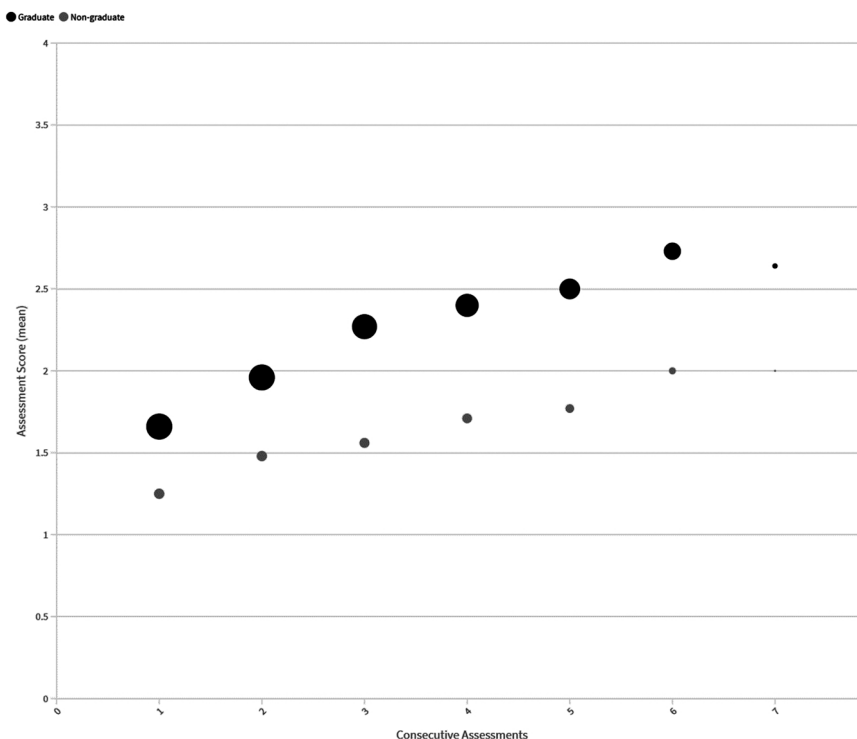
Fig. 5. Consecutive behavior evaluations with circle size showing population of resident dogs with shrinkage due to dogs leaving the program via graduation, euthanasia, or other outcomes. Black circles represent dogs who ultimately graduated the program and grey circles represent dogs who did not graduate.
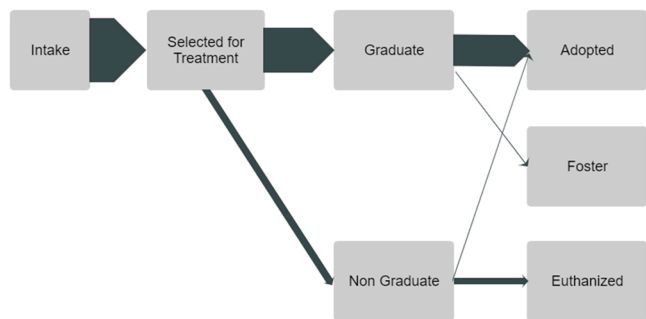

Fig. 6. Outcomes for dogs showing proportional (Sankey) flow reflecting the proportion of dogs entering the program that proceed through to the potential outcomes of adoption, foster, and euthanasia.

returned for 137 (46 %), with 121 (88 %) reporting that they were "Very Satisfied," 11 (8 %) "Somewhat Satisfied," 3 (2 %) "Neutral," and 2 (1 %) "Very Dissatisfied" with the dog.

4. Discussion

The behavior rehabilitation program described in this report proved effective in reducing fearfulness, with a majority (86 %) of dogs reaching a behavioral standard for adoption and adopter surveys indicating overall satisfaction with adopted dogs. As an observational study, our research did not include experimentally desirable elements, such as a control group that did not receive treatment or blinding of participants, for ethical and practical reasons. However, data from applied programs are crucial to objectively demonstrate outcomes and guide practices in this program, any current or future facilities with similar goals, and in animal shelters generally.

Sex and other preexisting factors (age, breed, and source) did not significantly influence severity of fearfulness in the initial behavior evaluation or treatment outcomes. There was a predominance of female dogs in the study, consistent with previous research suggesting that fear-based behavior problems are more prevalent in female dogs (Lund et al., 1996; Bamberger et al., 2006; Storengen and Lingaas, 2015). Treatment group assignment (delayed or immediate onset) did not affect length of stay in the program. However, we found that immediate-onset dogs, who started behavior modification sessions on Day 5, showed significantly more improvement during their second evaluation than those in the delay group, who received no treatment before their second evaluation. This strongly suggests that time in the environment, a predictable schedule, low-stress handling and the provision of enrichment were not sufficient for recovery to occur; we can attribute observed reduction in fear to the use of behavior modification protocols.

Successful treatment required an average of 78 behavior modification sessions over 96 days although there was considerable variation length of treatment. Non-graduating dogs tended to have more severe fear on intake and less improvement as measured by behavior assessments. Research is underway to scrutinize the data for additional factors that predict non-graduation, A better understanding of the contributors to treatment time variance for the dogs who did graduate has the potential to facilitate early identification of dogs requiring intensive treatment or benefitting from additional interventions, which could lead to program refinement—or aid in making decisions about which dogs to treat. This program represents a significant investment of time and expertise; we acknowledge that only well-resourced animal welfare agencies can provide a comparable program for moderately to extremely fearful dogs.

The presence of missing data requires some caution in making inferences from the adoption and adoption satisfaction data. Tracking adoption after animals were transferred to other groups for placement sometimes proved difficult. It is possible that shelters and adopters are more likely to respond when they have favorable results to report; however, simple procedural oversights within busy organizations are also implicated and would not be subject to this bias.

This report represents seven years of data collection from a program developed to assist dogs with poor prognoses for adoption from shelters.

The data collected and reported here demonstrate predominantly positive outcomes, particularly in producing behavioral improvement robust enough to transfer many of the dogs to a typical shelter setting for placement, and to achieve successful adoptions into homes. The use of behavior modification strategies to treat fearful dogs in a shelter environment has not previously been examined in the literature. Documenting and sharing the results of the BRC program represents a considerable advancement by demonstrating the potential for the rehabilitation of even the most fearful dogs and, thus, the prevention of euthanasia.

Participating shelters proposed dogs for treatment based on their extreme behavioral symptoms, which indicated a poor quality of life and poor chances for adoption. The outcomes discussed in this report offer hope for these animals. In this study, the majority of moderately to extremely fearful dogs proved responsive to rehabilitation efforts. In the past, such efforts may have been considered fruitless, given the severity of symptoms. Although the treatment time required was not insubstantial, we hope this report will encourage well-resourced organizations to invest in the recovery of homeless animals who fit this population's behavioral profile. Perhaps our most impactful conclusion is that the likelihood of rehabilitative success for moderately to extremely fearful dogs is surprisingly high—even for animals who come from impoverished, cruel and neglectful backgrounds.

This research represents one component of a suite of research, collaboration, and outreach with the goals of meaningfully improving the welfare and outcomes for dogs who enter animal shelters. In this context, evidence of the substantial potential for rehabilitation of extremely fearful dogs may contribute to widespread improvements in the quality of life and outcomes for this segment of the shelter population.

Conflict of interest statement

Acknowledgements

Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.applanim.2022.105689.

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