

MANAGEMENT AND REHABILITATION OF INTER-DOG AGGRESSION IN  
ANIMAL SHELTERS

by

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## ABSTRACT

Identification and treatment of inter-dog aggression is important so that animal shelters can re-home animals safely and reduce long-term confinement and euthanasia rates. This thesis describes 1) a survey study which identified current management of aggressive dogs in shelters and explored the feasibility of implementing rehabilitation for inter-dog aggression, and 2) an experimental study of the effectiveness of a rehabilitation program for reducing inter-dog aggression in shelter dogs. Of the 43 shelters that responded to the questionnaire, most admitted aggressive dogs, reported inter-dog aggression as a common problem, and estimated that less than 10% of adopted dogs are returned for inter-dog aggression. Management of aggressive dogs included humane destruction and rehabilitation. Rehabilitation methods were diverse, and respondents expressed varied levels of confidence over the success of their programs. Factors preventing rehabilitation included lack of time and financial constraints, but shelters indicated an interest in rehabilitation if a practical, scientifically validated program were available. In the experimental study, sixteen shelter dogs that showed inter-dog aggression in a behaviour test received a 10-day treatment of daily rehabilitation (rehabilitation group,  $n = 9$ ) or daily release into an outdoor enclosure (control group,  $n = 7$ ). Most rehabilitation dogs showed a decline in aggression scores when tested on the day after the last treatment, compared with their pre-treatment scores. Control dogs showed either an increase or no change in aggression scores. The change in aggression scores differed significantly between the groups ( $U = 8.5, p < 0.01$ ), but the difference was no longer significant when a reduced sample of dogs was tested one week after rehabilitation ended (Day 18). This study provides evidence of short-term reduction of aggression through a rehabilitation program, but further work is needed on effective and practical ways of maintaining the behavioural change.

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## CO-AUTHORSHIP STATEMENT

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This study was designed collaboratively by Jane Orihel, David Fraser, and Rebecca Ledger. Jane Orihel was responsible for the data collection, data analysis, and writing of the manuscript. Dr. Ledger contributed to the development of the questionnaire, choice of statistical tests, and interpretation of the findings. Drs. Fraser and Ledger contributed to the manuscript preparation.

### *Chapter 3:*

This study was designed collaboratively by Jane Orihel, David Fraser, and Rebecca Ledger. Jane Orihel was responsible for the data collection (with the help of research assistants), data analysis, and writing of the manuscript. Dr. Fraser contributed to the choice of statistical tests, interpretation of the findings, and the manuscript preparation.

## CHAPTER 1: General Introduction

### *Behavioural problems in shelter dogs*

Throughout most of the last century, animal shelters grew alongside a pet overpopulation problem (Moulton et al., 1991). Large numbers of kittens and puppies from unaltered pets were destroyed in shelters because of limited kennel space and resources. Since the early 1970's, efforts to control pet overpopulation, including sterilization programs, owner education, and animal control enforcement, appear to have successfully increased neuter rates among owned pets (Rowan and Williams, 1987). In addition, the numbers of animals admitted to and euthanized in shelters have been steadily declining (Zawistowski et al., 1998). Despite this trend, the Canadian Federation of Humane Societies reported that 37,800 dogs were admitted to 44 of its member shelters in 2004, and approximately 19% of these dogs were euthanised (CFHS, 2004).

Although shelters are receiving fewer dogs than in the past, those that they do receive are mostly young adults (Patronek and Glickman, 1994; Salman et al., 1998) and have behavioural problems that many owners are ill equipped to handle (Rollin, 1991; Patronek et al., 1996). Behaviours frequently associated with the relinquishment of pets to shelters include fearfulness, aggression, inappropriate elimination, and destructiveness (Salman et al., 1998; Wells and Hepper, 2000). Such behavioural problems are cited as the leading reasons for relinquishment in approximately 30% of cases (Wells, 1996; DiGiacomo et al., 1998). In addition, Wells and Hepper (2000) found that people adopting shelter dogs often reported unacceptable behaviour soon after adoption, and that behaviour was the primary reason (90% of cases) for dogs to be returned to the shelter.

Of behavioural problems in dogs, aggression is the most common and dangerous (Borchelt, 1983; Wright and Nesselrote, 1987; Borchelt and Voith, 1996). Inter-dog aggression (aggression towards other dogs) is one form of aggression that may disrupt the bond between owners and their pets (Haupt, 1983; Anderson, 1990). In a survey of 12 shelters in the United States, Salman et al. (1998) found that 8% of dogs were relinquished because of aggression towards other animals. Aggression towards other animals was reported to be one of the most common behavioural problems in returned

dogs by Ledger (1998, 7% of cases) and by Wells and Hepper (2000, 16% of cases) and in those admitted to a shelter with the owner's request for euthanasia (Kass et al., 2001).

### *Effects of shelter environment on dog behaviour and welfare*

Dogs face various challenges in the shelter environment. These include confinement, novelty, separation from attachment figures, and limited social interaction and exercise (Hennessy et al., 1997; Coppinger and Zuccotti, 1999; Tuber et al., 1999). In addition, the unpredictability and loss of control over the environment can further disrupt the dogs' ability to cope with the new surroundings (Seligman, 1975; Lindsay, 2000). For most social species, restrictive housing and isolation from conspecifics are considered to be significant stressors (Wolfe, 1990). Studies have shown that housing dogs under these conditions can result in hormonal changes associated with stress (Hennessy et al., 1997; Beerda et al., 1999b). For example, Hennessy et al. (1997) found that dogs confined to a shelter had higher cortisol levels than household pets in the home, particularly during the first three days after admission. The body's physiological response to stress can compromise an animal's immune function (Sapolsky, 1992), thereby reducing its long-term health.

In addition to physiological changes, it is also well known that social and spatial isolation can result in behavioural abnormalities in various species (Harlow and Harlow, 1962; Suomi, 1982; Hall, 1998). In dogs, these behavioural deficits are often displayed as stereotypies, inactivity, and excessive vocalization (Fox, 1965; Fuller, 1967; Hetts et al., 1992; Hubrecht et al. 1992; Mertens and Unshelm, 1996; Beerda et al., 1999a). Environmental stressors may contribute to the development or exacerbation of behavioural problems in shelter dogs, particularly destructiveness, vocalization and aggression (Voith and Borchelt, 1985; Tuber et al., 1999). Fear, anxiety and frustration have been suggested to increase an animal's level of arousal and aggression (Panksepp, 1998). Indeed, studies have shown that compared to dogs that were group housed, spatially and socially restricted dogs were more likely to react dominantly and aggressively towards other dogs (Mertens and Unshelm, 1996; Beerda et al., 1999a) and to show aggression in the new home (Mertens and Unshelm, 1996).

Shelter dogs are often housed in single kennels with wire fencing that allow for visual, auditory and olfactory stimulation from neighbouring dogs. This housing design can stimulate barking and aggressive behaviour (Fox, 1965; Wells, 2004) and contributes to food and cage guarding (Reid et al., 2004). Repetitive inter-cage aggression may contribute to a dog's level of stress and frustration and reduce its desirability to potential adopters (Wells and Hepper, 2000). Furthermore, inter-cage aggression may increase the likelihood of future aggressive behaviour towards humans passing by fenced boundaries (Lindsay, 2001):

#### *Improving the behaviour and welfare of shelter dogs*

Although efforts to improve the behaviour of captive dogs have often been directed toward enriching the inanimate environment (for example by increasing kennel size and/or providing furniture and toys), enrichment has also focused on providing dogs with more contact with humans and conspecifics (Hetts et al., 1992; Hubrecht, 1993; Hubrecht et al., 1992, Wells and Hepper, 2000). Shelter dogs generally receive little human interaction (0.3-2.5% of the time observed in Hubrecht et al., 1992), a situation which may be particularly difficult for dogs accustomed to human contact (Fox, 1986). Hubrecht (1993) found that laboratory dogs given small increases in daily handling (30 s) showed a reduction in destructive behaviours and were more sociable to strangers. Others have shown that gentle stroking of dogs and the presence of a caretaker can moderate the behavioural and physiological responses of shelter dogs to stress (Tuber et al., 1996; Hennessy et al., 1998, 2006).

The benefits of housing captive dogs in pairs or groups have been well documented (Hetts et al., 1992; Hubrecht et al., 1992; Mertens and Unshelm, 1996). Group housing may ameliorate some of the effects of solitary confinement by enabling dogs to behave socially and by increasing the physical complexity and size of the kennel (Hubrecht, 1995). Housing dogs together could also be used as an early intervention strategy to prevent aggression; for instance, one agency is reported to house an older resident dog with puppies to teach them inter-dog social skills (Loveridge, 1998). However, group housing may not be practical for shelters because of the increased risk of disease transmission, and is not suitable for aggressive or fearful dogs (Hubrecht, 1995).

Other concerns include the time needed to match compatible dogs, and the potential for dogs to experience stress and injury when being introduced to new groups.

### *Management of aggression in shelters*

Inter-dog aggression can contribute to difficult and dangerous working conditions for shelter staff. Movement through the shelter corridors can be stressful for workers if dogs are fighting at the cage fence, and noise levels from barking can exceed those known to cause auditory damage in humans (Sales et al., 1997). Large or very strong aggressive dogs often require two people to perform daily handling routines, and these dogs may need to be equipped with safety equipment such as muzzles or head collars (Dinnage et al., 2004). Moreover, workers may become injured during dog fights if the aggression is redirected toward the handler.

For reasons of public safety and liability, shelters often attempt to prevent the adoption of aggressive dogs by the public. Shelters may face legal action should an adopted dog cause a serious injury, and a number of municipalities and countries have introduced policies that prohibit the adoption of “dangerous” or “vicious” animals (e.g. UK’s Dangerous Dogs Act 1991, 1997). It is critical for shelters to evaluate and treat potentially aggressive dogs before considering them safe for adoption (Lacroix, 2004). However, the assessment of a dog’s vicious nature can be complex, and treatment cannot guarantee that the dog will not pose a safety risk to humans or other animals.

The recent “no-kill” movement has also influenced how shelters manage aggressive dogs. Stimulated by public debate about the appropriate role of euthanasia in shelters, many facilities have opted not to kill healthy and potentially adoptable animals (Zawistowski and Morris, 2004). Although most no-kill shelters often euthanize highly aggressive animals (particularly those aggressive to humans), dogs with less severe aggression may stay in the shelter until their behaviour improves, or they are matched with experienced adopters. Consequently, critics have expressed concern that no-kill shelters without behavioural treatment programs may be “warehousing” problem dogs by prolonging their confinement past the point where they should be humanely euthanised (Arluke, 2003).

Most shelters are ill equipped to provide adequate intervention for dogs with behavioural problems (Tuber et al., 1999). Shelters are often limited in space and funds (Moulton et al., 1991; Marston and Bennett, 2003), resources that are primarily directed towards housing and health care. Moreover, the absence of standardized rehabilitation programs for shelter dogs may be preventing their more widespread use, particularly for serious problems such as aggression. Possibly because of these limitations, shelters often rely on environmental interventions to manage behavioural problems (for example, by isolating aggressive dogs or placing visual barriers between dogs) (personal observation). However, demonstrations of the benefits of rehabilitation may serve to shift attitudes and resources towards such programs.

#### *Description, causes, and treatment of inter-dog aggression*

Inter-dog aggression can result from multiple factors and is manifested in many ways (Moyer, 1968; Voith, 1980; Beaver, 1983; Hart and Hart, 1985; Blackshaw, 1991; Borchelt and Voith, 1996). Most classifications of inter-dog aggression are based on the stimulus that elicits the aggression and/or the dog's motivation to behave aggressively. The motivation for aggression is often inferred by observing the dog's body posture and behaviour during exposures to the aggression-eliciting stimulus. Aggression motivated by fear (defensive aggression) is often exhibited in dogs by low postures, freezing and threatening behaviour. In contrast, offensive (dominance-related) aggression is often indicated by high postures, staring and chasing (Borchelt and Voith, 1996; Lindsay, 2001).

A number of authors have distinguished between aggression directed towards familiar (household) dogs and that towards unfamiliar (non-household) dogs (Hart and Hart, 1985; Borchelt and Voith, 1996; Overall, 1997; Fatjó and Manteca, 2003), although few studies have considered these contexts separately (Landsberg, 1991; Sherman et al., 1996; Roll and Unshelm, 1997). In addition, aggression may be shown towards specific dogs (e.g. a certain size, gender or breed) or shown in specific contexts (e.g. situations involving food, doors, or sleeping areas). Alternatively, aggression may be generalized to all unfamiliar dogs, or to all contexts involving hierarchy within the household (Overall, 1997).

Information on the incidence of inter-dog aggression is available through clinical records and owner surveys, although differences in the sample populations make comparisons difficult. For instance, Blackshaw (1991) reported that 12% of dogs referred to a clinic for behavioural problems were diagnosed with inter-dog aggression. Of the dogs presented specifically for aggression, cases of inter-dog aggression ranged between 12% (Borchelt, 1983) and 42% (Beaver, 1983). In a survey of dog owners, only 3% reported that their dogs were aggressive to other dogs (Campbell, 1975). In contrast, Voith (1980) suggested that inter-dog aggression is one of the most common behavioural problems: 30% of owners of intact males reported that their dogs fought with other male dogs.

Sherman et al. (1996) found that among the dogs brought to behaviour therapy, household aggression was three times more common than aggression towards unfamiliar dogs. Household attacks tended to be more severe than non-household attacks, especially among female pairs. However, these authors and others (Roll and Unshelm, 1997) have found that dogs aggressive towards unfamiliar dogs tend to fight frequently, suggesting that this problem is often seen in a smaller number of dogs that attack repeatedly. Dogs that are aggressive towards non-household dogs are more likely to be difficult to control (Sherman et al. 1996) and to show predatory behaviour (e.g. chasing small animals or moving objects).

It has been suggested that inter-dog aggression is the manifestation of anxiety or fear due to a conflict of social status (Hart and Hart, 1985; Borchelt and Voith, 1996; Overall, 1997). Inter-dog aggression typically appears at social maturity (1-3 years) when dogs begin to develop dominant-subordinate relationships (Borchelt and Voith, 1996). Dogs form hierarchies within their social systems, primarily based on size, age and sex. Status is communicated and contested by threats (growling, baring teeth, staring) and submissive behaviour (muzzle licking, rolling on back, averting eye contact) (Fox, 1970). In domestic situations, inter-dog aggression has been suggested to arise when the social relationship between resident dogs is uncertain. This can occur when a second dog is introduced into the home, or when the hierarchy is modified, for example when a dominant dog becomes ill. Aggression towards non-household dogs may be related to uncertain social relationships with unfamiliar dogs; these dogs may thus not have a

problem with another household dog as long as a stable hierarchy is maintained (Overall, 1997).

Dogs have a tendency to challenge other dogs, both within and outside their social group. However, confrontations in wild canids usually involve threats and posturing without overt attack (Lindsay, 2000). Domestication and selective breeding may have disrupted some of the natural communication patterns in dogs, such as their ability to interpret and display threat and submissive behaviours (Goodwin et al., 1997). The physical characteristics of certain modern breeds, such as short or cropped tails and ears, may further obscure communication (Bradshaw and Brown, 1990). More dramatically, dogs selectively bred for fighting or guarding often have lower aggression thresholds and greater pain tolerance than the average dog (Lindsay, 2001). Fighting dogs typically do not respond to the submissive signals of other dogs and will not show warning displays before an attack (Dinnage et al., 2004).

Inter-dog aggression often occurs between dogs of the same sex, but it is more prevalent among males (Voith, 1980; Beaver, 1983; Borchelt, 1983; Hart and Hart, 1985; Sherman et al., 1996; Roll and Unshelm, 1997). Intact males are not only the most common aggressors in dog fights, but also the most common targets (Roll and Unshelm, 1997). The male sex hormone, testosterone, is associated with increased roaming and urine marking in male dogs, behaviours that may facilitate confrontations between unfamiliar dogs. Castration has been found to decrease fighting, and this appears to be effective regardless of the dog's age (Hopkins et al., 1976). Male sex hormones may also influence a dog's level of aggression; Overall (1997) observed that compared to neutered males, aggression in intact males is often more intense, quicker, and lasts longer. In contrast, spayed females have been found to initiate aggression more frequently than intact females (Sherman et al., 1996) and to display more dominance-related aggression after spaying (Voith and Borchelt, 1982; Kim et al., 2006). Most household aggression involves spayed females (Sherman et al., 1996), whereas most non-household aggression involves unfamiliar intact males (Roll and Unshelm, 1997).

A dog's reactivity to other dogs can be influenced by its experiences during early life, a time that is critical for establishing social relationships (Scott and Fuller, 1965). Puppies raised in isolation until the end of the sensitive period (12 weeks of age) tend to

show deficits in play activity and to behave aggressively towards peers (Fox and Stelzner, 1967). Even if a dog learns to interact appropriately with littermates, these social skills may not be retained unless the dog continues to receive frequent conspecific socialization (Lindsay, 2001). Indeed, Roll and Unshelm (1997) found that almost half of aggressors and victims of dog attacks had few interactions with other dogs between 5 weeks and 5 months of age. Many authors therefore emphasize the need for prevention and early diagnosis of inter-dog aggression (Voith, 1995; Overall, 1997; Fatjó and Manteca, 2003).

A study comparing the aggressors and victims in dog fights has identified a number of differences in the characteristics of their owners (Roll and Unshelm, 1997). Owners of aggressors were commonly males who obtained the dog for security reasons, did not develop an emotional relationship with the dog, and used physical training methods. Many owners of victims were women, kept the dog for safety or to prevent loneliness, and used less forceful training methods. Almost half of the owners of aggressors showed no reaction during or after a dog fight, while others were passive but shouted at the dog after the fight. Some owners may be in denial about the seriousness of their dog's aggressiveness, or may tolerate the behaviour because of its perceived protective value (Lindsey, 2000).

Treatment of inter-dog aggression in clinical practice has been relatively successful (Mugford, 1992; Sherman et al., 1996) and commonly includes castration, progesterone therapy, behaviour modification, and/or drug therapy (Voith 1980, 1995; Hart and Hart, 1985; Blackshaw 1991; Sherman et al., 1996; Overall, 1997). Because inappropriate learning can cause aggression to escalate and become persistent (Overall, 1997), many veterinarians recommend that castration or medication is combined with behaviour modification (Juarbe-Díaz, 1997; Overall, 1997). Reducing the facilitative effects of hormones and arousal may also make the dog more amenable to behaviour modification.

A number of different methods are used in behavioural treatment for inter-dog aggression:

- Basic obedience is often recommended as the first phase of treatment (Blackshaw, 1991; Clark and Boyer, 1993; Overall, 1997; Fatjó and Manteca, 2003). Teaching deferential and compliant behaviour can establish owner control and give the dog a

sense of security, factors that may be beneficial during behaviour modification (Clark and Boyer, 1993; Juarbe-Díaz, 1997; Overall, 1997).

- Counter-conditioning can be used to teach the dog desirable behaviour that is incompatible with the original aggressive response elicited by the other dog (Voith, 1980; Hart and Hart, 1985; Overall, 1997). For example, the dog may be rewarded for sitting or lying down in the presence of other dogs.
- Overt aggressive behaviour can be prevented or interrupted by distracting the dog with noise or food, or correcting the aggression with a head collar (Mugford, 1992; Voith, 1995; Overall, 1997; Fatjó and Manteca, 2003).
- For non-household aggression, treatment often includes desensitization to the approaches of unfamiliar dogs (Hart and Hart, 1985; Mugford, 1992; Sherman et al. 1996; Overall, 1997). Desensitization aims to reduce anxiety and arousal in aggressive dogs by gradually exposing them to other dogs at increasingly close distances.
- For household aggression, treatment often consists of stabilizing the social hierarchy by reinforcing the status of higher-ranking dogs and reducing the privileges of lower-ranking dogs (Sherman et al., 1996; Juarbe-Díaz, 1997; Overall, 1997). For example, younger or stronger dogs can be fed and praised first, and given preferential access to sleeping areas and toys.

### *Behavioural assessment of shelter dogs*

Many shelters are beginning to use assessment tests to identify potential behavioural problems and improve owner-dog matching (Marston and Bennett, 2003). Assessment tests involve recording the dogs' responses to a series of controlled situations that are likely to elicit the target behaviours. Although various tests to assess dog behaviour have been described in the scientific literature (e.g. Goddard and Beilharz, 1986; Netto and Planta, 1997; Svartberg and Folkman, 2002; van den Berg et al., 2003), many are not suitable for shelter use because they are too long or rely on the presence of the dog's owner. A number of tests specific to shelter dogs are available (e.g. SAFER: American Humane Association, 2002; Sternberg, 2002); these are often communicated to the shelter community through instructional workshops, books, websites and videos.

However, only a few of these tests (Ledger, 1998; van der Borg et al., 1991; Weiss, 2002) have been scientifically validated by correlating the dogs' behavioural responses with external measures.

Testing for inter-dog aggression often involves recording the dog's response when confronted by another dog, usually of the same gender and sex as the test dog (van der Borg et al., 1991; Weiss, 2002), or when walked near other kennelled dogs (Ledger, 2003). These tests were found to predict later aggression with fairly good accuracy; however, van der Borg et al.'s (1991) test generated many false positives, whereas Ledger's (2003) generated many false negatives. Importantly, van der Borg et al. (1991) found that their test made twice as many correct predictions as did shelter staff. In general, such tests can provide shelters with a quick and fairly accurate indication of inter-dog aggression.

However, testing for inter-dog aggression with a single stimulus dog may not be sufficient when targeting dogs for behavioural treatment. The test context, including the characteristics of the particular stimulus dog, may influence whether a dog will show aggression (Goddard and Beilharz, 1985). Moreover, the motivation for inter-dog aggression may be related to fear or territorial aggression if the behaviour is restricted to these contexts (Overall, 1997). Fear aggression may be shown when a dog is unable to escape a fear-provoking situation, for example when a tethered dog is approached by a threatening stimulus. Territorial aggression is often shown towards individuals entering an area in which the animal has established itself (Lindsay, 2001). Because these forms of aggression may be difficult to distinguish (O'Farrell, 1986; Overall, 1997), testing dogs in different situations with several stimulus dogs may increase the sensitivity of the test and provide greater insight into the motivational cause for the aggression.

### *Research objectives*

Given the context that dogs are often relinquished to shelters because of potentially modifiable behavioural problems, rehabilitation programs are likely to play an increasingly important role in shelter practice. Such programs could improve the welfare of dogs with behavioural problems during their stay at the shelter, and increase their chances of adoption and retention within the new home (Wells and Hepper, 2000).

Furthermore, the introduction of rehabilitation programs could broaden the function of shelters to more directly address the factors contributing to pet relinquishment (Tuber et al., 1999).

However, little is known about how shelters are currently managing aggressive dogs, and whether rehabilitation is a feasible option. Moreover, there has been little empirical study to evaluate the effect of rehabilitation on the behaviour of shelter dogs. Many shelters may thus be reluctant to direct limited funds towards programs whose effectiveness and practicality have not been evaluated. Accordingly, the objectives of this thesis are twofold. First, the research aimed to describe the current management practices for aggressive dogs in Canadian shelters, and to explore the feasibility of implementing rehabilitation for inter-dog aggression. The second objective was to develop and experimentally evaluate a rehabilitation program to reduce inter-dog aggression in shelter dogs.

This thesis is composed of two manuscripts. The first (Chapter 2) describes a survey of the management of aggression by animal shelters in Canada. The second (Chapter 3) describes an experiment to evaluate the effectiveness of a shelter rehabilitation program for reducing inter-dog aggression. The final chapter (Chapter 4) provides a brief synthesis of the study findings and comments on the overall significance of the research. Chapters 2 and 3 were written as independent papers for publication, and therefore repeat some information presented in the introduction sections.

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## **CHAPTER 2: A Survey of the Management of Inter-dog aggression by Animal Shelters in Canada<sup>1</sup>**

### **INTRODUCTION**

Behavioural problems are a common reason why dogs are relinquished to rescue shelters (Patronek et al. 1996; DiGiacomo et al. 1998). Of dogs surrendered to shelters, it has been reported that 30% of cases are due to behaviour problems (Wells 1996). Moreover, many dogs adopted from shelters are returned because of misbehaviour; one study found that of the dogs returned to a shelter, behavioural reasons were cited as the cause for return in 72% of cases (Ledger 1998). Two of the most common behavioural problems in returned dogs are aggression towards people (22%) and aggression towards other dogs (inter-dog or intraspecific aggression) (7%) (Ledger 1998).

Dog aggression poses a threat to the safety of people in the family and the community. For this reason, many countries prohibit the re-homing of dangerous dogs (e.g. UK's Dangerous Dogs Act 1991, 1997). Consequently, many shelters have a legal as well as an ethical responsibility not to re-home aggressive dogs into the community. Where such policies exist, the aims are 1) to prevent harm to people and other animals by aggressive dogs, 2) to avoid prosecution for re-homing a dog that causes harm, 3) to safeguard the reputation of dogs in society, and 4) to reduce the number of dogs subsequently returned to shelters, thus reducing stress to the dog and owner and inefficient use of shelter resources (Ledger 2003).

As a result of these concerns, aggressive dogs are often kept long-term in the shelter, and/or ultimately euthanised (Hunthausen 1997; Tuber et al. 1999; Marston and Bennett 2003). Prolonged confinement reduces the welfare of the animal and is associated with stress in kennelled dogs (Beerda et al. 1999). Shelter facilities are often designed to provide physical containment and disease prevention rather than to promote the dog's emotional well-being (Marston and Bennett 2003). Dogs are often housed individually in close proximity, a situation likely to cause or exacerbate existing aggression problems (Beerda et al. 1999). To reduce problems with liability and limited

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resources, many shelters have a policy to euthanise aggressive dogs. As a result, large numbers of animals are euthanised each year in rescue shelters.

Veterinarians and animal welfare agencies are showing increased interest in behavioural therapies to treat canine aggression (Voith 1991; Tuber et al. 1999; Overall 1997). Numerous recommendations for the treatment of inter-dog aggression in clinical practice have been published (Voith 1980; Hart and Hart 1985; Blackshaw 1991; Overall 1997) and treatment of this behavioural problem has been relatively successful (Mugford 1992; Sherman et al. 1996). Rehabilitation for behavioural problems is also gaining the attention of animal rescue organizations, perhaps partly because of the recent shift towards “no-kill” policies (Arluke 2003).

Although many shelters are committed to improving the welfare of relinquished and stray dogs, they are often ill equipped to provide intervention for behavioural problems. Receiving a large number of unwanted pets each year, shelters are constrained by space and funds (Moulton et al. 1991; Marston and Bennett 2003) which must be directed primarily towards housing and health care. Additionally, the absence of structured rehabilitation programs for dogs in animal shelters is preventing widespread application, particularly for serious problems such as aggression.

Little information is available on how shelters are currently managing aggressive dogs, and whether rehabilitation is a feasible option. This paper describes a survey conducted to gain insight into the current management of aggressive dogs in animal shelters, and to explore how shelter staff perceive the challenges and feasibility of implementing rehabilitation for inter-dog aggression.

## METHODS

### *Participants*

A questionnaire was distributed by post to 95 member organizations of the Canadian Federation of Humane Societies (CFHS) with kennel facilities for dogs.<sup>2</sup> Seventy-six shelters with Internet services that had not responded within one month of receiving the questionnaire were re-contacted via email and encouraged to complete

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<sup>2</sup> This study was conducted in accordance with the guidelines of the UBC Behavioural Research Ethics Board (Appendix 2).

either the paper questionnaire or an electronic version. Thirty-three shelters replied by post and 10 completed the electronic version, giving a total of 43 shelters (45%) which formed the basis of the dataset. These included shelters from all provinces of Canada, with the highest number of responses from British Columbia (15). A subset of eight shelters with rehabilitation programs for inter-dog aggression and 14 without rehabilitation were subsequently contacted by telephone for additional information and discussion. The questionnaire was completed by a staff member in a managerial position (32 cases), a shelter animal behaviourist (3), an animal care worker or technician (6), or a person of unknown position (2).

### *Survey*

The questionnaire consisted of 24 open and closed questions regarding two types of aggression problems: inter-dog aggression and general aggression (any form including aggression towards people) (Appendix 1). Information was collected on the shelter's intake process for dogs with aggression, the incidence and perception of inter-dog aggression, and management practices for aggressive dogs. Participants also rated the suitability of various treatment techniques for inter-dog aggression.

Introductory questions asked respondents to report on: 1) the number of available dog kennels in the shelter, 2) the number of dogs typically received per year, and 3) the number of staff members employed by the shelter. The following information was collected about the intake process: 1) whether owners were required to indicate on the shelter intake form whether their dog is aggressive towards other dogs, 2) how often the shelter admits dogs reported by their owners as aggressive towards other dogs, and 3) whether the shelter conducts a behavioural assessment of dogs for aggression towards other dogs. Respondents also estimated 1) the number of newly admitted dogs that demonstrate inter-dog aggression upon intake, 2) the proportion of dogs returned to the shelter by new owners because of inter-dog aggression, and 3) the proportion of owners they believe are concerned about inter-dog aggression. Five scenarios (Table 2.3) were used to describe how a dog's behaviour towards conspecifics can change over time in the shelter. Participants rated each scenario on a 5-point Likert-type scale (1 = "never," 2 = "rarely," 3 = "sometimes," 4 = "very often" and 5 = "always") (Likert 1932).

A multiple response question was used to ask whether aggressive dogs are generally 1) put up for immediate adoption, 2) placed into foster homes, 3) rehabilitated within the shelter before adoption is allowed, or 4) humanely destroyed. An open-ended “other” category was included to allow participants to report management methods besides those listed.

Regarding the management of dogs with inter-dog aggression, respondents were asked whether these dogs were housed differently, were excluded from group exercise areas, or were subjected to special handling restrictions. Participants were asked whether the shelter performed obedience training or rehabilitation for inter-dog aggression, and, if so, how successful they judged the rehabilitation to be at reducing inter-dog aggression. Respondents who indicated that they did not presently rehabilitate dogs for inter-dog aggression were asked whether such a program would be feasible to implement in the shelter and what factors prevented them from implementing rehabilitation. In a follow-up telephone call to shelters without rehabilitation, a qualitative interview using open-ended questions determined whether participants would consider using a rehabilitation program if it was scientifically validated and designed specifically for use within animal shelters. Respondents were asked to comment on how implementing such a program may affect the number of dogs euthanised.

Finally, participants were given a list of various treatment approaches for reducing inter-dog aggression (Table 2.1). The techniques were based on a number of commonly recommended treatments (Voith 1980; Hart and Hart 1985; Blackshaw 1991; Mugford 1992; Overall 1997), including positive reinforcement, desensitization, counter-conditioning, correction of aggressive behaviour, and distraction. Two additional practices that may influence aggression were included: obedience training, which is often used as a preventative measure for canine aggression or in combination with treatment based on behaviour modification (Blackshaw 1991; Reisner et. al 1994; Cameron 1997; Overall 1997), and increased exercise and/or play, which is sometimes included in shelter enrichment programs as it may affect the psychological well-being of dogs (Reid et al. 2004). Participants were asked to rate the degree to which they believed the treatment would be *effective* (how successful it would be at reducing inter-dog

aggression), *practical* (its ease of use, and the availability of qualified staff and space) and *affordable* (financially possible) within the shelter.

#### *Data analysis*

Statistical analysis was performed with SPSS 11.0. To test whether shelters receiving more dogs per year experience a higher incidence of inter-dog aggression, Spearman rank-order correlation was used. Fisher's exact test of proportions was used to determine whether shelters with rehabilitation for inter-dog aggression have a lower proportion of dogs returned for this behaviour problem. A similar analysis tested whether shelters that assess dogs for inter-dog aggression are more likely to perform rehabilitation. The Kruskal-Wallis test for independent samples was used for ordinal and categorical variables with more than two possible values, and corrected multiple comparison tests were performed to identify significantly different pairs (Siegel and Castellan 1988). All tests were two-tailed with an alpha value of 0.05.

## **RESULTS**

Shelters had a range of 5-100 dog kennels (median = 16), received 40-3700 dogs per year (median = 442) and had 1-60 salaried employees (median = 6).

#### *Intake process of aggressive dogs*

Of the 43 shelters that responded, 42 (97.7%) reported that they require relinquishing owners to indicate on the intake form whether their dog tends to be aggressive toward other dogs. Thirty-three shelters (76.7%) admitted dogs reported by their owners as aggressive towards other dogs, and 10 (23.3%) rarely admitted such dogs. No shelter indicated that dogs reported as aggressive to other dogs are never admitted. Thirty-two shelters (74.4%) conducted behavioural assessments of the dogs, 28 of which included testing for aggression towards other dogs (65.1%). Fifteen shelters (34.9%) relied exclusively on owner reports as their source of information about the dog's level of inter-dog aggression.

### *Incidence and perception of inter-dog aggression*

The majority of respondents (25; 58.1%) reported that inter-dog aggression was moderately common, affecting 20-49% of dogs in the shelter (Table 2.2). Most respondents estimated the proportion of dogs returned to the shelter because of inter-dog aggression as less than 10% (Table 2.2), but three shelters reported a very high proportion of dogs returned for this reason. Thirty-one of the 43 shelters (72.1%) considered that more than 20% of owners are concerned about inter-dog aggression (Table 2.2). No correlation was found between the estimated proportion of dogs with inter-dog aggression and the number of dogs received per year at the shelter.

Respondents indicated how a dog's behaviour towards other dogs is likely to change after admission to the shelter (Table 2.3). The reported frequency of the five scenarios differed significantly ( $KW = 59.1$ ,  $df = 4$ ,  $p < 0.001$ ). Pairwise comparisons showed that respondents believed that the case where a dog "starts off not aggressive and stays the same" was more common than any of the other scenarios provided ( $p < 0.05$ ).

### *Management of general aggression*

The most frequently cited management practice for dogs showing any form of aggression was humane destruction (37 shelters; 86%). Other practices included rehabilitating the dog within the shelter before adoption is allowed (20 shelters; 46.7%) and placing the dog in foster care (15 shelters; 34.9%). Only two shelters (4.7%) reported putting the dog up for immediate adoption. Twenty-three shelters (53.5%) also selected the "other" category; 16 of these reported that they performed an assessment of the dog, 10 rehabilitated the dog outside the shelter, seven placed the dog in quarantine, one transferred the dog to another shelter, one consulted a behaviour specialist, and two placed the dog for adoption either with restrictions on potential adopters or with a warning regarding the dog's potential for aggression.

### *Management of inter-dog aggression*

Most shelters reported using special management methods for dogs with inter-dog aggression. Thirty shelters (69.8%) reported that dogs with inter-dog aggression are housed differently, for example singly in a kennel with adjacent kennels empty, or with a

visual barrier between the aggressive dog and neighbouring dogs, or by placing the dog in an area that minimizes contact with other dogs. Of the 40 shelters with areas where dogs can be exercised in groups, 33 shelters (82.5%) did not allow dogs to participate if they showed aggression to other dogs. Thirty-five shelters (81.4%) reported using special handling restrictions for dogs with inter-dog aggression, specifically by limiting handling to experienced staff, isolating the dog from other dogs when removed from the kennel, and restraining the dog on a leash at all times outside the kennel.

Of the 41 shelters that responded to the question about rehabilitation for behavioural problems, 26 (63.4%) reported performing rehabilitation and 14 (34.1%) indicated that they had rehabilitation specifically for inter-dog aggression. Most respondents described using a “socialization” process in which the aggressive dog is exposed to other dogs on a leash or through a fence. Other strategies included stress reduction techniques (providing more time outside, providing toys in the kennel, and isolating the dog from other dogs), desensitization (rewarding the dog for non-aggressive behaviour during increasingly close encounters with a stimulus dog) and distraction (providing the dog with a toy to carry in its mouth during exposure to other dogs). The majority of respondents described the frequency and duration of rehabilitation as variable, depending on the availability of staff, time and space. Of shelters that provided rehabilitation for inter-dog aggression, more than half (8 of 14) also performed obedience training.

Rehabilitation for inter-dog aggression was performed by 14 of the 18 shelters that assessed dogs for aggression towards other dogs, but by none of the eight shelters that did not perform assessments ( $\chi^2 = 13.48, p < 0.001, n = 26$ ). Of the 14 shelters that used rehabilitation for inter-dog aggression, 10 used standardized assessment tests, three relied on informal observations by staff and volunteers, and one provided no details.

Of the 13 shelters that described their rehabilitation program for inter-dog aggression, seven judged it to be “successful” or “very successful,” four rated it as either “unsuccessful” or “very unsuccessful,” and two reported that they were “uncertain” about the program’s success. Interestingly, the estimated proportion of dogs returned because of inter-dog aggression was similar for shelters that performed rehabilitation for this problem (11 of 14 shelters reporting that less than 20% are returned) compared to those

that did not perform rehabilitation (24 of 27 shelters reporting that less than 20% are returned).

#### *Feasibility of rehabilitation for inter-dog aggression*

Of the 29 shelters without a rehabilitation program for inter-dog aggression, 17 indicated that such a program would not be feasible to implement in the shelter. The two most frequently cited obstacles were "lack of time" and "financial constraints" (both reported by 28 shelters), followed by "lack of expertise" and "lack of facilities" (21 shelters), "danger to other dogs" (19 shelters) and "lack of equipment" (14 shelters). Respondents also expressed concern about the liability and risk associated with releasing a dog into the community if the dog had shown inter-dog aggression in the shelter. Beyond the liability issue, other respondents expressed concerns about the effect of releasing aggressive dogs on the public's perception of dogs and animal organizations. As one respondent noted, "Adoption of an aggressive dog may ultimately reflect badly on the dog community in general should there be an untoward display of aggression." Another reported that dogs that have been deemed vicious are "difficult to rehabilitate" and that there would be a degree of "uncertainty of rehabilitation success." One respondent stated that it would be "unethical to re-home an animal without serious rehabilitation."

When 14 shelters without rehabilitation programs for inter-dog aggression were subsequently contacted by telephone, all participants reported that they would consider using a validated rehabilitation program designed specifically for use in shelters. Most respondents predicted that such a program would significantly decrease (nine respondents) or marginally decrease (two respondents) the number of dogs that would otherwise be euthanised at the shelter. As one respondent reported, "If the program was effective, then more dogs would be put up for adoption, and approximately half of the dogs that are now euthanised would be rehabilitated." Three of the 14 respondents stated that the number of dogs euthanised would not be greatly affected; however, these were shelters that either had very low euthanasia rates (less than 10%), did not euthanise dogs for inter-dog aggression, or reported a relatively low incidence of inter-dog aggression in the shelter. Despite high levels of interest in a rehabilitation program, respondents

indicated that the feasibility of such a program would depend on its efficiency and practicality within the shelter: "Implementing it would depend on how easy it is and how long it would take for each dog to improve." Another respondent foresaw a formal rehabilitation program as a means to educate new owners and potentially increase the adoption rate of dogs with behavioural problems: "People are more receptive to adopting dogs with issues if they are given information, advice and training techniques on how to handle them and work with them."

#### *Effectiveness, practicality and affordability of rehabilitation techniques*

The Kruskal-Wallis test showed significant differences between the seven possible rehabilitation methods in ratings of their effectiveness ( $KW = 36.14$ ,  $df = 6$ ,  $p < 0.001$ , Figure 2.1a) and practicality ( $KW = 17.538$ ,  $df = 6$ ,  $p < 0.01$ , Figure 2.1b), but not affordability ( $KW = 9.739$ ,  $df = 6$ ,  $p = 0.136$ , Figure 2.1c). Pairwise comparisons were not significant. Positive reinforcement was rated very or somewhat effective by 38 of the 40 shelters that commented on this method (95%), desensitization by 38 of 41 shelters (92.7%), obedience training by 37 of 40 shelters (92.5%), and counter-conditioning by 36 of 42 shelters (85.7%), whereas less support was given to correction (21 of 41 shelters; 51.2%) and distraction (27 of 42 shelters; 64.3%). Respondents rated positive reinforcement as the most practical (33 of 39 shelters; 84.6%) and affordable (31 of 39 shelters; 79.5%) of the methods; correction received the least support for practicality and affordability (20 of 40 shelters on both; 50%). Respondents showed the most uncertainty regarding the effectiveness, practicality and affordability of distraction and correction.

## **DISCUSSION**

This survey found that the management of inter-dog aggression is an important issue for many shelters. Respondents represented shelters which differed in size, practices, and regions. All shelters were found to admit aggressive dogs, and many acquired information about aggression from owner reports and assessment tests. Interestingly, a shelter's total intake was not correlated with the estimated proportion of dogs with inter-dog aggression, suggesting that both large and small shelters experience the problem to a similar extent.

The incidence of inter-dog aggression was generally reported as moderate, with the majority of participants estimating its presence in 20-49% of dogs. Most respondents estimated that less than 10% of dogs are returned to the shelter because of inter-dog aggression, but a few reported much higher levels. The results are comparable to the 7% returned for aggression reported by Ledger (1998), and slightly lower than the 16% identified by Wells and Hepper (2000). On the other hand, van der Borg et al. (1991) found that inter-dog aggression was one behavioural problem shown by newly adopted shelter dogs that did *not* result in the dog being returned.

Most shelter employees believed that a dog's level of aggression toward other dogs remained relatively stable over time in the shelter. This suggests the perception that dogs starting off not aggressive towards other dogs are unlikely to develop aggression while in the shelter and that dogs showing inter-dog aggression upon admission would not normally worsen or improve over time in the shelter. This implies that most dogs with inter-dog aggression could be identified within a short time after admission to the shelter. In line with this result, Ledger and Baxter (1997) found that shelter dogs' responses to other dogs the day after admission to the shelter corresponded with inter-dog aggression after adoption.

Over half of shelters in this survey were found to conduct some form of behavioural assessment for aggression towards other dogs, and these shelters were more likely to use a standardized assessment test and provide rehabilitation for inter-dog aggression, presumably because behavioural therapy is often chosen on the basis of a behavioural assessment (van der Borg et al. 1991). The remaining shelters did not perform behavioural testing before re-homing, instead relying on owner reports. Despite efforts by shelter workers to obtain accurate records of behavioural problems through intake documents, it has been suggested that relinquishing owners may be under-reporting the presence of behavioural problems in their pets (DiGiacomo et al. 1998; Wells and Hepper 2000; Ledger et al. 2004), particularly if owners suspect it will result in euthanasia. More widespread use of standardized assessment tests by shelters to objectively assess canine aggression could improve the identification of dogs that may be unsafe to return to the community.

The most common management practice for aggressive dogs appears to be euthanasia, both in this study and others (Olson et al. 1991; Patronek et al. 1996). However, the results indicate that many shelters are currently applying behavioural intervention: 20 shelters reported rehabilitating aggressive dogs within the shelter, and 14 of these conducted some form of rehabilitation for inter-dog aggression. However, descriptions of rehabilitation methods were varied, and the frequency of rehabilitation depended on available resources. Respondents did not appear confident in the success of their rehabilitation programs as almost half (6 of 13) of those contacted by telephone indicated their program was unsuccessful or were uncertain about its success.

Many shelters reported that a lack of resources prevented them from implementing rehabilitation programs. However, strong interest was expressed for scientifically validated rehabilitation methods for shelter dogs. Shelters anticipated that such a program would likely reduce the number of dogs euthanised for aggression or released from the facility with a predisposition towards aggression. However, some respondents noted that even if an effective program were available, some uncertainty would remain about the safety of returning an aggressive dog to the community. The implementation of rehabilitation programs can broaden the function of shelters beyond housing abandoned pets (Wells and Hepper 2000), and also provide a resource for owners facing problem behaviour in their pets (Tuber et al. 1999).

Of the rehabilitation techniques listed, positive reinforcement was rated as the most effective, practical and affordable, whereas distraction and correction received the lowest ratings. Respondents were more confident in techniques such as desensitization, obedience training and counter-conditioning which are based on rewarding the dogs for desirable behaviour (positive reinforcement). This result is consistent with commonly recommended treatments for aggression between unfamiliar dogs (Voith 1980; Hart and Hart 1985; Sherman et al. 1996; Overall 1997).

Distraction and correction were consistently rated lowest in effectiveness, practicality and affordability compared to other techniques. The perceived infeasibility of these methods was surprising as the equipment required (e.g. head collars and rattle cans) is inexpensive compared to the cost of staff time necessary for desensitization or increased exercise. While survey participants did not judge punishment to be a suitable

treatment method, Borchelt and Voith (1985) suggest that punishment can effectively reduce an animal's motivation to engage in inappropriate behaviour if sufficient opportunities for acceptable behaviour are provided. However, the lower overall ratings may reflect unfamiliarity with these techniques, or a reluctance to accept punishment-based methods.

## **CONCLUSION**

Although most shelters humanely destroy dogs with aggression as a result of policies or liabilities associated with the re-homing of aggressive dogs, many shelters are now using rehabilitation as well. However, rehabilitation programs for inter-dog aggression varied in methods and the amount of reported success, and were hindered by a lack of resources. Considerable interest was shown for a scientifically validated rehabilitation program for reducing inter-dog aggression in shelter dogs. Such a program could potentially provide shelters with a tool for reducing the number of aggressive dogs that are adopted and the number that are returned to shelters for inter-dog aggression.

## **ACKNOWLEDGEMENTS**

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**Table 2.1.** Descriptions provided in the questionnaire of techniques used in the rehabilitation of inter-dog aggression.

Technique	Definition
Obedience training	The dog responds to cues given by a trainer by performing basic behaviours (e.g. recall, sit and stay).
Positive reinforcement	Non-aggressive behaviour is rewarded with something that the dog will work to gain at a given moment (e.g. food or attention).
Desensitization	The dog is repeatedly exposed to an unfamiliar dog at increasing proximity, as long as the dog being treated remains non-aggressive. Non-aggressive behaviour is rewarded. The procedure is repeated with other unfamiliar dogs.
Counter-conditioning	The dog is taught a behavioural response other than the original aggressive response in the presence of another dog (e.g. sitting upon command).
Increased exercise and/or play	Increasing the frequency or duration that the dog is exercised or engaged in play.
Correction of aggressive behaviour	Each time that an aggressive signal is produced by the dog in the presence of another dog (e.g., growling, staring or lunging), the trainer orients the head and/or body of the dog being treated away from the second dog.
Distraction	A distracting stimulus (e.g. rattle can or a spray of citronella) is used to interrupt an aggressive encounter when the dog being treated has initiated a threat signal towards another dog.

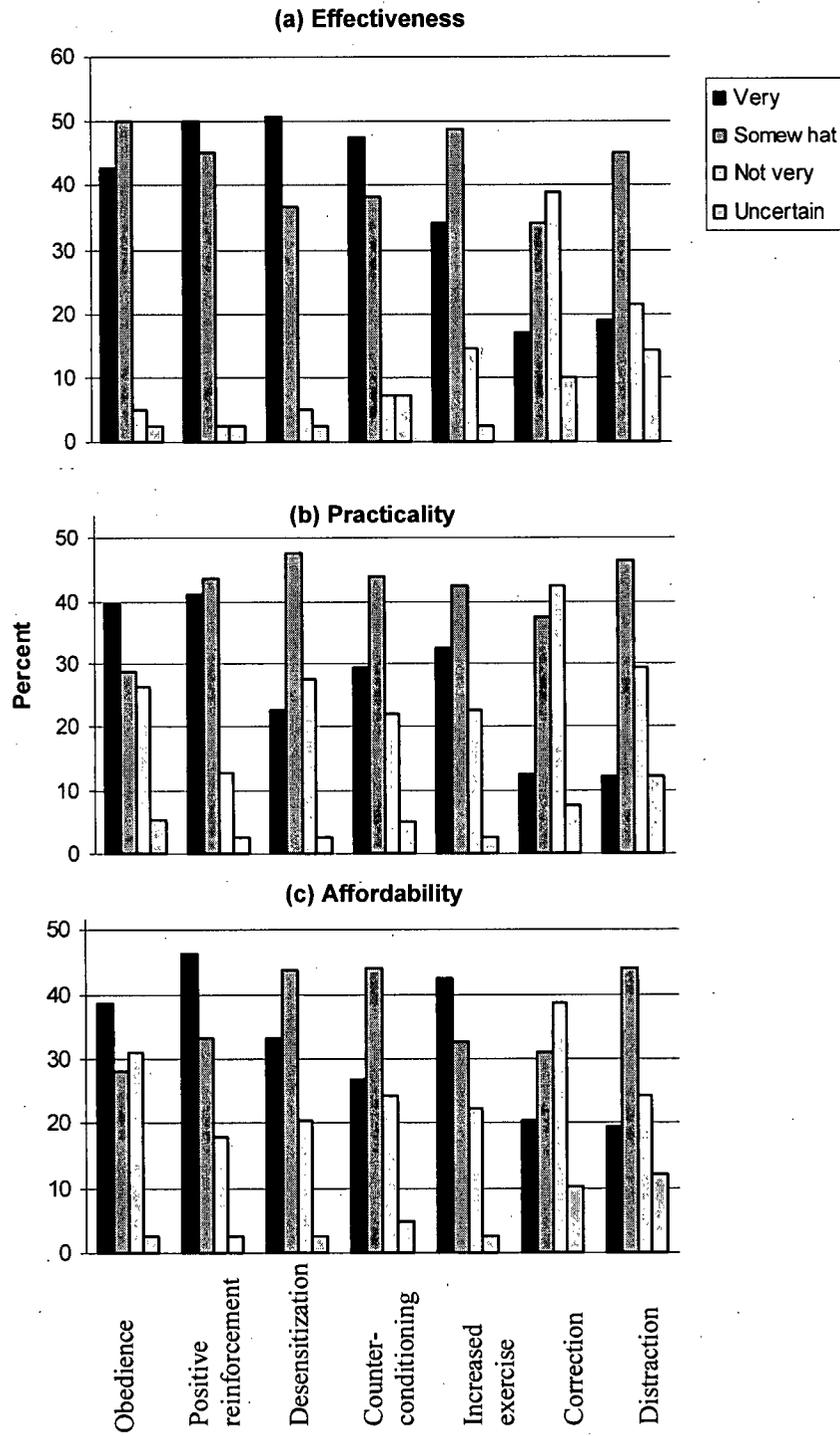
**Table 2.2.** Proportion of dogs displaying inter-dog aggression at intake, proportion of dogs returned because of inter-dog aggression, and proportion of owners concerned about inter-dog aggression as estimated by 43 shelters. Values are number of shelters responding in each proportion category.

Variable	Proportion category				
	< 10%	10 – 19%	20 - 49%	50 - 75%	> 75%
<i>Proportion of:</i>					
Dogs aggressive at intake	1	10	25	6	1
Dogs returned	29	8	3	0	3
Owners concerned	0	12	10	11	10

**Table 2.3.** Mean ( $\pm$  standard deviation) ratings of the commonness of five scenarios describing possible changes in a dog's behaviour towards other dogs while in the shelter. Ratings were 1 = "never," 2 = "rarely," 3 = "sometimes," 4 = "very often" and 5 = "always".

Scenario	Mean rating (SD)	n
1. Dog is aggressive at intake and then gets worse	2.93 (0.87)	42
2. Dog is aggressive at intake and then stays same	3.12 (0.71)	42
3. Dog is aggressive at intake and then gets better	3.00 (0.83)	42
4. Dog starts off <u>not</u> aggressive and stays the same	3.93 (0.46)	43
5. Dog starts off <u>not</u> aggressive and then gets worse	2.67 (0.68)	43

**Figure 2.1.** Ratings by survey participants of the (a) effectiveness, (b) practicality and (c) affordability of various techniques for the rehabilitation of inter-dog aggression (n = 36-40).



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## **CHAPTER 3: Evaluation of a Behavioural Rehabilitation Program for Reducing Inter-dog Aggression in Shelter Dogs**

### **INTRODUCTION**

Dog aggression towards other dogs (inter-dog aggression) is a frequent behavioural complaint of pet owners (Voith, 1980; Hiby et al., 2004). Managing inter-dog aggression may be distressing and difficult for owners, and injuries from dog fights can result in liability risks and veterinary costs. Moreover, dogs with behavioural problems are at risk of being relinquished by their owners to an animal shelter (Miller et al., 1996; Patronek et al., 1996; Tuber et al., 1999). Aggression towards other animals has been reported to be the second most common reason for dogs to be relinquished (Salman et al., 1998) or to be admitted to a shelter with the owner's request for euthanasia (Kass et al., 2001). Furthermore, of the dogs returned to shelters for behavioural reasons, studies have found that between 7% (Ledger, 1998) and 16% (Wells and Hepper, 2000) were because of aggression towards other animals.

On being admitted to a shelter, animals experience new surroundings, confinement, limited social interaction, and a generally uncontrollable and unpredictable environment. Studies suggest that shelter housing may influence the dogs' physiological responses; for example, Hennessy et al. (1997) found that compared to pets sampled in the home, dogs confined to a shelter showed elevated levels of the stress-related hormone cortisol. In addition, housing dogs in social isolation and spatial restriction has been associated with behavioural disturbances, including stereotypies, barking, withdrawal and aggression (Fox, 1965; Hetts et al., 1992; Hubrecht et al., 1992; Mertens and Unshelm, 1996; Beerda et al., 1999). Behavioural problems are common among dogs adopted from shelters (Voith and Borchelt, 1985; Voith et al., 1993) and although many dogs are relinquished because of undesirable behaviour, the shelter environment may contribute to these problems (Tuber et al., 1999).

Dog aggression is also a serious management and legal concern for shelters. Aggressive behaviour creates stressful and dangerous working conditions for shelter staff, and is the primary complaint of dog caretakers (Borchelt and Voith, 1996). Aggression provoked by other dogs can be redirected towards a human handler, or

workers may become injured when separating fighting dogs (CHIRPP, 1996). In addition, shelters may face legal action should a dog adopted from their facility cause an injury to a human or other animal. Many jurisdictions have also enacted regulations that authorize the seizure and impoundment of “dangerous” or “vicious” dogs (e.g. City of Vancouver Charter, 2004) and prohibit their release into the community (e.g. UK’s Dangerous Dogs Act, 1991, 1997). These factors may explain why aggressive dogs in shelters are often destroyed (Olson et al. 1991; Orihel et al., 2005). However, recent public controversy about euthanasia has led to an increase in the number shelters that do not kill healthy and potentially adoptable animals (Arluke, 2003). To prevent prolonged confinement and increase the adoptability of dogs with behavioural issues, many shelters are introducing programs to rehabilitate dogs with modifiable aggression problems.

Treatment methods for inter-dog aggression have been well documented (Voith 1980, 1995; Hart and Hart, 1985; Blackshaw 1991; Sherman et al., 1996; Overall, 1997) and their outcomes have been relatively successful (Mugford, 1992; Sherman et al., 1996). However, there has been little empirical study to evaluate the effect of rehabilitation on inter-dog aggression in animal shelters. Furthermore, rehabilitation methods used by different shelters are diverse, and shelter staff have expressed mixed levels of confidence in their respective programs (Orihel et al., 2005). Implementation of validated rehabilitation programs could reduce the number of dogs adopted and returned to shelters for behavioural problems, and allow shelters to be more certain that limited resources are being directed toward efficient programs.

This study evaluated the efficacy of a rehabilitation program to reduce inter-dog aggression in shelter dogs. The study used behavioural measures to compare shelter dogs that received rehabilitation for inter-dog aggression and control dogs that did not.

## **METHODS**

### *Selection of dogs*

The study was conducted at a municipal animal control shelter in British Columbia, Canada, with housing facilities for dogs. Dogs with inter-dog aggression were identified by an inter-dog aggression test (described below) which was administered to incoming shelter dogs between June and September 2004 and between May and August

2005. Most dogs were tested after an adaptation period of 4-10 days at the shelter because dogs tend to behave differently (Wells and Hepper, 1992) and show physiological indications of stress (Hennessy et al., 1997) during their first few days in a shelter. The acclimatization period was extended to 17 and 19 days for two dogs that were initially fearful or aggressive to humans upon admission. To reduce variation, puppies, seniors and small breeds (<15 kg) were excluded. Dogs known to be aggressive to humans were excluded in order to identify dogs whose primary problem was aggression towards conspecifics.

Of the 60 shelter dogs that underwent the inter-dog aggression test, 20 met the criteria for inter-dog aggression (described below) and participated in the experiment. Similar numbers of males and females were identified as showing inter-dog aggression, and about half had been neutered or spayed. Excluding one dog that was reclaimed by its owner during the treatment period, two dogs that were rejected because of stress, and one dog for which there were missing data, the final sample consisted of 16 dogs.

### *Housing*

Participant dogs were housed individually in 2.0 m x 1.3 m indoor concrete kennels. During treatment, all participant dogs received the same daily exercise. Dogs were released from their kennels by staff between 8:00 and 9:00 h into an outdoor exercise enclosure for 5 min, participated in a 30-min treatment (described below) between 11:30 and 14:30 h, received a 15-min walk by trained volunteers between 14:30 and 17:30 h, and were released again into the enclosure between 18:00 and 21:00 h for 10 min. No obedience training was performed during exercise periods, and close contact with other dogs was minimized. Participant dogs were not available for adoption or neutering until completion of the treatment.

### *Inter-dog aggression test*

Dogs were observed in five inter-dog aggression tests which exposed the dogs to other "stimulus" dogs. The tests were modified from other behaviour tests (Goddard and Beilharz, 1985; van der Borg et al., 1991; Netto and Planta, 1997) to make them applicable for shelter use. Testing was carried out both indoors and outdoors to simulate

situations in which aggression may occur in everyday life. The first two tests occurred around the dog kennels, and the last three tests in outdoor enclosures. The five tests were done in standard order and required approximately 20 min in total.

Stimulus dogs were mainly shelter residents that had displayed little or no inter-dog aggression in the test. Stimulus dogs were assigned to one of four categories according to their scores and reproductive status (Appendix 3), arranged from dogs least likely to provoke aggression (Category A) to those most likely (Category D) (Voith, 1980; Goddard and Beilharz, 1985).

The tests were as follows:

- (1) A friendly stimulus dog (Category A or B) of either gender is passed by the test dog's kennel.
- (2) The test dog is walked past other kennelled dogs.
- (3) A friendly stimulus dog (Category A or B) of the same gender as the test dog is walked past the dog at a distance of 1.2 m.
- (4) A confident stimulus dog (Category C or D) of the same gender as the test dog is walked towards the dog starting at 15 m, and stopping when the test dog becomes aggressive or otherwise when the stimulus dog is 1.2 m from the test dog.
- (5) Test 4 is repeated with a second confident stimulus dog (Category C or D) of the same gender as the test dog.

#### *Behavioural observations*

One female investigator and one of two trained female assistants performed the testing, alternating between the role of observer and stimulus dog handler. Observations were recorded on checklists.

Dogs' responses in each test were rated on four behavioural traits: aggression, fearfulness, excitability and playfulness. Five-point Likert-type scales (Likert, 1932) for each trait were used to rate the intensity of the behaviours, where 1 = no visible signs of the behavioural response and 5 = extreme signs of the behavioural response (adapted from Ledger, 1998, and Overall, 1997) (Table 3.1). Scores for each of the four behavioural traits were combined over the five tests for each dog; this resulted in a "total score" for each trait, ranging from 5-25.

Additionally, the presence (1) or absence (0) of 62 behavioural items was recorded for each test using an ethogram, a catalogue of behaviours typical of a particular species. Ethogram items (Appendix 4) included key behaviours and postures associated with agonistic behaviour in dogs (Goddard and Beilharz, 1985; Overall, 1997; and van den Berg et al., 2003). For each dog, a total score of 0-5 was calculated for each ethogram item as the number of tests in which the item was seen.

#### *Observer reliability*

A subset of 22 tests selected from various times throughout the study was videotaped for between- and within-observer reliability analysis. Each observer independently scored the 22 recorded tests on two occasions separated by one month.

#### *Criteria for participant dogs*

Based on a pilot study, dogs scoring <10 were judged as unlikely to need rehabilitation, and those scoring >18 were judged unlikely to be safe for adoption. Therefore, dogs with a total aggression score of 10 -18 were accepted into the study. As participation in the study could cause additional stress in some dogs, two dogs were excluded because they displayed three or more of five ethogram items (muzzle licking, rapid panting, yawning, raising forepaw, blowing out lips) believed to be indicative of anxiety or stress in dogs (Voith and Borchelt, 1996; Overall, 1997; Beerda et al., 1999, 2000).

#### *Criteria for stimulus dogs*

Dogs that did not meet the criteria for participants were potential stimulus dogs if they displayed fewer than three of the ethogram items associated with anxiety or stress as described above. Stimulus dogs were classified as “friendly” if they showed almost no sign of aggression (total aggression score < 8) and little sign of fearfulness (total fearfulness score < 10) (Appendix 3). These dogs were considered Category A (neutered) or Category B (intact). Stimulus dogs were classified as “confident” if they showed no more than modest aggression (total score <10) and no sign of fearfulness (total score = 5). These were considered Category C (neutered) and Category D (intact). The exceptions

were three stimulus dogs that were owned dogs; these were classified as friendly or confident based on the researchers' subjective judgement.

### *Experimental procedure*

One day after testing, dogs that met the criteria for participants were assigned to one of two 10-day treatments. Nine dogs (rehabilitation group) received daily rehabilitation for inter-dog aggression while seven dogs (control group) received daily release into an outdoor enclosure. To balance the groups for differences in pre-treatment (Day 0) aggression scores and for the influence of gender (Beaver, 1983; Hart and Hart, 1985), participant dogs were allocated to groups using restricted randomization based on these variables. To the extent possible, dogs were matched with another participant dog according to their aggression scores and gender, and were assigned to opposite treatments.

Participant dogs were four males and five females (rehabilitation group) and four males and three females (control group) (Appendix 5). The rehabilitation group included more spayed females than the control group (3 versus 1, respectively), and no intact males compared to three in the control group. The most common breeds were German Shepherd or mix (6), Labrador or mix (2), and Pitbull or mix (2). Most dogs were classified as adults and weighed between 20-36 kg. Eight dogs were strays, six were transferred from another shelter, and two were surrendered by their owners.

Rehabilitation was performed in a 36.5 m x 7.3 m outdoor enclosure, marked to indicate the initial positions of the participant and the stimulus dog (23 m apart), plus three progressively closer distances between the two dogs (Distance 1, 2, and 3; 13 m, 8 m and 5.5 m, respectively) (Figure 3.1).

Participant dogs were fitted with a body harness and a head collar (Halti®), which is often recommended for the correction of inappropriate responses during behaviour modification (Mugford, 1992; Voith, 1995; Overall, 1997, Landsberg et al., 2003). A double-ended leash attached to the head collar and body harness allowed the trainer to control the position of the dog's head and body. To habituate dogs to the equipment, dogs were trained with the head collar and harness for 20 min one day before the treatment. Commercial semi-soft treats were used as food rewards.

Rehabilitation consisted of daily 30-min sessions of repeated exposure to the approaches of stimulus dogs. Two different stimulus dogs were presented individually each day at successively closer distances to the dog being treated. Friendly, neutered dogs of the opposite gender were used on Day 1 (Category A; Appendix 3). Participant dogs were gradually exposed to higher categories of stimulus dogs (up to Category D) over the 10 days.

The procedure began with the trainer and participant dog at one end of the enclosure. The handler entered the opposite end with the stimulus dog and walked to Distance 1 and back to the starting position. Five approaches were performed at each of the three distances. If no aggression was observed during the five approaches at Distance 1 (aggression rating = 1), the procedure was repeated at Distances 2 and 3. If the participant dog was aggressive (aggression rating  $\geq 3$ ), the next approach was performed at the same distance rather than proceeding closer. Rehabilitation with a particular stimulus dog was stopped if the participant dog displayed severe aggression (aggression rating  $\geq 4$ ) or if the stimulus dog became aggressive.

The rehabilitation protocol included a number of commonly used methods for reducing inter-dog aggression: desensitization, counter-conditioning and positive reinforcement (Voith, 1980; Hart and Hart, 1985; Sherman et al., 1996; Overall, 1997; Fatjó and Manteca, 2003). The repeated and progressively closer approach of the stimulus dog constituted desensitization. To replace undesirable behaviour with alternative, appropriate behaviour (counter-conditioning), dogs were commanded to sit or make eye contact with the handler during approaches. The dogs' compliance with the commands during each approach was recorded on a checklist. Participant dogs were initially rewarded with food treats and verbal praise for relaxed and non-aggressive behaviour (positive reinforcement); thereafter, rewards were delivered intermittently for appropriate responses. In the early stages of the treatment, and whenever the participant dog reacted, the trainer orientèd the participant dog sideways from the stimulus dog and positioned herself as a visual barrier between the two dogs to lessen the dog's anxiety. Aggressive signals (e.g. direct staring and growling) were interrupted by directing the dog's head away from the stimulus dog, thereby disrupting and modifying the behaviour quickly (Overall, 1997).

Control group dogs were given the same head collar training as rehabilitation group dogs to control for any effects of handler and dog interaction on later behaviour. Control dogs were released individually into a 20 m x 25 m outdoor exercise enclosure for 30 min each day. A staff member or researcher was present during releases but was instructed to minimize their interactions with the dog. The enclosure contained water and toys.

The inter-dog aggression test was repeated one day after the treatment was completed (Day 11). Participant dogs were returned to the shelter's regular management schedule after Day 11 and became available for neutering and adoption by the public. To assess the lasting effects of the treatment, participant dogs remaining in the shelter on Day 18 (one week after the first post-treatment test) were retested using the same procedure.

#### *Experimenter expectancy effects*

Because the treatments and post-treatment test scoring were performed by the same individuals, a fourth ("naïve") observer rated aggression for 11 videotaped post-treatment tests of rehabilitation and control group dogs in case the expectations of the "informed" observers affected their scoring of aggression.

#### *Ethical considerations*

This study was conducted in accordance with the guidelines of the UBC Animal Care Committee (Appendix 6). Additionally, we monitored participant dogs in their kennels every second day for behavioural indicators of stress (Stephen et al., 2002; Appendix 7). None of the dogs displayed frequent or severe signs of stress during the experiment. A few dogs that showed signs of discomfort or anxiety due to heat or aggression during the procedures were returned to their kennels. A checklist adapted from Stephen et al. (2002) was used to monitor stimulus dogs during each rehabilitation session and in their kennels every fifth day (Appendix 8). We attempted to minimize stress in stimulus dogs by providing frequent praise and food rewards, basic obedience training during rehabilitation and in their kennels, and limiting restraint except when necessary for the procedures.

Upon adoption or redemption of participant dogs, owners were given an information handout about inter-dog aggression and behaviour modification (Appendix 9) and were offered a consultation at the shelter. Half of the participant dogs (8 of 16) were adopted by members of the community shortly after the experiment. Of the other dogs, five were transferred to other shelters, one was reclaimed by its owner, one was available for adoption at the shelter, and one was euthanized for inter-dog aggression.

#### *Data analysis*

For each dog, the aggression score from the pre-treatment (Day 0) test was used as a baseline measure. For the four traits scored on Likert-type scales (aggression, fearfulness, excitability and playfulness), difference scores were calculated for each dog by subtracting the dog's score in each post-treatment test (Day 11 and Day 18) from its score in the pre-treatment test (Day 0). Mann-Whitney *U*-tests (Siegel and Castellan, 1998) were used to test whether rehabilitation and control group dogs differed in these difference scores. Mann-Whitney *U*-tests were also used to test for initial differences between the rehabilitation and control group in pre-treatment (Day 0) scores for aggression, fearfulness, excitability, and playfulness. Wilcoxon signed-ranks tests (Siegel and Castellan, 1998) were used to test whether aggression scores changed significantly between different test days for dogs within each treatment group.

For each ethogram item, Wilcoxon signed-ranks tests were used to test whether the frequencies changed significantly from the pre-treatment test (Day 0) to either post-treatment test (Days 11 and 18) for dogs within each treatment group. For those ethogram items that differed significantly or nearly significantly ( $p < 0.10$ ), difference scores were calculated (as described above), and Mann-Whitney *U*-tests were used to determine whether the difference scores differed significantly between the rehabilitation and control groups.

Within-observer reliability in scoring the four behavioural traits was examined for each observer by calculating Spearman rank-order correlation coefficients between the scale ratings from their first and second videotape observations. For the between-observer reliability, Spearman rank-order correlation coefficients were calculated between the ratings of the two observers on each of the four behavioural traits. To test for effects of

the observers' expectations, total aggression rating scores for rehabilitation and control dogs produced by the "naïve" observer were compared to those of the two "informed" observers.

Data were analyzed using SPSS for Windows (Rel. 11.0.0. 2001. Chicago: SPSS Inc). Where we formulated explicit hypotheses, statistical tests were one-tailed. Specifically, we predicted that scores for aggression, fearfulness and excitability would decrease after treatment for rehabilitation group dogs, and that scores for playfulness would increase. Also, we expected that rehabilitation group dogs would have lower difference scores for aggression, fearfulness and excitability than control dogs, and the reverse for playfulness. All other tests were two-tailed. An alpha value of 0.05 was considered significant and 0.10 was termed "nearly significant."

## RESULTS

### *Pre-treatment test*

On average, the 16 participant dogs had higher total aggression scores than dogs that did not meet the criteria (median = 11 versus median = 5; Appendix 10). Compared to rejected dogs, participant dogs had a lower maximum fearfulness score (9 versus 12), higher excitability scores (median = 11.5 versus median = 8) and greater variability in excitability scores (inter-quartile range of 7.3 versus 3.0, respectively). Twenty of the forty rejected dogs, but none of the participant dogs, exhibited playfulness in the pre-treatment test, although the median score (5, indicating no sign of playfulness) was the same for the two groups.

### *Ratings of aggression, fearfulness, excitability and playfulness*

Dogs in the rehabilitation and control groups were similar in their pre-treatment (Day 0) test scores for aggression ( $U = 27.5, p = 0.67$ ), fearfulness ( $U = 18.0, p = 0.13$ ), and excitability ( $U = 22.5, p = 0.34$ ). Playfulness ratings were not analyzed because none of the participant dogs showed any playfulness on Day 0.

Six of 9 dogs in the rehabilitation group showed a decline in aggression score from pre-treatment (Day 0) to the first test after treatment (Day 11). The median difference score for the 9 dogs was -2, and this change from Day 0 to Day 11 was nearly

significant ( $W = 27.5, p = 0.09$ ; Table 3.2). In contrast, 5 of 7 control dogs increased their aggression scores from Day 0 to Day 11 for a median difference score of +2 ( $W = 15, p < 0.05$ ; Table 3.2). The difference scores (change in aggression scores from Day 0 to Day 11) differed significantly between the rehabilitation and control group ( $U = 8.5, p < 0.01$ ). When dogs were retested 1 week after treatment was completed (Day 18), aggression scores for the rehabilitation group dogs had largely returned to their initial values on Day 0 (Table 3.2).

Slightly more dogs in the control group than the rehabilitation group showed increases in fearfulness and excitability scores on Day 11, but these differences were not significant. Playfulness was omitted from the analysis because all but two dogs received a total playfulness score of 5 (indicating no playfulness) on Day 11. Similarly, the two groups did not differ significantly from Day 0 to Day 18 in fearfulness, excitability, or playfulness.

### *Ethogram*

Thirty-two ethogram items occurred in  $< 5\%$  of the 60 initial screening tests and were excluded from the analysis. Nine of the remaining 30 ethogram items showed a significant or nearly significant change from Day 0 to either Day 11 or Day 18 in one or both of the treatment groups. These nine ethogram items were therefore tested for differences between groups (Table 3.3).

The rehabilitation group showed a significant reduction from Day 0 to Day 11 in the frequency of "facing the stimulus dog" ( $W = 21, p < 0.05$ ) and a nearly significant reduction in "stiff posture" ( $W = 10, p < 0.10$ ; Table 3.3). Rehabilitation dogs also showed a significant increase in "ears back" ( $W = 21, p < 0.05$ ), and a nearly significant increase in "lowered neck" ( $W = 6, p = 0.10$ ) and "rapid tail wagging" ( $W = 10, p < 0.10$ ). The control group showed a nearly significant increase from Day 0 to Day 11 in occurrences of growling ( $W = 10, p < 0.10$ ) and muzzle licking ( $W = 10, p < 0.10$ ). The difference scores (change in aggression scores from Day 0 to Day 11) differed significantly between the rehabilitation and control group for "ears back" ( $U = 7.5, p < 0.05$ ), and was nearly significant for growling ( $U = 11.0, p < 0.10$ ; Table 3.3).

Consistent with their behaviour on Day 11, rehabilitation dogs showed a nearly significant decline from Day 0 to Day 18 in the frequency of “facing the stimulus dog” ( $W = 10, p < 0.10$ ), and a nearly significant increase in “lowered neck” ( $W = 6, p = 0.10$ ) and “ears back” ( $W = 10, p < 0.10$ ). Consistent with Day 11, the control group showed a significant increase in growling ( $W = 10, p < 0.05$ ), and a nearly significant increase in “ears up” ( $W = 10, p < 0.10$ ) on Day 18. The difference scores for “ears up” differed significantly between the two groups ( $U = 2.5, p = 0.01$ ), and was nearly significant for muzzle licking ( $U = 9.0, p = 0.10$ ). Although there were nearly significant differences in rapid panting (Table 3.3), these were thought to be due partly to hotter test days for rehabilitation dogs (mean temperature =  $19.2^{\circ}\text{C} \pm 2.7$  SD) than for control dogs ( $17.9^{\circ}\text{C} \pm 3.1$  SD).

#### *Compliance with commands*

By the third treatment day, all dogs in the rehabilitation group successfully responded when commanded to sit and make eye contact with the trainer during the approaches of stimulus dogs.

#### *Reliability and validity of scale ratings*

The mean Spearman rank-order correlations for the within-observer ratings were 0.90 for aggression, 0.82 for excitability, 0.72 for playfulness, and 0.62 for fearfulness. Between-observer reliabilities were slightly lower: 0.82 for aggression, 0.75 for excitability, 0.65 for playfulness, and 0.56 for fearfulness. The reliabilities for aggression and excitability are within the range considered acceptable for behavioural data ( $r > 0.70$ ) by Martin and Bateson (1993). The lower reliabilities for fearfulness and playfulness suggest that these categories were difficult to score consistently.

The naïve observer (who was unaware of which dogs received rehabilitation) and the informed observers were in exact agreement over the difference in aggression scores between the rehabilitation and control groups: for both the naïve observer and the informed observers, the median score for rehabilitation dogs was lower than the score for control dogs by a value of 2.5.

## DISCUSSION

This study provides evidence of the short-term effectiveness of rehabilitation for reducing inter-dog aggression in shelter dogs. Most dogs that received rehabilitation showed a decrease from pre-treatment (Day 0) to post-treatment (Day 11) in aggression scores, whereas aggression tended to increase in control dogs. In addition to a reduction in overt aggressive behaviour on Day 11, rehabilitation dogs showed reduced frequencies of body postures that are associated with challenge or aggression (“facing the stimulus dog” and “stiff posture”) (Overall, 1997; van den Berg et al., 2003), and increased frequencies of “lowered neck” and “ears back”. Lowered head postures, in combination with less threatening body postures, commonly represent a dog that is less actively assertive (Overall, 1997) and more passively submissive (Fox and Bekoff, 1975).

In contrast to our expectations, rehabilitation did not significantly reduce fearfulness scores. Because observer reliabilities for fearfulness were below the generally recommended level of  $r = 0.70$ , it is possible that changes in fearfulness were difficult to detect reliably by the scale ratings. In addition, dogs in both groups generally had low pre-treatment fearfulness scores, and these may help to explain the absence of a treatment effect for fearfulness. Low fearfulness in participant dogs suggests that most dogs showed offensive rather than defensive aggression. Consistent with this result, Wright and Nesselrote (1987) found that of 23 dogs diagnosed with inter-dog aggression, 20 predominantly showed approach/offensive behaviours, while only three exhibited defensive behaviours. These authors also found that aggression towards other dogs frequently involved dominance aggression.

Although participant dogs tended to have higher excitability scores than dogs that did not meet the selection criteria, there were no significant post-treatment differences in excitability between dogs in either treatment group. In fact, the majority of dogs in both groups showed higher excitability on Day 11 than on Day 0, although this result was more evident in control dogs. In addition, the decrease in aggression in rehabilitation dogs did not coincide with changes in playfulness, suggesting that the treatment was more effective at reducing threatening behaviour than promoting appeasement behaviour.

The different components of rehabilitation may have influenced aggressive behaviour in different ways. Lindsay (2000) suggests that desensitization and positive

reinforcement can reduce anxiety in dogs by weakening the association between the threatening stimulus and negative emotional reactions. Food and praise delivered during approaches of stimulus dogs appeared to elicit relaxation and eating in participant dogs, conditions which are likely to be incompatible with the state of aversive arousal that may prepare the dog for aggression. Because learning can be impaired if rehabilitation progresses too rapidly (Voith, 1980), exposures to stimulus dogs in this study were gradual and controlled. Others have reported reduced activity and vocalization in dogs while muzzled (Cronin et al., 2003); hence, it is possible that the head collars used in this study may have caused subordinate behaviour by forcing the dog's mouth closed. Rehabilitation also involved social interaction with humans, which has been shown to calm shelter dogs (Tuber et al., 1996) and ameliorate their behavioural and physiological responses to stress (Hennessy et al., 1998). Further research is needed to identify how these different components of rehabilitation contributed to the reduction in aggression.

One finding of concern is that participant dogs that did not receive rehabilitation showed a significant increase in aggression scores on Day 11 compared with their initial scores on Day 0. Control dogs also showed more occurrences of aggressive vocalization (growling) and higher ear posture ("ears up"); these behaviours are often seen in animals establishing dominance or behaving aggressively (Overall, 1997). In addition, control dogs showed a greater increase in muzzle licking than rehabilitation dogs, a behaviour that has been associated with uneasiness or anxiety (Voith and Borchelt, 1996). The finding that aggression and anxiety-related behaviour increased in control dogs during a period of confinement is consistent with others' results; for instance, spatially and socially restricted dogs have been found to show more aggression and excitability when challenged than group-housed dogs (Mertens and Unshelm, 1996; Beerda et al., 1999). Furthermore, male dogs housed under such conditions behaved more dominantly and aggressively in confrontations with unfamiliar conspecifics (Beerda et al., 1999).

Interestingly, the increased aggression in control dogs occurred despite relatively enriched exercise schedules (60 min per day in this study versus 0-30 min in 7 shelters studied by Stephen and Ledger, 2005). In line with our results, others have shown that supplementary exercise did not prevent the development of abnormal behaviours or induce differences in kennel activity patterns (Campbell et al., 1988; Hetts et al., 1992;

Clark et al., 1997). However, the amount of exercise in these studies was relatively low compared with the present study. Additionally, our own observations, as well as those of Campbell et al. (1988), suggest that dogs are generally inactive during releases except when a staff member enters the enclosure. Further work is needed to examine the effects of limited exercise on the well-being of dogs housed in captivity.

When dogs were tested one week after the last treatment (Day 18), we did not find evidence of a sustained effect of rehabilitation on aggression scores. This suggests that 10 days of rehabilitation were not sufficient for dogs to retain the improvements in behaviour. However, this finding pertains to dogs that remained in the shelter environment after rehabilitation; the effect on dogs that are transferred into the adopted home is yet to be determined. In addition, rehabilitation dogs showed behavioural changes from Day 0 to Day 18, for example more occurrences of "facing the stimulus dog", and more occurrences of "lowered neck" and "ears back", which may indicate a reduction in intentions to behave assertively. In contrast, most control dogs showed an increase in aggression on Day 18, and more occurrences of "ears up" and growling. Control dogs also showed signs of anxiety (Voith and Borchelt, 1996) on Day 18, indicated by a nearly significant difference between the groups in muzzle licking.

The findings suggest that rehabilitation did not result in sustained improvements in aggression, although the evidence is relatively weak because of the reduced numbers by Day 18. However, since the beneficial effects of rehabilitation declined rapidly, continued treatment is likely necessary for maintaining the behavioural change. Future longer-term studies are warranted to determine the optimal frequency and duration of rehabilitation. Retention of the behaviour may be further supported by providing new owners with information and modelling to continue the training in the home environment.

## **CONCLUSION**

This study provides evidence of the short-term reduction of aggression through a rehabilitation program. The findings also suggest that inter-dog aggression may worsen in aggressive shelter dogs without behavioural treatment. Further work is needed to understand the relative contribution of the different components of rehabilitation and

effective ways of maintaining its beneficial effects. By introducing validated rehabilitation programs, shelters could potentially improve the welfare of aggressive dogs while at the shelter and increase their chances of successful adoption and retention within the new home.

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**Table 3.1.** Five-point Likert-type scales used to rate the dogs' level of aggression, fearfulness, excitability and playfulness.

Behavioural category	Rating descriptors
Aggression	1 = no aggression 2 = barking and looking at stimulus 3 = growling 4 = snarling and lunging 5 = snapping and attempting to bite
Fearfulness	1 = no fearfulness 2 = body lowered, ears back and flat, tail below horizon, avoiding eye contact 3 = retreating and/or seeking support, piloerection, whining 4 = trembling, tail tucked 5 = freezing and submissive urination
Excitability	1 = no excitability 2 = whining, tail wagging 3 = barking, but controllable 4 = jumping, moderately controllable 5 = mouthing leash and spinning, difficult to control
Playfulness	1 = no playfulness 2 = relaxed posture, tail wagging slowly below horizon, looking at stimulus 3 = play-bowing or pouncing, but easy to control 4 = approaching stimulus, but controllable 5 = pulling towards stimulus, difficult to control

Adapted from Ledger (1998) and Overall (1997).

**Table 3.2.** Total aggression scores\* for (a) rehabilitation group dogs (n=9) and (b) control group dogs (n=7) on Day 0 (pre-treatment test) and Days 11 and 18 (post-treatment tests).

(a) Rehabilitation group

Time of test	Dog									Mdn	p
	1	2	3	4	5	6	7	8	9		
Day 0	16	13	11	10	10	12	15	13	10	12	-
Day 11	9	11	9	8	13	11	16	13	8	11	-
Day 18	14	13	-	-	11	14	14	15	10	14	-
Difference 1 <sup>a</sup>	-7	-2	-2	-2	3	-1	1	0	-2	-2	0.09
Difference 2 <sup>b</sup>	-2	0	-	-	1	2	-1	2	0	0	0.29

(b) Control group

Time of test	Dog							Mdn	p
	1	2	3	4	5	6	7		
Day 0	15	11	10	10	11	16	10	11	-
Day 11	16	13	13	10	14	16	14	14	-
Day 18	-	15	-	11	13	13	11	13	-
Difference 1 <sup>a</sup>	1	2	3	0	3	0	3	2	<0.05
Difference 2 <sup>b</sup>	-	4	-	1	2	-3	1	1	0.17

<sup>a</sup> Difference 1 = Day 11 - Day 0.

<sup>b</sup> Difference 2 = Day 18 - Day 0.

\* Scores of 1-5 were recorded for each of five tests. Table values are totals of these scores; hence the minimum possible score was 5 and the maximum possible score was 25. *Mdn* = median. Missing values are dogs that were sold or reclaimed after the first post-treatment test. *p* values are one-tailed comparisons within each treatment group using Wilcoxon signed-rank tests.

**Table 3.3.** Mean ( $\pm$  standard error) difference scores (change in scores from Day 0) for nine ethogram items for dogs in the rehabilitation group and control group on Day 11 and Day 18 (post-treatment tests).

Ethogram item <sup>a</sup>	Test on Day 11 <sup>b</sup>			Test on Day 18 <sup>c</sup>		
	Rehabilitation	Control	$p^d$	Rehabilitation	Control	$p^d$
facing stimulus dog	-0.78 (0.22)**	-0.33 (0.21)	ns	-0.71 (0.29) *	-0.20 (0.20)	ns
stiff posture	-1.22 (0.57) *	-0.50 (0.72)	ns	-1.57 (0.95)	0.00 (1.05)	ns
lowered neck	0.88 (0.61)*	0.50 (0.43)	ns	1.17 (0.60) *	0.60 (0.4)	ns
ears up	-0.63 (0.50)	0.50 (0.85)	ns	-0.17 (0.17)	1.60 (0.60) *	=0.01
ears back	1.50 (0.50) **	0.00 (0.26)	<0.05	1.33 (0.56) *	0.00 (0.95)	ns
growling	0.00 (0.27)	0.83 (0.31) *	<0.10	0.33 (0.42)	0.80 (0.20) **	ns
rapid tail wagging	1.38 (0.65) *	0.17 (0.31)	ns	1.33 (0.80)	0.20 (1.02)	ns
muzzle licking	0.50 (0.63)	1.33 (0.49) *	ns	0.00 (0.00)	0.60 (0.40)	=0.10
rapid panting	-0.25 (0.25)	-2.00 (0.97) *	ns	-0.50 (0.22) *	-1.60 (0.75) *	ns

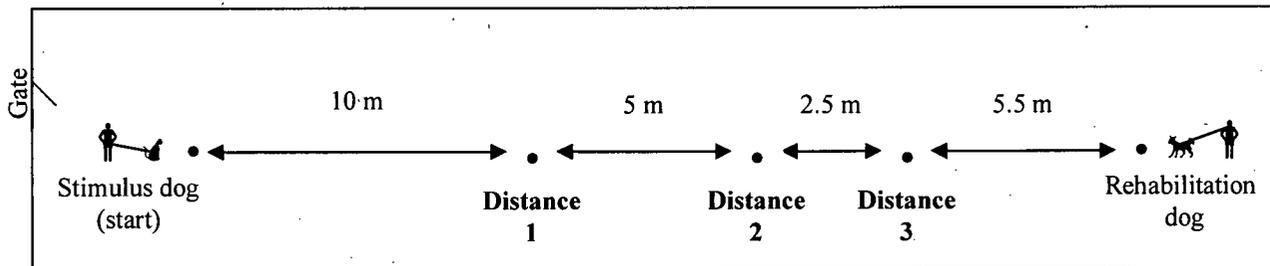
<sup>a</sup> Results are shown for the nine ethogram items that showed a significant or nearly significant change from Day 0 to either Day 11 or Day 18 in one or both of the treatment groups by two-tailed Wilcoxon signed-ranks tests, \*  $p \leq 0.10$ ; \*\*  $p < 0.05$ .

<sup>b</sup> Values are mean ( $\pm$  standard error) difference scores (Day 11 - Day 0),  $n = 14$  or  $15$ . Sign indicates the direction of the change from Day 0.

<sup>c</sup> Values are mean ( $\pm$  standard error) difference scores (Day 18 - Day 0),  $n = 11$  or  $12$ .

<sup>d</sup>  $p$  values are two-tailed comparisons of difference scores between the rehabilitation and control group by Mann-Whitney  $U$ -tests.

**Figure 3.1.** Diagram of rehabilitation area.



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## CHAPTER 4: General Conclusions

Although the potential benefits of rehabilitation programs have been recognized (Ledger, 1998; Tuber, 1999; Wells and Hepper, 2000), their feasibility and efficacy in the shelter setting are not well known. The first part of this research used a survey to advance knowledge about the management of aggressive dogs in shelters. The survey results suggest that limitations in time and money may be preventing more widespread use of rehabilitation in shelters. Participants cited liability and safety risks after adoption as additional impediments to rehabilitating dogs that are aggressive to other dogs. While this study and others (Olson et al., 1991; Patronek et al., 1996) suggest that most aggressive dogs are destroyed, over half of the shelters in our survey also used rehabilitation. However, the frequency and duration of rehabilitation varied depending on shelter resources. More commonly, inter-dog aggression was controlled by special management and handling methods, such as isolating the dog, placing a visual barrier between aggressive dogs, or restricting handling to experienced staff. Many participants believed that their rehabilitation program was unsuccessful or were uncertain about its success, and expressed interest in scientifically validated rehabilitation methods.

The second part of this research evaluated a rehabilitation program for reducing inter-dog aggression in shelter dogs. Rehabilitation methods were based on techniques supported by survey participants, including positive reinforcement, desensitization, and counter-conditioning. Most shelter dogs that received rehabilitation showed a reduction in aggression after treatment, but the changes were short-term. However, our ability to assess the lasting effects of rehabilitation may have been influenced by the small sample size. In addition, constraints imposed by time, space, and daily shelter operations necessitated a short treatment period (10 days). Future research is therefore needed to investigate the potential value of extended rehabilitation programs. Finally, studies designed to test the components of rehabilitation can provide an understanding of their relative contribution, and how they might affect dogs with different motivational causes for aggression.

Importantly, the experiment suggests that the behaviour of dogs with inter-dog aggression may worsen during their stay at the shelter. Confinement and social isolation

have long been associated with behavioural deficits in dogs (Fox, 1965; Fuller, 1967; Hetts et al., 1992; Hubrecht et al., 1992; Mertens and Unshelm, 1996; Beerda et al., 1999) and may contribute to behavioural problems in shelter dogs (Voith and Borchelt, 1985; Hennessy et al., 1997; Tuber et al., 1999). Interestingly, survey participants felt that a dog's behaviour towards other dogs is unlikely to change after admission to the shelter. However, some participants reported that they include stress reduction techniques in their rehabilitation programs; this suggests that shelter staff recognize the importance of reducing the negative effects of shelter confinement.

With further refinement and validation, the rehabilitation program tested in this thesis could provide shelters with an effective and practical tool for reducing inter-dog aggression. Such programs could potentially reduce the number of aggressive shelter dogs that are destroyed, and increase the number that are successfully adopted into new homes. Validated rehabilitation methods, and standardized and quantifiable ways to evaluate their outcomes, could allow shelters to be more confident in their treatment programs, and ensure that limited funds are being directed towards substantiated practices.

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**Appendix 1. Questionnaire on the management of inter-dog aggression in animal shelters.**

**SHELTER INFORMATION:** *Please provide the best estimates possible for the questions below.*

How many kennels does your shelter have available for dogs? \_\_\_\_\_

How do you house dogs (singly/paired/in groups)? \_\_\_\_\_

How many dogs do you typically receive in a year? \_\_\_\_\_

How many dogs do you typically adopt out in a year? \_\_\_\_\_

How many staff members does your shelter employ? \_\_\_\_\_

**I. Intake process for dogs**

1. Do you accept dogs relinquished by members of the public?

- Yes     No (*If no, please proceed to Question 3*)

**If yes, does your shelter's intake form require owners to indicate whether their dog tends to display aggression towards any of the following? (*Please tick all that apply*)**

- The owner**  
 **People other than the owner**  
 **Children**  
 **Dogs**  
 **Cats**

2. If a dog is reported by its owner as being aggressive to other dogs, is the dog:

- Always admitted**  
 **Very often admitted**  
 **Often admitted**  
 **Rarely admitted**  
 **Never admitted**

**If your shelter has a policy on the admittance of aggressive dogs, please describe the policy and its rationale below.**

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3. How are aggressive dogs usually managed? *(Please tick all that apply)*

- Put up for immediate adoption
- Placed into foster homes
- Rehabilitated in the shelter before adoption is allowed
- Humanely destroyed
- Other (Please explain)

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4. Does your shelter conduct a behaviour assessment of dogs for aggression towards any of the following?

- Adults       Children       Dogs       Cats

**If you have made a selection above, please describe the test that is performed (or enclose a copy of the test if available).**

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**II. Incidence of inter-dog aggression**

5. In general, how common is it for dogs to show inter-dog aggression when they come into your shelter?

- Very common      (>75% of dogs)
- Common      (50-75% of dogs)
- Moderately common      (20-50% of dogs)
- Uncommon      (10-20% of dogs)
- Very uncommon      (<10% of dogs)

Please provide the precise numbers if they are available \_\_\_\_\_

6. Of the dogs that are returned to your shelter by their new owners, approximately what proportion of dogs are returned because of inter-dog aggression?

- >75% of dogs
- 50-75% of dogs
- 20-50% of dogs
- 10-19% of dogs
- <10% of dogs

7. Do you feel that inter-dog aggression is something that owners are concerned about?

- Always** (>75% of owners)
- Very often** (50-75% of owners)
- Often** (20-50% of owners)
- Rarely** (10-19% of owners)
- Never** (<10% of owners)

8. In your experience at your shelter, how often do kennelled dogs exhibit the following changes in their behaviour towards other dogs?

	Never	Rarely	Sometimes	Very Often	Always
Dog is aggressive at intake and then gets worse	<input type="checkbox"/>				
Dog is aggressive at intake and stays the same	<input type="checkbox"/>				
Dog is aggressive at intake and then gets better	<input type="checkbox"/>				
Dog starts off <u>not</u> aggressive and stays the same	<input type="checkbox"/>				
Dog starts off <u>not</u> aggressive then gets worse	<input type="checkbox"/>				

**III. Management of dogs with inter-dog aggression**

9. Are dogs with inter-dog aggression housed differently?

- Yes**       **No**

If yes, please describe how they are housed differently.

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10. Does your shelter have areas where dogs can be exercised in groups?

- Yes**       **No**

If yes, are dogs with inter-dog aggression included or excluded?

- Included**       **Excluded**

If dogs are included, please describe any special restrictions (use of muzzles, etc).

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11. Do dogs with inter-dog aggression receive special handling restrictions?

- Yes     No

If yes, please describe what special restrictions are applied.

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**IV. Obedience training and rehabilitation**

12. Does your shelter presently perform **obedience training**?

- Yes     No (*If no, please proceed to Question 13*)

If yes, please describe the type of commands that are taught.

- Sit         Heel         Down         Recall  
 Stay         Leave         No             Other \_\_\_\_\_

On average, what is the frequency of obedience training? \_\_\_\_\_ sessions per \_\_\_\_ (day/week)

On average, what is the duration of each session? \_\_\_\_\_ minutes

Who typically performs the obedience training? (*Please tick all that apply*)

- Obedience trainers             Volunteers  
 Staff members                  Other \_\_\_\_\_

If obedience training is performed by staff or volunteers, please describe any special training (courses, workshops, seminars) that is available. Approximately what proportion of staff/volunteers complete this training?

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If training is performed by obedience trainers, are the trainers normally accredited?

- Yes     No

If yes, what type of accreditation? \_\_\_\_\_

13. Does your shelter presently undertake **rehabilitation**?

- Yes     No (*If no, please proceed to Question 15*)

If yes, please indicate the type of rehabilitation that is undertaken.

- Aggression towards people     Inter-dog aggression     Separation anxiety  
 Fears and phobias     House-training     Hyperactivity  
 Other (Please explain)

What criteria qualify a dog for rehabilitation?

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On average, what is the frequency of the rehabilitation?    \_\_\_ sessions per \_\_\_ (day/week)

On average, what is the duration of each session?    \_\_\_ minutes

Who typically undertakes the rehabilitation? (*Please tick all that apply*)

- Obedience trainers     Volunteers  
 Staff members     Other \_\_\_\_\_

If rehabilitation is performed by staff or volunteers, please describe any special training (courses, workshops, seminars) that is available. Approximately what proportion of staff/volunteers complete this training?

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If rehabilitation is performed by obedience trainers, are they normally accredited?

- Yes     No

If yes, what type of accreditation? \_\_\_\_\_

14. In general, how successful would you judge your rehabilitation program to be in reducing **inter-dog aggression** before adoption?

- Very successful  
 Successful  
 Unsuccessful  
 Very unsuccessful  
 Uncertain

15. If you do not presently have rehabilitation for dogs with inter-dog aggression:

Is rehabilitation for inter-dog aggression feasible within your shelter?

- Yes     No

What factors are preventing you from developing a rehabilitation program?

- Financial constraints       Lack of expertise       Lack of equipment  
 Lack of time       Lack of facilities       Danger to other dogs  
 Other (Please explain)

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16. Does your shelter have plans to implement any of the following programs in the near future that you do not currently offer?

- Obedience training  
 Rehabilitation  
 Other behavioural training (Please explain)

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If you have ticked any of the above, please describe the type of program(s).

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What criteria will qualify a dog for the program(s)?

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On average, what will be the frequency of the behaviour training? \_\_\_\_ sessions per \_\_\_\_ (day/week)

On average, what will be the duration of each session? \_\_\_\_ minutes

*(Continued on next page)*

Who will undertake this training? (Please tick all that apply)

- Obedience trainers       Volunteers  
 Staff members       Other \_\_\_\_\_

If the training will be performed by staff members or volunteers, please describe any special training that would be available or required.

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If the training will be performed by obedience trainers, will they require accreditation?

- Yes     No

If yes, what type of accreditation? \_\_\_\_\_

17. Below is a list and description of possible treatments for inter-dog aggression. Please indicate the degree to which you believe each treatment would be **effective** (successful), **practical** (ease of use, availability of qualified staff, available space, etc.), and **feasible** (financially) at reducing inter-dog aggression within your shelter.

I. Obedience training

Description: The dog responds to cues given by a trainer by performing basic behaviours (such as recall, sit and stay).

- |                   |                               |                                   |                                   |                                    |
|-------------------|-------------------------------|-----------------------------------|-----------------------------------|------------------------------------|
| <b>Effective:</b> | <input type="checkbox"/> Very | <input type="checkbox"/> Somewhat | <input type="checkbox"/> Not very | <input type="checkbox"/> Uncertain |
| <b>Practical:</b> | <input type="checkbox"/> Very | <input type="checkbox"/> Somewhat | <input type="checkbox"/> Not very | <input type="checkbox"/> Uncertain |
| <b>Feasible:</b>  | <input type="checkbox"/> Very | <input type="checkbox"/> Somewhat | <input type="checkbox"/> Not very | <input type="checkbox"/> Uncertain |

II. Positive reinforcement

Description: Non-aggressive behaviour is rewarded with something that the dog will work to gain at a given moment (e.g. food, attention).

- |                              |                               |                                   |                                   |                                    |
|------------------------------|-------------------------------|-----------------------------------|-----------------------------------|------------------------------------|
| <b>Effective:</b>            | <input type="checkbox"/> Very | <input type="checkbox"/> Somewhat | <input type="checkbox"/> Not very | <input type="checkbox"/> Uncertain |
| <b>Practical:</b>            | <input type="checkbox"/> Very | <input type="checkbox"/> Somewhat | <input type="checkbox"/> Not very | <input type="checkbox"/> Uncertain |
| <b>Financially feasible:</b> | <input type="checkbox"/> Very | <input type="checkbox"/> Somewhat | <input type="checkbox"/> Not very | <input type="checkbox"/> Uncertain |

III. Desensitization

Description: The dog is repeatedly exposed to an unfamiliar dog at greater proximity, as long as the dog being treated remains non-aggressive. Non-aggressive behaviour is rewarded. The procedure is repeated with other unfamiliar dogs.

- |                              |                               |                                   |                                   |                                    |
|------------------------------|-------------------------------|-----------------------------------|-----------------------------------|------------------------------------|
| <b>Effective:</b>            | <input type="checkbox"/> Very | <input type="checkbox"/> Somewhat | <input type="checkbox"/> Not very | <input type="checkbox"/> Uncertain |
| <b>Practical:</b>            | <input type="checkbox"/> Very | <input type="checkbox"/> Somewhat | <input type="checkbox"/> Not very | <input type="checkbox"/> Uncertain |
| <b>Financially feasible:</b> | <input type="checkbox"/> Very | <input type="checkbox"/> Somewhat | <input type="checkbox"/> Not very | <input type="checkbox"/> Uncertain |

IV. Counterconditioning

Description: The dog is taught a behavioural response other than the original aggressive response in the presence another dog (e.g. sitting upon command).

**Effective:**             Very     Somewhat     Not very     Uncertain  
**Practical:**             Very     Somewhat     Not very     Uncertain  
**Financially feasible:**     Very     Somewhat     Not very     Uncertain

V. Increased exercise and/or play

Description: Increasing the frequency or duration that the dog is exercised or engaged in play.

**Effective:**             Very     Somewhat     Not very     Uncertain  
**Practical:**             Very     Somewhat     Not very     Uncertain  
**Financially feasible:**     Very     Somewhat     Not very     Uncertain

VI. Correction of aggressive behaviour

Description: Each time that an aggressive signal is produced by the dog in the presence of another dog (e.g., growling, staring or lunging), the trainer orients the head and/or body of the dog being treated away from the second dog.

**Effective:**             Very     Somewhat     Not very     Uncertain  
**Practical:**             Very     Somewhat     Not very     Uncertain  
**Financially feasible:**     Very     Somewhat     Not very     Uncertain

**Using the following equipment:** *(Please select as many as apply)*

Head halter            **Effective:**  Very     Somewhat     Not very     Uncertain  
(E.g. Halti ®,  
Gentle Leader®)        **Practical:**  Very     Somewhat     Not very     Uncertain  
                                 **Feasible:**  Very     Somewhat     Not very     Uncertain

Harness                **Effective:**  Very     Somewhat     Not very     Uncertain  
                                 **Practical:**  Very     Somewhat     Not very     Uncertain  
                                 **Feasible:**  Very     Somewhat     Not very     Uncertain

Neck collar            **Effective:**  Very     Somewhat     Not very     Uncertain  
                                 **Practical:**  Very     Somewhat     Not very     Uncertain  
                                 **Feasible:**  Very     Somewhat     Not very     Uncertain

*(Continued on next page)*

- |   |                   |                               |                                   |                                   |                                    |
|---|-------------------|-------------------------------|-----------------------------------|-----------------------------------|------------------------------------|
| <input type="checkbox"/> Single leash       | <b>Effective:</b> | <input type="checkbox"/> Very | <input type="checkbox"/> Somewhat | <input type="checkbox"/> Not very | <input type="checkbox"/> Uncertain |
|   | <b>Practical:</b> | <input type="checkbox"/> Very | <input type="checkbox"/> Somewhat | <input type="checkbox"/> Not very | <input type="checkbox"/> Uncertain |
|   | <b>Feasible:</b>  | <input type="checkbox"/> Very | <input type="checkbox"/> Somewhat | <input type="checkbox"/> Not very | <input type="checkbox"/> Uncertain |
|   |                   |                               |                                   |                                   |                                    |
| <input type="checkbox"/> Double-ended leash | <b>Effective:</b> | <input type="checkbox"/> Very | <input type="checkbox"/> Somewhat | <input type="checkbox"/> Not very | <input type="checkbox"/> Uncertain |
|   | <b>Practical:</b> | <input type="checkbox"/> Very | <input type="checkbox"/> Somewhat | <input type="checkbox"/> Not very | <input type="checkbox"/> Uncertain |
|   | <b>Feasible:</b>  | <input type="checkbox"/> Very | <input type="checkbox"/> Somewhat | <input type="checkbox"/> Not very | <input type="checkbox"/> Uncertain |

VII. Distraction

Description: A distractive stimulus (e.g. rattle can or a spray of citronella) is used to interrupt an aggressive encounter when the dog being treated has initiated a threat signal towards another dog.

- |                              |                               |                                   |                                   |                                    |
|------------------------------|-------------------------------|-----------------------------------|-----------------------------------|------------------------------------|
| <b>Effective:</b>            | <input type="checkbox"/> Very | <input type="checkbox"/> Somewhat | <input type="checkbox"/> Not very | <input type="checkbox"/> Uncertain |
| <b>Practical:</b>            | <input type="checkbox"/> Very | <input type="checkbox"/> Somewhat | <input type="checkbox"/> Not very | <input type="checkbox"/> Uncertain |
| <b>Financially feasible:</b> | <input type="checkbox"/> Very | <input type="checkbox"/> Somewhat | <input type="checkbox"/> Not very | <input type="checkbox"/> Uncertain |

Using the following equipment: *(Please select as many as apply)*

- |   |                   |                               |                                   |                                   |                                    |
|---|-------------------|-------------------------------|-----------------------------------|-----------------------------------|------------------------------------|
| <input type="checkbox"/> Sound alarm                        | <b>Effective:</b> | <input type="checkbox"/> Very | <input type="checkbox"/> Somewhat | <input type="checkbox"/> Not very | <input type="checkbox"/> Uncertain |
|   | <b>Practical:</b> | <input type="checkbox"/> Very | <input type="checkbox"/> Somewhat | <input type="checkbox"/> Not very | <input type="checkbox"/> Uncertain |
|   | <b>Feasible:</b>  | <input type="checkbox"/> Very | <input type="checkbox"/> Somewhat | <input type="checkbox"/> Not very | <input type="checkbox"/> Uncertain |
|   |                   |                               |                                   |                                   |                                    |
| <input type="checkbox"/> Spray can                          | <b>Effective:</b> | <input type="checkbox"/> Very | <input type="checkbox"/> Somewhat | <input type="checkbox"/> Not very | <input type="checkbox"/> Uncertain |
|   | <b>Practical:</b> | <input type="checkbox"/> Very | <input type="checkbox"/> Somewhat | <input type="checkbox"/> Not very | <input type="checkbox"/> Uncertain |
|   | <b>Feasible:</b>  | <input type="checkbox"/> Very | <input type="checkbox"/> Somewhat | <input type="checkbox"/> Not very | <input type="checkbox"/> Uncertain |
|   |                   |                               |                                   |                                   |                                    |
| <input type="checkbox"/> Remote control<br>activated collar | <b>Effective:</b> | <input type="checkbox"/> Very | <input type="checkbox"/> Somewhat | <input type="checkbox"/> Not very | <input type="checkbox"/> Uncertain |
|   | <b>Practical:</b> | <input type="checkbox"/> Very | <input type="checkbox"/> Somewhat | <input type="checkbox"/> Not very | <input type="checkbox"/> Uncertain |
|   | <b>Feasible:</b>  | <input type="checkbox"/> Very | <input type="checkbox"/> Somewhat | <input type="checkbox"/> Not very | <input type="checkbox"/> Uncertain |

18. What factors do you consider contribute to the success of an inter-dog aggression rehabilitation program?

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19. What factors do you consider contribute to the failure of an inter-dog aggression rehabilitation program?

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**V. Adoption of dogs with inter-dog aggression**

20. Are there any legal restrictions within your jurisdiction concerning adopting out dogs with inter-dog aggression?

- Yes     No

If yes, please explain the restrictions.

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21. Does your shelter have a formal policy regarding adopting out dogs with inter-dog aggression?

- Yes     No

If yes, please explain what that policy entails.

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22. In which of the following cases would your shelter adopt out a dog with inter-dog aggression?

- To an experienced owner  
 To a home with no other dogs  
 To an owner willing to participate in training/rehabilitation with the dog  
 If the aggression appears to have improved  
 If the dog has undergone rehabilitation  
 If the dog has been (or will be) spayed/ neutered  
 Never  
 Other (Please explain)

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23. If a potential adopter is interested in a dog with inter-dog aggression, but does not meet the shelter's criteria, is adoption still possible?

- Yes     No

24. Are new owners of dogs with inter-dog aggression required to participate in behaviour training or rehabilitation after adoption?

- Yes     No

If yes, where is the training or rehabilitation undertaken?

- Within the shelter     Outside the shelter

*Thank-you for your time!*

**Appendix 3.** Classification of stimulus dogs into categories (A - D) based on aggression and fearfulness test scores and reproductive status.

Category	Descriptor	Test criteria *	Reproductive status
A	Friendly	Total aggression score < 8 Total fearfulness score < 10	Neutered
B	Friendly	Total aggression score < 8 Total fearfulness score < 10	Intact
C	Confident	Total aggression score < 10 Total fearfulness score = 5	Neutered
D	Confident	Total aggression score < 10 Total fearfulness score = 5	Intact

\* Scores had a maximum possible of 25 and minimum of 5.

**Appendix 4.** Description of the ethogram items.

Category	Item	Definition
<i>Orientation</i>	facing stimulus dog	Dog positioned towards the stimulus.
	sideways to stimulus dog	Dog positioned lateral to the stimulus.
	approaching	Dog moves towards the stimulus while gazing directly at the stimulus.
	retreating	Dog moves away from the stimulus.
<i>Posture</i>	stiff posture	Legs are straight and stiff with no movement.
	leaning forward	Body slightly sloped forward, feet braced.
	relaxed posture	Breed specific posture in neutral context.
	sitting	Hind quarters and hind legs touching the ground with front legs extended and chest up.
<i>Eyes</i>	body lowered	Crouched body with legs bent, head and neck in line with dorsum, lowered tail.
	direct staring	Looking straight at the stimulus. Pupils may be slightly widened.
	avoiding eye contact	Eyes turn away from the stimulus for at least 3 seconds.
<i>Mouth</i>	squinting	Eyelids partially closed.
	snarling	Lips curled to expose incisors and canines, or all teeth and gums.
	oral cavity exposed snapping	Mouth open to expose back of throat. Mouth opens and closes quickly, may lunge forward or display a rapid head movement.
<i>Neck</i>	neck erect or arched	Neck raised above dorsum.
	lowered neck	Neck lowered in line with dorsum.
	turning head while baring teeth	Head turns away from the stimulus with teeth exposed.
	piloerection	Hairs raised along the back of the neck and/or spine and hindquarters.
<i>Ears</i>	ears up	Ears erect.
	ears forward	Ears slightly forward.
	ears relaxed	Ears midway between forward and back.
	ears back and/or flat	Ears pulled back or back and flat against head.
	ears vertically dropped	Ears pulled slightly back and sideward spread.
	ears switching	Ears switching backward and forward.

Category	Item	Definition
<i>Vocalization</i>	barking	Short, repeated vocalizations.
	growling	Low to midrange pitched sustained vocalization.
	growl-barking	Low midrange pitched combination of growl and bark.
	whining	Sustained, high-pitched cry.
	yelping	Short, high-pitched bark or series of barks.
<i>Tail</i>	tail above horizontal	Tail above the horizontal.
	tail arched or vertical	Tail up or curved over back.
	tail below horizontal	Tail lower than horizontal, but above legs.
	tail tucked	Tail near hind legs or tucked.
	tail tucked with belly presented	Tail near hind legs or tucked with belly exposed.
	tail tip wag; stiff	Slight tail wag with sharp bend in tail.
	bristled	Hairs raised along the tail.
	tail wagging	Repetitive wagging movements of the tail in a lateral plane.
	wagging slowly	Broad, slow tail wag.
	wagging rapidly	Rapid tail wag.
	body wagging	Wide, sweeping motions of tail with hindquarters moving from side to side.
<i>Body movements</i>	lunging	Dog rapidly bounds towards the stimulus.
	seeking support	Dog attempts to hide behind the handler, approaches and/or pushes itself against the handler.
	freezing	Dog is motionless.
	trembling	Dog shivers all over its body.
	mouthing leash	Dog clasps leash in mouth or teeth.
	jumping	Dog jumps up at an object or person with its two front feet, with hind legs on the ground.
	pouncing	Dog bounds with front paws together.
	circling	Dog repeatedly walks in a small circle.
	play-bowing	Paws out, front end down, hindquarters up, tail wagging.
	ground scratching	Digging at ground with front or hind feet.

Category	Item	Definition
<i>Anxiety/ submission</i>	muzzle licking	Tongue shortly appears at the front of the mouth as the dog licks its upper lip or the air.
	rapid panting	Increased frequency of inhalation and exhalation with mouth open.
	yawning	Mouth opens with a prolonged, deep inhalation.
	raising forepaw	One front paw is raised for a short time.
	lying on back	Dog lies on its back or side with head down.
	blowing out lips	Lips puff out as dog inhales air through the mouth and closes mouth rapidly.
	submissive urination	Urination in the presence of the stimulus while dog displays a low posture, ears back and/or flat, avoids eye contact and may tremble.

Adapted from van den Berg et al. (2003), Overall (1997), Goddard and Beilharz (1985), and Coren (2001).

**Appendix 5.** Demographic data of dogs in the rehabilitation group (n = 9) and control group (n = 7).

Variable	Number of dogs		
	Rehabilitation	Control	Total
<i>Gender and reproductive status</i>			
Intact males	0	3	3
Neutered males	4	1	5
Intact females	2	2	4
Spayed females	3	1	4
<i>Breed</i>			
German Shepherd or Mix	1	4	5
Labrador Mix	1	1	2
Border Collie Mix	1	0	1
Heeler Mix	1	0	1
Siberian Husky	1	0	1
Malamute Mix	1	0	1
Akita	0	1	1
Dalmation Mix	1	0	1
Pitbull or Mix	1	1	2
Staff Bull Terrier Mix	1	0	1
<i>Age category</i>			
Adult	8	7	15
Older adult	1	0	1
<i>Estimated weight</i>			
20- 27 kg	3	3	6
28- 31 kg	2	1	3
32- 36 kg	4	3	7

Variable	Number of dogs		
	Rehabilitation	Control	Total
<i>Source</i>			
Stray	1	4	5
Brought in by police	3	0	3
Transfer from another shelter	3	3	6
Surrender by owner	2	0	2

Note: Age and weight estimated by shelter staff upon admission.

**Appendix 7. Stress monitoring checklist for participant dogs.**

**INSTRUCTIONS:** Please stand in front (but off to the side) of the dog's kennel so that you are still able to see the entire kennel. Allow the dog to calm down in your presence for approximately 5 minutes, without staring at the dog. After this, scan the kennel for any of the behaviours listed below for another 5 minutes. Record a check mark next to the behaviours that you observe (refer to definitions on the reverse side of this sheet). Add up the scores for each of the behaviours and identify the dog's risk category (see reverse for decision values). Please also record the time of the assessment and your initials. Thank you!

CALENDAR DAY	SCORE	MONTH									
		0	2	4	6	8	10	18	25	32	
PACING	2										
WALL BOUNCING	5										
TAIL CHASING	4										
CIRCLING	4										
PANTING	1										
LISTLESSNESS	3										
CHEWING BEDDING	3										
LICKING/ CHEWING	3										
EXCESSIVE DRINKING	1										
LACK OF APPETITE	1										
PLAY BOUNCING	1										
ATTEMPTING TO ESCAPE	1										
EXCESSIVE BARKING	2										
BAR / CAGE BITING	5										
HIDING UNDER BED	5										
NIPPING/ MOUTHING	4										
BITING	5										
OTHER _____											
OTHER _____											
<b>TOTAL:</b>											
<b>RISK CATEGORY</b>											
<b>TIME</b>											
<b>ASSESSOR'S INITIALS</b>											

Adapted from Stephen et al (2002)

BEHAVIOUR	DESCRIPTION
PACING	Dog paces around kennel for long periods, usually in a fixed route.
WALL BOUNCING	Dog jumps up kennel wall from side to side for prolonged periods.
TAIL CHASING	Dog chases tail repeatedly for no apparent reason.
CIRCLING	Dog walks around in small circle repeatedly for no apparent reason.
PANTING	Dog pants for other reason than physical exertion or overheating.
LISTLESSNESS	Dog appears unresponsive and listless (appears depressed).
CHEWING BEDDING	Dog chews bedding inside kennel, most probably out of boredom.
LICKING / CHEWING ITSELF	Dog licks or chews its body excessively for no apparent reason.
EXCESSIVE DRINKING	Dog drinks large volumes of water, in excess of what is normal.
LACK OF APPETITE	Dog eats noticeably less food.
PLAY BOUNCE	Dog repeatedly displays the play bow posture and barks repeatedly.
ESCAPE BEHAVIOUR	Dog attempts to escape kennel in a frantic manner whenever door is opened and closed.
EXCESSIVE REPETITIVE BARKING	Dog barks for prolonged periods in the absence of a stimulus.
BAR / CAGE BITING	Dog repeatedly chews and bites at the wire of kennel.
HIDE BEHIND BED	Dog cowers or attempts to hide using the bed as a barricade.
NIPPING/ MOUTHING	Dog's clasps leash, clothing, or handler's body part in mouth or teeth (without puncturing skin).
BITING	Dog's clasps teeth on handler's body part, with pressure and puncturing skin, with or without drawing blood.

**TOTAL DAILY SCORE:**

CATEGORY	ACTION
0 - 4 LOW RISK	Continue monitoring for changes in stress.
5 - 10 MEDIUM RISK	Implement handling or housing modifications to reduce stress. Continue monitoring for changes in stress.
11 - 50 HIGH RISK	Withdraw dog from study.

**NOTES:**

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**Appendix 8. Stress monitoring checklist for stimulus dogs.**

ENTRY DATE													
STIMULUS CATEGORY													
NUMBER OF SESSIONS	SCORE	1	2	3	4	5	6	7	8	9	10	11	12
<b>DURING SESSION</b>	LOW POSTURE	1											
	FREEZING	4											
	TREMBLING	5											
	GROUND SCRATCHING	1											
	SEEKING SUPPORT	2											
	SEEKING COVER	1											
	MUZZLE LICKING	1											
	RAPID PANTING	1											
	YAWNING	1											
	LIFTING PAW	1											
	BLOWING OUT LIPS	1											
	SUBMISSIVE URINATION	5											
	LAYING DOWN	1											
<b>IN GENERAL</b>	AGGRESSION	3											
	LISTLESSNESS	3											
	ESCAPE ATTEMPTS	1											
	OTHER _____												
	TOTAL:												
	RISK CATEGORY												
INITIALS													

DURING SESSION	
CATEGORY	ACTION
0 - 4 LOW RISK	Continue monitoring for changes in stress.
5 - 10 MEDIUM RISK	Implement handling or housing modifications to reduce stress. Continue monitoring for changes in stress.
11 - 50 HIGH RISK	Withdraw dog from study.

*Adapted from Stephen et al. (2002)*

ENTRY DATE													
STIMULUS CATEGORY													
NUMBER OF SESSIONS	SCORE	1	2	3	4	5	6	7	8	9	10	11	12
<b>IN KENNEL</b>	PACING	2											
	WALL BOUNCING	5											
	TAIL CHASING	4											
	CIRCLING	4											
	PANTING	1											
	CHEWING BEDDING	3											
	LICKING/CHEWING SELF	3											
	EXCESSIVE DRINKING	1											
	LACK OF APPETITE	1											
	PLAY BOUNCING	1											
	EXCESSIVE BARKING	2											
	BAR / CAGE BITING	5											
	HIDE UNDER BED	5											
	NIPPING/ MOUTHING	4											
	BITING	5											
TOTAL													
RISK CATEGORY													
TIME													

IN KENNEL/GENERAL	
CATEGORY	ACTION
0 - 2 LOW RISK	Continue monitoring for changes in stress.
3 - 4 MEDIUM RISK	Implement handling or housing modifications to reduce stress. Continue monitoring for changes in stress.
5 - 28 HIGH RISK	Withdraw dog from participation as a stimulus dog.

**NOTES:**

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## Managing dog-to-dog behaviour problems



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### *Facts about social conflicts between dogs*

- Commonly occurs between two males or females.
- Tends to be more prevalent among intact males, and is often reduced by castration.
- Usually arises at social maturity (18 to 24 months of age), but can appear at any age.
- Can be directed towards a familiar dog (e.g. household dog) or an unfamiliar dog (e.g. an unknown neighbourhood dog). A dog that is reactive towards unfamiliar dogs may be able to coexist with another household dog, but it is not recommended until the dog's behaviour has significantly improved.
- The target dog can be very specific (e.g. large black dogs or one dog breed), or it may be more general (e.g. intact males) or generalized to all other unfamiliar dogs.
- There are two possible causes. The first arises from a *conflict of status*, where the dog is uncertain of its role in the social hierarchy. This can be due to a conflict in *actual* or *perceived* social ranking. For instance, dogs that are unable to read the signals of other dogs may believe that they are being threatened whenever they meet another dog. Although it is commonly suggested that higher-ranking dogs usually initiate dog fights, it is often the case that dogs experiencing the uncertainty of being lower in the hierarchy will display threats such as snarling and growling. Second, problem behaviour towards other dogs may be motivated by *fear*. For instance, a fearful dog may have learned that by using threats, he can remove the target of his fear (i.e. the other dog). The dog will continue to use this strategy as long as it remains effective.

## ***10 tips for managing dog-to-dog behaviour problems***

1. **If you cannot control your dog in a particular situation, avoid the situation.** Until your dog obeys and defers to you in many different contexts (at home, in the yard, at a friend's house) do not place your dog in a situation in which he/she is likely to become reactive, such a dog park.
2. **Identify the target of your dog's behaviour problem.** Is it only larger males, dogs with cropped ears and tails, or all other dogs?
3. **Avoid reinforcing (or rewarding) your dog's problem behaviour.** Allowing your dog to display threatening behaviour towards other dogs, and then removing the dog from the situation, may unintentionally reinforce your dog's undesirable response. The owner of the other dog is likely to move their dog away, and as a result your dog may feel that he/she has won the contest. Your dog's reaction has been rewarded, and the dog is likely to repeat this behaviour. Similarly, reassuring your dog by saying "It is okay, Sparky" will only further reinforce the behaviour by indicating to the dog that his/her reaction was acceptable.
4. **Prevent the inappropriate response.** Prevention involves being attentive to possible situations that may provoke an undesirable reaction in your dog. Be on guard at all times when outdoors for approaching dogs that may trigger your dog to become reactive. If you feel that you do not have sufficient control over your dog's behaviour at this point, distract your dog by calling his/her name and slightly arch your path to avoid a confrontation.
5. **Use correction to prevent escalation of the reaction.** If you have already mastered the steps above and feel confident about your dog's level of obedience and trust in your relationship, you are ready to work with the dog in a more reactive state. This is best done with the help of a friend and their well-behaved

dog. Equip your dog with a good neck collar, leash, and a head-collar such as a Halti® or Gentle Leader®, with an added security strap attached between the head collar and the neck collar. The procedure can be performed in a fenced-in yard, a vacant park, or in your house. Stand in one corner of the area with the dog sitting attentively at your side. Ask your friend to enter the area from the furthest point possible (this should be at least 10 meters, but as far as possible). Have your friend approach with their dog until they are about 6 meters from you, and then have them turn and walk back. If your dog remains relaxed and non-reactive, reward him/her with praise and food treats. In addition to more overt reactions such as growling, snarling and lunging, watch for more subtle signs such as prolonged staring, stiff posture, leaning forward, and raised hair on the dog's back. If your dog's behaviour escalates before you can prevent it, tell the dog a firm but calm "no". Being reactive yourself will increase the dog's arousal and reactivity. While you issue the "no" command, use the head-collar to gently break the stare and position the dog away from the other dog. When your dog appears relaxed at a given distance, and has consistently responded in an appropriate manner, have your friend approach closer with the other dog. Repeat this procedure with as many friendly dogs as possible.

6. **Teach desirable behaviours to replace inappropriate reactions.** As your friend's dog approaches, give your dog the look command ("Sparky, watch me"). This will gain your dog's attention while he/she is in a reactive state, therefore making the dog more amenable to learning a more appropriate response. After your dog has learned to break eye contact with the approaching dog and to look to you for the next command, ask him/her to sit. Essentially, you are replacing the previous reactive response with more appropriate sitting behaviour. This helps to reduce your dog's level of anxiety, and will result in much more desirable behaviour in your dog for both yourself and your fellow dog owners!

7. **Provide plenty of positive reinforcement for appropriate behaviour.** All non-reactive behaviour around other dogs should be rewarded with plenty of vocal praise, petting, and occasional food treats.
8. **Good timing and consistency is essential.** Dogs learn about the consequences of their behaviour based on what happens within 30 seconds after an event. This means that corrections and rewards must occur as close as possible to the time that your dog produces the response. Have a food treat ready in your hand when you are about to issue a command, or use on vocal praise which can be given instantaneously. This also means that telling your dog that he/she was a “bad boy” or punishing the dog after you return home from a walk will not be effective, and may cause confusion and fear in the dog. Consistency refers to being committed to preventing or correcting your dog’s inappropriate behaviour every time that it occurs. Even one slip in the routine can teach the dog that he does not necessarily have to comply with your commands, and may compromise the dog’s progress.
9. **Safety first.** Use caution at all times when your dog is around other dogs to prevent possible injuries to people or other dogs. Even if your dog consistently behaves appropriately during training, he/she may still become reactive in certain contexts or with certain individuals. In the case that you are unable to prevent a dogfight, please do not attempt to intervene. Use any method available to distract the dogs’ attention, such as throwing a jacket over the dog’s head or blowing a whistle. Remember that a dog that is reactive to other dogs may redirect its aggressive behaviour towards people.
10. **Patience and commitment will pay off over time.** Although this procedure involves a considerable amount of time, patience, and hard work, the rewards to your relationship with your dog are invaluable. Remember to make ample opportunities to reward your dog every day, such as ending off each training session with a few simple commands followed by plenty of praise and treats.

**Appendix 10.** Total aggression, fearfulness, excitability, and playfulness scores \* in the pre-treatment (Day 0) test by (a) participant dogs that met the criteria for inclusion in the experiment, and (b) rejected dogs that failed to meet the criteria.

Class of dog	n	Aggression			Fearfulness			Excitability			Playfulness		
		<i>Mdn</i>	<i>Min</i>	<i>Max</i>	<i>Mdn</i>	<i>Min</i>	<i>Max</i>	<i>Mdn</i>	<i>Min</i>	<i>Max</i>	<i>Mdn</i>	<i>Min</i>	<i>Max</i>
Participants	16	11	10	16	6	5	9	11.5	5	17	5	5	5
Rejected	40	5	5	8	6	5	12	8	5	14	5	5	13

\* Scores of 1-5 were recorded for each of the five tests. Table values are totals of these scores, hence the minimum possible score was 5 and the maximum possible score was 25. *Mdn* = median; *Min* = minimum; *Max* = maximum. Data were excluded for one dog that met the study criteria but was redeemed, two dogs that were rejected because of stress indicators, and one dog for which there was missing data.

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