



LITERATURE REVIEW OF PRACTICES TO SAVE ANIMAL LIVES
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List of Abbreviations

AF – Adoption Fee

BC – Basic Communal Treatment

BS – Basic Single Treatment

C-BARQ – Canine Behaviour Assessment and Research Questionnaire

C4C – Capacity for Care

CSS – Cat Stress Score

DAP – Dog Appeasing Pheromone

DRO – Differential-Reinforcement of Other Behaviour

EC – Enriched Communal Treatment

EE – Environmental Enrichment

ES – Enriched Single Treatment

GH – Group-Housed

HSUS – Humane Society of the United States

LOS – Length of Stay

LRR – Live Release Rate

NAF – No Adoption Fee

PH – Pair-Housed

OHS – Ottawa Humane Society

SH – Single-Housed

S/N – Spay/Neuter

SAFER – Safety Assessment for Evaluating Rehoming

SNR – Shelter-Neuter-Return

TNR- Trap-Neuter-Return

URI – Upper-Respiratory Infection

Introduction

In 2004, animal welfare leaders drafted the *Asilomar Accords* to establish transparency, proper data collection and data sharing. Accordingly, the *Asilomar Accords* created clear definitions for animal shelter organizations while also developing formulas to calculate the annual live release rate (LRR) for each shelter. Annual LRRs are a transparent strategy to track a community's efficiency of saving animal lives. This tracking should contribute towards developing and implementing new strategies to save more animal lives. Unfortunately, there are inevitable instances in which the fate of a companion animal may lead to euthanasia—specifically when prolonging the life of an animal actually prolongs unnecessary animal suffering. However, animal sheltering procedures, policies and financial initiatives may be established to significantly increase the safe release of companion animals into forever homes. Accordingly, this literature review emerged from the Ottawa Humane Society's (OHS) desire to enhance animal wellbeing and improve sheltering strategies that save animal lives.

While many animal shelters anecdotally report varying strategies that improve their annual LRR, there is a clear absence of peer-reviewed research supporting many of these strategies. Because implementing different shelter practices requires financial support, staff training, and often a revised structural approach, consulting the peer-reviewed research is paramount. Frank Gannon (2001) explains that “most scientists will not consider a scientific pronouncement as valid unless it has been approved by this anonymous process, known as peer-review” (p. 743). This seriousness displayed by scientists is the attitude of the OHS. Consequently, this literature review is specifically concerned with the findings reported in peer-reviewed literature. However, as a result of the lack of peer-reviewed research in the field of animal sheltering, a small concluding segment is dedicated to the anecdotal reports of North

American animal shelters who report having a high LRR. The purpose of this literature review is to determine what policy, procedural, and financial initiatives have the greatest positive impact on the LRR of an animal shelter.

Literature Review Methodology

Peer-reviewed research was predominantly searched for and collected through the use of the University of Ottawa library databases. Some peer-reviewed research was also suggested and provided by notable animal shelter researchers, veterinary researchers, and other animal welfare organizations. Notes were taken from each relevant source and ultimately compiled into a master list of 10 shelter policy and procedural categories. These peer-reviewed research categories, which are extrapolated below are: 1) feline housing; 2) feline behaviour/socialization; 3) feline enrichment; 4) olfactory stimulation; 5) canine behaviour/socialization; 6) canine interaction and training; 7) canine housing; spay/neuter initiatives; 8) Capacity for Care; 9) working cats program; 10) disease control; 11) reduced/waived adoption fees; 12) community cat management; and, 13) volunteer training.

Peer-Reviewed Research

Feline Housing

Felines may be placed in two basic housing options: either in a single-housing unit or in a pair/multi-cat unit. Suchak and Lamica (2018) examined group-housed (GH) cats and single-housed (SH) cats in order to understand whether SH and GH cats have similar shelter experiences and similar outcomes. The researchers examined 220 GH cats and equally divided these cats into both GH and SH cages. This was the first shelter experience for each cat. To

reduce external variables, each SH cat corresponded with a paired GH cat according to defining features such as age, sex, primary breed, primary coat colour, and size. GH cats were placed in colony rooms in groups ranging from 2-8 individuals. The researchers studied cat shelter experiences by measuring the number of relocations (to other cage or room), average time spent in each location, length of time on the adoption floor, offsite moves, foster moves, and bite/scratch cases. The outcomes considered were length of stay (LOS), live release, and return to shelter following adoption. The researchers found that housing-type impacted the number of moves and the average time spent in each location. SH cats were 2.5 times more likely to be moved offsite than GH cats. GH cats spent a significantly greater amount of time visible on the adoption floor and SH cats were 3.2 times more likely to be moved to isolation. The greater time spent in isolation greatly impeded time spent visible on the adoption floor. All other outcomes were insignificant.

Kessler and Turner (1997) also examine the relation between types of housing and stress and adaptation in cats. The researchers studied the development of stress in 60 SH cats, 40 pair-housed (PH) cats, and 40 GH cats. The study asked whether two weeks are enough time for cats to adapt to an unfamiliar environment.

A seven-level Cat-Stress-Score (CSS) was employed to assess stress levels. The scores ranged from 1 = fully relaxed; 2 = weakly relaxed, 3 = weakly tense, 4 = very tense; 5 = fearful stiff; 6 = very fearful; and 7 = terrorized. The CSS was used four times per day for 14 days of stay. The daily mean CSS of SH cats significantly declined from Day 1 to 5 while it declined significantly for the PH and GH cats from Day 1 to Day 4. The daily mean scores for all housing types was significantly higher than the mean scores of the control cats on each of the 14 days of study. Within the first week of the study, 75% of cats scored above 'weakly tense' while 24% of

the cats scored above the level 'very tense.' However by the second week, only 35% of the cats scored above 'weakly tense' and only 4% scored above 'very tense.' The daily mean CSS of the cats housed in different housing types did not differ significantly on any day of the study. This indicates that full stress adjustment to a boarding cattery may require more than two weeks. However, stress decreased after 4 and 5 days for PH/GH cats and SH cats, respectively. Because cats were assigned a housing type predicated upon the cat's housing origin, results may have been different if this history was unknown. As shelters regularly house cats without knowing housing history, these findings must be understood as being optimal whereas the reality of the situation is more complex.

Kessler and Turner (1999) investigate whether the socialization of cats towards conspecifics and people influences cat adaptation when placed in either single-housing or group-housing. The study examined 114 cats between the ages of one and eight. Cat socialization to conspecifics and people was determined by using a socialization-questionnaire and two behavioural approach-tests (a human-approach test and cat-approach test). The socialization-questionnaire asked owners who surrendered the participating cats about the socialization of their cat with cats and humans.

Animals observed in single cages and group housing were held singly and in groups, respectively, for 10-20 days prior to the study. When the study commenced, CSS (see above) was used to assess stress levels. CSS was used regularly throughout the first seven days of the study. Following this, each cat was randomly tested twice per day for four days with either the human-approach test or cat-approach test.

Following the tests and questionnaires, cats were divided into eight groups depending on their socialization towards conspecifics and people and the housing type in which they were

observed. Cats socialized towards conspecifics had a lower CSS than cats not socialized towards conspecifics. Adding a non-socialized to conspecifics cat to the control group elevated stress in the control group. Furthermore, non-socialized towards conspecifics cats had a significantly greater inter-individual distance than socialized to conspecifics cats. Active, unfriendly interactions did not differ between the two groups. The 13 SH socialized to conspecific cats and 15 SH non-socialized to conspecifics cats did not significantly differ in their CCS. However, GH non-socialized to conspecifics cats had significantly higher CSS than SH non-socialized to conspecifics cats. This indicates that non-socialized to conspecifics should be singly housed. About one third of the GH non-socialized to conspecifics cats became completely inactive, hid from visibility, and displayed passive, unfriendly behaviour. This would impact adoption.

The 25 SH socialized to people cats had significantly lower CSS than the 7 non-socialized to people cats. There were no other significant differences between the socialized to people cats group regardless of housing type. This study reflects the importance of understanding the socialization of cats when deciding upon the appropriate housing for sheltered cats (this topic will be addressed further below).

In reviewing articles pertaining to housing types, Finka et al. (2014) found that 4 out of 6 articles reviewed did not find a relationship between housing type and stress. Despite the apparent absence of a relation, the researchers similarly stress the importance of a cat's socialization level.

Gourkow and Fraser (2006) found that basic single housing induces higher CSS and negatively affects adoption rates, increases LOS and may encourage fearful behaviour. The four-month study aimed to understand how housing and handling affected the welfare, behaviour, adoption rate, and selection of individual cats. The CSS developed by Kessler and Turner (1997)

was used to assess cat stress. 165 cats were studied and randomly divided into four treatment groups: 1) basic single treatment (BS); 2) enriched single treatment (ES); 3) basic communal treatment (BC); and, 4) enriched communal treatment (EC). Modifications were made to ensure equal distribution of cat characteristics to each group. However, the BC housing still contained shelves and hiding places, which actually qualify as enrichment—especially compared to the bare environment of BS housing. In addition, the SH cages were located nearby canines and thus more noisy—this would affect the BS cats especially due to the absence of hiding places. Consequently, more controlled environments against these variables may yield different results.

Ultimately, housing appeared to affect cat adoptions. Only 45% of BS cats were adopted within 21 days, while 76% of ES cats were adopted, 74% BC cats were adopted, and 69% of EC cats were adopted. 16% of BS cats were euthanized, while 6% of ES and EC cats were euthanized, and 2% of BC cats were euthanized. CSS were similar for all treatments on Day 1, but CSS was higher for BS cats compared to the other treatments afterwards up until Day 9. Only 12% of ES cats were placed in isolation, compared to 26% BS cats, 22% BC cats, and 22% EC cats. This study indicates that unenriched single-housing is negative for feline outcomes. However, the presentation of cats may have affected adopter's decision-making as well (i.e. viewing a cat in a barren cage versus a cat with a perching shelf and toy), however adopters were not questioned. Indeed, Fantuzzi, Miller and Weiss (2010) found that the presence of toys in a cage affects adopter decision-making (see more below). Lastly, because the shelter euthanizes cats for medical reasons, the higher number of euthanized cats indicates greater illness for BS cats, which would also have influenced adopters avoiding to adopt sick cats.

Peer-reviewed research also examines the issue of appropriate cage sizes and its effect on feline behaviour. Wagner, Kass and Hurley (2018) examined cage size, movement in and out of

the cage, and other environmental factors and found that these factors significantly affect the rate of upper respiratory infection (URI) in animal shelters. Nine North American shelters participated in this study between August 1, 2008 and July 31, 2009. Baseline data was provided by shelters through a survey and monthly updates were sent from the shelters to report significant changes away from the baseline data. Using an online URI database, all shelters recorded the daily number of adult cats –excluding feral—in the shelter population, which was categorized by health status (healthy and unhealthy). Daily intake of adult felines was also recorded. Cats were recorded as either ill with URI or healthy. A shelter’s monthly URI rate was calculated by dividing the number of new URI cases with the total number of cat-days at risk for URI for that particular month. Variables examined were: double compartment housing; intake housing floor space; hiding space provided in intake housing; mixed-age housing; frequency of cat moves in and out of the cage in the first week; use of intranasal vaccine; and, monthly shelter intake. Five shelters examined URI pathogens with 20 randomly selected felines.

The URI rate varied from 0.7 to 33.3 cases/1000 cat days at risk. The overall average annual URI rate for adult cats was 14.8 cases/1000 cat days at risk. Intake housing floor of $> 8 \text{ ft}^2$ and two or fewer moves during the first week of stay were determined to be positive protective efforts against URI. Double compartment cages are therefore recommended as cages may be cleaned without moving cats. Conversely, providing hiding places and the use of an intranasal vaccine were determined to significantly increase URI cases. However, the researchers acknowledge that five of the six shelters that did provide hiding places also housed cats in small cages with less than 6 ft^2 of floor space. The less floor space may have negatively affected the control of URI pathogens rather than the hiding places. A major limitation of this study is that each shelter individually defined URI according to its own parameters. This ranged from “any

single sign of URI such as sneezing...to strict...ocular discharge and/or systemic illness” (p. 11). This may have substantially skewed results.

To examine the relationship between cage size and cat behaviour, Uetake et al. (2013) examined six neutered cats in different cage sizes. Cats were placed in groups of two and each group was housed in a room for at least seven months before the study. Cats were then singly housed and experienced the different cage sizes for 6 days. The cages ranged from small, medium, and large. The large cages also had a double-deck shelf, and a wall-mounted rack that cats could jump onto from a wooden log. Cats were observed when staff were absent. In addition, these observations only occurred during the last two days of the cats’ time in each cage environment so as to reduce unfamiliar-induced anxiety/weariness. Behaviours to be analyzed were: resting; drinking water; eliminating; vacuum behaviour; locomotion; social/solitary play; exploring; self-grooming. The time spent performing each activity was compared across the different housing conditions. Urine samples were collected in the morning and evening during cleaning to analyse cortisol levels, as cortisol levels indicate animal stress.

Cats moved significantly more when group housed in the large group room compared to small and large single housing. Cats played significantly more when group housed compared to single housed in the large cage. Cortisol levels were also higher, although not significantly, in SH cats compared to when GH. The extremely small sample and the continuous relocation of the cats is a strong limitation to this study, which may have affected results.

Many of the previous studies find a negative influence between smaller cages and the wellbeing of cats. Accordingly, Stella, Craney and Buffington (2017) investigate whether providing cats with greater than the recommended floor space improves outcomes. The researchers compare the effects on cats when housed in managed or unmanaged rooms and

enriched and unenriched cages. 59 neutered cats were included in this study and randomly assigned to one of the four different housing options. The housing room contained 10 cages along three walls. The managed room had little noise and disturbances while the unmanaged room contained “multiple, random, unpredictable disturbances each day” (p. 298). In the cage environment, cats were housed in stainless steel cages. The enriched cages had a two-tiered cardboard Hide, Perch & Go Box™, which featured a hiding and perching area. These two areas also had bedding. The unenriched cages contained only a litter box, bedding and food/water dishes. Both caged animals were fed the same diet.

Researchers recorded the previous night’s food intake, urination, defecation, and other sickness behaviours each day. A scan sample of the cage was conducted by researchers every two hours between 8:00h and 16:00h, which recorded the cat’s position in the cage, behaviour, and vocalization. Cats were also recorded during alternate times from the scan sample to avoid influence from the presence of the researchers. At the end of the last scan sample on Day 2, all cages were covered and a stranger-approach test was conducted within 30 minutes. This test involved three steps wherein the stranger stood quietly 1 m from the cage for 30 seconds, then the stranger approached the cage and placed a hand on the cage for 30 seconds, and lastly the stranger opened the cage door and stood quietly with an extended hand towards the cat for 30 seconds.

Housing-type did not affect food intake, but specific days were significant as over 40% of cats consumed more than half of their food on Day 2, whereas only 20% had consumed more than half on Day 1. Similarly, the effect of day was significant when examining urination behaviour. Cats displayed a significant decrease in sickness when in managed rooms and enriched cages, but not in unmanaged rooms and unenriched cages. Cats in the managed and

enriched environments displayed less hiding behaviour from Day 1 to Day 2. Although Kry and Casey (2007) report that hiding places encourage feline approach behaviour, Stella et al. (2017) did not find any significant result. However, Stella et al.'s (2017) lasted two days, which is a tremendous limitation. Ultimately, this study found that cage size itself does not greatly affect feline wellbeing, but rather that environmental enrichment may be an influential factor.

To examine the factors influencing cat adoptions, Fantuzzi et al. (2010) examined cage location as one component of their examined adoption considerations. 111 cats were singly housed over a period of time with 24 single cages. Five to eight cats were observed at once. The cages were arranged in two rows of 46 cm and 112 cm above the ground. Cats were also assigned to either a toy group or a control group, with one group provided with toys. The toys were a yellow ping-pong ball and a "Cat Dancer" toy. With specific attention to feline housing, the researchers found that cats in the upper tiers were viewed more often than cats housed on the bottom row. Cats housed in the upper row also appeared more active than those on the bottom row. The researchers found a significant positive relationship between how frequently a cat was viewed and adopted; which indicates that cats on the upper row were adopted more frequently than those on the bottom row. This finding is reflective of zoo research, which shows that visitors view exhibits longer when animals are visible or in close proximity (see Davey, 2005; Johnston, 1998). Fantuzzi et al. (2010) however do not discuss the impact that the toys' presence may have had on cat behaviour and adopter's decision-making.

Through reviewing research on the impact of single housing and multi-cat housing on feline stress levels in an animal shelter, Finka, Ellis and Stavisky (2014) determine that "it is important to consider [cats'] likely prior experience" (p. 9). The authors find that only CSS measurement is validated through other studies. The reviewers found that a cat's socialization, or

lack of socialization, appears to affect its CSS when housing is considered. That is, a less socialized cat will benefit from being single housed, while a socialized cat may benefit from a multi-cat enclosure. They conclude by recommending that cats should be housed singly if their previous social history is unknown, however cat cages should always be environmentally enriched. Indeed, this aligns with the findings of Kessler and Turner (1999) who suggest that single-housing does not negatively affect cats regardless of their socialization level to conspecifics. The other housing studies presented are endowed with significant limitations including small sample sizes and uncontrolled variables. Future research should investigate these topics while isolating variables. Particularly, some of these studies integrate feline enrichment, however do not account for enrichment as influencing results. Accordingly, feline enrichment is specifically examined below.

Feline behaviour/socialization

Shelter initiatives rely on understanding animal behaviour/socialization. This understanding affects animal LOS as animals benefit if placed and treated according to their behaviour/level of socialization. Accordingly, Slater et al. (2013) emphasize the need for effective, accurate, and valid socialization assessments. The researchers developed a socialization assessment, which tested 297 owned cats over three days. Owners also completed a behaviour and background survey for their cat. The survey considered 11 behavioural ratings and granted a *socialization score* to each cat. Subsequently, cats were placed in a socialization category as either *more socialized* or *less socialized* and individually housed. The recorded assessment was conducted in six steps: 1) greet (15 s); 2) crack cage door (30 s); 3) novel object hung outside of cage door (30 s); 4) interactive toy lowered into cage to play with cat (30 s); 5)

cat is stroked with 1-meter rod and then pushed with rod (40 s); and, 6) eating in presence of observer (10 mins). The assessment was coded with a *strong/weak* socialization checklist, and was accepted/refuted by four of the researchers through reviewing the video footage. The checklist included 25 *strong* behaviours and 26 *weak* behaviours. Follow-ups were conducted for cats with differences between their socialization category and checklist scores. Caretakers completed the behaviour and background survey again if they noticed a changed behaviour in their cat. The association between behaviours and socialization category was analyzed.

The study found that 31% of *more socialized* cats did not demonstrate one or more *strong* or four or more *weak* behaviours and were consequently deemed not to be socialized. More than half (55%) of *more socialized* cats did not display *strong* behaviours on Day 1 and 17% did not show any *strong* behaviour until Day 3, while only 15% displayed *strong* behaviours for all time periods. 15% of *more socialized* cats only displayed *strong* behaviours during a single time period. 13% of the cats identified as *less socialized* actually displayed one or more *strong* behaviour. 51% of *more socialized* cats did not display any *weak* behaviours on Day 1 while 16% did not display four or more *weak* behaviours until Day 3. Finally, 38% of *less socialized* cats displayed fewer than four *Weak* behaviours and no *strong* behaviours and were consequently deemed not sociable.

Importantly, the researchers found that, “Providing cats with three days to adjust to environments and continued interaction in the form of the structured assessments resulted in many changes in behaviour” (p. 1183). Accordingly, this supports Kessler and Turner (1997; 1999) who also found that cats reduce stress and adapt to new environments in three days. These findings reflect the importance of providing at least three days for cats to adapt before conducting assessments.

Amat et al. (2009) examined 336 cats to ascertain common feline behavioural problems and to identify risk factors on which preventative measures should be taken. The data was collected from questionnaires that owners completed during consultations from 1998 to 2006. Criteria were created to categorize cases of behavioural problems. This criteria was: 1) the beginning and evolution of the problem; 2) the target of aggression; 3) the context of aggression; and, 4) the cat posture during the aggression. Cats that did not meet these criteria were added to the “other forms of aggression” category. A control group of 189 random cats was also created using the same database during the same time. The relationship between the occurrence of the behavioural problem and cat characteristics was analyzed.

The researchers found that 47% of complaints regarded feline aggression, while 39% pertained to inappropriate elimination. The remaining complaints were compulsive behaviours (3.5%), excessive vocalization (2.5%), fear and phobias, (2.5%), and a collection of others (5.4%). No significant association between cat characteristics and behaviour problems was found. Problematic cats were most often from pet stores—this source could represent a risk factor associated with future behavioural problems. Cats from multi-cat homes displayed fewer cases of aggression towards their owners compared to single cat homes. The researchers find that Persian cats had elimination problems more frequently than any other breed; however, it should be noted that Persians represented 60.97% of the pure breeds in the study. Lastly, intact females were significantly more likely to have behavioural problems compared to spayed females. These insights may aid shelters in pre-emptively providing adopters with resources to avoid future behavioural problems which could otherwise lead to unsuccessful adoptions. For example, if Persians are more likely to have elimination problems, then informing adopters and providing resources to manage this problem may prevent return surrenders.

Broadley, McCobb and Slater (2014) examined 63 cats from an open admission shelter to examine the relationship between home history and stress. The two-month-long study only included owner surrendered cats and used Kry and Casey's (2004) approach test to assess cat behaviour. Each cat was also assessed with CSS. Cat characteristics were recorded and cats were divided into two groups according to their home history. 23 cats were from single-cat homes and 41 from multi-cat homes. Although CSS differences between the groups were insignificant, CSS was significantly associated with age, demonstrating that stress decreased with age. The researchers specifically found a significant association between decreased CSS in single-home cats as they aged. A significant association between LOS of less than four days and higher CSS was found regardless of feline home history, which indicates LOS as an influential factor. The researchers found that cats from single-cat homes had significantly lower CSS after three days, which further corroborates evidence that cats require at least three days to adapt to their environment. However, single-home cats had higher CSS up to Day 3 compared to cats from multi-cat homes. Having an understanding of home history therefore may aid in handling, approaching, and assessing shelter cats within their first few days in the shelter.

Feline Enrichment

Environmental enrichment (EE) is a pertinent component of animal sheltering, which provides sheltered animals with the "ability to maintain or improve its physical, behavioural, and psychological functioning via modifications to the housing environment" (Miller & Zawistowski, 2013, p. 541). In reviewing EE strategies, Rochlitz (1999) and Ellis (2009) identify three types of EE: 1) toys; 2) hiding enrichment; and, 3) perching. Stella & Croney (2016) review shelter practices and suggest that EE may improve/socialize feline behaviour, which can

ultimately reduce the probability of future relinquishment to an animal shelter. Accordingly, EE may be pertinent in animal retention after adoption. Indeed, Shore (2005) explains that one third of all unsuccessful rehoming of abandoned animals is due to behavioural problems. However, EE may not only reduce the likelihood of surrender, but rather it might influence feline LOS. As cats tend to hide when confronted with stressful situations (Stella, et al., 2017), reducing feline stress is essential in making cats more visible to potential adopters. In addition, EE with toys provides the ability for a feline to be active in their environment.

To date, relatively few studies have examined how toys affect cat behaviour in an animal shelter environment. Fantuzzi et al. (2010) found that toys did not significantly affect cat behaviour. However, the researchers found that the mere presence of toys in the cage positively influenced adopter decision-making. The researchers found that adopters spent a longer time viewing the cat if the cat had a toy present in the cage. Gourkow and Fraser (2006) found a similar correlation between the provision of toys and increased cat adoption. In a survey distributed to adopters, Gourkow and Fraser (2006) found that 38% of respondents reported that the sight of a toy in a cage influenced their decision to adopt a cat. De Monte and Pape (1997) observed 10 SH cats for five days and found that cats experienced a novelty effect when provided toys. Cats were provided a hanging ball and a log, which significantly reduced inactive time spent. Specifically, these cats engaged in self-play and were generally more active; however the amount of time spent in self-play decreased over time. Nonetheless, the toys encouraged active behaviour. This active behaviour can reduce a cat's LOS due to the increased likelihood of adoption; Gourkow and Fraser (2006) report that 86% of respondents found 'playfulness' to be an important factor when deciding to adopt a cat. Sinn (2016) also found that 'playfulness' was

the third most influential adoption factor, with 68% of respondents rating it as important. This adoption influence followed ‘A happy cat’ and ‘Friendliness toward adopter.’

Hiding enrichment is the most common form of feline enrichment covered in peer-reviewed research. The research specifically indicates that felines hide in order to manage stress in uncontrollable environments. Carlstead, Brown, and Strawn (1993) examined 16 laboratory cats to determine behavioural and psychological indicators of chronic stress. Following the 10 day baseline period, cats were equally divided into a stress-induced group and a control group and experienced their treatments for 21 days. The stress-induced group encountered inconsistent care, which established higher stress rates in the cats. Stress-induced cats were fed and had their cages cleaned at different times, caretakers did not interact with cats, had the front of their cage covered with a bag, and experienced occasional food deprivation, random moves in carrier, and random 30 minute car rides. The cats were recorded 24hr/day and a sample of urine was taken from each cat following each 24hr period. Cats in the stress-induced group hid behind their litter pan significantly more often. Hiding behind the litter pan was the only behaviour significantly correlated to cortisol concentrations in stressed as well as control cats. This indicates that cats hide while under stressful conditions and suggests the importance of providing hiding places.

In studying feline preference for enrichment type, Ellis et al. (2017) determined that cats preferred hiding enrichment the most. The study included 26 SH cats in a cage with four compartments. These four compartments were: empty; contained a prey-simulating toy; a perch; and, a hiding area. Each cat experienced the housing for 10 days. Each compartment was separated by door flaps and once a cat was able to use the door flaps correctly, the study would begin the following day. The time and frequency spent in each compartment was recorded. Cats

spent the greatest percentage of time in perching and hiding compartments, but only the hiding compartment was found to be significantly greater than the toy and control compartments.

Vinke, Godijn, and van der Leij (2014) find that shelter cats experience less stress when provided with hiding opportunities. 19 recently surrendered shelter cats were examined for this 14-day study, and divided into a hiding box group ($n = 10$) and a control group ($n = 9$). The researchers highlight that reducing feline stress is important because according to researchers (see Gaskell & Povey, 1977; Tanaka, et al., 2012; Speakman, 2005) stress may lead to animal infections such as feline URI. The holding area at the shelter was divided into multiple smaller quarantine rooms, with upper and lower rows of SH metal cages. Cats had a water dish, food bowl, three towels, a litter tray, and a perching shelf. One towel covered this shelf while the other two covered the cage floor. If a hiding box was present, one or two towels also covered the hiding box floor. Ultimately, cats provided with a hiding box had a lower mean CSS compared to the control group, specifically when examining Days 3 and 4. This contrast on Days 3 and 4 indicates that the hiding box offered an easier transition for cats. In fact, the researchers found that the CSS of the hiding group decreased quicker over the study period and stabilized on Day 3, whereas it took until Day 5 for the control group to begin stabilizing their CSS. However, by Day 14, both groups had equal CSS. Furthermore, the cats in the control group still displayed hiding behaviour by attempting to hide behind their litter pan, which further emphasises the behavioural tendency to hide.

EE must be concerned with both animal welfare and positive outcome. Consequently, Kry and Casey (2004) examine how hiding enrichment may affect cat stress and affect adoption. The researchers divided 43 cats into an enriched group ($n = 22$) and a control group ($n = 21$). Cats had a water and food dish, a toy, an outdoor area containing a shelf and a tray, and a bed

with a heating pad and duvet. Housing was identical except the enriched group also had a Hide & Perch box. Again, CSS was used to assess daily feline stress and two 15-minute approach tests were conducted with each cat. Scan samples were conducted twice daily. The first occurred when cats were viewable to the public while the second occurred when the shelter was closed. Cat location was recorded as well as its activity. The amount of days for the cat to be adopted by the end of the observation period was also recorded. Adopters received a survey inquiring why they had decided to adopt that cat. Throughout the study, the enriched group had a significantly high change rate for CSS compared to the control group. Between Day 1 and 2, cat stress decreased for the hiding group while stress increased for the control group. This decrease/increasing trend continued for the hiding and control groups, respectively, until the conclusion of the study.

Significant differences also existed during the initial approach test. The hiding group approached more often and retreated less often. In the hiding group, 18% of cats approached and only 1% retreated, while only 10% of control cats approached and 8% retreating. In the second approach test, the hiding group approached 32% of the time and retreated 9% of the time, while cats in the control group approached 25% of the time and retreated 14% of the time. The cats in the hiding group most often slept restfully—sleep represented 20% of all hiding group activity compared to 10% for the control group. In contrast, control cats rested alert and sat more often compared to the hiding group. The hiding group was observed either on or in their Hide and Perch 77% of the time compared to control cats who instead used their bed 61% of the time. However, there was not a significant difference in adoption between groups. There was also not any significant differences found between the two groups when adopters completed their adoption surveys. This study shows that hiding enrichment reduces stress in shelter cats. The

claim that hiding enrichment negatively impacts adoption due to poor visibility of the cat was disproven as there was no adoption differences between the groups.

Clicker training is another form of feline enrichment that may positively impact the wellbeing of cats and potentially reduce their LOS. Kogan, Kolus and Schoenfeld-Tacher (2017) assessed the ability of 100 shelter cats to perform clicker training tricks and found that within only two weeks of training, cats with no prior training could perform tricks ranging from targeting, sitting, spinning, and giving high-fives. Importantly the researchers state that clicker training may “modify unwanted behaviours and enhance the human-animal bond, and...these factors can reduce the likelihood of relinquishment” (p. 9). Gourkow and Phillips (2016) examined the effects on clicker training on cats identified as frustrated upon their surrender. These fifteen SH cats were placed in an enrichment group ($n = 7$) and a control group ($n = 8$). Enriched cats were provided with a clicker training program 4 times a day by the same experimenter. Cats were trained to listen to the clicker and then complete the necessary training steps to complete a high five (sitting, raising paw to shoulder height, touching the experimenter’s hand, and sustain paw-to-hand contact momentarily). Cats were given either a ‘positive rating’ or ‘negative rating’ to assess responses to training.

Using a behavioural test, researchers found that enriched cats were 3.6 times more likely to remain content until the end of the study. Males and stray cats were significantly more likely to respond positively to clicker training than females and owner-surrendered cats. Lastly, once frustration was reduced in cats, the control group was identified as apathetic, while the enriched group was content. Cats remain content because of clicker training, while also reducing apathy in shelter cats. As a result of the small sample size, conclusive generalizations cannot be made, however the results may contribute towards future research.

Lastly, research suggests that television may function as EE. Ellis and Wells (2008) find that cats spend significant time looking at television monitors when an animate and/or inanimate stimuli are presented. This preliminary study finds that cats will look at a monitor when stimuli is displayed, however subsequent research is needed to evaluate its impact on feline behaviour, stress, LOS, and outcome. Poe and Hope (2000) and Shyan-Norwalt (2005) also recommend television as EE for captive cats, but do not examine its impact.

Olfactory Stimulation

Similar to other forms of enrichment, olfactory stimulation is sometimes suggested to calm both felines and canines. Rochlitz (1999; 2005) and Ellis (2007) recommend olfactory enrichment, but do not provide research supporting its effects. Machado and Genaro (2014) found that a prey-scented cube affected exploring, sniffing, rubbing, and urine spraying habits in domestic house cats. Ellis and Wells (2010) examined 150 cats for five days in order to determine how, if at all, olfactory stimulation may affect shelter cats. Cats were equally separated into five groups, constituting a control group with no scent, an odourless cloth, a prey-scented cloth, lavender scented cloth, and catnip scented cloth. Each cat was exposed to the condition from 12:00 to 15:00, for five days and researchers documented each cat's behaviour for three of the five days. Researchers used a list of ten activities to assess behaviour. Cats spent 6.25% of their time interacting with the cloths. Cats exposed to the catnip scent spent a significantly more time sniffing the cloth than any other group. Cats spent significantly more time interacting with cloths during the first hour of exposure. Cats exposed to the catnip and prey scents displayed a significantly higher occurrence of sleeping and significantly less standing compared to the control group. Cats exposed to the catnip and prey scents spent significantly less

time exploring compared to the control group. Cats exposed to catnip spent significantly less time grooming than the odourless group. Furthermore, cats exposed to catnip spent significantly less time playing than the control group. Lastly, cats exposed to the prey scent significantly frequented their sleeping area compared to any other group. Ultimately, cats exposed to the catnip spent a significantly greater time on average interacting with the scented cloth. However, research must examine olfactory stimulation on feline stress, adoption, and euthanasia.

Pereira et al. (2016) examine the effect of Feliway on veterinarian handling of cats. The researchers investigate whether Feliway calms cats to make them more susceptible to handling. The researchers examined 87 cats of all breeds, sexes and sterilization status, while ensuring that each cat had visited a veterinarian before. Using CSS in a double-blind assessment, the researchers found that a 15-minute exposure to Feliway decreased stress in cats, but there was not a significant handling difference between the Feliway group and the placebo group. However, 41% of Feliway cat owners stated that their cats were *easier to handle/more relaxed* compared to only 3% of placebo cat owners. This indicates that Feliway may benefit shelters to reduce feline stress, however is not particularly useful for handling.

Olfactory stimulation is not exclusive to felines as research also considers its effect on canines. Wells and Hepper (2000b) found that dogs who move in a back-and-forth motion while inside their kennel, increase their LOS by 25%. Consequently, reducing this habit may increase canine attractiveness to potential adopters. The calming effect of olfactory stimulation may aid shelters with this. Graham, Wells and Hepper (2004) examined the effects of five different olfactory conditions on the behaviours of 55 shelter dogs. These five olfactory conditions were control, lavender, chamomile, rosemary, and peppermint. Each dog experienced each condition between 12:00 and 16:00 for five days between two-day intervals. Dog kennels were divided in

half with the front of the kennel exposed to other shelter dogs and passing humans, while the back was secluded. Observations began 30 minutes after dogs were exposed to the olfactory stimulation and behaviours were recorded for Days 1, 3, and 5.

Dogs spent significantly more of their time standing when exposed to peppermint and rosemary, however dogs spent significantly less time standing on Days 3 and 5 compared to Day 1 for the rosemary condition. Dogs spent the most time resting when exposed to lavender. In contrast, dogs rested significantly less when exposed to rosemary and peppermint scents, which suggests a stimulating effect. Furthermore, dogs spent significantly more time moving when exposed to peppermint than to rosemary. When exposed to lavender and chamomile, dogs spent significantly less time moving. Dogs were significantly less vocal when exposed to lavender, while dogs spent significantly more time vocalizing when exposed to peppermint. This research indicates olfactory stimulation affects dog behaviour. Specifically, the research found that lavender is profoundly calming for dogs, while peppermint and rosemary tend to make dogs more active. Although more research is needed, this indicate that shelters may use lavender to reduce canine energy, which consequently appeals to adopters (Protopopova & Wynne, 2014). As these studies do not examine shared scents, research should verify the findings presented here.

Binks et al. (2018) similarly examined the effects of olfactory stimulation on shelter canine behaviours, however the researchers examined the effects of vanilla, coconut, ginger, and valerian. The 15 dogs were also exposed to an odourless rag and a control group was also recorded. Dogs vocalized significantly less when exposed to the olfactory treatments compared to the odourless cloth and control groups. Dogs also spent significantly less time moving compared to the control group and spent significantly more time resting compared to the

odourless cloth group. In addition, dogs spent significantly more time sleeping when exposed to ginger and coconut compared to the odourless cloth and control groups. Dogs spent significantly more time at the front of the kennel during the odourless cloth condition compared to all olfactory conditions and the control group. Ultimately, the olfactory conditions examined in this study indicate that these types of stimulation do effect canine behaviour. Tod et al. (2005) also found that dogs exposed to a natural forming dog appeasing pheromone (DAP) (a synthetic pheromone) significantly affected barking and sniffing. The pheromone was administered to 37 dogs while 17 dogs comprised of a control group. On the seventh day of the study an observer walked past the kennels and the mean of barking amplitude was significantly less in the treatment group compared to the control group. However, peak barking amplitude was not significantly different between groups. When observers stood out of sight for one minute, there was a significant reduction in mean barking amplitude for the treatment group. During the stranger test, barking frequency was significantly reduced in the treatment group and sniffing significantly increased. Using an ethogram and blind-study observers, Mills et al. (2006) also found that DAP reduced anxiety in 15 problematic shelter dogs. These findings suggest DAP's efficacy, however the small samples reflect the necessity for further research using larger samples. Although further research is needed to verify findings, the research demonstrates that olfactory stimulation affects canine behaviour.

Canine behaviour/socialization

Relinquishment documents provide history and information integral to understanding canine behaviour and socialization. However, canines still require behavioural assessments, which literally decide the outcome of dogs. Consequently, behavioural assessments for dogs are

a significant factor affecting LRR. Standardized assessments are shown to be more effective in predicting future behaviour compared to opinion (van Der Borg et al., 1991). Many assessments exist but the Safety Assessment for Evaluating Rehoming (SAFER) behavioural assessment is the most commonly used (Bennett, et al., 2015). However some researchers have emphasized that these behaviour assessments are not scientifically validated and are unpredictable in assessing behaviour outside of the shelter (Patronek & Bradley, 2016; Taylor & Mills, 2006). In their analysis using realistic and optimistic sensitivity/specificity characteristics, the researchers find that predicting future real behaviour is either precarious or chance. Diedrich and Giffroy (2006) found that six behavioural tests using a ball were not similar in their assessments while the data and observations were also uniquely interpreted by each author. Similarly, Poulsen, Lisle and Phillips (2010) found that behaviour results differed between shelter assessment and post-adoption assessment despite using the same assessment protocols. In this case, canines were better behaved than in the shelter, which could be due to the calm environment of the home. Indeed, predicting future canine behaviour is difficult as Christenson et al. (2007) find that dogs may pass assessments only to display aggression after adoption. In their study, 67 dogs passed a temperament test and were adopted, however post-adoption interviews uncovered that 40.9% of dogs showed some form of aggressive behaviour including biting, snapping, lunging, and growling. In reviewing six research articles regarding behaviour assessment, Diedrich and Giffroy (2006) found that when dogs confronted a ball-object, the article researchers interpreted dogs as displaying fear, curiosity, panic, or shyness, however Diedrich and Giffroy argue that these characteristics are typical canine behaviour when encountering a novel or unfamiliar object. While this does not suggest the inadequacy of behavioural assessments, it indicates its unpredictability. Furthermore, it indicates the unstructured approach to assessment.

In addition, Mohan-Gibbons et al. (2012) and Marder et al. (2013) argue that food guarding assessments are unpredictable to the reality of in-home food guarding. Marder et al. (2013) specifically assert that only 5 out of 97 contacted dog owners consider food guarding as a “A great challenge,” while 27 dog owners perceived it as “Not a challenge at all.” The researchers argue that while food guarding assessments may determine the fate of dogs, dog owners are considerably unconcerned with this behaviour and find strategies to accommodate the behaviour. Patronek and Bradley (2016) ultimately remark that, “the test has failed the dogs, rather than the dogs failing the test” (p. 75). Rather than prodding for negative reactions, these researchers suggest that more effort should encourage and monitor *expected* canine behaviour when adopted such as walking, playing and socializing. These criteria might predict regular canine behaviour once adopted. This is also reinforced by Luescher and Medlock’s (2009) finding that the only significant aspect positively influencing canine adoption was conspecific socialization. However, there is not research identifying or demonstrating the efficacy/pragmatics of this assessment.

The literature also conflicts over when to appropriately assess a dog’s behaviour. On the one hand, Klauz et al. (2009) suggest it should be on Days 1 or 2 before dogs become stressed from the shelter, while Bollen and Horowitz (2008) assert that assessments should be delayed until dogs acclimatize to the shelter environment. In using SAFER as a behavioural assessment tool, Bennett et al. (2015) found that results vary regardless of when the assessments are administered. However, the researchers did notice that 50% of dogs who did not eat on Day 0 ate on Day 3. This might indicate the dogs are adapting to the shelter. Interestingly, the researchers assigned the extreme score of 5 for aggression if a test had to be skipped because of canine aggression, however the following day the same dogs would score either a 1 or 3, which

indicates low aggression. This “illustrates that there is not even a 50% chance of being accurate when an assumption is used to replace blank scores” (p. 165). This again reflects the challenge in accurately predicting future canine behaviour.

One assessment that appears to show promise is the Canine Behaviour Assessment and Research Questionnaire (C-BARQ). C-BARQ is a questionnaire that asks owners to assess their dog’s behaviour in a variety of daily situations. The questionnaire was developed by Hsu and Serpell (2003) who had 1 851 dogs assessed with the questionnaire by their owners and ultimately created eleven canine behaviour categories. The questionnaire was then validated by the researchers by assessing 200 behaviourally problematic dogs and accurately placing them into seven of the C-BARQ categories. Over 100 breeds of dogs participated in the sample, which indicates the applicability of the questionnaire to all breeds. Van den Berg et al. (2010) used C-BARQ to measure *stranger-directed aggression* in 1000 dogs comprising only of German Shepherds, Golden Retrievers and Labrador Retrievers. This study verifies that C-BARQ assesses behaviour regardless of sex, neuter status, or these three breeds. The questionnaire shows promise because Foyer et al. (2014) demonstrated that it accurately predicted future canine behaviour. Using the questionnaire on a sample of 71 dogs in their first year of life, the researchers validated the original C-BARQ assessment by using a temperament test on the same dogs one and a half years later. The researchers explain that the, “results show that important aspects of dog behaviour...could already be assessed during the first year of life in the home environment” (p. 98). Although dogs were assessed in the home environment, this research suggests that shelters could even use C-BARQ on younger canines as a strategy to predict future behaviour of dogs. This may be useful when discussing dogs with potential adopters.

C-BARQ questionnaires may be used by shelters when owners relinquish dogs. However Segurson, Serpell and Hart (2005) found that owners will provide misleading information if they believe that provided information may affect the outcome of their dogs. The researchers equally divided 57 relinquishing owners into two groups: one group was told the provided information would remain confidential, while the other group was told the information was not confidential. The owners reported *owner-directed aggression* and *fear of strangers* more often when owners believed the information would remain confidential. However, in analyzing 438 C-BARQ questionnaires, Duffy, Kruger and Serpell (2014) found that relinquishing owners do not give misleading information. In evaluating the outcomes of dogs, dogs intended for adoption received favourable scores for *stranger-directed aggression* compared to dogs that were eventually euthanized. This further highlights the value of C-BARQ as an effective assessment tool at intake. Because of the substantially larger sample compared to Segurson et al. (2005), pet-owners likely do not provide misleading information on the C-BARQ questionnaire when relinquishing dogs. That being said, although some of the other assessments mentioned above are not strong predictors, the research suggests that C-BARQ is a reliable assessment tool for shelters.

Canine Interaction and Training

Canine-human interaction and training may affect canine behaviour, reduce stress, and encourage adoption success. Willen et al. (2017) found that interacting with dogs for as little as 15 minutes per day was enough to moderate cortisol in shelter dogs. Accordingly, exercise may be effective in calming shelter dogs, which is important because Protopopova and Wynne (2014) found that 27% of people in their study did not adopt a specific dog because the dog was

perceivably overly active. Some researchers found that sheltered dogs associate human presence with outdoor activity, and may mistakenly become overly energetic when potential adopters view shelter dogs (Arhant & Troxler, 2014; Wells & Hepper, 2000a). Hewison et al. (2014) also found that when visitors are not permitted to view dogs, dogs spend more time resting and less time barking. This has implications for adoption. However, Protopopova et al. (2018) found that exercise and calm interactions may positively affect canine in-kennel behaviour. Dogs increased back and forth motion, decreased jumping at the door and rubbing on the wall behaviour when dogs received an additional 15 minutes of daily exercise. Although not significant, calm interaction decreased facing forward, being at the front of the kennel, back and forth motion, jumping on the door, and barking. These findings indicate a mixed result of desirable and undesirable behaviours. Hennessy et al. (2002) also examined the independent and combined effects of positive reinforcement training and diet. The experimental diet included a higher nutritional value for animal-based protein (44.6%), fat (6.9%) and calories while the control diet comprised mostly of carbohydrates (59.3%) derived only from ground corn. Firstly, the researchers did not find any difference in learning behaviour between the diets when exposed to training. Dogs were instructed not to cross a designated line, however only experimental diet dogs adhered to instructions. The researchers suggest that the diet likely relaxed dog behaviour. Furthermore, dogs who received both the experimental diet and the training made significantly less escape attempts. This research shows that shelters may use training and an enhanced quality diet to calm dogs while also communicating this information to adopters as it could potentially reduce relinquishments upon the basis of canine escape attempts. Bergamasco et al. (2010) found that human contact did not significantly affect canine heart rate variability nor cortisol levels, but did find that it positively impacted canine sociability and diffidence. Schipper et al. (2008) also

found that feeding enrichment toys may improve the in-kennel behaviour of dogs. Feeding enrichment toys feed dogs through interaction with the toy. By examining the pre-toy, toy, and post-toy presence on eight dogs, compared to a nine dog control group, the researchers examined the toy's influence on appetite, activity levels, and abnormal behaviour patterns. Dogs in the toy group spent significantly less time inactive compared to the control group. While the time spent moving by the toy group significantly increased when exposed to the toy, the time spent standing significantly decreased for the control group. The increased activity may be detrimental to canine adoption as Protopopova and Wynne (2014) found that volunteers decide not to adopt a dog if the dog appears overly energetic. Dogs also barked less when having a toy. Consequently, feeding enrichment toys may benefit canine presentation as dogs are less vocal. Research with larger samples should validate these findings and specifically examine the association between feeding enrichment toys and adoption.

Similar to feline enrichment, canine-human interaction and training are integral to reducing sheltered canine stress. Although Hennessy et al. (1997) unexpectedly found that female volunteers were more effective at moderating canine cortisol levels, they subsequently found (1998) that the gender of handlers did not matter. Shiverdecker, Schiml and Hennessy (2013) examined 79 dogs with a passive stranger, pet, and play interactions. All treatments significantly lowered cortisol levels compared to the isolation/control dogs. Each treatment also significantly reduced vocalization compared to the isolation/control groups, which may affect adoption. Dogs who experienced the passive stranger test also panted significantly less than did dogs in isolation. While most shelters encourage human-canine interaction, this research suggests that varying strategies may best affect canines.

The effect of human-canine interaction may be significant enough that a single occurrence significantly reduces cortisol levels in dogs. Coppola, Grandin and Enns (2006) determined that one instance of human-dog contact reduced cortisol in dogs. On the second day after being relinquished to the shelter, human interaction occurred for 45 minutes and included outside and inside play, walking on a leash, grooming activities, obedience commands, treat rewards, and verbal and tactile contact. Cortisol levels were measured two hours after human contact on Day 2 and Days 3, 4, and 9. Cortisol levels decreased for human-contact dogs on Day 3 compared to Day 2, while the control group's cortisol levels increased. This indicates that the effects of human-canine interaction affect dogs for at least 24 hours. However, cortisol levels increased Days 4 and 9, which reflects the impact of the absence of human-canine interaction. Overall, although not deeply researched, the evidence suggests that human-canine interactions benefit canines by reducing cortisol levels and improving canine behaviour.

Human-canine interaction may ultimately benefit canines by increasing the likelihood of adoption. Protopopova et al. (2014) and Patronek and Crowe (2018) found that people are mostly concerned about appearance and dog type, however Protopopova et al. (2014) determined that behaviour is a mitigating factor to an extent. Protopopova et al. (2014) found that positive behaviours did not affect the LOS of dogs which "suggests that adopters were more sensitive to undesirable than to desirable behaviours" (p. 17). This likely explains why Herron et al. (2014) found that canine adoption remained unaffected after teaching good habits to dogs. Accordingly, if human-canine interaction reduces stress and negative behaviours, adopters will be more attracted to shelter dogs during viewings. Wagner et al. (2014) also found that daily walking may reduce inappropriate elimination in kennelled dogs which will affect presentation. Furthermore, Wells and Hepper (2000b) found that 89.7% of respondents who returned adopted dogs to a

shelter did so because of undesirable behaviour. Consequently, shelters should attempt to reduce undesirable behaviours in order to both encourage canine adoption while simultaneously encouraging canine retention by the adopters.

Protopopova et al. (2012) argue that shelter management must consider the cost-benefit of training programs because these programs potentially require additional funding. Protopopova et al. (2012) determined that training dogs to gaze into potential adopters' eyes is an ineffective training strategy to increase adoption success—likely because it does not reduce negative behaviours. However, Luescher and Medlock (2009) determined that basic obedience training for dogs while in the shelter improves adoption probability. The researchers examined the effects on adoption when dogs were trained not to pull while being walked, not to jump on people, to sit, and were also trained to not bark when a person walked by the kennel. With a sample of 92 dogs in the training group and 88 dogs in a control group, the researchers determined that trained dogs were 1.4 times more likely to be adopted compared to the control group. The only significant factor influencing adoption was whether the dog was good with other dogs. Incidentally, training may influence conspecific socialization. This insight may also support developing behavioural assessments that assess a dog's friendliness to other dogs. Ultimately, the researchers determine that basic obedience training is an effective strategy to encourage the adoption of shelter canines.

Protopopova et al. (2014) found that habits such as leaning or rubbing on the enclosure wall, facing away from the front of the enclosure, and standing negatively affected LOS. Accordingly, training and human interaction should prioritize the reduction of these bad habits. By using response-independent treat delivery and differential-reinforcement-of-other behaviour (DRO) strategies, Protopopova and Wynne (2015) found that both procedures effectively reduce undesirable behaviour. Response-independent treat delivery is pairing the presentation of a

person with food. Undesirable behaviour decreased by 88% for the DRO and 66% for the independent-response treat delivery strategy. As the DRO procedure is relatively complicated and time consuming, the researchers suggest that the response-independent treat delivery is an option for animal shelters to effectively reduce undesirable behaviours.

Bright and Hadden (2017) examine the effects that a unique dog training program has on the adoptability of dogs. Named Safewalk, the program involves different qualification and trainer levels to walk different levelled dogs. The program did not have a significant impact on the adoption levels of non-pit bull-type breeds, however it was extremely significant on the adoptability of pit bull-type breeds. In the pre-training data, pit bull adoptions were at 77%, however pit bull adoptions rose to 96% by the end of the study. The increase in pit bull-type adoptions was determined to be a remarkable 260% across all periods after Safewalk. While it did not significantly impact non-pit bull-type breed adoptions, the researchers determined that Safewalk did significantly reduce non-pit bull breed LOS by reducing LOS from 17 days to 15 days.

Canine Housing

Canine housing may determine canine LOS, however the research in this area is scarce. In studying 579 dogs at two shelters, Wagner et al. (2014) found that when dogs eliminate in their kennels, they overwhelmingly defecate/urinate on the opposite side from their food, water, and bed. The researchers advocate the necessity of double-compartment kennels in order to provide space for elimination, which also enables easier cleaning and control of possible disease transmission. Furthermore, if double-compartment kennels are not viable, kennels should at least

be large enough that the elimination can occur without the obstruction of either the food, water, or rest areas.

Serpell and Poole (1992) recommend group housing dogs rather than single housing because SH dogs were significantly inactive compared to GH dogs, and SH dogs spent significantly more time circling. Mertens and Unshelm (1999) assert that kenneling dogs in pairs or groups is better than single-housing dogs and that GH dogs bark much less than SH dogs. This finding is supported by Hitts et al. (1992). SH dogs passively viewed their environment significantly more often than GH dogs. Overall, 31% of single housed dogs displayed undesirable behaviour while only 11% of group housed dogs did. SH dogs also displayed active submission significantly more often than GH dogs. Upon adoption, 52% of owners who had adopted GH dogs stated that there were not behavioural problems, while only 11% of SH dog adopters reported no behavioural problems. However, inter-dog confrontation often occurred, although this did not always lead to fights. Nonetheless, within the three-month study period, three dogs suffered light wounds as a result of fighting. In studying an off-leash dog park over the course of 8 months, Shyan, Fortune and King (2003) found that inter-dog aggression was actually quite rare—only occurring 0.25% of the observed time. However, there is selective bias as dog owners would presumably only bring dogs to an off-leash dog park if the dogs were friendly with other dogs.. Controlling disease must be considered if dogs are to interact with one another, however none of the research here demonstrates even a consideration of this issue.

Spay/Neuter Initiatives

Across North America subsidized spay/neuter (S/N) initiatives have developed as a shelter strategy to stabilize pet populations while simultaneously helping low-income individuals

afford the service. Low-cost S/N initiatives greatly benefit members of the community. Frank and Carlisle-Frank (2007) explain that without low-cost S/N opportunities, some pet owners would not have their pets sterilized. Chu, Anderson and Rieser (2009) examine the association between income and cat sterilization and find that only 51.4% of cats living in low-income households were reported as sterilized. Interestingly, 90.4% of cats living in middle-income households and 96.2% of cats from high-income households were reported as sterilized. Similarly, Benka and McCobb (2016) also determined there was a strong association between level of income and veterinarian visits. Weiss et al. (2015) also find that pet owners with an annual income of less than \$50 000 are more likely to rehome their pets due to costs or feline behaviour. Consequently, offering low-cost S/N services could detract future relinquishment and potentially reduce shelter intake. Furthermore, Dolan et al. (2014) found that many pet owners who relinquish their pets would actually keep their pets if they could find proper assistance to address issues. In fact, when informed about opportunities for assistance, 88% of pet owners chose to pursue these opportunities.

Depending on the community, some veterinarian clinics may feel threatened by subsidized S/N programs as clinics may perceive shelters as stealing clients. However, Frank and Carlisle-Frank (2007) show that although some pet owners will sterilize pets through low-cost S/N programs, these same pet owners would likely not have their pets sterilized at all without low-cost S/N programs. If a low-cost S/N program was unavailable, Benka and McCobb (2016) found that low-income cat owners would consider sterilizing their cat through a private veterinary S/N clinic, however, “nearly half of these owners stated that the surgery would have been delayed because of the cost” (p. 495). In 99 telephone interviews, the researchers found that 68% of owners reported that the mobile S/N clinic was the first time their cat visited a

veterinarian. In fact, according to Frank and Carlisle-Frank (2007) shelter low-cost S/N programs actually increase veterinary clinic S/N services because communities become aware about the importance of sterilizing pets. This sentiment is expressed by White et al. (2010) who suggest that, “public education is likely to be a vital part of any successful neutering initiative” (p. 210). Low-cost shelter S/N clinics spread public awareness and correct misunderstandings regarding pet sterilization. For example, Chu et al. (2009) found that 40.7% of owners with unsterilized cats believed it was healthier for female cats to have at least one litter before being spayed. This belief was more popular than costs being problematic for unsterilized cat owners (38.8%). Dolan et al. (2017) also found that S/N initiatives positively affect community animal welfare as a result of educational outreach. Accordingly, such programs benefit communities as a whole rather than contributing to competition between shelters and veterinarians.

White, Jefferson and Levy (2010) examine the effects of a state-sponsored neutering program in New Hampshire and a mobile S/N clinic in Austin. The latter program targeted seven ZIP codes comprising of low average household income, a scarcity of veterinarian facilities, and tendency to contribute to high shelter intake. During the study, shelter intake and euthanasia from the target and non-target areas increased, however the rate of increase in the target areas was much slower. Non-target areas increased intake 6.1 times faster than target areas while euthanasia increased 3.1 times faster. This suggests that the mobile S/N clinic affected the rate of shelter intake. In New Hampshire, the program may have decreased euthanasia rates, although the researchers admit that the results of the program may still be too early to determine. Indeed, in a simulated model, Frank (2004) demonstrates that theoretically low-cost S/N programs are the single most effective means of managing canine population rates. As a model, the researcher

acknowledges that the variables and predictors are fixed when in reality they vary according to unique populations.

Scarlett and Johnston (2012) examined the impact of a subsidized S/N clinic on shelter intake and euthanasia and found that shelter dog intake significantly declined from 33.3 dogs/1000 community residents in 2001 to 18.1 dogs/1000 community residents in 2007. Cats similarly were affected, decreasing from 17.6 cats/1000 community residents in 2001 to 7.8 cats/1000 community residents in 2007. The S/N clinic opened in 2005 and was found to have accelerated the decline in shelter intake. Furthermore, service and complaint calls significantly declined and maintained a lower rate immediately following the opening of the S/N clinic. Feline intake and euthanasia decreased significantly, while intake and euthanasia for dogs declined after the S/N clinic opened. Because the data comprises six years, it is likely that other variables influenced the results, however these are not accounted for. Nonetheless, it is likely that the S/N clinic did have some impact as the target areas were specifically affected. The researchers explain that if the specific goal of the S/N initiative is to reduce shelter intake then target “those segments of the human and nonhuman animal population that potentially contribute most dramatically to the shelter population” (p. 66). Marsh (2010) similarly asserts that community intake demographics must drive the planning process of low-cost S/N initiatives.

OHS’ minimum age of feline S/N is entirely appropriate considering the research regarding early-age sterilization. Howe et al. (2000) and Spain, Scarlett and Houpt (2004) did not find significant negative behavioural/physical issues resulting from early-age feline sterilization. Spain et al. (2004) found that asthma, gingivitis, and hyperactivity were reduced in both sexes who experienced early-age sterilization, while the only behavioural effect displayed was increased shyness. The researchers also found that males sterilized at an age of less than 5.5

months displayed less aggression towards veterinarians, reduced sexual behaviours, and spraying, but an increased behaviour of hiding. Prepubertal sterilization also permits a more expedient surgery compared to sterilizing at older ages (Root Kustritz, 2002; Howe, 1997). Howe et al. (2000) found that early-age feline sterilization actually reduced the probability of developing feline lower urinary tract disease. Furthermore, Overly et al. (2005) found that sterilization at less than six months of age reduced mammary carcinoma by 91% compared to intact cats. Lastly, in a study of 480 shelter kittens, Porters et al. (2014) found that there was no correlation between early sterilization and the development of undesirable behaviours. The researchers examined the reported behaviours of these adopted kitten from the first month of adoption until 24 months afterwards.

Capacity for Care

Capacity for Care (C4C) is a shelter management strategy promoted mostly in grey literature to enhance shelter LRR. The logic behind C4C is simple: reduce adoption choices, and as long as the same number of potential adopters frequent the shelter, the greater the probability of animal adoption (Wagner, Hurley & Stavisky, 2018). However, little research actually examines the effects of C4C and the few studies that do examine C4C fail to isolate individual aspects of the program (there are a total of ten components). Rather the studies examine the program in its entirety, which consequently cannot attribute the findings to specific C4C components. This is a significant limitation as some C4C aspects may be beneficial to shelter management and saving animal lives, while others may be ineffectual or even detrimental.

Karsten et al. (2017) explore the effects of C4C in three animal shelters. Each shelter shared data from the previous two years and submitted data following two years of enacting C4C

strategies. This data included the number of cat housing units, sizes, and type of unit, as well as the use of cat housing. Researchers also analyzed the intake month and year, time of intake, outcome, and LOS of each cat entering the shelter. After implementing C4C, the shelters did not require temporary housing to meet the needs of peak seasons. Optimal populations were lower than the average shelter population in the previous years (44%, 28%, and 17%), and all shelters operated at optimum population. Cats in isolation decreased by 84%, 46%, and 39%, respectively. LOS decreased by 31%, 11%, and 9% for each shelter. In addition, cats increased their likelihood of adoption at two of the three shelters, while reduced euthanasia probability. Because of the reduced population, cats were presumably less stressed, which possibly increased their immunity to disease. However, this association was not measured. Because the researchers did not isolate variables or specifically measure C4C components, it is unknown why adoption increased in two shelters but decreased in one shelter. The researchers state that the likelihood of adoption “increased at all three shelters, likely due to fewer choices for adopters, changes in the adoption process, and improved housing” (p. 19). The researchers express this enthusiasm despite that one shelter actually had decreased adoptions in the post-C4C data. Indeed, the decrease actually raises questions about C4C efficacy. In addition, the acquired understanding from the findings are actually presumptions wherein “LOS was *likely* [my italics] reduced since URI treatment time in shelter was reduced” (p. 19) and that decreased adoptions at one shelter was “*likely* a reflection of the managed intake process implemented” (p. 20). Because C4C components were not measured, the study is incapable of reaching conclusive findings. Future research should specifically isolate these C4C variables as currently its findings are not conclusive and are instead grounded in presumptions.

Janke et al. (2017) also examine how C4C affects feline LOS and found that feline LOS decreased by 24% following C4C implementation. Accordingly, median LOS decreased from 37 days to 32 days. Exotic male adult cats specifically benefited following C4C. In comparing the examined pet shelter animal populations following the implementation of C4C, exotic breeds were found to have an LOS 64% shorter than domestic short hairs, while males had a 20% shorter LOS than female cats. Janke et al. (2018) examine the effects of C4C on cat admission. The C4C components used were: cage portals; scheduled intake; fast-tracked adoption; shorter adoption forms/fewer restrictions; barn cat program; shelter-neuter-return program; categorical pricing; adoption specials/events; cage enrichment; and, running below shelter capacity. During the study, the shelter's monthly mean was 55 cats, however one year after implementing C4C, monthly mean cat intake was 37 cats. Prior to implementing C4C, the shelter decreased adult cat intakes by 8%, however this further decreased by 24% following C4C. However, when kittens were included, it was determined that C4C did not significantly affect total cat admissions. The different C4C components were not individually examined. Because compared data is only the intake data in pre- and post-C4C implementation, there is no actual understanding generated concerning *how* the C4C elements decreased shelter intake. The pervasive problem with all C4C studies is the blanket examination of the program without individually evaluating the ten components. Rather, pre- and post-C4C data does not conclusively prove the effect of C4C, especially when considering pet population fluctuations and environmental variables.

Working Cats Programs

Working cat programs, also sometimes referred to as barn cat programs, are regularly suggested as a strategy to relocate non-socialized cats to farms or warehouses, wherein the cat

may act as a ‘rodent manager.’ Although the program is recommended in peer-reviewed research (see Janke, 2017; 2018; Van Patter, 2015), the efficacy of the program itself is not researched. However, Van Patter and Hovorka (2018) found that conservationists, a group normally opposed to feral cat trap-neuter-return programs, consider working cat programs an appropriate strategy for addressing feral cat problems. These researchers interviewed 21 animal welfare advocates, 15 conservationists, and four individuals falling between these two groups. Most participants viewed working cat programs favourably, including staunch conservationists who viewed feral cats as unacceptable in the environment. Indeed, the researchers found that working cat programs were most often perceived as a “win-win situation” (p. 288). Although this study does not specifically address working cat programs within the context of shelter LRR, it does indicate conservationist acceptance. This may at least be helpful when launching a working cats program because the conservationist opposition should be minimal. Working cat programs are a topic nearly absent from the peer-reviewed research despite often being recommended (this will be discussed further below).

Disease Control

Controlling infection and disease exposure is a consistent challenge for animal shelters. Respiratory tract disease is the most common and challenging infection confronting animal shelters (Foley & Bannasch, 2004; Pedersen, et al., 2004), while Steneroden, Hill and Salman (2011) also included ringworm and canine parvovirus. Furthermore, McManus et al., (2014) found that the type of upper respiratory pathogens varies depending on the type of feline management (i.e. short-term care, cats in foster care, sanctuary, TNR colony). Aziz, Janeczko and Gupta (2018) found that URI is prevalent for cats undergoing transport. Accordingly,

providing necessary care sometimes impedes the adoption/transfer of shelter animals. Litster et al. (2011) found that puppies and kittens with gastrointestinal and respiratory symptoms are most likely to experience delays between intake and reaching the adoption floor. This is because of the challenge to contain pathogens while offering healthy animals to adopters. Furthermore Dinnage, Scarlett and Richards (2009) determined that URI is the primary reason for euthanizing kittens. Consequently, managing and controlling infections are integral to saving animal lives in a shelter.

Bannasch & Foley (2005) found that cats are more likely to succumb to infection when management strategies fail to control and prevent URI. The researchers found that cats are more likely to develop URI when housed nearby dogs, have an LOS over six days, and are under one year of age. Aziz et al. (2018) also found that kittens under five months of age were most likely to develop URI upon reaching their transfer location. In addition, Gourkow et al. (2013) found that stray cats were 2.2 times more likely to develop URI compared to owner-surrendered cats and that cats shedding pathogens during time of intake were 2.6 times more likely to develop URI. However, this study does not consider vaccination history as an influential variable. It is possible that unknown vaccination history may have affected the results.

Because there are many variables influencing the development of URI, Kommedal, Wagner, and Hurley (2015) examine whether a software system accurately tracks URI frequency in an animal shelter while suggesting URI risk factors present in the shelter. The researchers found that software programs have the potential to track and identify risk factors for URI, however they found that much of the data entered into the system was either vague or incorrect compared to the 4-week data collected through their observations. In fact the agreement between the software program and the observer was only 59%. The researchers found that only a few of

the shelter staff received extensive training with the software program and consequently deduce that the lack of training and lack of understanding influenced the disparity between the software data and observer data. However, the researchers assert that software systems may be an effective tool in tracking URI and identifying risk factors if staff are properly trained with the program.

Shelters should reduce the stress of shelter cats because excessive stress contributes to lower immunity and consequently higher rates of infection (Gaskell & Povey, 1977; Griffin & Frank, 1989; Speakman, 2005; Tanaka, et al., 2012). Tanaka et al. (2012) specifically determined that cats with higher stress scores were more likely to develop URI than less stressed cats. Accordingly, procedures that reduce feline stress will reduce the likelihood of developing URI. Vinke, Godijn and Van der Leij (2014) and Kry and Casey (2007) found that providing a hiding box reduced stress levels in shelter cats, while conversely Wagner et al. (2018) found a correlation between cats with hiding boxes and increased URI rates. However, Wagner et al (2018) explain that five of the six shelters that provided hiding places also placed cats in small cages, which likely increased feline stress. In highlighting the proper strategies for preventing infectious diseases in animal shelters, Möstl et al. (2013) specifically recommend providing hiding boxes for cats in order to reduce stress. This contradiction requires further research.

Lastly, Wagner et al. (2018) also found that intranasal URI vaccines were significantly associated with higher risk of developing URI. However, Edinboro et al. (1999) found that the intranasal URI vaccine significantly reduced the risk of URI. In fact the latter researchers determined that the vaccines “appeared to prevent at least 50% of URI cases in cats” (p. 10). Edinboro et al. (1999) recognize that controlling infectious disease is a multi-variant strategy whereby vaccination is only one component. The researchers also suggest proper quarantine,

isolation, and reduced population density. In addition, Rees and Lubinski (2008) examined 291 cats to determine if an oral supplementation of L-lysine would reduce URI in shelter cats, but determined that the supplements did not affect URI development. Again, these areas require further research as the results between Wagner et al. (2018) and Edinboro (1999) significantly differ.

Reduced/Waived Adoption Fees

Fee-waived and reduced adoptions are both popular and contested. Although little research exists in this area, Patronek et al. (1996) found that cats freely obtained directly from previous owners were at a higher risk for surrender compared to cats gifted, purchased, or adopted. This supports research that cats acquired from friends are at the greatest risk of relinquishment (New, et al., 2000). To assess adopter attachment levels to pets, Weiss and Gramann (2009) examine a free adoption initiative. The researchers compare the attachment levels of free adopters and fee-based adopters, in which 95 adopters adopted their cat with no adoption fee (NAF) while 78 adopted their cats with an adoption fee (AF). Kitten adoption prices were increased from \$75 to \$100 during the fee-waived initiative. This parallels the strategy by Lord, Olynk Widmar, and Litster (2014) who suggest that reduced adoption fees must parallel an increase in funds through other routes. In this instance, waived adoption fees occurred in conjunction with increased kitten adoption fees.

Survey responses between adopters indicated no significant difference in attachment levels. However, the researchers acknowledge that more AF adopters completed the survey compared to NAF adopters, which could reflect a level of attachment in and of itself. In addition, shelters were not perceived to be devaluing animals because of waived adoption fees. AF

adoptions increased 2% compared to the previous year, while NAF adoptions increased by 12%. Kitten adoptions remained similar between all periods with the previous year, however euthanasia rate increased by 1.2% during the NAF. Because the shelter only euthanizes animals for health reasons, NAF would not likely influence this increase.

Similarly, Crawford, Fontaine and Calver (2017) examine the impact that NAF have on reducing overcrowded shelters and whether NAF affects adopter attachment levels to their cats. The researchers studied a three-day NAF event for adult cats (> 1 year of age) in response to an intense kitten season. Prior to the event, a week-long campaign advertised the event. 100 NAF adopters and 120 AF adopters were provided with surveys inquired about husbandry, fate of cats, as well as the gender and adoption history of adopters, and how they heard about the shelter.

Impressively, all free adoption cats were adopted by the end of the first day of the event. This represents a 533% increase compared to the year before. In addition, 154 kittens were adopted, which represents a 381% increase compared to the date of the previous year. The event benefited the shelter as the cat population significantly declined in three days. Furthermore, according to the CEO, “the weekend was a remarkable success. Adopters made generous donations, and bought quality food, and accessories for the cats they adopted” (p. 11). However, there is no discussion whether these donations and revenue satisfied the loss of revenue from waiving adoption fees.

Similar to Weiss and Gramann (2009), survey responses did not significantly differ between groups, however more NAF adopters responded. Between the two groups, there was no significant difference between adopted cat demographics, while there was also not a significant difference in the fates of adopted cats. Both groups had more female adopters than male adopters, however more of the NAF adopters were first time adopters. Most NAF adopters

became aware of the shelter due to the advertising campaign, while most of the fee adopters heard about the shelter through word of mouth. There were also no significant differences between adopters' adherence to municipal pet regulations. It would have however been valuable to inquire if NAF adopters intended to pursue veterinary care for their pets. While more research is required, these studies indicate that fee-waived adoption events may be effective. However, the adoption events have not been isolated from the promotional campaigns behind the events. Accordingly, the studies do not necessarily demonstrate the efficacy of NAF events, as the reported success may actually be the result of promotional campaigns instead. As indicated by the quoted CEO, free adoption events may financially benefit shelters, however there is no discussion concerning the significance of replaced finances. According to Lord et al. (2014), strategies to replace lost funds must be considered when reducing adoption fees. The researchers created a simulation model to examine the economic impacts of adoption and fundraising strategies. When adoption fees were waived, the researchers found that "the financial performance of the shelter was dramatically reduced" (p. 427). Without accompanying reduced adoption fees with other revenue strategies, a shelter's financial performance will be negatively affected. The NAF event generated donations and increased purchases at their on-site pet store according to the CEO, however the researchers do not discuss the significance of lost revenue. Consequently, although not measured in the study, these donations and purchases possibly eased the degree to which the shelter's financial performance was affected. While the studies here indicate that there is no difference between the AF and NAF adopters' attachment levels, there is no research that examines future veterinary care for cats. If individuals are more likely to adopt cats when fees are reduced/waived, does it not follow that veterinary care will be delayed due to costs as well? Research has yet to examine the association between reduced/waived adoptions

and veterinary care, however this is important as shelters should not willingly adopt cats to owners who will not provide necessary care.

Community Cat Management

Community cats are local cats without a permanent home, and are free-roaming, unowned, and sometimes feral (Kass, Johnson & Weng, 2013). Rather, these cats survive through temporary feeding by local residents and through hunting. Although all communities are unique, research suggests that 100 people per 1000 community residents on average regularly feed community cats (see Levy, Gale & Gale, 2003; Lord, 2008; Kass, et al., 2013). The stress these cats experience from being confined to smaller areas can be detrimental to their life. Consequently, community cat management plans are mostly offered through shelter-neuter-return (SNR) programs. Healthy, free-roaming cats are sterilized by a shelter and returned to their found location in an SNR program. There is often cross-over in terminology between SNR and trap-neuter-return (TNR) however, TNR programs often refer specifically to feral cat colonies, whereas SNR is specifically concerned with community cats. Community cat management here regards SNR programs. To identify cats appropriate for SNR programs, Johnson and Cicirelli (2014) used criteria to identify only *fearful* and *feral* cats as eligible for alteration and return to field. In this case, cats are altered, ear-tipped (removal of one tip of an ear), microchipped, and vaccinated. Targeted SNR programs should be focused on areas with higher complaint calls because these are reflective of higher free-roaming intact cat populations (Kortis, 2014).

SNR campaigns targeting community cats may reduce the overall shelter intake of cats due to a variety of reasons. Levy, Isaza, and Scott (2014) studied a two-year SNR program that

incorporated a community education component and the adoption of socialized community cats into its program. The researchers found that S/N surgeries increased from an average of 4-10 per 1000 community residents to 57-64 per 1000 community residents while shelter intake and euthanasia rates decreased below rates from the previous five years. By the end of the study, shelter euthanasia in the target area was 17.5 times lower than the non-target area and shelter intake decreased by 66%. 47% of cats were also either adopted or transferred to other rescue shelters rather than returned to their locations. However, the study does not discuss whether transfers influenced intake/euthanasia reduction rather than adoptions. Surprisingly, shelter dog intake also decreased by 36% in the target area while it increased by 9% in the non-target area. It is believed that the program's community education component influenced this decline in shelter dog intake as pet owners learned responsible pet ownership. Animal control officers were instructed to first offer residents resources to solve animal issues instead of immediately impounding animals. The study does not isolate these components and thus the entire SNR program is credited with overall impact, however it is possible that one of these programs affected the effects. Similarly, Spehar and Wolf (2018a) found that an SNR program prompted an 84.1% decline in euthanasia and reduced the overall shelter cat intake by 37.6%. The researchers also determined that the programs substantially increased the shelter's LRR from 60.6% to 89.5%. Perhaps even more impressive, six years following the launch of the programs, feline euthanasia declined by 93.3%. This decrease occurred despite a 2% increase in the local human population. However, again, variables were not considered and the results, which developed six years following the launch of the SNR program, may be the result of many factors.

These results mirror those found by Johnson and Cicirelli (2014) who examined four years following the implementation of an SNR program. The researchers found that within four

years, feline euthanasia decreased from 8 466 cats to 1 954 cats. Euthanasia for URI dropped from 736 to 7, which marks a 99% decrease. Furthermore, feline shelter intake decreased from 11 429 to 8 386. However, shelter feline intake was already in steady decline since the early 1990s and the researchers refer to this decline as the result of a free/low-cost S/N programs. The study does not isolate external variables to guarantee that these results are entirely due to the SNR program. Consequently, it is likely that the effects of the free/low-cost S/N programs influenced the final intake data. The feline euthanasia decline coincides specifically within the four years of the study, which indicates that healthy feral/unfriendly cats were being euthanized in large numbers prior to the study. However, the wellbeing of these cats after being returned to the field is unknown as the researchers admit that follow-ups on these cats was not undertaken.

Edinboro, Watson and Fairbrother (2016) examined how an SNR program affects intake, euthanasia, and adoptions. The researchers found that over seven years, euthanasia decreased from approximately 66% to just under 35%, adoptions increased from 13% to 17%, and transfers to rescue groups increased from 1% to 24%. Impressively, the shelter euthanized 69% of stray cats prior to the SNR program but had a stray cat euthanasia rate of 35.8% upon completion of the study. However, an S/N voucher program and public education program were initiated two years prior to the study began, which may have affected the study's results. Furthermore, the study did not specifically isolate the SNR program from variables. Many variables would have influenced the results throughout seven years, however because this is not accounted for, the full extent of the SNR program's effects cannot be ascertained, nor can other variables—excluding the S/N voucher and education programs—be identified.

SNR programs may impact shelter capabilities to save lives while preventing unnecessary suffering of feline populations. Nutter, Levine and Stoskopf (2004) found that community cats

have a high mortality rate, with kittens living less than a mere six months. When including the adoption of socialized cats, Levy et al. (2003) found that a SNR program may reduce the overall community cat population. The researchers found that the SNR and adoption programs reduced the community cat population by 66% while enabling the adoption of 47%. Indeed, a ten-year neighbourhood SNR program in Chicago (Spehar and Wolf, 2018b) also induced a dramatic decrease of community cats. In this program, 30% of cats were directly adopted or transferred to rescues. However, Kilgour et al. (2017) found that feline populations migrate considerably between urban areas, which may explain why 34% of cats in Spehar and Wolf (2018b) were eventually labeled as ‘disappeared.’ However, the sterilization of community cats ensures that these individual cats could not contribute towards community cat populations. Research suggests that SNR programs must not be a single-year effort, and instead must be ongoing. Furthermore, it reflects the importance of incorporating adoption programs alongside SNR programs.

Ultimately, the research indicates that SNR campaigns for community cats may be effective in reducing shelter feline intake and euthanasia. However, the research does not discuss the outcome of cats after being returned to the field. This is especially problematic in Canada due to long and cold winters. Much of the research is presented in southern American states without winters and thus the concept of feline wellbeing is different from the Canadian concept which must consider the winter climate. In general, research should follow-up with cats returned to field because it is possible these cats are dying after struggling with illnesses. While the research indicates the effect of SNR programs when paired with educational components and adoption of socialized cats, the research does not specifically isolate the efficacy of SNR programs. Similar to public awareness via low-cost S/N programs, it is possible that the educational components of SNR programs —mentioned in the above studies— influence the effects credited to SNR

programs. Research should specifically target SNR programs' effect upon adoption, euthanasia, shelter intake, and importantly, feline wellbeing when returned to field. Furthermore, research should study the efficacy of public awareness campaigns and its impact on adoption, euthanasia, and shelter intake to consider these as viable programs in and of themselves.

Volunteer Training

Volunteers are fundamental to humane society operations and specifically influence animal behaviour. Luescher and Tyson Medlock (2009) found that trained dogs have higher adoption rates compared to their untrained conspecifics, while Wells and Hepper (1992) found that dogs with behavioural problems have a longer LOS. Accordingly, Kiddie and Collins (2015) assert that volunteers are elemental in enhancing shelter dogs' quality of life. Consequently, optimal volunteer training may enhance a shelter's LRR. In addition, Skoglund (2006) found that an effective training and orientation program will actually prolong volunteers' dedication.

Video-training is an often explored strategy for training volunteers. While time consuming to produce a well-made and effective training video, Macurik et al. (2008) found that training videos took less time to deliver. On average, the researchers noted that video training took 11 less minutes to complete than live training, while it also did not rely on the direct support of a trainer. The researchers conclude that one cannot conclusively evaluate the effectiveness of *solely* training with a video; however they acknowledge the effectiveness video training may have on re-training volunteers who find they are having difficulties with a particular task or whose general performance has deteriorated.

Howard and DiGennaro-Reed (2015) evaluate the effectiveness of video training, traditional training, and coaching specifically for animal shelter volunteers. The comparison

assessed three volunteers performing the proper 76-step procedure for walking a shelter dog. The results showed that participants performed 57%, 54%, and 53% of accurate steps when exposed to training as usual, but performed 83%, 75%, and 67% of the correct steps, respectively, when video trained. Coaching was however the most effective with 95%, 91% and 81% of participants performing the correct tasks, respectively. However, coaching is also the most time consuming as it involves a trainer personally managing the volunteer as s/he performs the necessary steps. Producing the training video was the most expensive method. When asked for their preference, all volunteers reported that video training was one of the best training methods, while all participants would not recommend traditional training. Video training is also deemed superior compared to traditional training in other research (see Todd, et al., 1998; Neef, et al., 1991; Catania, et al., 2009; DiGennaro-Reed, et al., 2010; Howard & DiGennaro-Reed, 2014; 2015). Catania et al. (2009) found an increase in training proficiency from traditional training results of 48%, 21% and 63% to 98%, 85% and 94% in three participants, respectively. By pairing three volunteers each with a dog, Howard and DiGennaro-Reed (2014) examined the effect of different types of training on shelter volunteers and how the types of training affects canine compliance. The researchers found that written instruction did not affect trainer capability while the low level of dog compliance remained. A single viewing of video training notably improved trainer performance but did not satisfy 90% integrity. Similar to Howard and DiGennaro-Reed (2015), coaching was the most effective training program and each volunteer acknowledged it as the most effective. All canine behaviour improved with video modeling and coaching, however improved canine behaviour was highly variable. Regardless of the training method however, only one trainer ever reached 90% integrity, which was during coaching. DiGennara-Reed et al. (2010) also found that video training was optimal when combined with direct feedback, however

their examination of video training alone also produced positive results. All studies scaffold the training programs by examining the effects of traditional training, then move to video modeling, and lastly to coaching. One limitation of these studies is that participants are receiving the same information several times, which could explain the increase in test scores/proper procedural adherence. Furthermore, all samples are extremely small and as a result merely indicate video-training's efficacy. To accurately demonstrate the effectiveness of video-training, larger samples must be examined and a more reliable testing method must be used.

Conclusive Findings

According to the peer-reviewed research, three areas show conclusive evidence for positively impacting a shelter's LRR. These areas are feline enrichment, canine-human interaction, and low-cost S/N initiatives.

Feline Enrichment

Feline enrichment is demonstrated as beneficial for shelter cats in moderating/reducing stress (Carlstead, et al, 1993; Stella, et al, 2017; Vinke, et al, 2014; Kry & Casey, 2004). Providing hiding places is a specifically essential enrichment component as cats attempt to hide under stressful/unfamiliar conditions (Carlstead, et al, 1993). Because hiding places reduce stress, cats are also more likely to reduce the probability of developing an illness. Wagner et al. (2018) found a correlation between providing hiding places and an increase in URI, however the researchers acknowledge that the majority of shelters housed cats in smaller cages and used varying descriptors for URI. In addition, Ellis et al. (2017) found that cats prefer hiding places compared to other EE options. Feline enrichment may also increase adopters' appeal towards

cats. While Fantuuzzi et al. (2010) determined that toys will not significantly affect feline behaviour over time, the researchers found that the mere presence of toys in a cage positively influenced adopters' decision-making. Gourkow and Fraser (2006) and Sinn (2016) also found the presence of toys and *playfulness* to positively influence adopter decision-making. Lastly, while it may be feared that hiding places will reduce visibility and thus negatively affect feline adoption, reducing feline stress actually makes cats more visible (Stella, et al., 2017; Kry & Casey, 2004). In fact, Kry and Casery (2004) determined that cats with a hiding place approached viewers more often and retreated less often than unenriched cats. This also benefits adoption as Sinn (2016) found that 'Friendliness towards adopter' is the most important adoption factor, which may explain why Gourkow and Fraser (2006) found that enriched SH cats experienced the highest rate of adoption and the lowest rate of euthanasia.

Canine-Human Interaction

Adopters appear to be more concerned with negative canine behaviour compared to positive behaviour (Protopopova & Wynne, 2014; Protopopova, et al., 2014; Herron, et al., 2014). However, research suggests that human-canine interaction and training may reduce negative behaviours in shelter dogs. Reducing canine energy levels is important for adopting-out dogs because dogs increase their LOS simply by moving in a back-and-forth motion inside their kennels (Wells & Hepper, 2000b). Similarly, Protopopova and Wynne (2014) found that 27% of potential adopters did not adopt a particular dog because the dog appeared too energetic. However, Protopopova et al. (2018) found that providing exercise for dogs may reduce vocalization, jumping at the door, and rubbing on kennel walls. Passively interacting with a stranger, being pet, and played with also significantly reduced vocalization (Shiverdecker, et al.,

2013). In fact, Luescher and Medlock (2009) found that training dogs benefits their adoption as trained dogs were 1.4 times more likely to be adopted than untrained dogs. Trained dogs may reduce their LOS by increasing their appeal to potential adopters while also reducing their probability of being returned to a shelter for behavioural problems (Wells & Hepper, 2000b). Furthermore, dogs receiving daily walks reduce in-kennel elimination, which also increases their appeal for adopters (Wagner, et al., 2014). Lastly, research shows that human-canine interaction in shelters will reduce and moderate canine stress (Hennessy, et al., 1997; 1998; Shiverdecker, et al., 2013; Coppola, et al., 2006). This further prevents negative behaviour and consequently reduces canine LOS.

Low-Cost S/N Programs

Low-cost S/N clinics stabilize local pet populations while also decreasing shelter intake and euthanasia rates, while increasing LRR. Low-income households are significantly more likely to have unsterilized pets (Frank & Frank-Carlisle, 2007; Chu, et al., 2009; Benka & McCobb, 2016; Weiss, et al., 2015; Dolan, et al., 2014). Benka and McCobb (2016) determined that if a low-cost S/N option was unavailable, nearly half of the pet owners would have to delay pursuing fixing their pet due to costs. While veterinarians may feel threatened by low-cost S/N clinics, Frank and Carlisle-Frank (2007) find that the pet owners using this service would likely not have their pets fixed at all without a low-cost S/N program. In fact, as communities become more aware of responsible pet ownership through low-cost S/N programs, more pet owners will contact veterinary services for S/N services.

Offering low-cost S/N services to lower income demographics increases pet sterilization in this population while also preventing relinquishments. According to Dolan et al. (2014), many

pet owners would not surrender their pets if they had information/assistance to resolve problems. In fact, 88% of pet owners would pursue these opportunities rather than relinquish their pets. Therefore, providing resources may reduce the intake of problematic cats which will therefore relieve shelter staff and potentially fosterers from being overwhelmed. In addition, low-cost S/N spreads public awareness. For example, Chu et al. (2009) discovered that pet owners delayed sterilization because they believed it was healthier for cats to have one litter first. In fact, the researchers discovered that this belief influenced delaying surgery more than the financial costs of the services. The public awareness generated by low-cost S/N programs may affect dog intake as pet owners become more aware of responsible pet ownership (Scarlett and Johnston, 2012). Consequently, low-cost S/N clinics are valuable for communities in both providing a valuable service to those who cannot afford the costs and for spreading awareness to responsible pet ownership.

Indications of Positive Impact

Indications of positive impact are areas mentioned within the peer-reviewed literature, but require direct and critical examination. Two areas indicating positive impact are: double-compartment housing and inter-canine interaction.

Double-compartment housing

Double-compartment housing is helpful in that it may reduce stress and reduce disease transmission. Although more research into double-compartment housing is needed, Wagner et al. (2014) found that when housed in double-compartment kennels, dogs defecated/urinated in the area opposite of their bedding, food and water. The researchers explain that the dogs studied

were also in a walking program, which allowed dogs to be walked two to three times daily. Wagner et al. (2018) also recommend double compartment cages for cats because it enables easy cleaning while limiting feline stress. Similarly, portals separate food and water from the litter area, which aids in easy cleaning. Following C4C guidelines, Janke et al. (2018) also suggest that portals reduce the number of cats on the adoption floor which is “hypothesized to increase adoption rates” (p. 285). Peer-reviewed research should examine whether portals do actually increase adoption rates.

Inter-canine interaction

The research determining that canine group housing is more advantageous for shelter dogs than single housing raises important considerations. Mertens and Unshelm (1999) found that formerly GH adopted dogs displayed significantly fewer behavioural problems compared to SH dogs. This is beneficial because future relinquishments may be reduced. The researchers report that inter-dog confrontations occurred, which understandably deters shelters from restructuring canine housing in this fashion. However, it is not that group housing research indicates a positive impact, but rather that inter-canine socialization (i.e. play groups, group walks, etc.) may reduce undesirable behaviour and satisfy the canine need for inter-canine contact (Sonderregger & Turner, 1996). This would positively impact the live release of shelter dogs as Protopopova et al. (2014) found that adopters are concerned about negative behaviour. Because SH dogs attempt to view one another, Wells (2004) even suggests that the mere ability to see/hear other dogs in-and-of-itself is a form of canine enrichment. Future research should measure the effects between inter-canine and canine-human interaction and the respective impacts on shelter dog behaviour. If the purported effects of group housing on canine behaviour

can be acquired without exposing shelter dogs to danger and without restructuring housing areas, this research could potentially lead to beneficial strategies.

Research Showing Promise

Three areas show promise, however require further research before conclusions can be made. These are reduced/waived adoption fees, community cat management programs, and video training for volunteers.

Reduced/Waived Adoption Fees

Weiss and Gramann (2009) and Crawford et al. (2017) find that adopters' attachment levels to cats do not significantly differ regardless of whether or not adopters paid an adoption fee. These studies relied on surveys to assess adopters' attachment levels, however longitudinal studies tracking relinquishment are needed to understand the long-term effects of reduced/waived fee adoptions. Research is needed to investigate whether the level of veterinary care varies depending on the type of adopter (NAF vs AF). This is needed because if adopters are looking to pay less to adopt a pet, then this financial consideration may be influencing decisions regarding veterinary care. In addition, if this association does exist, it is possible that these adopted cats are passed on to other owners or eventually surrendered to shelters instead of seeking preventative veterinary care. Ultimately, the available research indicates that reduced/waived fees increase adoptions and may be a useful strategy during periods of high intake.

Crawford et al. (2017) found that kitten adoptions increased exponentially although only cats aged ≥ 1 year were free. As the researched adoption events were preceded by promotional

campaigns it is also possible that the promotional campaigns increased adoptions and not necessarily the reduced adoption fees. That being said, research should examine whether promotional campaigns yield the same public response as special adoption events. If responses are similar, then shelters may use promotional campaigns to increase adoptions without losing funds as a result of reduced adoption fees. Lord et al. (2014) demonstrate that when shelters implement fee reduced/waived adoption events, shelters should consider other avenues to replace lost revenue. These studies reflect the potential benefits to all animals during targeted reduced/waived adoption events; however, the studies fail to account for whether special adoption events increase adoptions or if the promotional campaigns for the events induce this success.

Community Cat Management

A continuous community cat program comprising of both an SNR program and an adoption program for non-socialized cats may significantly decrease euthanasia rates and shelter intake, and increase adoption and LRR. Researchers find that community cat programs are reduce these shelter aspects (Levy, et al., 2003; 2014; Spehar & Wolf, 2018a; Johnson & Cicirelli, 2014; Edinboro, et al., 2016). Community cat programs that include SNR and adoption initiatives are preventative in that the program ultimately reduces community cat populations over time (see Levy, et al., 2003; Spehar & Wolf, 2018b). Because community cats have high mortality rates and that community kittens live on average for only six months (Nutter, et al., 2004), community cat programs are vital strategies for reducing unnecessary suffering in free-roaming cat populations. However, it is pertinent that research examines the wellbeing of cats upon being returned to the field. As it stands no research actually investigates cat wellbeing after

being returned to field and it is therefore not known whether this program actually benefits the animals returned to field. If cats are undergoing unnecessary suffering upon being returned to field, then other options may be more appropriate.

Researchers (Levy, et al., 2014; Edinboro, et al., 2016) report that a community educational component was included with the community cat program and that it encouraged local enthusiasm towards the community cat program. This component fundamentally spread responsible pet ownership awareness, which may affect other animal populations. Edinboro et al. (2016) report that shelter canine intake decreased in the community cat program target area by 36% while it increased by 9% in the non-target area. However, this raises questions about how the educational components affected the final results of these studies. As the research does not examine an SNR program alone, the full extent of SNR's effects are not known. Lastly, because the studies examined data from many years, it is likely that external variables affected the results. The research indicates that SNR programs may reduce community cat populations, but much more research must examine SNR on its own while isolating external variables and must also examine the wellbeing of the cats returned to field.

Video training volunteers

Video training also shows promise when it comes to training volunteers. This is because video training does not require direct support of a trainer. The only costs necessary are the initial materials for video production, however upon completion, the use of videos is cost-beneficial as staff members may still complete necessary shelter tasks while volunteers are video-trained. In fact, Macurik, et al. (2008) found that it took less time to deliver training videos than traditional training. Researchers (Todd, et al., 1998; Neef, et al., 1991; Catania, et al., 2009; DiGennaro-

Reed, et al., 2010; Howard & DiGennaro-Reed, 2014; 2015) find that video training is more effective than traditional training at increasing retention of learned content. However, because the research often tests the type of training in sequence –beginning with traditional training—it is possible that video training produces better results simply because volunteers have already been exposed to the same information. Furthermore, many of these studies only use three participants, which is a tremendously small sample. Although the research shows promise, researching video training should use larger samples so as to reach conclusive results.

Canine behaviour assessment and research questionnaire

C-BARQ shows promise as an effective canine behavioural assessment. The studies examining C-BARQ use large samples to assess the efficacy of C-BARQ in identifying canine behaviour. In addition, Foyer et al. (2014) demonstrated that C-BARQ accurately identifies future canine behaviour in young canines. In this example, canines were assessed with C-BARQ in their first year of age and then assessed a year and a half later. The results indicated that C-BARQ accurately identifies future individual canine behaviour. C-BARQ may then be used by shelters in order to predict how shelter dogs will behave once adopted. Although Segurson et al. (2005) found that dog owners intentionally provide misleading information on C-BARQ questionnaires so as to avoid euthanasia, Duffy et al. (2014) examined a much larger sample of dog owners and determined that dog owners do not actually provide misleading information on C-BARQ. If canine assessments can be developed that accurately predict post-adoption canine behaviour, then these should be paired with C-BARQ. Doing so may result in fewer dogs being misidentified as behaviourally unadoptable and thus save canine lives.

Lack of Peer-Reviewed Research

Many of the discussed areas are limited or unrepresented in peer-reviewed research despite the fact that these areas are often recommended and practiced. The notable four areas include working cat programs, managed intake, C4C, and olfactory stimulation.

Working Cats Program

Although Van Patter and Hovorka (2018) examine conservationists' reception towards working cat programs and several researchers (see Janke, 2017; 2018; Van Patter, 2015) recommend the program, peer-reviewed research does not examine the efficacy of the program. Because the program has not been examined, there is no findings to suggest how working cat programs should be properly managed. Furthermore, feline wellbeing is not examined at all and therefore it is unknown specifically how well cats are experiencing the program. Lastly, there is not an established criteria for what types of cats are appropriate to be entered into a working cats program. While the program could operate as an extension to a trap-neuter-return program, wherein feral colonies are placed onto rural properties, it is possible that other shelters may consider socialized house cats with elimination problems as viable for working cats programs. This aspect of working cats programs is specifically needed as some cats may only be being placed in unnecessarily stressful/unfamiliar situations.

Managed Intake

Managed intake is also not studied. Although it is included in the C4C studies presented here, the researchers do not isolate the different components and therefore the actual efficacy of managed intake is not determined. Similar to working cat programs, managed intake is regularly

recommended as a strategy to save animal lives and improve LRR, however the strategy is not actually examined within the peer-reviewed literature. Managed intake is mentioned within the C4C literature, however this is extremely brief and uncritical. For example, Karsten et al. (2017) associate the decrease of feline admissions with the managed intake strategy, wherein this decrease was, “likely a reflection of the managed intake process” (p. 20). However, this is merely an assumption—managed intake cannot both be positively credited with increasing and decreasing adoptions. Accordingly, managed intake requires further research that may examine its effect on adoption, euthanasia, and LRR. However, it must also examine the wellbeing of the animals being diverted from shelter intake. If shelters must remain under their optimal capacity, what are happening to the animals being diverted? Oftentimes theory does not equal reality, and accordingly research should actually examine the guiding logic of managed intake. That is, does providing fewer adoption choices yield higher adoptions? And if so, does it justify diverting intake to maintain capacity?

Capacity for Care

C4C is largely promoted as the most effective sheltering management system, however only three peer-reviewed studies examine the efficacy of C4C (Karsten, et al., 2017; Janke, et al., 2017; 2018). Compared to its promotion in the grey literature, C4C is significantly under-represented in peer-reviewed research. Furthermore, all three peer-reviewed studies do not examine the ten components of the program on an individual basis. Consequently, the effects of C4C are generalized as being results of C4C without the studies having actually generated any understanding about *how* C4C was effective. Rather, because the *how* is excluded, the research equates correlation with causation, which is misguided. This results in the studies proffering

findings predicated upon presumptions; which cannot therefore be accepted as conclusive evidence for C4C. Due to this discrepancy, certain facets of C4C may be ineffective or even detrimental to sheltering objectives. Research should examine the separate components of C4C to determine whether these components are effective and beneficial for animals. In doing so, studying the individual components will support combining all into C4C.

Olfactory Stimulation

Olfactory stimulation is shown to affect both feline and canine behaviour. However, all mentioned studies examine different scents. Further research should instead cross-examine these different scents to determine if the same scents produce identical results across studies, while also highlighting the most effective. Research should also examine whether these scents reduce animal stress. This is important because reduced stress inhibits illness and may reduce negative behaviour. Accordingly, research should examine whether olfactory stimulation does prevent illnesses to some extent and how this may impact LOS. Accordingly, research should investigate whether olfactory stimulation affects adoption rates. Olfactory stimulation impacts animal behaviour, however future research should examine if olfactory stimulation increases positive behaviour, or at least reduce negative behaviour, necessary to enhance adoption rates and reduce euthanasia. The research indicates that olfactory stimulation affects feline and canine behaviour, however the research must use larger samples and specifically target the same examined scents in order to verify applicability and effectiveness. Feliway and DAP specifically appear

promising, however more studies are needed. This strategy may be a simple method of easing animals to transit into shelters, while also reducing their LOS.

Contradictory Findings

There are a three areas in the peer-reviewed research wherein different studies reach opposing conclusions. These contradictions are: the association between hiding places and increased URI; hiding places and fear to approach strangers; and, contradictory and ambiguous outcomes for GH and SH cats.

Hiding Places and URI

An important contradiction that emerged is the correlation between providing hiding places for cats and increased URI (Wagner, et al., 2018). This is a surprising correlation. While there is a definite association between feline stress and infection (see Gaskell & Povey, 1977; Tanaka, et al., 2012; Speakman, 2005), researchers (Kry & Casey, 2007; Vinke, et al., 2014) determine that hiding boxes are crucial in moderating feline stress levels. This implies that cats provided with a hiding box should actually have lower URI rates. Carlstead, et al. (1993) found that stress-induced cats were significantly more likely to hide behind their litter pans when stressed, which indicates that cats should be encouraged to hide in order to manage stress under unfamiliar/stressful conditions. However, because Wagner et al. (2018) find an association between cats with hiding places and higher URI rates, research should address this association. Shelters often provide hiding places for cats but are also dedicated to preventing infectious diseases. Although the researchers do recognize that most cats were also housed in smaller cages

—which would increase stress—future research should resolve the contradiction as hiding places are an encouraged form of feline enrichment. .

Hiding Places and Feline Fear to Approach Strangers

Another contradiction also concerns hiding places. Stella et al. (2017) found that cats provided with a hiding place were less likely to approach a stranger than a control group. However, Kry and Casey (2007) found that providing cats with a hiding place encouraged feline friendliness and were significantly more likely to approach strangers. However, Stella et al.'s (2017) study only lasted for two days, which is a significantly short time to make conclusive findings. Nonetheless, future research may be directed towards determining the impact of hiding places on feline approach behaviour. This is important to clarify because if hiding places encourage feline friendliness and approach behaviour then it is possible that this behaviour will improve adoptability. According to Gourkow and Fraser (2006) and Sinn (2016), respondents overwhelmingly consider 'playfulness' an influential factor when deciding to adopt a cat. In contrast, if providing hiding places encourages retreating from strangers, adopters will find these cats less appealing to adopt. Consequently, future research should examine the relationship between providing cats with hidings places and its impact on friendly/approach behaviour.

Outcomes between Group-Housed and Single-Housed Felines

The outcomes for enriched GH and SH cats should be further examined because the research is contradictory. On the one hand, Suchak and Lamica (2018) did not find significant differences between GH and SH cat outcomes. This indifference exists despite the fact that GH

cats were significantly more visible than SH cats. Fantuzzi et al. (2010) found a significant positive relationship between the amount of times a cat was viewed and adoption, which reflected why SH cats housed on the upper row of cages were more likely to be adopted compared to cats on the bottom row. Sinn (2016) found a similar parallel. This should indicate that GH cats are most likely to be adopted because they are the most visible, however Gourkow and Fraser (2006) found that 76% of enriched SH cats were adopted in their study, while 74% of basic GH cats and 69% of enriched GH cats were adopted. The SH cats in this study were also housed in double rows, which is surprising considering the higher (albeit insignificant) adoption rates of the enriched SH cats. However, both basic SH cats were also housed with enriched SH cats and the basic SH cats had a significantly low adoption rate of only 45%. The researchers do not however describe the housing mix between the basic SH and enriched SH cats and it is possible that a greater degree of basic SH cats were located on the bottom row and therefore less visible. Considering that there was not a difference between basic and enriched GH cats, visibility of SH cats may have been a factor. This is especially possible considering the inconsistency between the evidence supporting feline enrichment and the high adoption rates for basic GH cats. Nonetheless, further research should be conducted in this area. Theoretically, if socialized to conspecifics cats can be group housed, these cats will be more active (Uetake, et al., 2013) and more visible (Fantuzzi, et al., 2010; Gourkow & Fraser, 2006; Sinn, 2016), which may increase adoption. Subsequently, if more cats can be group housed then more space may be available to visibly present enriched SH cats without resorting to bottom row caging.

Anecdotal Practices

Nine North American animal shelters completed a questionnaire comprising of 38 questions. These shelters were contacted because of their reported high LRR ($\geq 90\%$). The intention was to determine what practices are potentially effective especially if unrepresented in peer-reviewed research. Statistical commonalities are displayed in Appendix A. Shelter intake varied depending on shelter but ranged from annual shelter intake in low thousands (~1 400 - 3 600), mid thousands (~5 000 - 8 000) and high shelter intake (~11 000 - 31 000).

As indicated, the majority of shelters will run over capacity (66%), run a barn/working cats program (88%), practice some form of intake diversion (88%), run or support a return-to-field program (66%), practice open adoption (77%), and all mentioned some form of criteria for waived/reduced adoption fees. Four (44%) shelters reported running special adoption programs/events as well. All shelters transfer animals out and most (89%) also transfer animals in from other organizations.

Most successful shelter initiatives

Interestingly, all shelters reported several different initiatives as being their most successful initiative(s). However, among the responses, two shelters mentioned their TNR program, two shelters mentioned C4C, four shelters mentioned open adoption strategies (one direct mention to Adopters Welcome HSUS), and two shelters mentioned double-compartments/portals. The other initiatives mentioned were : 1) mandatory registered microchips; 2) partnering with local rescue groups; 3) foster program; 4) strategic intake; 5) transferring in more animals in need; 6) surrender prevention; 7) fast-tracking adoptions; 8) creative marketing for shelter animals; 9) Asilomar Accords; 10) Canadian Standards of Care;

11) Hide Perch and Go™; 12) additional isolation space; and, 13) Barn Cat Program.

Interestingly, one shelter responded that their most successful initiatives, open adoption and strategic intake, were also their biggest obstacles due to lack of staff enthusiasm, compassion, and understanding the procedural shift. Encouraging staff to embrace the removal of adoption barriers was also reported as a challenge by another shelter. This insight should impart prudence when shifting from open admission to strategic intake and when dismantling adoption barriers as staff familiar with prior procedures may require training and support when adopting new procedures. Planning for such changes may be vital in avoiding unforeseen challenges.

Adoptions fees

Most shelters (66%) reported variable pricing, largely depending upon the type of breed, desirability, size, cuteness, age, and/or behaviour. The remaining shelters had set prices according to age/weight but also reported reduced fees for animals with a longer LOS, for bonded-paired animals or multiple adoptions, reported that dogs and cats seven years of age or older were 50% off (another shelter waived fees for animals seven years or older), and/or reduced fees on a medical case-by-case basis. One shelter also offers a “pick your price” fee for adopting adult cats.

Behaviourally unadoptable

All shelters considered a dog behaviourally unadoptable if the dog displayed notable aggression towards either humans or other animals. One shelter reported that they originally used

a temperament test to determine the outcome (failing the test is grounds for euthanasia), however the shelter has now moved to a case-by-case discussion with staff leadership to determine options for each dog. This shelter also uses Ian Dunbar's bite assessment scale to determine euthanasia as an appropriate outcome. The scale is a six-level scale used to assess the severity of dog bites to identify the danger posed by a dog. Another shelter will first place dogs and cats into a partner organization to assess the animals in "a more calm, stable environment...if we haven't been able to get a good read on them or if their behaviour appears heavily influenced by the shelter environment, or who we believe will need a behaviour modification program and heavy counselling and adopter guidance before placement into a permanent home." As a second level, this shelter will also discuss the options for each animal on a case-by-case basis.

Intake diversion

Various forms of intake diversion are practiced, however the most frequently mentioned are: 1) low-cost S/N; 2) running a pet food bank/supplying food; 3) medical care (either directly, subsidized, provided through partnering veterinarians, or referrals to more affordable veterinarians); and, 4) help lines/call centre/consultations. Other mentioned strategies are: 1) behavioural and housing support; 2) training classes; 3) refer to rescue groups; 4) rehoming packet; 5) staff training; 6) delaying surrender until placement found; 7) humane education; 8) community based/outreach programs; and, 9) a wellness centre. Accordingly, diverting intake is a widespread practice with varying strategies. All shelters that reported practicing intake diversion did not report only one strategy, rather every shelter reported at least three separate components. This indicates that effective intake diversion is diverse in strategy. Furthermore, as

low-cost S/N was frequently mentioned, low-cost S/N initiatives in general (i.e. low-cost mobile S/N clinics) may prevent future shelter intake.

Medically adoptable pets

One shelter also mentioned that an interesting shift has occurred wherein adopters are becoming more interested in adopting animals with medical problems. What were once considered medically unadoptable are increasingly finding interest from unique adopters. For example, one shelter mentioned that a person with diabetes specifically wanted to adopt a diabetic cat. This is particularly insightful as Patronek and Crowe (2018) found that 29.6% of 2 631 dogs surrendered for euthanasia were deemed adoptable after discussing with the owners at intake. This reflects the stance of another shelter which uses ‘untreatable’ instead of ‘unadoptable’ because “we have recognized that while one person considers a dog/cat as unadoptable, someone else may feel otherwise.” In this case, shelter capacity, ability, and resources determine the treatability of an animal in relation to potential harm to other sheltered animals. Most shelters specifically report that medically unadoptable refers to a poor prognosis in relation to quality of life, while one shelter also states that animals with FIV/PARVO will be adopted out while animals with leukemia are adoptable as long as the illness does not accompany another illness.

Return-to-field programs

Two shelters do not have a return-to-field program, but one shelter supports organizations that run an SNR program, while another supports caretakers running a trap-neuter-return program. This is done through an S/N voucher program for colony caretakers or providing low-

cost/free S/N for those that run return-to-field programs. All shelters that do manage return-to-field programs sterilize cats and cats must be in good health. Ear tipping, vaccinating, and microchipping are varyingly conducted by 75% of shelters. One shelter specifically designates that all cats must be six months of age or older. 44% of shelters will not accept healthy stray cats at all while 33% of shelters accept strays but request finders to temporarily care for the stray cat or to bring the cat to another rescue. In order to assist individuals find a permanent home for found strays, one shelter specifically uses online resources and provides a rehoming guide on their website. One shelter collects information and holds strays, but transfer them to the municipal shelter.

Transfers

Although all shelters transfer out, the reasons for doing so vary considerably. Two shelters did report that animals are transferred if specialized rescue organizations may be better suited to helping an animal, while the remaining reasons are: 1) animal struggling in current shelter; 2) special needs (case-by-case); 3) animal has high LOS; 4) near capacity; 5) behavioural reasons; 6) breed; 7) requested by other shelters. Conversely, all shelters, except one, transfer animals in from other shelters.

Working cats program

Lastly, 78% of shelters have a barn cat program, however the criteria for eligible felines varies. 57% of these shelters specifically include under-socialized cats while 28.5% require

friendly cats. 28.5% include cats that have house soiling problems, while the remaining include: 1) no FIV; 2) no declawed cats; 3) propensity to survive outside; 4) primarily used to outdoors; and, 5) feral. One shelter in particular works with a local horse organization and together are able to easily place cats in barns. Considering the large rural landscape surrounding Ottawa and the many horse/riding clubs and stables in the Ottawa area, a barn cats program might be particularly successful. However, a proper working cat program should guarantee the wellbeing of its animals. A cat with a history of being a house-cat, is not appropriate to be living in a barn hunting prey, nor should socialized cats appropriate for in-house adoption be designated as a barn/working cat. Rather, cats that display a challenge as a house-cat are appropriate for the program because the environment suits their behaviour while their wellbeing may also be safeguarded. Working cat programs are valuable because non-socialized cats—that are not appropriate for adopters looking for a house-cat – receive the chance to live without the dangers of being free-roaming or, of course, euthanized.

Recommendations for Subsequent Research Questions

Several research questions emerged throughout the indications of positive impact, contradictory findings, and areas lacking peer-reviewed research. These potential research questions are:

1. Does double-compartment housing significantly reduce canine/feline stress? What effect, if any, does this have on disease transmission and adoption?
2. How does inter-canine interaction in a shelter affect canine behaviour? Does this impact the adoption rate of dogs?

3. How do hiding places affect feline URI rates? Does a correlation between hiding places and URI rates differ between housing types (single and group)?
4. Do hiding places encourage approach behaviour in cats? If so, how does this affect feline adoption rates?
5. When individually examined, how do C4C Key Practices (CFHS, 2016) affect animal LOS and adoption rates, and a shelter's LRR?
6. Does managed intake and deferring intake reduce admissions and preserve animal welfare or merely prolong the time until relinquishment? What is happening to animals being diverted?
7. Does assessing expected positive canine behaviour better predict future behaviour rather than other forms of established behavioural assessments? Does this model affect LOS and adoption rates? If so, what is the correlation between positive behavioural assessments and future canine behaviour?
8. How does providing catnip to cats affect feline behaviour and does this affect feline LOS and adoption rates?
9. Does a working cats program significantly affect the live release of cats who would otherwise be euthanized? What is the status of wellbeing for cats adopted into a working cats program? What sort of criteria is appropriate for cats being placed in a working cats program?
10. How do promotional campaigns affect adoption rates for cats and dogs when not paired with reduced/waived fees?

11. What level of veterinary care do cats and dogs receive if adopted out through reduced/waived adoption fees? Is there any association between these animals and surrender to shelter?
12. What is the status of wellbeing for cats who are returned to field in a community cat management program?
13. When staff are well-trained with an infection tracking software system, does the software system accurately track infection and identify potential risk factors?

Final Recommendations

With regards to conducting future research, the above research questions should be considered before enacting these strategies. The questions are largely reflective of gaps within the available peer-reviewed research. Although the questions are not ordered in any particularly manner, future research should specifically ensure that animal wellbeing is considered when pursuing new policies. The available research indicate that this is not always the case. Some of the available research highlights strategies as effectively reducing intake and increasing adoptions but the studies do not discuss the wellbeing of animals (see above). Instead, often times the question emerges “So, what happens to the animals?” Furthermore, by pursuing these research questions, strategies may become more thorough having had these considerations examined, validated or modified. The research indicates that the conclusive findings discussed above are beneficial to saving animals lives and this pursuing these policies are recommended. Ironically, much of the recommended initiatives in the grey literature are actually lacking peer-reviewed research. These are imperative areas of research requiring research.

Conclusion

Peer-reviewed research demonstrates that cats benefit from environmental enrichment, specifically through hiding places, in order to manage and reduce stress. Hiding enrichment may encourage friendlier behaviour, which will positively affect adoption. Canines similarly benefit from human interaction and the interaction reduces canine stress, decreases high energy, and decreases the probability of in-kennel elimination. These two procedures benefit these animals by reducing stress, disease, and negative behaviour and consequently reduce their LOS by enhancing their appeal to adopters.

Low-cost S/N programs are also effective in providing this valuable service to members of the community who would otherwise not acquire the service. Low-cost S/N services are shown to spread responsible pet ownership awareness and correct misunderstandings about pet sterilization. This initiative is highly effective in preventing future shelter intake and stabilizing local pet animal populations. Furthermore, low-cost S/N services give low-income pet owners the opportunity to learn information that may assist in problems they may be experiencing with their pet. This aspect is important for low-income pet owners—who may not usually, if ever, visit veterinarians—because it reduces shelter intake by resolving pet issues that may lead to surrender.

Double-compartment housing indicates a positive impact on the live release of animals, however as only one study specifically examines double-compartment housing, further specific studies are needed. Nonetheless, 22% of the contacted shelters specifically highlighted double-compartments as one of their most successful initiatives. Inter-canine interaction may also benefit shelter dogs as GH dogs are reported to display fewer behavioural problems. However, studies do not specifically examine inter-canine interactions in shelters. Research should first

examine the impact that inter-canine interaction may have on canine behaviour if conducted in the forms of group walks or play groups. Importantly, the research should be prudent in examining potential risks for disease transmission.

Research concerning reduced/waived adoption fees indicates that this strategy shows promise towards positively affecting the live release of animals. In fact, all contacted shelters also reported variable adoption pricing or reducing/waiving adoption fees for specific criteria while some also specifically reported holding special adoption events. This may especially be an effective strategy for shelters when experiencing high volume intake. However, the peer-reviewed studies do not examine the financial impact of reducing/waiving adoption fees. Furthermore, research should be directed towards examining the level of veterinary care to animals adopted through reduced/waived fees. While it may appear positive with regards to shelter LRR, these animals may not be receiving proper veterinary care as NAF adopters may possibly be delaying veterinary services due to costs. It would be valuable to examine whether promotional campaigns for adoption events yield high public response rather than the reduced/waived adoptions as this strategy would increase shelter adoptions without reducing revenue produced through adoptions.

SNR may function as an effective community cat management program, however the research examined does not isolate external variables and often recognize other shelter initiatives operating simultaneously. Without being isolated, it is impossible to determine the true effect of these community cat management programs. In addition, it is possible that the strong campaigns for responsible pet ownership have improved shelter intake, but is being credited to community cat programs. Research should specifically examine a community cat management program,

without external variables, while also examining the wellbeing of cats after being released into the field again.

Lastly, the research also suggests that video training volunteers may be more effective for teaching proper procedures to volunteers. As volunteers are integral to animal wellbeing and positive behaviour, this option is very interesting especially considering that video training requires less cost and personal involvement over time. The research shows that coaching paired with video-training is the most optimal training option, however this is both cost-ineffective and time consuming. However, further research is needed before conclusive findings can be reached as the studies consulted rely on small participants.

This literature review has demonstrated that peer-reviewed research into animal sheltering is limited, however as indicated by the recent dates, one may relish in the fact that it is a growing area of research. Many of the studies reported here have significant limitations while many studies also require future research to verify findings. The grey literature reports successes with recent sheltering strategies, however, these strategies are either minimally examined in the peer-reviewed research, or completely absent. As the body of research grows, findings will be verified and repudiated and shelters will fundamentally acquire clearer insights into what practice are the most effective for saving animal lives. However, all initiatives are dependent upon the unique community that shelters serve. What may be effective in one shelter might be ineffective and perhaps even detrimental in another. Shelters have relied upon grey literature to enact policies and procedures, and although this is indicative of supportive collaboration, the possibility of error is great. Effective sheltering procedures and policies will develop as the body of research grows; meanwhile the risk for pursuing novel initiatives will also diminish.

Appendix A

Statistical Commonalities between Contacted Shelters

Criteria	
Open Admission	33%
Managed Intake	67%
Run Over Capacity	67% (YES) 33% (NO)
Barn/Working Cats Program	78% (YES) 22% (NO)
Practices Intake Diversion	89% (YES) 11% (NO)
Admit Strays	22% (YES) 45% (NO)
Admit Strays as Last Resort (First Strategy is to Divert)	33%
Return to Field Program	45% (YES) 33% (NO)
No Return-to-Field Program but Directly Supports Local Return-To-Field Programs	22%
Open Adoption	78% (YES) 22% (NO)
Standardized Behavioural Assessment (Dogs)	56% (YES) 44% (NO)
Reduce/Waive Adoptions	100% (YES)
Transfer In	89% (YES) 11% (NO)
Transfer Out	100% (YES)

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