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Moore, AM

Bain, MJ

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Research

Evaluation of the addition of in-cage hiding structures and toys and timing of administration of behavioral assessments with newly relinquished shelter cats

Alexandra M. Moore¹, Melissa J. Bain*

Department of Veterinary Medicine and Epidemiology, School of Veterinary Medicine, University of California-Davis, Davis, California

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ABSTRACT

Most cats entering shelters are euthanized. This study used behavioral assessments to determine how quickly a cat acclimated to its new environment and whether enrichment eased this transition. Twenty-five cats at 2 municipal shelters were evaluated with 2 separate standardized behavioral assessments at 3 separate times, beginning the day after entering the shelter. One behavioral assessment included an in-cage evaluation, whereas the other assessment involved a stepwise combined in- and out-of-cage evaluation. Eleven of the cats were given a cardboard box to hide in and a toy in the cage, whereas 14 cats were not given these objects. Our results suggest that cats need 72 hours to achieve optimum behavioral scores and a decrease in stress levels based on the 2 separate evaluations. The tests were correlated in their outcomes.

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Introduction

Cats are frequently relinquished to shelters, often for behavioral problems (Salman et al., 1998, 2000). Approximately 70% of cats entering shelters in the United States are euthanized (Humane Society of the United States, 1997). A main goal of shelters is maximizing the numbers of cats that successfully leave the shelters. Reasons for a cat to be euthanized in a shelter environment include illness, such as an upper respiratory infection, and/or behavioral issues, such as aggression (Foley and Bannasch, 2004). Both these types of conditions are exacerbated by increased stress levels and are strongly interrelated (Moberg, 2000). Stress, as used here, is a state of tension measured by an animal's response via behavioral, neuroendocrine, autonomic, and immune system pathways, which may be a factor in disease development.

Many shelters use behavioral assessments (temperament tests) for animals to help determine the adoptability of an animal and

what environmental or behavioral modifications can be undertaken to make its stay least stressful as possible (Reid et al., 2004). Most of the research and implementation has been in dogs (Kroll et al., 2004; Jones and Gosling, 2005; Christensen et al., 2007; Pullen et al., 2010). Little work has been done to evaluate feline behavior in shelters. Shelters often have to make quick decisions about whether to place an animal for adoption, sometimes within 72 hours after entering the shelter (California SB 1785). It is unclear whether such quick decisions are valid, and whether the cat's behavior changes as it acclimates to the shelter or if simple husbandry and management could positively affect adoption.

Data have shown that providing cats with enriched environments (e.g., places to hide) (Carlstead et al., 1993; Kry and Casey, 2007), communal housing (Dantas-Divers et al., 2011), and handling (Gourkow and Fraser, 2006) decreases stress (Ellis, 2009). Adding other types of cage enrichment, such as a ball, has been demonstrated to decrease inactivity and increase play behaviors (de Monte and Le Pape, 1997). Increasing the housing complexity to mimic the environments of homes is deemed important for decreasing the animal's stress levels (Loveridge et al., 1995).

The Cat Stress Score (CSS) has been used to evaluate the stress levels of cats in shelters (Kessler and Turner, 1997) and veterinary hospitals when evaluating stress related to handling (Kronen et al., 2006). The CSS has also been used in some cases to evaluate cats in shelters (Dybdall et al., 2007). Another evaluation, Meet Your Match

* Address for reprint requests and correspondence: Melissa J. Bain, DVM, DACVB, MS, Department of Veterinary Medicine and Epidemiology, School of Veterinary Medicine, University of California-Davis, One Shields Avenue, Davis, CA 95616; Tel: 530-752-6226; Fax: 530-752-7616.

E-mail address: mjbain@ucdavis.edu (M.J. Bain).

¹ Current address: 20469 Black Road, Los Gatos, CA 95033, USA.

(MYM; American Society for the Prevention of Cruelty to Animals, 2008), has been used in many shelters across the United States to help match owners to new cats, increase adoptability, and decrease returns to the shelters.

The goals of this study were to use behavioral and stress assessments to determine how quickly newly relinquished cats' behaviors change, and whether providing a hiding box and a toy affects these evaluations. A decrease in behavioral problems and disease with a subsequent increase in adoptability may be possible if stress levels can be decreased. We hypothesized that newly relinquished cats receiving enrichment would have improved behavioral stress scores compared with those not receiving enrichment. We also hypothesized that behavioral measurements of stress would decrease with time.

Materials and methods

The protocol was approved by the Institutional Animal Care and Use Committee at the University of California-Davis. Two local open-admission municipal animal shelters, which were required to take in all animals that are found or relinquished, were solicited for participation in the study: City of Sacramento Animal Care Services (CSACS) and Sacramento County Animal Care and Regulation (SCACR). A third municipal shelter, Yolo County Animal Services, was used during the pilot testing of the evaluations but not for the final data collection.

All cats were singly housed and fed once daily in the morning. In all 3 shelters, the cats were housed in separate buildings from dogs, and the rooms in which the evaluations were done were also separate from those used for dogs. Figures 1 and 2 demonstrate the layout of these facilities, whereas Figure 3 shows the rooms where the out-of-cage behavioral evaluations took place.

Inclusion criteria for the study stated that cats had to be at least 6 months old and apparently healthy, surrendered by their owner or entered as "stray," and not severely aggressive or labeled as "feral" by the shelter. Information was gathered from the kennel information cards. The cats were randomized into treatment and control groups based on the cat's kennel location in the room, proximity to the door, and height off of the floor. This meant that cats from all kennel locations were assigned across groups. The sequence in which the cats were evaluated rotated every other evaluation day, starting with the cats in the treatment group.

Enrichment was given to those in the treatment group after the initial evaluation on day 1. Each cat in this group received a box in which to hide and a ping-pong ball. Both the box and ball remained in the cage. The box was a standard 20-pound paper ream box turned upside down with a large hole on the long side. Each cat's individual ping-pong ball was also used in that cat's assessment.

Evaluations began at 7:00 AM and were repeated at the same time 48 and 72 hours later. The same evaluator (AMM) conducted all evaluations, recording results individually for each cat, between June and August 2009 using 2 different parts, the CSS and the

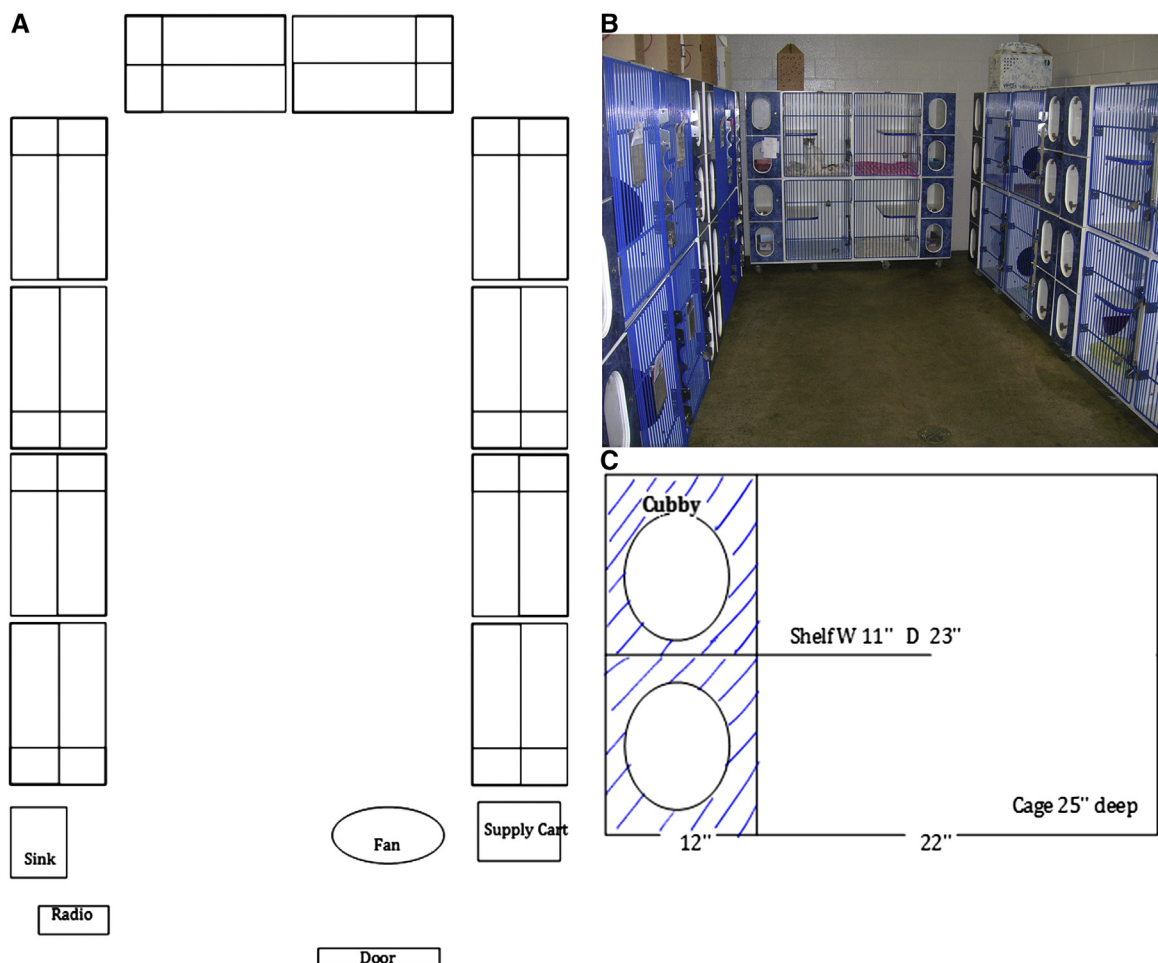


Figure 1. (A) Top view of CSACS stray hold feline kennel area. (B) Image of stray hold feline kennel area, taken from door. (C) Front view of cage at CSAS. Note "cubby" and shelf as a resting perch. Top cubby holds resting area and bed, whereas bottom cubby holds cardboard litter pan. CSACS, City of Sacramento Animal Care Services.

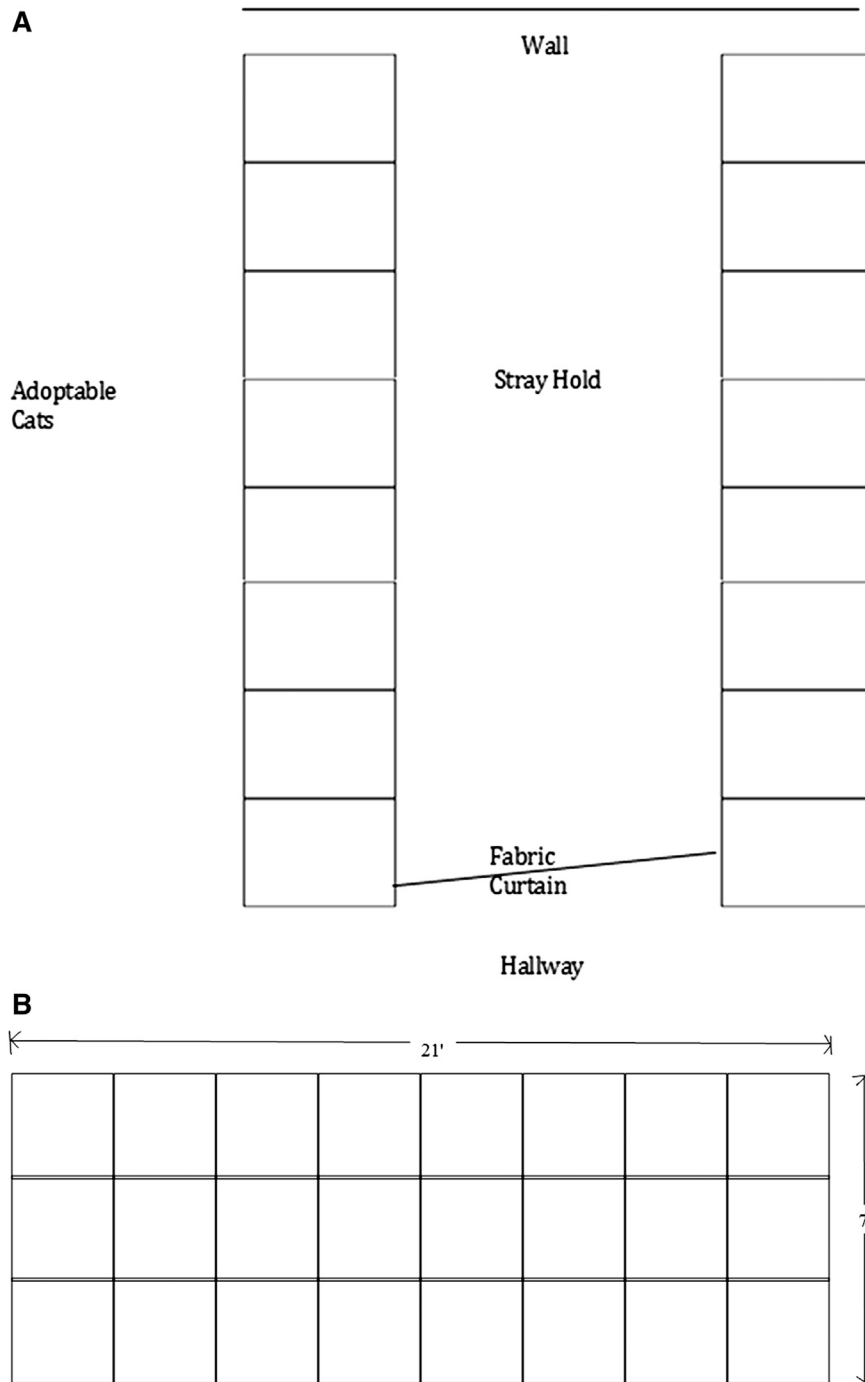


Figure 2. (A) Top view of stray hold feline kennel area at SCACR. The boxes denote the tops of cage banks. The stray hold is in the same room as the adoptable cats, separated by a fabric curtain. This facility is no longer in use. (B) Front view of a bank of cages at SCACR. Each box is a cage; all were steel with no perches. SCACR, Sacramento County Animal Care and Regulation.

Modified Meet Your Match (MMYM). Data were recorded on the Cat Assessment Data Sheet (online only [Appendix 1](#)), which included the MMYM data and the summary score from the CSS (online only [Appendix 2](#)). Any behaviors observed but not already on the evaluation sheet were captured as free text. Results of both tests were live scored as they occurred and were not videorecorded.

The CSS was used first to assess the cat while still in its cage. Results were immediately transcribed after the cat had been observed for 30 seconds. Cats not in view received a stress score of 0. If the cat was visible, its behavior was rated using the 7-level CSS

(McCobb et al., 2005). A score of 1 signified a “fully relaxed” cat, and a score of 7 signified a “terrorized” cat (online only [Appendix 2](#)). When the evaluator could see the cat, the respiratory rate was measured in breaths per minute.

The MMYM assessment was performed after the CSS. The assessment began with the cat in its cage. During the greeting approach, the evaluator calmly called to the cat and put a finger into the cat’s cage if the cat did not appear aggressive. The location of the cat with respect to the front or the back of the cage was noted, both during passive observation during the CSS and when the cat was

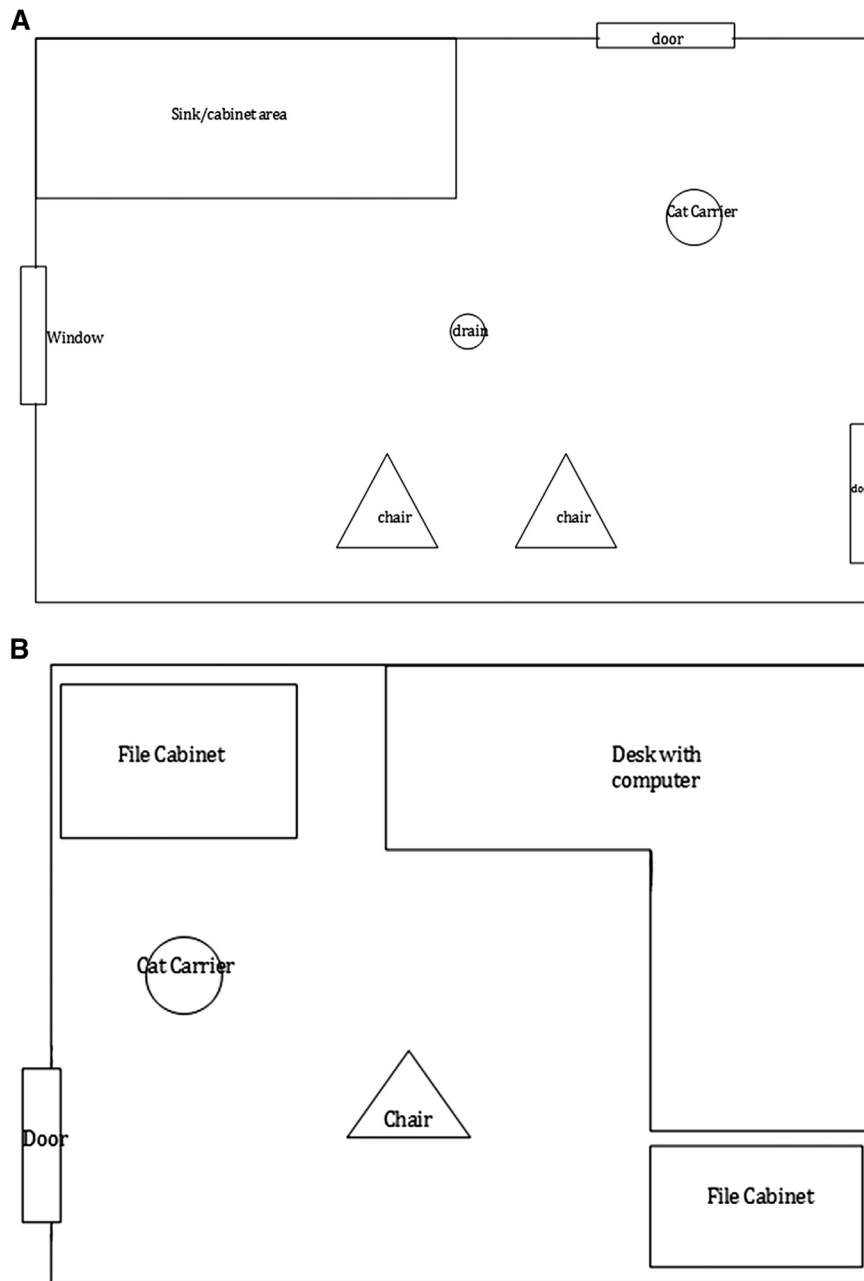


Figure 3. (A) Assessment room used for the MMYM at CSACS. (B) Assessment room used for the MMYM at SCACR. This room is an office in a portable building. MMYM, Modified Meet Your Match; SCACR, Sacramento County Animal Care and Regulation; CSACS, City of Sacramento Animal Care Services.

called to the front of the cage during the MMYM. The reason for noting the location in the cage is that it has been informally noted by some shelter workers that cats will not come to the front of the cage if there is a box in which it could hide, thus decreasing the chances of adoption.

The cat was transferred gently into a standard cardboard cat carrier provided by each shelter. The cat's reaction to this transfer was noted and scored based on difficulty and reaction (see scoring in the online only [Appendix 1](#)). The cat was then brought to a novel room used for testing. In both shelters, this required the cats to be carried outside the building in which they were housed, past dog kennels, and into a room in another building. At SCACR, the room was a vacant carpeted office that contained a desk, computer, chair, and filing cabinet, with one door to the interior hallway. At CSACS,

the room had a linoleum floor, a sink, cabinets, window, and 2 doors, one of which opened to the shelter, whereas the other opened to the outside.

The carrier was opened in a clear part of the room. The evaluator stepped away and sat on the chair for up to 2 minutes, without interacting with the cat, while recording its behavior. If the cat did not exit the carrier within these 2 minutes, the cat was removed from the carrier. If the cat initiated interaction with the evaluator before 1 minute, the time latency of the interaction was recorded by category (<30, 30–60, and >60 seconds).

Immediately after the cat initiated interaction with the evaluator, or after 1 minute if the cat did not initiate interaction with the evaluator, the cat was called and approached by the evaluator using an extended hand and a closed fist. The hand was held near the cat

for 30 seconds or until the cat interacted with the evaluator. At the first interaction, or at 30 seconds, whichever came first, the evaluator opened the extended hand and left the hand still and open for 30 seconds or until the cat rubbed the evaluator. At the cat's first touch or at 30 seconds, whichever came first, the evaluator touched the cat with 4–5 long strokes moving cranially to caudally along the dorsum.

In the next step, a wand toy (a thin and 12-inch wooden dowel with a piece of yarn tied to a commercially available stuffed mouse) and a ping-pong ball were used. The ping-pong ball was tossed into the air within the reach of the cat. The wand was waved in front of the cat in the air and on the ground to initiate play. For cats in the enriched group, the cat's own individual ping-pong ball was used. For cats in the control group, a separate ping-pong ball was used for each cat. Ping-pong balls were washed and reused. Objective descriptions of the play were recorded on the Cat Assessment Data Sheet (online only [Appendix 1](#)).

After the toys were removed and the cat was calm, the cat was gently picked up and hugged against the evaluator's chest for 2 seconds. If the cat was unwilling to be hugged or was aggressive before or during this interaction, this behavior was noted and the cat was not held. The cat was then placed on the ground where the evaluator applied steady but gentle upward pressure to the tail base for 1 second. This step was skipped if the cat had not been hugged.

When the assessment was completed, if the cat showed signs of enjoying the interaction (e.g., back arched, tail raised, purring, head butting, and chirruping [Beaver, 2003]), the evaluator spent approximately 5 minutes with the cat before returning it to its carrier and taking it back to the cage. Assessments varied in total length from 5–15 minutes, depending on the individual cat.

Cats that were overtly ill or that displayed overt aggression in the cage were only evaluated with the CSS.

Statistical analysis

Data were analyzed using Stata SE9 statistical software (Stata-Corp, College Station, TX). A higher MMYM score is thought to be indicative of behaviors related to "valiance" (response to novel stimuli, either relatively fearful or bold) and "gregariousness" (social behavior) in the original MYM, and a higher CSS is thought to be indicative of higher stress. Chi-square or Fisher exact tests were used to evaluate the relationship between categorical variables. A Friedman analysis of variance (ANOVA) was performed to test for differences in CSS and MMYM over time. Wilcoxon rank sum tests were performed on the CSS and MMYM scores with respect to shelter, treatment group, days in the shelter, sex, fecal output, and location of cat in the cage. Kendall rank correlations were used to evaluate the relationship between the behavioral evaluation scores. Significance was set a priori at $P < 0.05$, and all tests were 2-tailed.

Results

Twenty-five cats were initially evaluated at 2 separate municipal shelters—15 cats at CSACS and 10 cats at SCACR. There was no difference in the age and sex of the cats at the 2 shelters. All cats were classified as either domestic shorthair or domestic longhair, based on visual identification or owner-relinquishment records. Eleven cats received no enrichment (6 SCACR and 5 CSACS), and 14 cats received enrichment (9 SCACR and 5 CSACS). Twelve cats were originally assigned to the control group and 13 assigned to the treatment group, but shelter employees gave a hiding box to 1 cat immediately after the first day of testing, so this cat was assigned to the treatment group.

All cats were assessed using the CSS on all assessment days. Twenty-four cats were evaluated with the MMYM evaluation on

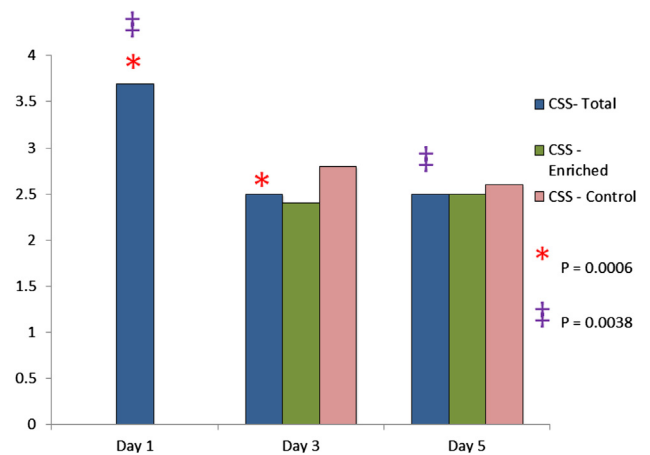


Figure 4. Change in CSS between days 1 and 5 in cats with and without enrichment. CSS, Cat Stress Score.

day 1. On day 3, 23 cats were evaluated with the MMYM. On day 5, only 22 cats were evaluated with the MMYM. Cats not completing all days of the evaluation were not included in the analysis and results.

The change in CSS and MMYM scores from day 1 to day 3 was significant (Friedman ANOVA, CSS: $P = 0.0001$; MMYM: $P = 0.015$). There was a significant decrease in CSS ($z = 3.441$, $P = 0.0006$) and a significant increase in MMYM scores ($z = -2.55$, $P = 0.011$) from days 1 to 3 and days 1 to 5, respectively ($z = 2.89$, $P = 0.0038$; $z = -2.54$, $P = 0.0111$) (Figures 4 and 5). There was no significant difference between the shelters in the CSS and MMYM scores for any testing day. Results for all cats are shown in [Tables 1 and 2](#), respectively.

In a pairwise comparison of scores from the CSS and MMYM, there was a negative correlation between the scores on day 1 ($z = -85$, $P = 0.045$) and day 3 ($z = -72$, $P = 0.049$) but not on day 5 ($z = -33$, $P = 0.32$). There was no difference in CSS and MMYM scores between cats in the enrichment and control groups on day 3 (CSS: $z = 0.79$, $P = 0.432$; MMYM: $z = 0.869$, $P = 0.385$) and day 5 (CSS: $z = -0.302$, $P = 0.763$) ([Table 3](#)). There was no relationship between the scores from the CSS or MMYM and age, sex, or food intake (CSS only).

Cats in the enrichment group were no less likely to be in the front of the cage on day 5 after intake, either when passively observed or called to the front, than were cats in the control group (Fisher exact test, $P = 1.0$). There was a significant association between having low MMYM scores on day 5 and not defecating on day 5 ($z = -2.51$, $P = 0.0122$).

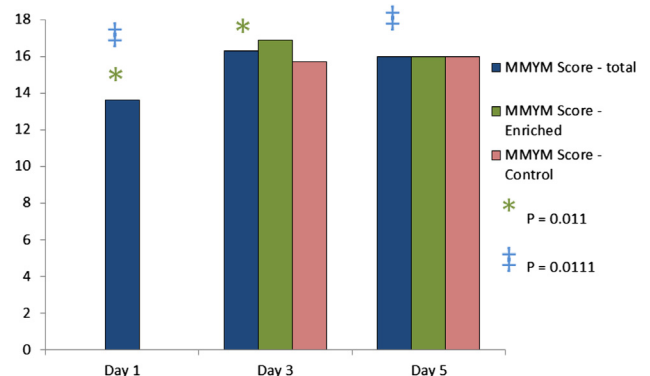


Figure 5. Change in the MMYM score of cats between days 1 and 5 in cats with and without enrichment. MMYM, Modified Meet Your Match.

Table 1
Demographic information, CSS, and MMYM evaluation results

Variable	Day 1	Day 3	Day 5		
	All cats (n = 25)	Enriched (n = 13)	Control (n = 12)	Enriched (n = 14)	Control (n = 11)
Sex					
Male	9	5	4	5	4
Female	16	8	8	9	7
CSS					
Median	4 (0-6)	2 (0-5)	3 (0-5)	2 (0-4)	3 (2-4)
95% Confidence interval	3-5	2-3.9	0.8-3.6	2-3.3	2-3.2
MMYM total score					
Median	13 (6-21) (n = 24)	16 (11-21) (n = 12)	18 (10-19) (n = 12)	16 (11-21) (n = 12)	16 (11-23) (n = 10)
95% Confidence interval	10.1-15.9	13-19	16-18.2	14.1-17.9	13-19
Feces present					
Yes	4	8	8	9	5
No	21	5	4	5	6
Location of cat in cage when called					
Back	17	9	9	10	7
Front	8	4	3	4	4
One-fourth of food eaten					
Yes	15	11	10	10	8
No	10	2	1	3	2

CSS, Cat Stress Score; MMYM, Modified Meet Your Match.

Only 7 cats were adopted. The shelter staff decided to euthanize the remaining 18 cats because of unspecified behavioral problems (2 CSACS and 3 SCACR), illness (4 CSACS and 8 SCACR), or space constraints (1 CSACS and 0 SCACR). There was no relationship between behavioral scores and eventual outcome.

Discussion

We attempted to determine how quickly newly relinquished cats' behaviors change and whether enrichment can alter cats' behaviors.

The addition of hiding boxes and toys did not have an effect on scores across the evaluation period. The lack of a statistically significant result may be because shelter environments are too stressful for this level of intervention to make a measurable difference. [McCobb](#)

[et al. \(2005\)](#), in a study using the CSS, concluded that differences in enrichment can make a difference in stress levels of cats. The small number of cats we were able to study at each shelter may have also been insufficient for small effects to be detected.

Based on our results, if time spent evaluating cats is at a premium at a shelter, and if the cat's time in the shelter is limited by factors like as overcrowding, it would be beneficial to do the evaluations no earlier than day 3. Other studies have shown further decrements in stress measure if evaluated beyond 5 days after entering into a shelter ([Kry and Casey, 2007](#)).

The MMYM evaluation used in this study was modified for assessment purposes. In the original MYM Feline-ality, cats were assessed based on valiance and independent-gregariousness scales. The scores were then used to assign 1 of 6 possible personalities, with the intent that these will help match the cats to adopters. In

Table 2
CSS for individual cats

Cat ID	Sex	Enriched	Shelter	CSS day 1	CSS day 3	CSS day 5	Felscore 1	Felscore 2	Felscore 3
A318470	M	N	SCACR	5	0	4	16	16	13
A318548	F	N	SCACR	3	2	2	14	18	16
A319899	M	N	SCACR	5	2	2	12	19	17
A320384	F	N	SCACR	2	2	2	17	18	13
A320392	F	N	SCACR	1	3	2	20	18	20
A293670	MN	N	CSACS	4	3	3	15	17	16
A502162	F	N	CSACS	4	3	2	21	19	16
A503904	F	N	CSACS	3	3	2	19	18	
A503906	F	N	CSACS	4	3	2	20	17	23
A504076	F	N	CSACS	5	4	2	8	10	11
A504079	F	N	CSACS	6	4	4	6	16	15
A318476	F	Y	SCACR	4	3	2	15	13	16
A318550	M	Y	SCACR	4	3	3	13	20	18
A319854	M	Y	SCACR	3	2	2	11	16	18
A320391	F	Y	SCACR	5	2	2	14	19	21
A320427	F	Y	SCACR	2	2	2	19	19	16
A502161	MN	Y	CSACS	5	5	4	13	11	14
A503876	M	Y	CSACS	0	0	3	7	15	15
A503912	F	Y	CSACS	3	3	3	16	16	16
A503921	F	Y	CSACS	6	4	3	9	12	17
A504005	F	Y	CSACS	5	0	3	10	13	14
A504075	F	Y	CSACS	6	5	0	9	13	11
A504207	F	Y	CSACS	2	2	1	0		
A504223	MN	Y	CSACS	8	0	4	11	21	16
A504224	F	Y	CSACS	6	5	4	6		

CSS, Cat Stress Score; M, male; F, female; MN, male neutered; SCACR, Sacramento County Animal Care and Regulation; CSACS, City of Sacramento Animal Care Services; N, no; Y, yes.

Table 3
MMYM scores for individual cats

Cat ID	Sex	Enriched	Shelter	MMYM day 1	MMYM day 3	MMYM day 5
A318470	M	N	SCACR	16	16	13
A318548	F	N	SCACR	14	18	16
A319899	M	N	SCACR	12	19	17
A320384	F	N	SCACR	17	18	13
A320392	F	N	SCACR	20	18	20
A293670	MN	N	CSACS	15	17	16
A502162	F	N	CSACS	21	19	16
A503904	F	N	CSACS	19	18	a
A503906	F	N	CSACS	20	17	23
A504076	F	N	CSACS	8	10	11
A504079	F	N	CSACS	6	16	15
A318476	F	Y	SCACR	15	13	16
A318550	M	Y	SCACR	13	20	18
A319854	M	Y	SCACR	11	16	18
A320391	F	Y	SCACR	14	19	21
A320427	F	Y	SCACR	19	19	16
A502161	MN	Y	CSACS	13	11	14
A503876	M	Y	CSACS	7	15	15
A503912	F	Y	CSACS	16	16	16
A503921	F	Y	CSACS	9	12	17
A504005	F	Y	CSACS	10	13	14
A504075	F	Y	CSACS	9	13	11
A504207	F	Y	CSACS	0	b	b
A504223	MN	Y	CSACS	11	21	16
A504224	F	Y	CSACS	6	a	a

MMYM, Modified Meet Your Match; M, male; F, female; MN, male neutered; N, no; Y, yes; SCACR, Sacramento County Animal Care and Regulation; CSACS, City of Sacramento Animal Care Services.

^a Not evaluated because of overt illness.

^b Not evaluated because of aggression.

our study, we simply calculated scores without separating the valiance or independent-gregarious scales.

Cats in the enriched group were no less likely to be at the front of the cage than those not given a box. Shelter employees may be concerned about using hiding boxes because the cat may not be seen by the adopting public, but in our study, these cats came to the front of the cage when called. Cats who approach the front of the cage may be less stressed and so able to overcome any concern related to the unfamiliar person standing in front of its cage. Providing hiding boxes may facilitate this process. Based on our data, we would recommend that veterinary clinics use such boxes, even if the cats in the boxes must be checked. The ability to hide from bright lights and noise outweighs any potential problems, as has been shown for laboratory cats and people (Carlstead et al., 1993; Tedstone and Tarrier, 2003).

To avoid spreading infection and prevent injury to the evaluator, ill and aggressive cats were only assessed using the CSS. Accordingly, a number of cats entered into the study did not have the MMYM performed. Loss of these data may have had an effect on the final results of the study and on our ability to detect potential effects of enrichment.

Shelters are not controlled laboratory environments. Effects of shelter staff, the public, and cage setup were substantial and difficult to quantify and control. At CSACS, the room used for the behavioral assessments was approved by the American Society for the Prevention of Cruelty to Animals as appropriate for performing the MMYM evaluation. The cages at CSACS have 2 separate (cubby) areas and a perch, which increase the living space of the cat. SCACR had traditional metal cages without perches. Both shelters used pine litter (Feline Pine; Church & Dwight Co., Inc., Princeton, NJ) for their litterbox substrate. Cats in both shelters had similar CSS, which may show that they were equally stressed. The path followed to transport the cats to the assessment room at both shelters

inevitably went past dog kennels, which may have further stressed the cats. A larger study, with more cats and shelters, could potentially help to mitigate these concerns.

Conclusion

Cat stress levels, as evaluated using 2 standardized tests, varied over 5 days in a shelter. Scores significantly improved between day 1 and day 3, but there was no significant change in scores between day 3 and day 5. We conclude that cats should be given at least 3 days before any behavioral assessment is performed.

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Supplementary material

Supplementary data associated with this article can be found in the online version at <http://dx.doi.org/10.1016/j.jveb.2011.10.003>.

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