Exploratory study of cat adoption in families of children with autism: Impact on children's social skills and anxiety

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ABSTRACT

Purpose: The diagnosis of Autism Spectrum Disorder (ASD) occurs in one in 54 children and companion animals (CA) are common in families of children with ASD. Despite evidence of CA ownership benefits for children with ASD, little is known about cats. The purpose was to explore the impact of shelter cat adoption by families of children with ASD.

Design and methods: This was the first randomized controlled trial of adoption of a temperament screened cat by families of children with ASD. Families assigned to the treatment group adopted a cat and were followed for 18 weeks. Families assigned to the control group were followed for 18 weeks without intervention, then converted to treatment, by adopting a cat and were followed another 18 weeks. Adopted cats were screened using the Feline Temperament Profile to identify a calm temperament. Surveys measured children's social skills and anxiety and parent/child cat bonding.

Results: Our study (N = 11) found cat adoption was associated with greater Empathy and less Separation Anxiety for children with ASD, along with fewer problem behaviors including Externalizing, Bullying and Hyperactivity/Inattention. Parents and children reported strong bonds to the cats.

Conclusion: This exploratory study found introduction of a cat into the home may have a positive impact on children with ASD and their parents. Based on this intial finding, future studies with larger sample sizes are recommended.

Practice implications: If parents of children with ASD are considering cat adoption, health care providers might consider recommending adoption of a cat screened for calm temperament.

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Background

Companion animals (CAs) are common in families of children with Autism Spectrum Disorder (ASD). However, research has primarily focused on dogs with very little known about cats. Exploring the impact of cats in the home will aid families in the decision-making process of CA ownership.

Approximately one in 54 children are diagnosed with ASD (Maaenner et al., 2020). Children with ASD are challenged by social communication and repetitive behaviors, with most children diagnosed in early childhood (American Psychiatric Association, 2013). In addition, psychiatric comorbidities, particularly anxiety, occur frequently in children with ASD (Jennett, Vasa, & Hagopian, 2013; Muskens, Velders, & Staal, 2017; Spoke, Maenner, Christensen, Kurzius-Spencer, & Schieve, 2018; van Steensel & Heeman, 2017). This combination of symptoms has a significant impact on the child and family as a whole (Hayes & Watson, 2013; Lavelle et al., 2014). A wide variety of therapies and treatment approaches are used to alleviate symptoms of ASD. Many treatments aid children by improving social skills. Despite these interventions, young adults with ASD experience high rates of isolation and families report stress levels increase as children age (; (Taylor and Seltzer, 2011; Cheak-Zamora &Teti, 2015). CAs may provide a unique method of addressing social skill deficits and anxiety for children with ASD.

Companion animals in families

CAs are found in 67% of U.S. households and owners report benefits of companionship, and affection, while often identifying the animals as

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members of the family (American Pet Products Association, 2019). Among typically developing children, CAs are identified as sources of social support and many children name their CAs when asked about close relationships (Bryant, 1990; Melson, Swarz, & G. F., 1994). CAs have also been associated with decreased stress in typically developing children (Gadomski et al., 2015; Hansen, Messinger, Baun, & Megel, 1999). While research examining CA benefits for children with ASD is less extensive than the typically developing population, evidence suggests CAs may provide benefits.

Children with autism spectrum disorder and companion animals in families

CAs have been associated with improving social skills and positive displays of emotion for children with ASD (O'Haire, 2013). Children with ASD living with CAs were found to have greater social assertion, than children without CAs and their parents reported children benefiting from companionship, stress relief and learning responsibility from animal caretaking (Carlisle, 2015) ( ). Another study of children with ASD found introducing a new CA was associated with greater child prosocial behaviors (Grandgeorge et al., 2012).

In addition to child anxiety (Jennett et al., 2013), parents of children with ASD have greater stress than parents of children with other health issues (Postorino, Gillespie, Lecavalier, Smith, & Johnson, 2019; Schieve et al., 2011). Mothers report high levels of burden, low levels of well-being and poor quality of parent-child relationships (Taylor, & Taylor & Seltzer, 2011). These factors become worse when children have problem behaviors (Kring, Greenberg, & Seltzer, 2008). While mothers seem to experience the highest rates of parental stress, all family members report high stress rates (Lavelle et al., 2014; Ward, 2016). Stress in adults has been closely related to poor health (Barry et al., 2020). Parents' stress often stems from fear their children will be unable to manage their own safety and health care needs independently as they age (Cheak-Zamora, Teti, & First, 2015). Minimizing stress is imperative for the health of families of children with ASD. Lower parenting stress has been associated with living with CAs for parents of children with ASD (Allen, 2003; Carlisle et al., 2020; Hansen et al., 1999; Wright et al., 2015). Identifying a well-matched CA may aid stress relief.

While CAs can be beneficial to the entire family, parents of children with ASD frequently report being overwhelmed and lacking the necessary time for self and family care (Carlisle, 2015)( ). For a CA to be beneficial to the family and alleviate stress for parents and children, the CA must be a good fit for the family. Housecats may be exceptionally well suited for families of children with ASD. A quiet calm tempered cat may increase the likelihood of positive outcomes for cat integration into families of children with ASD. No studies have examined attachment to cats in children with ASD and their parents.

Cats as companion animals

CA temperament may play a role in the benefits for children with ASD. Benefits have been associated with trained CAs such as those in animal assisted therapy (O'Haire, 2017), and with service dogs (Burrows, Adams, & Spiers, 2008; Viau, Fecteau, Champagne, Walker, & Lupien, 2010). Animals working in those settings are typically described as calm and quiet. Children with ASD commonly present with hypo and/or hyper-sensory issues, with sound over-reactivity being identified most often (Klintwall et al., 2011). Loud or overly playful CAs may heighten the child's environmental sensitivity and lead to additional behavioral problems. Parents of some children with ASD have reported their children had sensory issues related to dogs, which were large, loud and boisterous (Carlisle, 2014). The benefits associated with CAs for some children with ASD could be related to calm and quiet CA behavior. Housecats are a species known for their calm and quiet behavior. A self-report parent survey study by Hart et al. (2018) indicated cats younger than three years were more likely to be affectionate than

older cats. Children with ASD were described as having affectionate interactions with their cats and parents perceived their cats as providing a calming effect on their children (Hart et al., 2018).

Ease of care for cat owners, may increase the likelihood of positive outcomes for cat integration into families of children with ASD. A further benefit of a cat, compared with other CAs, may be flexibility for families. Parents of children with ASD reported travel limitations for dog ownership were a burden (Carlisle, 2014). The ability of cats to use a litter box and lack of the need for a daily walk may decrease parental burden.

Purpose

The overall purpose of this study was to investigate the effect of the introduction of a temperament screened shelter cat into the family of a child with ASD on child social skills and anxiety. This was a randomized controlled trial, which allowed the benefit of removing group selection bias. Toward this end, we posited the following hypotheses:

Hypothesis 1. Children with ASD will have more social skills after the introduction of a shelter cat into their family.

Hypothesis 2. Children with ASD will have lower anxiety after the introduction of a shelter cat into their family.

Hypothesis 3. Children with ASD and their parents will develop a bond with their adopted cat.

Methods

This study used a two-group randomized, repeated measures design with a delayed treatment control group. Shelter cats were adopted by families randomized to the treatment group, while the control group had no cat (Fig. 1). Participants randomized to the control group converted to the treatment group after 18 weeks and adopted a cat. We selected the 18-week period because children with ASD have been found to demonstrate behavior changes in 16 weeks (McNally Keehn, Lincoln, Brown, & Chavira, 2013). We posited such changes would be measurable by 18 weeks.

Our study complied with the university's Health Sciences Institutional Review Board (protocol #2008460) for human participants, and Animal Care and Use Committee (protocol #9583) meeting ethical standards for the cats. The study was registered with clinicaltrials.gov #NCT03625297.

Families were provided with cat supplies including a cat carrier, toys, litter box, along with food and litter throughout the study. Each family also received a climbing tree with scratching posts and a small soft covered apartment to serve as a quiet space for the cats. Educational material was provided in written and verbal forms including information on introducing a cat to a new home, litter box practices, cat play, and entertaining guests, which was sourced from The Ohio State Indoor Pet Initiative (The Ohio State Indoor Pet Initiative, 2018). Families were also provided access to a certified veterinary behaviorist who was available to answer questions or concerns about their cat's behavior.

Sample

The sample included children with ASD ages 6–14 years, and the child's primary caregiver (hereafter referred to as the parent). Human participants were recruited using contact information of parents from the database of the University of Missouri Thompson Center for Autism and Neurodevelopmental Disorders for children meeting inclusion criteria. We also promoted the study using email, newsletters, fliers, social media, and websites serving the geographical recruitment area.

Study inclusion criteria included English-speaking participants living less than 125 miles from the study site. Our exclusion criteria were
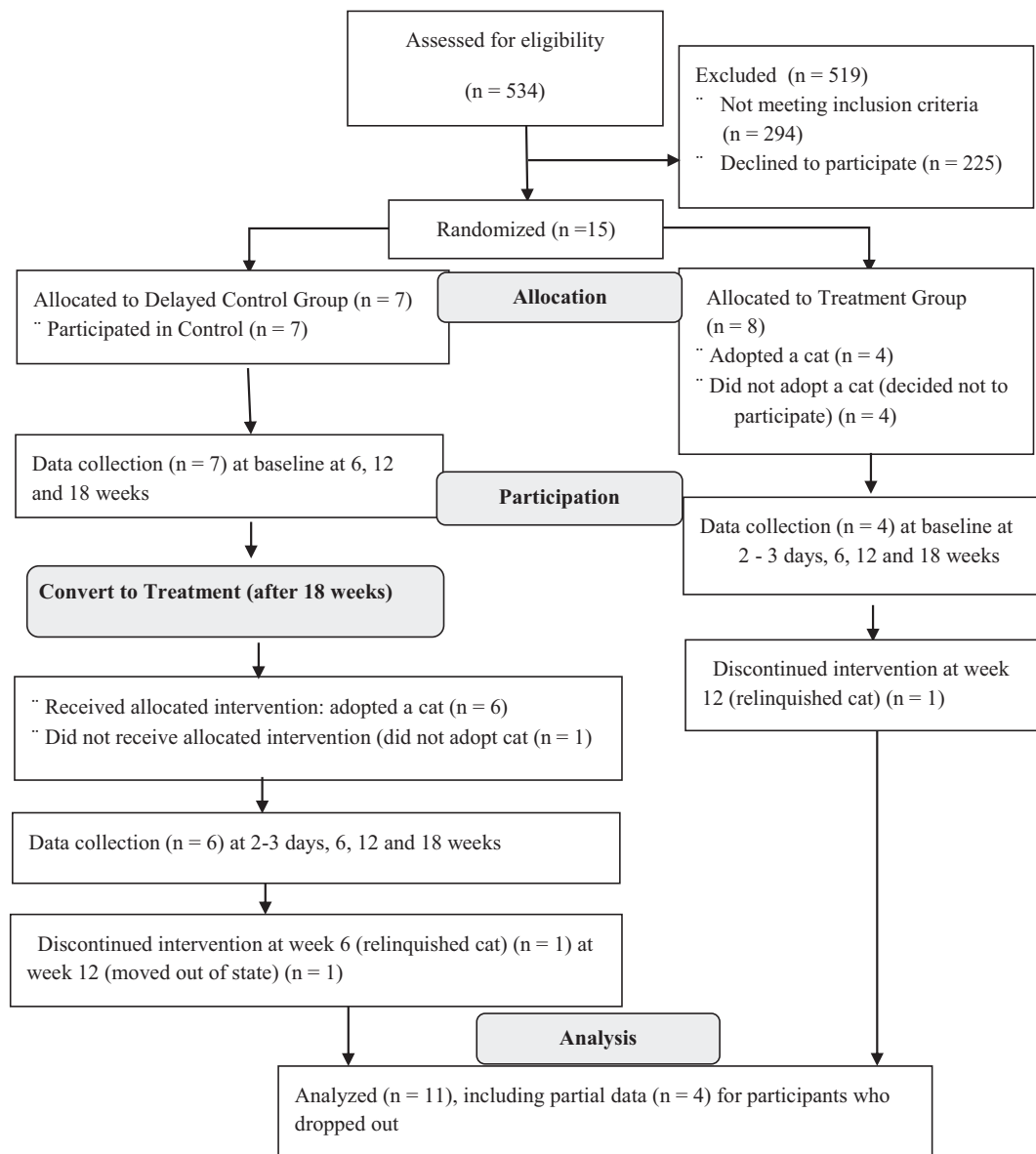
Fig. 1. CONSORT Flow Diagram.

any family with a household member having cat allergies, dislike of cats or history of harming any animal. Families who currently lived with a cat were also excluded. Parents interested in participating were asked questions about these criteria during the consent process. Parents consented and children assented to adopt a shelter cat. Parents were required to complete the adoption procedure of the animal shelter and be approved for cat adoption. Parents agreed to assume responsibility for cat veterinary medical care upon adoption. Parents were informed they would be terminated from the study and the cat removed if evidence showed a cat's welfare was in jeopardy.

The cats were obtained from two local animal shelters. Cat inclusion criteria required cats to be 10 months to 4 years of age (estimated age since unknown in most cases). This age was chosen given adult cat temperament has not been found to significantly change after age eight months (Siegford, Walshaw, Brunner, & Zanella, 2003). Younger cats were also selected based on findings suggesting younger cats were engaged more with children with ASD than were older cats (Hart et al., 2018). Cats were current on vaccinations, spayed/neutered and free of health concerns at the time of adoption. All cats were assessed by study staff using the Feline Temperament Profile (FTP) to aid in

assessing cat temperament (Siegford et al., 2003). To be eligible for adoption, cats were required to score at least 20 on the FTP, indicating docile temperament.

Instruments

Demographics

Parents completed a 19-item investigator developed Demographic Questionnaire (DQ) including parent's marital status, education and income, and parent's/child's age, gender, race/ethnicity, along with total number of children in the home.

Child outcome variables

We used the Social Skills Improvement System Rating Scale (SSiSRS) to address Hypothesis 1. The SSiSRS is a 79-item instrument completed by parents to assess children's Social Skills (subscale items Communication, Cooperation, Assertion, Responsibility, Empathy, Engagement, and Self-control), and Problem Behaviors (subscale items Externalizing,

Bullying, Hyperactivity/Inattention, Internalizing, and Autism Spectrum Behaviors) The SSiSRS includes a Likert scale with response options "never," "seldom," "often," and "almost always" (Gresham & Elliott, 2008). The Cronbach's alpha for the SSiSRS-parent-completed version was 0.93 and the test-retest reliability coefficient for Total Social Skills was 0.84. (Gresham, Elliott, Vance, & Cook, 2011). The coefficient alpha values for Total Social Skills from our data ranged from 0.89 to 0.97 across different time points. The SSiSRS also provided data in our study regarding children's Problem Behaviors (coefficient alpha values for Total Problem Behaviors across different time points from our data ranged from 0.71 to 0.94).

The Screen for Child Anxiety Related Emotional Disorders (SCARED) was used to address Hypothesis 2. The SCARED is a 41-item, parent-completed instrument measuring children's anxiety and uses a Likert scale with response options "not true or hardly ever true," "somewhat true or sometimes true," and "very true or often true" with lower score indicating less anxiety (Birmaher et al., 1999). SCARED subscale items include Externalizing, Bullying, Hyperactivity/Inattention, Internalizing and Autism Spectrum. The coefficient alpha for the parent-completed version was 0.90 (Birmaher et al., 1999). Due to an error, one item was inadvertently omitted, thus including only 40-items on the SCARED. The coefficient alpha values from our data for the Total SCARED ranged from 0.71 to 0.94 across different time points.

Human-animal bond

The Lexington Attachment to Pets Scale (LAPS) and Companion Animal Bonding Scale (CABS) were used to measure attachment to the cats for parents and children respectively, addressing Hypothesis 3. The LAPS is a 23-item instrument measuring attachment to pets and has a Likert scale with response options "strongly agree," "agree somewhat," "disagree somewhat," "disagree strongly," and "don't know, refuse" (Garrity, Stallones, Marx, & Johnson, 1989). The LAPS was significantly and positively correlated with Bradshaw's Attachment Scale for women's attachment to their cats ($rho = 0.5969$, $p < .0001$, $n = 294$) (Stammbach & Turner, 1999). A higher score equals a stronger attachment. The coefficient alphas based on our data ranged from 0.87 to 0.97 across different time points.

The CABS is an eight-item instrument measuring the bond between people and CAs (Poresky, Hendrix, Hosier, & Samuelson, 1987). The CABS has Likert scale response options of "never," "rarely," "often," "generally," and "always" and has been used reliably in children with ASD with Cronbach alpha estimates of 0.82 and 0.77 (Carlisle, 2015)(). A higher score equals a stronger attachment. The coefficient alpha values based on our data ranged from 0.71 to 0.90 across different time points. In cases where parents determined their child verbally capable of responding to questions, the child completed this instrument. If the child was determined not capable, the parent completed the CABS for the child.

Feline temperament

The Feline Temperament Profile (FTP) provided the measure of inclusion criterion for the cats. The FTP is a standardized temperament test of cat sociability, aggressiveness, flexibility, and cat-human compatibility (Siegford et al., 2003). No statistically significant difference was found in cats testing with acceptable scores before adoption, and at three and six months after adoption ($F = 1.29$. $P = .28$) (Siegford et al., 2003). The FTP scores are stable in cats over eight months of age (Siegford et al., 2003).

Data collection

Pre-screening of human participants occurred via telephone with study staff to ensure inclusion criteria were met. Of 534 parents contacted and offered study participation information, 294 did not meet inclusion criteria (predominantly due to allergies or already cat owning) while 225 declined participation with most common reasons being they did not want a cat or lived in housing which prohibited pets. Fifteen parents agreed to participate, however during consent process, four parents declined so that 11 families enrolled. Families were randomized to treatment ($n = 4$) or delayed treatment control groups ($n = 7$). All data collection occurred in participant homes where parental consent and child assent were obtained and baseline data collected (DQ, SSiSRS and SCARED). The treatment group immediately adopted a cat. During treatment phase, data were collected at 2–3 days post adoption (LAPS and CABS) and at weeks 6, 12 and 18 (SSiSRS, SCARED, LAPS and CABS). Study staff read the CABS items to the children, if verbally capable, and a graphic depiction on an 8 ½ X 11 in. paper with progressively larger solid black colored circles was used. Study staff pointed to each circle as they asked children to respond to the Likert rating for each item, with the largest circle representing "always" and the smallest circle representing "never." Families in the control group participated in data collection at weeks 6, 12 and 18 (SSiSRS and SCARED), then converted to the treatment phase and adopted a cat and participated in an additional 18 weeks of data collection.

Cats were scored by study staff using the FTP at two participating shelters and those who had a score of at least 20 were identified as eligible for study adoption. Families in the treatment phase traveled to the shelter at a time convenient for them and selected from among eligible cats.

Data analysis

The IBM Statistical Package for Social Sciences Statistics Version 25 was used for analysis. Mean scores were calculated at each data point for total and all subscales of each instrument. A significance level of 0.05 was considered statistically significant for all analyses.

To address Hypothesis 1, 2 and 3, repeated measures analysis of variance (ANOVA) were used. To test Hypothesis 1 and 2, data from the SSiSRS and SCARED were analyzed for the control phase and the treatment phase separately. For Hypothesis 3, data from the CABS and LAPS were analyzed during the treatment phase only, because they apply to cat ownership.

For each of the variables from the SSiSRS and SCARED, two separate repeated ANOVAs were conducted for the control phase and treatment phase respectively. For CABS and LAPS, a repeated measures ANOVA was conducted for each variable since data were only collected during the treatment phase. To assess internal consistency of items, the Cronbach's alpha coefficients were calculated for each instrument at each data collection time point. As a design quality control check, no statistically significant time effect on SSiSRS and SCARED during the control phase was identified.

Results

Eleven families participated in the study; four participants were in the initial treatment group and seven were in the delayed treatment control group. One family assigned to the delayed treatment control group left the study before cat adoption. Of the ten families that adopted cats, one child moved out of state 12 weeks after adoption to live with a different parent and took the cat to the new home. Two of the families relinquished their cats to the adopting shelters. In one case, the family reported relinquishing the cat at six weeks because the cat was eliminating outside the litter box and the child was not bonding with the cat. According to study staff, this parent voiced expectations the child would assume care of the cat after adoption, yet the child was reported having difficulty with these tasks. In the other family, the cat was relinquished at 12 weeks. The parent reported the child liked the cat but the cat cried while the child was gone at school and the parent did not like this behavior.

Demographic characteristics are presented in Table 1. The control group, consisting of seven participants, was a delayed treatment group. They were combined with the initial treatment group, consisting of four participants, to provide data for the total treatment condition. Therefore, the "treatment" condition includes data from all participants because all received treatment. Demographic characteristics for the control (i.e., delayed treatment) group and the initial treatment group were similar. We also included a single item question of whether the child with ASD was afraid of animals, and if so, what animal(s). Three parents responded positively saying the fear was of dogs, and one of spiders.

Hypothesis 1

Children with ASD will have more social skills after the introduction of a shelter cat into their family. This hypothesis was partially supported by data from the SSiSRS instrument. In the control phase, there was no statistically significant time effect on Total Social Skills, Total Problem Behaviors, or any of the subscales. During the treatment phase there was statistically significant time effect for the subscale of Empathy (F $(3,18) = 5.61$, $p = .007$). More specifically, compared with baseline, Empathy was statistically significantly higher at week 12 ($p = .006$), and at week 18 ($p = .018$). Mean scores for Total Social Skills and subscales of Cooperation and Responsibility improved but did not reach statistical significance. As to Problem Behaviors, during the treatment phase there was statistically significant time effect for the subscales of Externalizing ($F(3,18) = 4.24$, $p = .020$), Bullying ($F(3,18) = 4.06$, $p = .023$) and Hyperactivity/Inattention ($F(3,18) = 3.16$, $p = .050$). Compared with baseline, Bullying was statistically significantly lower at week 6 ($p = .034$) and at week 12 ($p = .033$) and Hyperactivity/

Inattention was statistically significantly lower at week 6 ($p = .042$) and week 18 ($p = .037$). Mean scores were lower over time for Total Problem Behaviors, but this did not reach statistical significance. Tables 2 and 3 present the descriptive statistics of variables at each time point for Social Skills and Problem Behaviors, respectively.

Hypothesis 2

Children with ASD will have less anxiety after the introduction of a shelter cat into their family. Hypothesis 2 was partially supported by data from the SCARED instrument. In the control phase, there was no statistically significant time effect on the Total SCARED or any of the subscales. During the treatment phase, there was a statistically significant time effect for Separation Anxiety in the predicted direction. ($F(3,18) = 4.57$, $p = .015$). The drop in Separation Anxiety was statistically significant from baseline to week 6 ($p = .047$) and remained at similar levels after week 6 at weeks 12 and 18. Mean values were lower comparing baseline with week 18, but there was no statistically significant time effect for the subscales Panic Disorder, School Avoidance, Social Anxiety, or Generalized Anxiety. Table 4 presents the descriptive statistics of variables at each time point.

Hypothesis 3

Children with ASD and their parents will develop a bond with their adopted cat. At two to three days after adopting a cat, parents and children reported strong bonds with their cat for LAPS and CABS, respectively. There were no statistically significant changes in either the LAPS or CABS bonding scores over time. Mean scores at each time point are shown in Table 5.

Discussion

The aim of this exploratory study was to identify whether children with ASD living in a family that adopted a temperament screened shelter cat would have increased social skills and decreased anxiety, and whether the child and parents would bond with the cat. In our study we found a significant time effect increase in Empathy after cat

Table 1
Demographic characteristics of parents and children.

	Cat Adopters $n = 10$	Control $n = 7$
Parents:		
Age (years	Range 23–61, Mean 37.20	Range 23–61, Mean 38.86
Gender - female	10	7
Number of children in home	Range 1–7, Mean 3.40	Range 1–6, Mean 3.71
Race/Ethnicity:		
African American	1	1
Caucasian/Non-Hispanic	7	5
Native American	2	1
Family income:		
<$39,999	1	2
$40–64,999	3	2
$65–99,999	3	1
>$100,000	0	1
Education:		
High school graduate	1	1
Some college	5	3
College degree	4	2
Graduate/professional degree	0	1
Marital status:		
Married	6	5
Divorced/separated	3	2
Never married	1	1
Children:		
Age (years)	Range 6–14, Mean 9.00	Range 6–14, Mean 8.57
Gender:		
Female	2	2
Male	8	5
Race/Ethnicity:		
African American	1	1
Caucasian/Non-Hispanic	7	5
Native American	2	1
Live with CA, other than cat	6	4
Afraid of animals	3	0

Table 2
Descriptive statistics for the Social Skills items for each time point.

	Treatment (Cat adopters)			
SSiSRS	Baseline	6 weeks	12 weeks	18 weeks
Total social skills				
Mean (SD)	2.57 (0.43)	2.60 (0.37)	2.66 (0.33)	2.68 (0.27)
Range	1.85–3.09	2.09–3.13	2.13–3.13	2.30–3.13
Communication				
Mean (SD)	2.61 (0.39)	2.79 (0.37)	2.73 (0.28)	2.76 (0.33)
Range	2.00–3.14	2.14–3.29	2.43–3.29	2.14–3.14
Cooperation				
Mean (SD)	2.73 (0.44)	2.81 (0.29)	2.81 (0.28)	2.88 (0.19)
Range	2.00–3.50	2.33–3.33	2.17–3.17	2.67–3.17
Assertion				
Mean (SD)	2.69 (0.66)	2.57 (0.63)	2.68 (0.57)	2.73 (0.58)
Range	1.43–3.43	1.71–3.57	2.00–3.43	2.00–3.57
Responsibility				
Mean (SD)	2.62 (0.48)	2.72 (0.42)	2.76 (0.35)	2.83 (0.17)
Range	2.00–3.17	2.17–3.50	2.17–3.17	2.50–3.50
Empathy *				
Mean (SD)	2.62 (0.68)	2.76 (0.67)	2.89 (0.68)	2.79 (0.60)
Range	1.67–3.83	1.67–3.67	2.00–3.83	2.17–3.50
Engagement				
Mean (SD)	2.53 (0.74)	2.46 (0.64)	2.52 (0.63)	2.47 (0.44)
Range	1.14–3.29	1.57–3.14	1.57–3.29	1.71–3.00
Self-control				
Mean (SD)	2.23 (0.45)	2.16 (0.34)	2.33 (0.44)	2.39 (0.43)
Range	1.57–3.14	1.71–2.71	1.57–3.00	1.71–2.86

* indicates variable had a statistically significant time effect at the 0.05 level.

Table 3
Descriptive statistics for the Problem Behavior items for each time point.

SSiSRS	Treatment (Cat adopters)			
	Baseline	6 weeks	12 weeks	18 weeks
Total problem behaviors				
Mean (SD)	2.23 (0.31)	2.11 (0.33)	2.09 (0.036)	2.05 (0.49)
Range	1.85–2.91	1.48–2.45	1.33–2.48	1.06–2.61
Externalizing *				
Mean (SD)	2.40 (0.27)	2.28 (0.38)	2.23 (0.41)	2.12 (0.56)
Range	2.08–3.00	1.50–2.67	1.33–2.58	1.00–2.75
Bullying *				
Mean (SD)	2.28 (0.24)	2.07 (0.34)	2.04 (0.37)	1.99 (0.54)
Range	1.90–2.60	1.40–2.50	1.3–2.40	2.50–1.99
Hyperactivity/Inattention *				
Mean (SD)	2.39 (0.45)	2.27 (0.39)	2.27 (0.40)	2.20 (0.49)
Range	1.43–3.00	1.57–2.71	1.43–2.71	1.14–2.57
Internalizing				
Mean (SD)	2.01 (0.33)	1.94 (0.36)	1.84 (0.39)	1.94 (0.49)
Range	1.57–2.57	1.43–2.43	1.00–2.29	1.00–2.57
Autism spectrum				
Mean (SD)	2.41 (0.39)	2.40 (0.29)	2.41 (0.35)	2.33 (0.29)
Range	1.87–3.07	2.07–2.87	2.00–2.93	2.00–2.73

* indicates variable had a statistically significant time effect at the 0.05 level.

Table 4
Descriptive statistics for the SCARED items for each time point.

SCARED	Treatment (Cat adopters)			
	Baseline	6 weeks	12 weeks	18 weeks
Total SCARED				
Mean (SD)	0.54 (0.28)	0.47 (0.24)	0.54 (0.32)	0.46 (0.33)
Range	0.03–0.88	0.15–0.85	0.03–1.00	0.00–0.90
Panic disorder				
Mean (SD)	0.27 (0.27)	0.24 (0.21)	0.34 (0.31)	0.34 (0.43)
Range	0.00–0.77	0.00–0.54	0.00–0.85	0.00–1.15
School avoidance				
Mean (SD)	0.30 (0.31)	0.32 (0.34)	0.17 (0.28)	0.21 (0.39)
Range	0.00–0.75	0.00–1.00	0.00–0.75	0.00–1.00
Social anxiety				
Mean (SD)	0.73 (0.53)	0.81 (0.55)	0.83 (0.64	0.64 (0.49)
Range	0.00–1.83	0.17–2.00	0.00–1.67	0.00–1.33
*Separation anxiety				
Mean (SD)	0.73 (0.51)	0.54 (0.24)	0.61 (0.43)	0.52 (0.32)
Range	0.00–1.50	0.14–0.86	0.00–1.25	0.00–0.88
Generalized anxiety				
Mean (SD)	0.72 (0.44)	0.59 (0.40)	0.72 (0.57)	0.57 (0.49)
Range	0.00–1.44	0.00–1.33	0.00–1.56	0.00–1.33

* indicates variable had a statistically significant time effect at the 0.05 level.

Table 5
Descriptive statistics for the CABS and LAPS for each time point.

Variables	Treatment (Cat adopters)			
	2–3 days	6 weeks	12 weeks	18 weeks
CABS				
Mean	22.1	23.9	20.6	19.7
Range	11–29	8–33	11–26	8–29
LAPS				
Mean	79.8	85.6	88.2	76.9
Range	38–142	53–135	44–144	49–126

adoption. Previous studies exploring empathy and CAs have had mixed results. Carlisle, 2014 found no significant difference in empathy for children with ASD with CAs versus no CAs. In another study, parents described the relationship between their child with ASD and their dog as helping their child to be more understanding and more empathetic (Harwood, Kaczmarek, & Drake, 2019). Daly and Morton (2006) found children who were bonded with their CAs had greater empathy.

Our study did find a trend in increasing social skills for Total Social Skills, Communication, Cooperation, Assertion, Responsibility and Self-control. Increased social skills in children with ASD have been associated with dogs in animal assisted therapy (Martin & Farnum, 2002; Sams, Fortney, & Willenbring, 2006; Solomon, 2010); however, less is known about CAs in families. One study of children with ASD living with CAs found the children to have greater social skills than those not living with CAs (Carlisle, 2015). In families of typically developing children, parents reported obtaining a CA for the children to learn responsibility (Fifield & Forsyth, 1999). Similarly, parents of children with ASD have reported the ability of their child to learn responsibility as a reason for obtaining a CA (Carlisle, 2014). Our study was able to directly measure changes in responsibility based on children's SSiSRS scores and while we did not find significant increase in Responsibility after the adoption of their cat, we did find a trend in increased Responsibility. Exploring this relationship between CAs and responsibility may be especially meaningful since adolescents with ASD often report having limited independence (Smith, Maenner, & Seltzer, 2012).

In examining differences in problem behaviors for children with ASD and CAs, Viau et al. (2010) found a decrease in problem behaviors for children with ASD after the introduction of a service dog into the family. However, Carlisle, 2014 found no significance difference in problem behaviors for children with ASD who lived with a CA compared with no CA. Our finding of decreased problem behaviors for Externalizing, Bullying and Hyperactivity/Inattention on the SSiSRS was significant for time effect. Externalizing behaviors such as aggression, difficulty in controlling temper and being argumentative are more common in children with ASD than typically developing children (Bauminger, Solomon, & Rogers, 2010). These externalizing behaviors in children with ASD have been ranked by parents as more prevalent than other maladaptive behaviors (Hall & Graff, 2012) and associated with parent stress (Hall & Graff, 2012), so reductions may alleviate parent stress. Attention-deficit/hyperactivity disorder (ADHD) has been identified as a comorbid condition in up to 52% of children with ASD (Montes & Halterman, 2007). Our findings of decreased Hyperactivity/Inattention after cat adoption show promise that cats may provide a calming influence for children with ASD. Additionally, children with ASD presenting with ADHD are more likely to display bullying behavior than typically developing children (Montes & Halterman, 2007). Given those findings, our study provides early exploratory evidence for cat adoption as a support for children with ASD, addressing co-occurring conditions of Bullying and Hyperactivity/Inattention. These findings reflect a need for additional studies to shed light on our results.

Insistence on sameness has been associated with anxiety in children with ASD (Uljarevic, Richdale, Evans, Cai, & Leekam, 2017), yet the introduction of a sentient being (a cat) has not been explored. Fear of animals is a challenge for some children with ASD, but no children in our study were reportedly afraid of cats. In this study, not only did we see no evidence for the disruptive impact of bringing in new cat into the home, we found the environmental change of adopting a cat was associated with significantly less Separation Anxiety. Identifying calm cats for families to adopt, may have alleviated some of the anxiety associated with change.

Measuring a time effect difference in the human-animal bond was challenging since participants reported strong bonds on the second or third day after adopting their cat, with no significant change over time. Other studies have found strong bonds of children with ASD and their CAs (Carlisle, 2015; Harwood et al., 2019). In this study, the addition of a cat to the family may have been exciting for the participants. Other investigators have reported parents of children with ASD may engage their child in a new activity at which time there is enthusiasm, but as time passed, the child lost interest in the activity, or it became burdensome (Claybaugh, Becerra, Deng, Ragusa, & Mataric, 2018). Yet in our study, the strength of the bond was maintained. In our case of the relinquished cat due to reported poor child bond, one factor contributing to poor bond may be that children with ASD often experience

emotional outbursts and have difficulty regulating their emotions (Ashburner, Ziviani, & Rodger, 2010). For some children, these outbursts may lessen the likelihood of bonding, as environmental stress has been associated with behavior problems and fear in cats (Casey & Bradshaw, 2000). Another parent relinquished her cat because it cried while her child was at school, a verbalized undesirable behavior. She reported her son loved the cat, but she may have perceived the benefit to her child was not worth the burden. In our study only one child was reported as not bonding well with their adopted cat, with others acclimating quickly with the children and their parents. Screening cats for a social and calm temperament may have played a key role in the success of these adoptions.

Practice implications

If the family of a child with ASD is considering CA adoption, health care providers might consider recommending consideration of a cat. Housecats are a more socially reserved and quiet CA and thus may be a good match for a child with ASD, while being less burdensome for the parent.

Parents should be coached to have realistic expectations of cat behavior and child caretaking ability. Parents should expect an adjustment period and not relinquish a cat without allowing acclimation time. When interviewing families who are considering or who have recently adopted a cat, the child's responsibility may not improve immediately. In our study, responsibility did not improve until 12 weeks after adoption. Parents may need assistance from their health care provider in establishing progressive and realistic expectations of CA care. If the health care provider learns a CA's behavior is causing family stress, the provider should refer parents to their veterinarian for assistance in behavior modification of the cat.

Shelter staff need to assist families of children with ASD by screening adoptable cats for social and calm temperament. The staff should also discuss with parents the likelihood that cats may be stressed on initial arrival in the home, and it may take 12 weeks for the cat to adapt.

Limitations

A challenge in this study was recruitment. Despite community advertising and the ability to prescreen families for eligibility utilizing a large database only 11 families consented to participation. Therefore, generalization is limited, including the recognized selection bias of those willing to adopt a cat. We also allowed participation by families that had previously owned a cat, creating an additional bias. However, given the prevalence of cat ownership, it would be nearly impossible to conduct the study if we excluded families who never owned a cat. Thus, we allowed this scenario, but excluded families owning a cat at the time of enrollment.

Our sample was small, so while we found several statistically significant changes during the treatment phase, our study was underpowered and thus limiting time effect findings. Important to note was that while not significant, nearly all the subscale items changed in the predicted direction.

Out of the scope of this study was cat impact on the daily life of the parent. Evidence suggests incorporating a service animal into a family may add to the daily tasks of parents (Bibbo, Rodriguez, & O'Haire, 2019), so incorporation of a CA would likely do the same. Future work should include the impact on the parents.

Immediately strong bond scores after adoption, decreased likelihood of increase over time, however scores might have decreased given the caretaking burden. We found no change in parent bond over time and LAPS and CABS had strong coefficient alpha coefficients over time, indicating strong internal consistency.

Cat stress levels were studied and will be reported in a separate publication.

Conclusion

The children in our study had better Empathy and less Separation Anxiety following adoption of a cat. They also had fewer problem behaviors exhibited by less Externalizing, Bullying and Hyperactivity/Inattention. Children and parents felt strong bonds with their new cat, almost immediately after adoption and despite the cat caretaking burden, these bonds did not decrease over time. Temperament screened shelter cats may be beneficial for some children with ASD while not necessarily imparting undue burden to the children's parents. Further research is indicated to confirm these findings in a larger sample.

Authorship contributions

Gretchen K. Carlisle provided substantial contribution to conception and design of the study, coordinated data collection, analyzed and interpreted the data, wrote the initial draft of the manuscript, revised and approved the manuscript for final submission.

Rebecca A. Johnson provided substantial contribution to the conception and design of the study, analyzed and interpreted the data, revised and approved the manuscript for final submission.

Ze Wang analyzed the data, provided critical revision and approved of the manuscript for final submission.

Jessica Bibbo participated in the design of the study, provided revision and approved the manuscript for final submission.

Nancy Cheak-Zamora analyzed the data, provided critical revision and approved of the manuscript for final submission.

Leslie A. Lyons participated in the design of the study, revised and approved of the manuscript for final submission.

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Declaration of Competing Interest

The authors declare that they have no conflict of interest.

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