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Pet Ownership, Child Anxiety, Child Physical Activity and Mother's Perception of Children's Health Status

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This study examined possible connections between pet ownership and children's health status, as mediated by children's anxiety and physical activity. A total of 134 mothers with a preschool age child participated in the study. Mothers completed a demographic survey, responded to questions about owning a pet, and reported on their child's anxiety, physical activity, and physical health status. Mean comparisons revealed that children from households with a pet had lower scores on mother reported anxiety, higher scores on mother reported physical health and psychosocial health, and lower scores on mother reported vulnerability to illness, compared to children from households without a pet. Regression analyses revealed that associations between pet ownership and mother's reports of children's physical health and lower vulnerability to illness, but not psychosocial health, remained significant even after accounting for mother education and family income. In addition, the association between pet ownership and child physical health and vulnerability to illness was partially mediated by mother reported child anxiety. The present study supports previous evidence to suggest that pet ownership is associated with better health outcomes for children, and that this link may be accounted for by child anxiety.

Keywords: pet ownership, child health, child anxiety, child physical activity, preschool children.

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Whether dogs, cats, horses, or guinea pigs, pets are very popular because of the companionship they provide and the enjoyment they add to humans' leisure time. The popularity of pets is illustrated by the fact that more than 63% of households own at least one pet according to data from the American Pet Products Association National Survey (APPA, 2017). Of households with pets, 75% include minor children (APPA, 2017). Data also indicates that the majority of pet owners refer to their pets as their friends (McConnell, Brown, Shoda, Stayton, & Martin, 2011), or even as family members (Tipper, 2011; Tovares, 2010), which suggests that for many people pets play a major role in their social network.

The widespread presence of pets in the lives of children has prompted interest in the role that pets may play in children's health. However, empirical support regarding the health benefits of animal companionship is not definitive. Children who have companion animals have been found to have better health outcomes, such as lower weight status and lower likelihood of obesity (Timperio, Salmon, Chu, & Andrianopoulos, 2008). On the other hand, several studies have found no significant differences between the health outcomes of pet owners and non-pet owners (Mathers, Canterford, Olds, Waters, & Wake, 2010). Additionally, research suggests that there may be both benefits and drawbacks to owning a pet. In his review of empirical findings, Herzog (2011) concluded that the evidence regarding the contribution of pet ownership on human health provides conflicting results and there is simply not sufficient evidence to conclude that people who own pets are healthier. Questions about the health benefits of animal companions are also raised by evidence that interactions with animals have potential health risks to humans. Estimates are that 855,000 people receive medical attention for dog bites each year in the US, and that another 3.6 million suffer bites that do not require medical treatment (Gilchrist, Sacks, White, & Kresnow, 2008). Furthermore, dog attacks result in approximately 30 deaths per year in the U.S. (Patronek, Sacks, Delise, Cleary, & Marder, 2013). Animals can also carry diseases that may be contracted by humans through direct skin-to-skin contact, or contact with bodily secretions, such as saliva and urine (Robertson, Irwin, Lymbery, & Thompson, 2000). Humans are also susceptible to immunologic responses to animals as a result of allergies, asthma, or hypersensitivity pneumonitis (Anyo et al., 2002). Given the equivocal nature of the empirical link between pet ownership and health, and the potential detrimental health effects of pet ownership, additional research is needed that compares the health outcomes of children living with and without pets.

Questions also remain regarding the mechanism by which pet ownership is linked to health quality in children. One proposal is that pets contribute to better overall health status by providing psychological benefits in the form of reduced stress and anxiety (Hoffmann et al., 2009). Support for this argument comes from evidence that interventions employing animals improve the treatment outcomes of children by lowering their stress reactions. For example, Charnetski, Riggers, and Brennan (2004) found that children showed an improved physiological stress response in the form of a significant increase in

blood levels of immunoglobulin after petting a dog. In a study on pet ownership Gadomski et al. (2015) found that even after controlling for age, sex, poverty level, and parent rated physical health quality in multivariate models, the presence of a pet dog in the home was associated with lower child anxiety scores. Most recently, Kertes et al. (2017) found that children who had their pet dog present during the Trier Social Stress Test of Children reported experiencing less stress than children who were alone or with their parent. In addition, the authors found that although there was no significant difference across conditions in children's objective experience of stress as assessed by cortisol levels, among the children with their pet dog present, those who were actively petting their dog had a lower cortisol response to the stressful situation (Kertes et al., 2017).

A second proposed mechanism by which a pet may contribute to children's positive health outcomes is through the promotion of higher levels of physical activity (Christian, Trapp, Lauritsen, Wright, & Giles-Corti, 2013). That is, as energetic play companions, pets provide children with opportunities to be physically active. Physical activity in turn conveys many health benefits including greater muscle strength, increased bone density, a higher resting heart rate, and improved cardiovascular functioning (Janssen, & LeBlanc, 2010). The benefits of physical activity to health outcomes have been documented as early as the preschool years (see review by Timmons et al., 2012). Support for a connection between pet ownership, increased physical activity, and better health outcomes comes from evidence that children who live in a household with a pet are more physically active and less likely to be overweight (Timperio et al., 2008). In addition, results from a study of 2065 children in England (Owen et al., 2010) suggest that 9- to 10-year-old children from households with a pet dog have higher levels of physical activity, measured objectively by an accelerometer, than children from households without a pet dog.

Research indicates that the benefits of pet ownership for personal health may accrue more for individuals in certain demographic categories than others. Jacobson and Chang (2018) found that pet owners and non-pet owners differ across several socio-demographic characteristics including gender, race, living arrangements, income, and employment status. The researchers found that income and full-time employment were closely linked with the likelihood of owning a pet. It is also well established that family income is a major predictor of children's health status (Chaudry & Wimer, 2016). Thus, evidence of connections between pet ownership and children's health may represent a confounding of the association between family income and children's health. Additional research is needed that examines the relative contribution of family income and pet ownership on children's health in order to address the relationship between family income and pet ownership.

With the potential for both costs and benefits to owning a pet (Herzog, 2011) the goal of the present study was to examine the relationship between pet ownership and children's physical health. A secondary goal was to examine the role that child anxiety and physical activity play in links between pet ownership and child health. It was hypothesized that children from families who owned a pet would be rated by mothers as having better

health status than children from families who did not own a pet. It was also hypothesized that children living with pets would be less anxious and more physically active than children who do not live with pets. Child anxiety and physical activity were hypothesized to mediate the association between pet ownership status and child health status.

Method

Participants

For this study 134 mothers from families with at least one child between the age of 3 and 7 (*M* age = 51 months, *SD* = 5 months; with 7 children between 72 and 75 months old) were recruited as participants. The average age of mothers in the sample was 27-years-old. Mothers came from diverse ethnic backgrounds, with 96 (73%) mothers being European American, 18 (13%) Latino, 11 (8%) African American, 6 (4%) Native Hawaiian or Pacific Islander, and 3 (2%) Asian American. Mothers also reported that among fathers, 91 (68%) were Caucasian, 22 (17%) Latino, 11 (8%) African American, 7 (5%) Native Hawaiian or Pacific Islander, and 3 (2%) Asian American. Families were predominately middle-to-upper-middle class, with 44 (33%) mothers having some college education, 28 (21%) having a college degree, and 26 (19%) having completed high school. Employment data for the mothers showed that 46 (34%) worked full time, 43 (32%) were unemployed, and 43 (32%) worked part-time. Based on mother's reports, 35 (26%) fathers had completed some college, 28 (21%) had a college degree, and 21 (16%) had completed high school. The employment status of the fathers showed 125 (93%) worked full time, and 11 (8%) were unemployed. The average hours worked per week for mothers was 28, and for fathers was 42. There were 58 families (42.5%) with one child in the home, 46 (34.3%) families with two children in the home, 24 (17.9%) families with three children in the home, and six (5.2%) families with four or more children in the home.

Procedures

Convenience sampling was used to recruit mothers from various locations within the community identified as being most likely to be frequented by parents of preschool age children, including 16 (12%) from retail stores, 20 (15%) from restaurants, 86 (64%) from child care centers, and 12 (9%) from churches, by verbal invitation. Mothers who were recruited met the inclusion criteria: having one or more children between 3- and 7-years-old, coming from families in which both parents resided at home, and no multiple births. Mothers also were only recruited if their children did not have a medical condition, such as Down syndrome, Cerebral Palsy, or Fetal Alcohol syndrome, and the mother did not have a medical condition, such as visual or hearing impairments. Mothers were called two weeks after recruitment in order to schedule the data collection visit.

Data collection was conducted in the families' homes by appointment. Before data collection, mothers were given consent forms which explained the purpose of the study and the procedures used to obtain the data. Appointments began with mothers participating in a structured interview for the purpose of gathering family demographic

information. After the interview, the mothers completed self-report surveys to assess children's anxiety, activity level, health status, and pet ownership status. When completing surveys to assess their perception of their children's anxiety, activity level, and health status, mothers with multiple preschool age children were asked to focus on only one child who was randomly selected by the researchers. All procedures used in the current study were approved by the university IRB where the research was conducted.

Measures

Demographic Characteristics. During the structured interview, mothers responded to questions about their own, and the father's, age, ethnicity, education, employment status, work hours, and family income. Mothers also reported on children's birth order and age. Family income information was used to calculate an income-to-needs ratio (reversed) to be used as an index of *family income* representing family economic resources. Family income was calculated from U.S. Census Bureau tables as the ratio of family income to the appropriate poverty threshold for each household size and number of children under 18, with higher scores indicating greater financial resources in the household.

Pet Ownership Status. Mothers were asked to report on their family's pet ownership status using a single question: "Does your household have one or more pets?" Based on mothers' responses, a *pet ownership status* variable was created with a 1 indicating the household did not include a pet and a 2 indicating the household included at least one pet.

Child anxiety symptoms. Mothers completed the Preschool Anxiety Scale-Revised (PAS-R; Edwards, Rapee, Kennedy, & Spence, 2010; Spence, Rapee, McDonald, & Ingram, 2001) designed to assess anxiety symptoms in children between the age of 3- and 6-years-old. The PAS-R consists of 30 items rated using a Likert scale ranging from 0 (not at all true) to 4 (very often true), comprising four scales: social anxiety (7 items; e.g., acts shy and quiet around new people), generalized anxiety (7 items; e.g., gets upset if something unexpected happens), separation anxiety (5 items; e.g., becomes distressed if separated from parents), and specific fears (9 items; e.g., is afraid of doctors and/or dentists). For the purpose of this study all items of the PAS-R were summed to provide an overall measure of mother reported *child anxiety symptoms* (α = .81). The PAS-R has shown adequate reliability and evidence of validity in use with children up to 11-years-old (Broeren, Muris, Diamantopoulou, & Baker, 2013).

Child Physical Activity. Mothers were asked to complete the Burdette outdoor playtime checklist (Burdette, Whitaker, & Daniels, 2004) to provide a measure of children's physical activity. The checklist contains two items that ask respondents to report the amount of time their child spent playing 'in the yard or street around the house' and 'at a park, playground, or outdoor recreation area' on a typical day in the last month. For each location, three time periods were identified: wake-up time until noon, noon until six PM, and six PM until bedtime. For each time period, mothers were asked to use a five-point

scale to identify the number of minutes their child played in that location: 0 = 0 min, 1 = 1–15 min, 2 = 16–30 min, 3 = 31–60 min, and 4 = over 60 min. Ratings for both locations were summed to provide a child physical activity index score ranging from 0–24. Validity for the Burdette outdoor playtime checklist has been demonstrated by positive correlations with accelerometry assessments of overall physical activity in preschool children (Burdette, et al., 2004). The Burdette outdoor playtime checklist has shown adequate reliability for use with children as young as three (Burdette, & Whitaker, 2005) and as old as 10 Bammann et al., 2011).

Child health questionnaire. Mothers completed the Child Health Questionnaire (CHQ PF50) a standardized multidimensional measure of subjective functional health and well-being for children aged 5 to 18 years (Landgraf, 1995). The CHQ PF50 contains 50 items grouped into 13 multi-item scales: 1) physical functioning, 2) role limitations-behavioral functioning, 3) role limitations-emotional/social, 4) role limitations-physical, 5) bodily pain, 6) behavior, 7) mental health, 8) self-esteem, 9) general health perceptions, 10) parental impact–emotional, 11) parental impact–time, 12) family activities, and 13) family cohesion. Items use a Likert-type scaling mechanism to measure poor to good health during the past 4 weeks. Each multi-item scale score is calculated by totaling contributions from each item resulting in a score with values from 0 (representing worst health) to 100 (representing best health). In the present study, two summary scores, *general health* (i.e., physical functioning, role limitations-behavioral functioning, role limitations-physical, bodily pain, general health perceptions, parental impact-emotional, parental impact-time, and family activities; α = .88) and *psychosocial health* (i.e., role limitations-emotional/social, behavior, mental health, self-esteem, and family cohesion; α = .77) were created from weighted composites of subscale scores to represent mother's perceptions of children's health. The CHQ-PF50 has been validated and shown to be psychometrically sound in the assessment of child health and well-being in representative populations of children in the United States, Canada, the UK, Australia, Germany, and the Netherlands (Landgraf et al., 1998; Raat, Bonsel, Essink-Bot, Landgraf, & Gemke, 2002; Waters, Salmon, & Wake, 2000), and in samples with children as young as 1-year-old (Sung et al., 2003; Vargus-Adams, 2006).

Each mother also was asked to complete the Child Vulnerability Scale (Forsyth, Horwitz, Leventhal, Bruger, & Leaf, 1996) to assess perceptions of her child's general vulnerability to health problems. Responses to the 8-item scale were made on a 4-point Likert scale ranging from "Definitely False" (0) to "Definitely True" (3). Sample items include "I sometimes get concerned that my child doesn't look as healthy as s/he should," and "I often check on my child at night to make sure s/he is okay." A *vulnerability to illness* score was created by averaging responses across items, with higher scores reflecting perceptions of more vulnerability. Adequate reliability with children between the ages of 2- and 10-years-old has been demonstrated for the Child Vulnerability Scale with an internal consistency of α = 74 (Forsyth et al., 1996) and a test-rest reliability coefficient of

r = .84 (Thomasgard, Shonkoff, Metz, & Edelbrock, 1995). Convergent validity has also been demonstrated (Forsyth et al., 1996). Internal reliability in this sample was α = .82.

Plan of Analysis

Preliminary *t*-test analyses were carried out to examine possible difference in demographic characteristics of families with and without pets. Next, *t*-tests were used to examine the hypothesized mean differences between mothers from households with pets and mothers from households without pets on ratings of child anxiety, physical activity, and child health. Third, regression analyses were conducted in order to examine whether the hypothesized links between pet ownership, child anxiety, child physical activity, and mother's perception of children's health status held after controlling for the shared influence of family socioeconomic status. Finally, a mediation model was tested using the PROCESS model in SPSS (Hayes, 2017) with 10,000 bootstrap samples (Preacher & Hayes, 2008). The model examined whether pet ownership had a direct effect on mothers' ratings of children's health, or if the effect of pet ownership was indirect and mediated by child anxiety and physical activity.

Results

Preliminary analyses

Among the 134 mothers who participated in the study, 90 (67% of the sample) came from families with one or more pets in the home. An independent samples *t*-test (see Table 1) revealed that compared to mothers who did not own a pet, mothers who did own pets were younger, $t(132) = 1.86$, $p = .05$, and were less educated, $t(132) = 2.54$, $p = .01$. Mothers who did not own pets had higher income than mothers who did own pets, $t(132) = 1.83$, $p = .05$. There were no differences between mothers who did not own pets and mothers who did own pets on the number of hours worked per week, $t(132) = -.24$, $p = .81$.

Differences between pet owners and non-pet owners

It was hypothesized that children who lived with a pet would have lower mother-rated anxiety scores and higher physical activity scores than children who did not live with a pet. To examine this hypothesis, two independent samples *t*-tests were conducted. Consistent with hypothesis, analyses revealed a significant difference for child anxiety, $t(122) = 2.36$, $p = .01$. Children from homes with pets were rated by their mother as having significantly lower anxiety scores than children from homes without pets (see Table 1). Contrary to hypothesis, analyses revealed no significant difference for child activity level, $t(122) = .92$, *ns*, for children from homes with and without pets.

The primary hypothesis guiding this study was that mothers who owned a pet would rate the health status of their children higher than mothers with no pet. To examine this hypothesis, three independent samples *t*-tests were conducted to compare child health status scores of pet owners and non-owners. Analyses revealed a significant difference for child's general health, $t(122) = -3.14$, $p = .002$), child's psychosocial health, $t(122) = -2.60$, $p = .01$, and child's vulnerability to illness, $t(122) = 2.79$, $p = .006$. Mothers with pets

reported significantly higher general health and psychosocial health, and significantly lower vulnerability to illness scores compared to mothers without pets (see Table 1). Consistent with hypotheses, mothers from families who owned one or more pets perceived their child as having better health than mothers from families with no pet.

Table 1
Descriptive Statistics

	Pet owners (n = 90)			Non-pet owners (n = 44)		
	M	*SD*	Range	*M*	*SD*	Range
Demographic variables						
Mother age	26.77[a]	5.38	23.67 – 40.82	28.48[a]	5.04	24.34 - 44.81
Mother education	14.07[b]	2.71	8.00 – 21.00	15.23[b]	1.94	12.00 - 18.00
Mother hours worked	18.63	17.24	.00 – 50.00	17.91	15.69	.00 – 50.00
Family income	$48K[c]	$15K	$13K - $95K	$53K[c]	$17K	$13K - $88K
Child anxiety	36.11[d]	19.04	0 – 76.00	41.51[d]	19.12	0 – 84.00
Child activity level	13.27	.04	8.00 – 24.00	12.12	.06	7.00 – 24.00
Mother rated child health						
General health	61.51[e]	7.35	14.75 – 74.10	53.08[e]	7.43	14.50 - 73.75
Psychosocial health	33.35[f]	10.34	6.70 – 64.32	27.17[f]	10.33	5.10 – 63.70
Vulnerable to illness	1.38[g]	.97	00 – 2.12	2.01[g]	.92	00 – 2.44

Note: Similar superscripts indicate significant differences between means of pet owners and non-pet owners at $p < .05$

Relative Contribution of Pet Ownership, Child Anxiety, and Child Physical Activity to Children's Health

For thoroughness in reporting, correlations were computed between child anxiety, child physical activity, and child health outcomes, separately for pet owners and non-pet owners (see Table 2). Regression analyses were conducted in order to examine whether the hypothesized links between pet ownership, child anxiety, child physical activity, and mother's perception of children's health status may be accounted for by the shared influence of family socioeconomic status (see Table 3). Specifically, three regressions were conducted to predict mother-perceived: a) child general health, b) child psychosocial

health, and c) child vulnerability to illness. Demographic characteristics (i.e., family income, mother education) were entered simultaneously in the first step to control for their effects. Next, pet ownership status was entered. In step three, the two proposed mediators, child anxiety and child activity level, were entered simultaneously. Variables were mean-centered prior to use in analyses.

Table 2
Correlations among variables for pet owners (n = 90) and non-pet owners (n = 44).

	1	2	3	4	5	6	7	8	9
Demographic									
1. Mother age		.44**	.09	.33*	-.10	.07	-.08	.17	.01
2. Mother education	.27**		.33*	.27*	.05	.27*	.25*	.21	-.17
3. Mother work hours	.12	.11		.18	.12	.13	.12	.03	.13
4. Family income	.24*	.25*	.31**		.03	.26*	.31*	.26*	-.22
Child Characteristics									
5. Child anxiety	-.12	.02	.11	.07		-.24*	-.29*	-.28*	.22
6. Child activity level	.05	.22*	.15	.24*	-.12		.09	.08	-.11
Child's health									
7. General health	-.06	.25*	-.11	.27**	-.24*	.06		.49**	-.48***
8. Psychosocial health	.05	.22*	-.05	.24*	-.20*	.10	.43**		.26*
9. Vulnerable to illness	.04	-.14	.12	-.19	.22*	-.09	-.44***	-.27*	

Note: Correlations for non-pet owners are presented above the diagonal line and correlations for pet owners are presented below the diagonal line. * = $p < .05$; ** = $p < .01$; *** = $p < .001$

In the first equation predicting mother's perception of children's general health, family socioeconomic status accounted for a significant 14% of the variance. Only the beta for family income was significant, suggesting that it was the major contributor to general health scores. In step 2, pet ownership accounted for an additional significant 7% of the variance, increasing the explained variance in mother's perceptions of children's general health to 21%. In step 3 of the equation, child anxiety and activity level accounted for an additional significant 8% of the variance, increasing the explained variance to 29%. Examination of the beta weights revealed that only child anxiety was significantly negatively associated with child's general health.

Table 3
Regression analyses examining relative contribution of pet ownership status, child anxiety, and child activity level to mother reported child health status variables.

	General Health				Psychosocial Health				Vulnerability to Illness			
Variables	*B*	*SE B*	β	ΔR^2	*B*	*SE B*	B	ΔR^2	*B*	*SE B*	β	ΔR^2
Step 1:				.14**				.16**				-.10*
Family Income	.20	.03	.34**		.19	.05	.25*		-.18	.10	-.20*	
Mother education	.07	.05	.10		.17	.05	.21*		-.22	.15	-.19*	
	F(2, 132) = 5.81**				*F*(2, 132) = 6.02**				*F*(2, 132) = 4.56*			
Step 2:				.07*				.03				-.06*
Pet ownership	.27	.15	.30*		.11	.21	.10		-.25	.17	-.28*	
	F(3, 131) = 6.01*				*F*(3, 131) = 3.24				*F*(3, 131) = 5.61*			
Step 3:				.08*				.09*				.07*
Child Anxiety	-.11	.08	-.26*		-.21	.12	-.28*		.16	.11	.25*	
Child Activity Level	.02	.11	.05		.05	.15	.09		-.06	.13	-.06	
	F(5, 129) = 7.16*				*F*(5, 129) = 3.63				*F*(5, 129) = 7.51*			

Note: Pet ownership was coded 0 = non pet-owner, 1 = pet owner. * = $p < .05$; ** = $p < .01$; *** = $p < .001$

In the second equation predicting mother's perception of children's psychosocial health, family socioeconomic status accounted for a significant 16% of the variance. Both the beta for family income and mother education were significant, suggesting that both contributed to mother's perception of children's psychosocial health. In step 2, pet ownership accounted for a non-significant 3% of the variance. In step 3 of the equation, child anxiety and child activity level accounted for a significant 9% of the variance. Examination of the beta weights revealed that only child anxiety was significantly negatively associated with child's psychosocial health.

In the third equation predicting mother's perception of children's vulnerability to illness, family socioeconomic status accounted for a significant 10% of the variance. Both the beta for family income and mother education were significant, suggesting that both contributed to mother's perceptions of children's illness scores. In step 2, pet ownership status accounted for an additional significant 6% of the variance, increasing the explained variance to 16%. In step 3 of the equation, child anxiety and child activity level accounted for an additional significant 7% of the variance. Examination of the beta weights revealed that only child anxiety was significantly associated with mothers' perception of child vulnerability to illness.

Mediation Analyses

The results of the mediation model indicated that pet ownership had significant direct effect on child general health and vulnerability to illness, but not on child psychosocial health (see Figure 1). The indirect effect of pet ownership mediated by child anxiety was found to be significant due to the absence of zero from the bootstrap generated confidence intervals (Preacher & Hayes, 2017). However, the indirect effect of pet ownership mediated by child physical activity was not significant. The model was statistically significant, $R^2 = 0.42$, $F(4, 127) = 37.21$, $p = .006$, and the significant indirect effect of pet ownership was mediated through child anxiety. The model accounted for 27% of the variance in current health, and 22% of the variance in vulnerability to illnesses.

Discussion

In U.S. homes with children under the age of 16, 75% have pets, a proportion that is much higher than for the population in general (APPA, 2017). The present study was conducted to further elucidate the role that pet ownership may play in children's health status. Data from a community sample of families with a preschool age child revealed that the number of pet owners was comparable to the national population. In addition, the results are consistent with past research in suggesting there is a significant positive association between pet ownership and children's physical health even after taking into account family socioeconomic status.

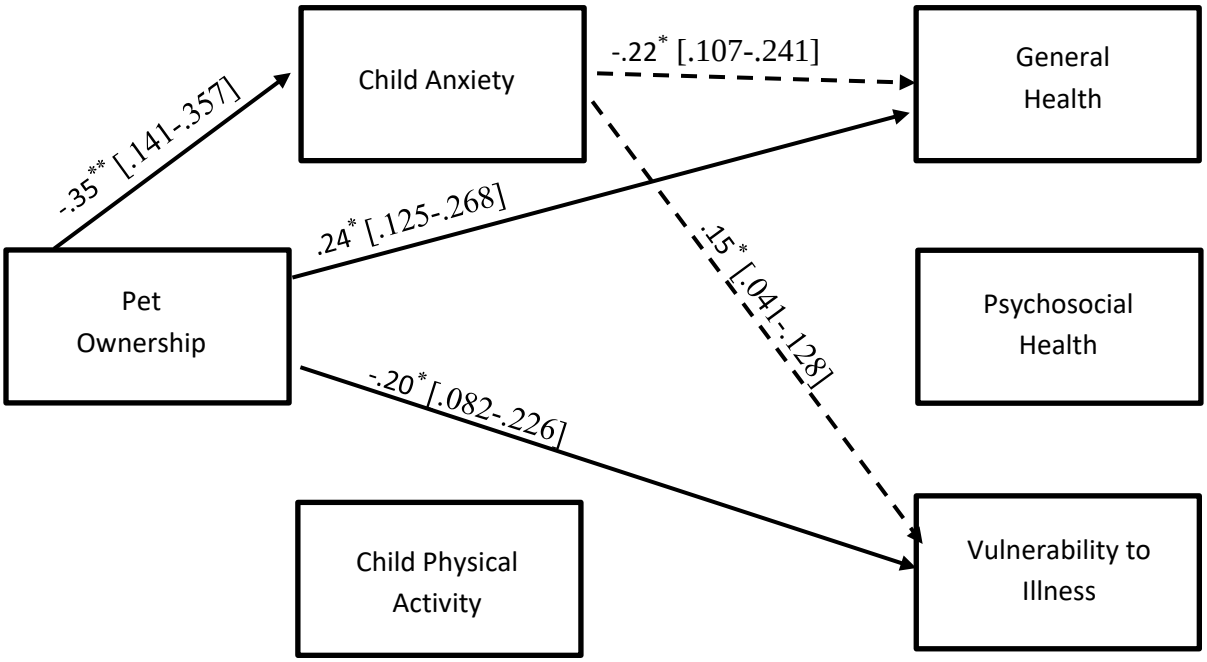

Figure 1
Note: The bias-corrected 95% confidence intervals are included in parentheses. For ease of interpretation only significant direct and indirect effects are depicted. The unbroken lines indicate the direct effect of pet ownership and the broken lines indicate the indirect effect of pet ownership. With respect to the direct effects, * = $p <$ .05; ** = $p < .01$; *** = $p < .001$. With respect to the indirect effects, * indicates a significant effect due to the absence of zero from the Bootstrap generated intervals

Our findings are particularly noteworthy because mother-reported child health status is the predominate measure used in epidemiological studies as an indicator of a child's actual state of health (Pastor & Reuben, 2011). Moreover, we used multidimensional measures to capture mothers' perception of children's general health, psychosocial health, and vulnerability to illness. On all three dimensions mothers from households with pets differed from mothers from households with no pets. Therefore, the difference between mothers who owned a pet and mothers who did not own a pet extended beyond their child's general health to include an assessment of their child's psychosocial health and their child's health stamina. In subsequent analyses controlling for family demographic characteristics, however, pet ownership status was linked only to mother rated general health and vulnerability to health, not psychosocial health. Specifically, family income and mother education accounted for the variation between pet owners and non pet-owner's perceptions of child psychosocial health, but not child general physical health and vulnerability to illness. Our findings thus suggest that the difference between

children from homes with pets and without pets in terms of mother's perceptions is specific to the area of physical health rather than psychosocial health.

Because this was a correlational study examining cross-sectional associations between pet ownership and mother's perceptions of children's health, no cause or effect can be inferred. One interpretation that can be made is that mothers who perceive their children as having robust physical health are more likely to elect to own a family pet. An alternative explanation is that the presence of a pet in the home offers some health benefit to children that contributes to mothers' perception of their child being more healthy than other children. To tease apart directional issues regarding the link between pet ownership and child health it would be necessary to conduct a prospective quasi-experimental design in which families who acquire a pet are followed longitudinally with a comparison group. The correlational nature of the study also raises the possibility that other confounding variables that were not assessed may account for the observed associations. For example, it is possible that mothers who are highly anxious may be less likely to own a pet and more likely to perceive their children as having health problems, so that it is mother anxiety rather than pet ownership status that is the more robust predictor of mother's perceptions of children's health. Again, experimental studies that allow for controlling confounding variables will help to more precisely determine the effect of pet ownership on children's health outcomes.

In this study we also examined two potential mediators of the connection between pet ownership and children's health status, specifically child anxiety and child physical activity. Both theory and research suggest that pets provide psychological benefits to their owners in the form of reduced stress and anxiety (Hoffmann et al., 2009). Researchers have found that companion animals can ease children's stress and anxiety during hospital stays (Kaminsky, Pellino, & Wish 2002) and help children cope with stress inducing experiences in the laboratory (Charnetski et al., 2004; Kertes et al., 2017). Consistent with this evidence, in the present study children from homes with pets were rated by their mothers as being significantly less anxious than children from homes with no pet. Moreover, analyses revealed that child anxiety mediated the connection between pet ownership and mother rated health status. Specifically, pet ownership was significantly associated with lower anxiety scores, and lower anxiety scores were in turn associated with mother's ratings of children having higher general health and less vulnerability to illness. To the best of our knowledge this represents the first empirical support for the theorized link between pet ownership, child anxiety, and children's health. However, interpretations of this finding should be exercised with caution given that all data was based on mother's self-report. It is possible that the associations could be the result of negativity or positivity bias in mother's reports of children's anxiety and health status. Additional research is needed to further examine the role that child anxiety plays in connections between pet ownership and health status using multiple methods of data collection.

A second mechanism examined as a potential link between pet ownership and child health status was child physical activity. It has been suggested that pets provide children with energetic play companions and opportunities to be physically active, with physical activity in turn contributing to better health outcomes (Janssen, & LeBlanc, 2010; Timperio et al., 2008). Contrary to this proposal, however, there was no significant difference in the physical activity scores of children from homes with pets and children from homes with no pets. It may be that the focus on preschool age children in the present study accounts for the lack of difference in physical activity between children from homes with and without pets. The amount of involvement preschool age children have in the care of a pet is likely to be low compared to that of older children, so that pet ownership has a negligible impact on normative levels of physical activity in this age group. Future work should include cross sectional samples of children so that comparisons of links between pet ownership and physical activity levels can be made for children of different ages.

It is of interest to note that contrary to past findings, in the present sample family income was significantly lower among pet owners than non-pet owners. In addition, mothers who owned pets were significantly younger and had less education than mothers who did not own pets. The discrepancy between this study and previous studies regarding demographic characteristics of pet owners and non pet-owners suggests that the current sample may be somewhat unique and thus findings should be interpreted with caution. Future research should assess parent's beliefs and explanations for pet ownership to better illuminate the demographic differences in pet ownership status.

It worth reiterating that pet ownership has been associated with small but important risks to health. Injuries from dog bites account for over half a million medical visits per year in the U.S. (Gilchrist et al., 2008). Pets have also been linked to infectious diseases in both children and adults (Esposito, Picciolli, Semino, & Principi, 2013). Pets are also a common source of allergies and can aggravate other respiratory conditions, such as asthma (Anyo et al., 2002). Given these data, it is possible that some participants in our non-pet owner group had previously owned a pet but had to relinquish the pet due to child health issues. This could have led to an over estimation of the link between pet ownership and positive perceptions of child health. It will be important for future work to obtain data on children's history of pet ownership to more precisely assess associations between pet ownership experience and child health.

Other limitations of the study include the high degree of homogeneity in the sample (96% white) that limits generalizability of the findings and indicates replication with more racially and ethnically diverse populations is needed before firm conclusions can be drawn. In addition, the exclusive reliance on mother's reporting of both pet ownership and child health raises concerns about multicollinearity playing a role in the results of analyses. Although moderate-to-high concordance between parents' report and objective measures of children's health have been documented in past research, the results of the present study await replication with data based on objective measures, such as number of visits to the

doctor, cardiovascular functioning, or immunoglobulin levels in the blood. Another issue is that demand characteristics (expectations unintentionally conveyed by the investigator to the participants) may have played a role in the present study. Although we did not reveal our hypotheses about pet ownership to participants during study recruitment, the nature of the questions completed by mothers may have alerted them to the focus of the study in a way that influenced their responding.

The majority of empirical evidence suggesting that there are benefits to interacting with pets for children's health is based on the use of animal-assisted therapy/interventions (AAT/AAI) (Kamioka et al., 2014). In this study, we collected data from a non-clinical population to examine the potential benefits of pets to children's health. Our findings contribute to existing literature by suggesting that the link between pet ownership and child health is specific to physical health, rather than to children's psychosocial health. Moreover, the findings offer support for the argument that child anxiety at least partially mediates the link between pet ownership and mother's perceptions of their young children's physical health. Although potential health risks of pets cannot be ignored, the present study joins with a growing body of evidence to suggest that owning a pet may have salutary associations with young children's health.

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