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Does Exposure to Cats or Dogs in Early Life Alter a Child's Risk of Atopic Dermatitis?

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Many physicians are unsure of how to respond to parents who ask about lay-press articles stating that scientific studies have demonstrated that living with cats and dogs protects children from developing allergic disease. For many years it was assumed that exposure to cats and dogs in infancy was associated with an increased risk of becoming allergic to these animals;(1,2) however, during the past 10 years many studies have appeared challenging this assumption.(3–6)

Recent systematic reviews have demonstrated relatively consistent reductions in the risk of allergic sensitization or allergic disease among children with close contact with animals during infancy whether the animals are farm animals or indoor pet cats or dogs.(3–5) Each of these reviews analyzed from 30 to 39 separate studies. The one systematic review specifically examined cat and dog exposure in relationship to eczema and found evidence of protection related to both cat and dog exposures with pooled odds ratios of 0.79 (95% confidence interval [CI] 0.62–0.92) and 0.68 (95% CI 0.53–0.87) respectively. However, in the one cohort study which adjusted for animal avoidance behavior there was no effect leading to the conclusion was that there was no convincing evidence of a protective effect of early pet exposure on atopic dermatitis.(5) This highlights a common problem in systematic reviews of how to reconcile the many inconsistencies between individual studies. Some inconsistencies are related to specific study details such as prospective or retrospective designs or the specific details of how primary outcomes are defined. Another potentially important difference is a large variation in pet keeping prevalence between the countries which presumably could influence the risk of acquiring sensitization from animal allergen exposure outside of the home. In some countries virtually no families keep pets,(7) and in other countries nearly 60% of homes have pets.(8) Intensity of exposure or allergen “dose” varies with pet-keeping practices, such as whether a dog is primarily kept inside or outside the home. There are also major differences in other important factors that likely contribute to allergic disorders; including climate, ethnicity and genetic backgrounds, diet and possibly vitamin intake.

In this issue of *The Journal*, Epstein et al report that the relationship between skin test positivity to dog or cat at age 1, 2, or 3 years of age and eczema at 4 years of age depends

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upon whether the child lived with a dog or cat, respectively during the first year of life.(9) In their previous examination of eczema in this cohort the investigators reported that exposure to a dog in the home was protective of eczema at 2 and 3 years of age (adjusted OR = 0.54, 95% CI 0.30–0.97), but they did not provide analysis of cat exposure.(10) In the current study, the investigators again report that living with a dog in the first year of life is protective of having eczema now up to 4 years of age (OR = 0.4, CI 0.2–0.7, $p=0.002$) and they have extended their observations to also consider allergic sensitization to cat, dog and other allergens as determined by skin testing at 1, 2 and 3 years of age. They report that if there was a dog in the home during the first year of life, a positive skin test to dog allergen at any one of these ages does not increase the risk of eczema, but if a child did not live with a dog during the first year of life and is skin test positive to dog allergen, the child has an almost 4-fold increased risk of eczema that is statistically significant. The relationship of a positive skin test and eczema stratified by early exposure to a cat is just the opposite. Children who lived with a cat during the first year and who have a positive skin test to cat allergen have an over 13-fold increased risk of eczema at 4 years of age. In contrast, for those not exposed to a cat skin, test reactivity to cat allergen is not associated with an increased risk of eczema.

How can these differing results be interpreted? It is known that over 90% of homes in the United States have measurable levels of cat and dog allergens whether the home has ever had a furred pet living in it or not and these allergens are also commonly found in public places such as schools.(11,12) This almost universal presence of cat and dog allergen provides a source of allergen exposure that can lead to sensitization of any susceptible child. An interesting question is whether the differing relationships between cat and dog exposure, skin test sensitivity, and eczema reported by Epstein et al, result from differences in the timing and level of exposure to allergen, the nature of cat and dog allergens, or from ways in which cats and dogs alter home environments beyond allergens.(9)

Although exposure to cats or dogs could differentially influence the outcome of sensitization versus the outcome of eczema it is usually impossible to differentiate cause and effect since the exposure, pet ownership, is typically ongoing for many years with most exposures, including the putative critical interval of the first year of life.(9,13) It is possible that some factor correlated with pet exposure could decrease risk of sensitization, but if sensitization still occurs, the same or other factors associated with pets could induce immune tolerance and reduce eczema, or, just the opposite. In favor of the hypothesis that the results of Epstein et al are related to differences in cat and dog allergens are studies suggesting that cat allergen can induce much higher levels of specific IgE antibodies than other inhalant allergens and that continued high levels of cat allergen exposure can induce an IgG4 antibodies which may reduce allergic symptoms.(14)

One report suggesting that cats and dogs bring things beyond their own allergens into homes was a relatively large study examining two different cohorts of children for an association between a loss of function mutation in the filaggrin gene and the risk of eczema.(15) In both cohorts cat exposure in the home was a statistically significant risk factor for eczema if the child had a filaggrin mutation (hazard ratio [HR] = 11.1, 95% CI 3.79–32.6, $p<0.0001$ and HR=3.82, 95% CI 1.35–10.81, $p=0.01$ in Copenhagen and Manchester cohorts, respectively). This was not in children without this mutation. In this same study, the relationship of dog exposure to eczema was not influenced by the presence of the filaggrin mutation, but dog exposure alone was protective of eczema (HR =0.49, 95% CI 0.24–1.01, $p=0.05$) only in Copenhagen but not in Manchester. The increased risk of eczema related to the filaggrin mutation and cat exposure was evident as early as 2 months of age, well before IgE sensitization is typically thought to occur to aeroallergens.(15) Other studies have shown that dogs and cats also alter the types of bacteria in homes.(16,17) One of these

studies also reported that bacterial communities differed between the homes of children with recurrent wheezing and those without wheezing.⁽¹⁷⁾ Exposure to bacteria from animals in the first year of life may alter the risk of eczema by influencing the overall development of an infant's immune system or by altering the types or relative proportions of commensal bacteria colonizing an infant's skin.

Where do the results of Epstein et al and other similar studies leave the clinician and parents? Although there are still many inconsistencies and questions in the literature, there is no convincing evidence from large prospective studies that living with a cat or dog during the first year of a child's life increases the risk of the child becoming allergic either to these animals or to any other allergen. In contrast, the majority of studies suggest a modest protective effect, in the range of 20–30%, on the risk of developing allergic disease by living with a cat or dog. This modest protective effect for allergic disease must be weighted against the multiple other risks and benefits of keeping pets in homes. These studies do suggest that there is still much to learn about how environmental exposures influence the risk of developing allergic disease. One part of this challenge is recognizing which environmental exposures are directly influencing the progression of allergic disease.

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