whole-cell vaccine and the subsequent development of asthma or atopy during later childhood.

Reviewer's Comments. This is a nice study evaluating whether there is an association between pertussis vaccination in infancy and the development of asthma or allergy in a large birth cohort. The lack of association by multivariate analysis agrees with some of the more recent studies that have looked at cross-sectional or earlier childhood outcomes. The results of this study in older children are encouraging and provide additional evidence that the benefits of vaccination far outweigh any risks.

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NO EPIDEMIOLOGICAL EVIDENCE FOR INFANT VACCINATION TO CAUSE ALLERGIC DISEASE

Koppen S, de Groot R, Neijens HJ, et al. *Vaccine.* 2004; 22:3375–3385

Purpose of the Study. Because the prevalence of allergic disease has increased in the last decades and one theory for the increase is immune dysregulation associated with hygiene and reduced infection, the study sought to determine if healthy children vaccinated at an early age have an increased risk for the development of allergic disease.

Methods. Epidemiologic studies with original data on the correlation between vaccination with diphtheria, pertussis, tetanus (DPT), measles, mumps, rubella (MMR), and bacille Calmette-Guérin (BCG) immunizations in infancy and the development of allergic diseases were selected and reviewed for their quality and validity. To increase the likelihood of considering all relevant literature, Medline searches (from January 1966 to March 2003) were performed, bibliographic lists from retrieved articles were reviewed, and experts in the field were asked to identify relevant articles.

Results. Methodologic design and quality varied markedly between the studies reviewed. Ethical issues regarding vaccination precluded randomized, controlled trials (only 1 such study was found). Many studies did not address possible confounders such as the presence of lifestyle factors, which resulted in bias. The studies offering the stronger evidence indicate that the investigated infant vaccinations do not increase the risk of developing allergic disease. Furthermore, BCG does not seem to reduce the risk of allergies.

Conclusions. The authors concluded that the reviewed epidemiologic evidence indicates that current infant vaccines do not cause allergic diseases.

Reviewers' Comments. In an effort to reduce the risk of development of allergies, families knowledgeable about the "hygiene hypothesis" sometimes worry that vaccination of their children will increase the risk of allergic disease. Although most pediatricians can easily point out that vaccination carries clear advantages for their use and that a concern for allergy would not be a good reason to defer immunization, this analysis of available data additionally supports the argument that there is no evidence to indicate that childhood vaccinations are the cause of the increase in allergic disease in Westernized countries. There is likely a complex interplay of environmental factors contributing to the apparent skewing toward an allergic, or T-helper 2–dominant, immune response and the resulting increased prevalence of atopic disease.

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ALLERGENS AND ENVIRONMENTAL EXPOSURES

DOG ALLERGEN (Can f 1) AND CAT ALLERGEN (Fel d 1) IN US HOMES: RESULTS FROM THE NATIONAL SURVEY OF LEAD AND ALLERGENS IN HOUSING

Arbes SJ Jr, Cohn RD, Yin M, Muilenberg ML, Friedman W, Zeldin DC. *J Allergy Clin Immunol.* 2004;114:111–117

Purpose of the Study. To estimate the levels of dog and cat allergens in US homes and provide the characteristics of households associated with these allergens.

Study Population. A total of 2456 individuals from 831 permanently occupied, noninstitutional housing units in 75 US locations that permit resident children.

Methods. Data for this study were obtained from the National Survey of Lead and Allergens in Housing conducted by the National Institute of Environmental Health Sciences and the US Department of Housing and Urban Development from 1998 to 1999. Vacuum-collected dust samples from a bedroom floor, bed, living room floor, living room sofa, or equivalent piece of upholstered living room furniture were analyzed for concentrations of primary dog allergen (Can f1) and primary cat allergen (Fel d1) in micrograms of allergen per gram of dust by using monoclonal antibody enzyme-linked immunosorbent assays. Housing and household characteristics were determined by questionnaire or observation. Bivariate associations between housing characteristics and the presence of an indoor dog and cat were examined.

Results. At the time of the survey, 55% had no cat or dog in the home for the past 6 months, 10% had both a cat and a dog, 21% had at least 1 dog and no cat, and 13% had at least 1 cat and no dog. The percentage of homes with an indoor dog was higher if they were outside of the Northeast US, were a single family, owned versus rented, had >1 occupant, had an income greater than $20 000.00 per year, and were white. The percentage of homes with an indoor cat was higher if they were in the Northeast or West or were white. A greater concentration of Can f1 was associated with single-family homes with >1 occupant, higher income levels, white race, and forced-air heating and air conditioning and presence of an indoor cat or dog. For Fel d1, a higher geometric mean concentration was associated with living in the West, being white, having an education above the high school level, and presence of an indoor dog or cat. The presence or absence of a cat had the greatest influence. Respectively, Can f1 and Fel d1 were detectable in 93.8% and 96.6% of beds, 95.6% and 96.9% of bedroom floors, 94.9% and 96.1% of living room floors, and 98% and 97.9% of sofas. Of the 97.7% of homes with detectable antigen, 99.9% had detectable Can f1 in at least 1 sample location. Of the 99% of homes with detectable antigen, 100% had detectable Fel d1 in at least 1 sample location. For Can f1 and Fel d1, 55.7% and 66% of US homes exceeded previously published sensitization threshold levels of >2 and >1 μg/g, respectively. Additionally, 34.9% and 34.7% of US homes exceeded the asthma-symptoms threshold for Can f1 and Fel d1.

Conclusions. Can f1 and Fel d1 are ubiquitous allergens in US homes. Levels associated with both sensitization and exacerbation of asthma are found even in homes without cats or dogs. Demographic groups associated with greater likelihood of pet ownership implicate the role of the community as a source of the allergens.

Reviewers' Comments. This study demonstrates the need for greater consideration of the role of dog and cat allergens in both the sensitization and symptom exacerba-

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Pediatrics 2005;116;542
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