
Knowledge and practice of dust mite control by specialty care

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Background: Dust mites are the primary indoor allergen risk for increasing asthma attacks and morbidity. Adherence to allergen avoidance recommendations decreases bronchial reactivity and asthma morbidity.

Objective: This study compared the knowledge and practice of environmental control advice of families of children with asthma seen by an allergist or a pediatrician. Studies suggest that knowledge and practice of environmental control recommendations is inconsistent.

Methods: Subjects were aged 6 to 17 years, diagnosed with asthma, and had positive skin test to dust mites. There were 114 eligible pediatric patients, and 69 had also seen an allergist before the study. An in-home evaluation was completed during which parents were asked about environmental control knowledge and practice. An environmental technician then completed a walk-through evaluation to observe which recommendations were implemented in the home.

Results: Families who saw an allergist demonstrated significantly greater awareness of environmental control recommendations for dust mite allergens than those who had not. Knowledge and placement of allergen-proof mattress and pillow covers was significantly higher in these families. However, 30% of families who saw an allergist reported no knowledge of any environmental control recommendations for dust mites. Less than half of the allergist families (48%) who were advised to use mattress encasements actually had encasements on their children's beds.

Conclusions: The parents of dust mite-sensitive, asthmatic children who saw an allergist were more aware of dust mite allergen control recommendations and made more indoor environmental changes.

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INTRODUCTION

Allergy plays a significant role in most children with asthma, and allergen exposure has been shown to increase the risk of developing asthma¹ and asthma morbidity.² In 1997, the National Heart, Lung, and Blood Institute (NHLBI)³ developed *Guidelines for the Diagnosis and Management of Asthma*, which states the “first and most important step in controlling allergen-induced asthma is to reduce exposure to relevant indoor and outdoor allergens.” Similarly, in 2001,⁴ the American Academy of Asthma, Allergy, and Immunology published a position statement recommending that physicians teach indoor allergen avoidance approaches when caring for people with allergic asthma. Although both the NHLBI and the American Academy of Asthma, Allergy, and Immunology recommend allergen avoidance and environmental control of allergens to patients with chronic allergic asthma, little is known about the degree to which those treating patients with asthma or the patients themselves follow these recommendations.

In this study, we evaluated knowledge about dust mite control among families of children with asthma and dust mite sensitivity. These children were being enrolled in an educational intervention study of allergen avoidance. We compared the knowledge of families of children who had been evaluated by an allergist with those treated only by pediatricians, and whether there were observable differences in the implementation of dust mite control measures.

METHODS

This was a cross-sectional study using secondary data analysis from a clinical trial of parents and their children with asthma. Children were enrolled in a pediatric clinical trial of home environmental control of indoor allergens in Baltimore City and its suburbs from fall 1999 to fall 2000. The overall goals of the primary study were to compare two groups (treatment and control) on the effectiveness of an educational intervention. The expected outcomes of the intervention study are to improve quality of life and decrease indoor allergen levels. The current analysis used skin test results, baseline questionnaires, and an in-home inspection to determine eligibility and to evaluate knowledge and practice of indoor environmental control recommendations for the reduction of dust mite exposure.

Study Participants

Four pediatric practices in the Baltimore metropolitan area provided lists of children with a diagnosis of asthma. Three of the practices are located in suburban Baltimore, and the fourth is in Baltimore City. Each child was identified as

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having asthma by using the International Classification of Diseases (ICD9). Children, aged 6 to 17 years, were recruited over the course of 1 year. Of these subjects, 114 had a positive skin test to at least one type of dust mite, qualifying them for the present study. The Johns Hopkins University School of Medicine Institutional Review Board, Joint Commission on Clinical Investigation, approved the study, and all parents and children provided informed consent.

Recruitment

Parents received a letter explaining the purpose of the study and informing the families that someone affiliated with the study would call to inquire about interest in participation. After consent, the interviewer collected information about daytime and nighttime symptoms of coughing or wheezing and asthma medication use. If the family reported that the child used asthma medications or had daytime or nighttime symptoms at least once a week in the previous month, the child is invited to a clinic visit to determine further eligibility based on skin testing and additional questionnaires. As of fall 2000, a total of 1,229 letters were sent, 762 families were contacted, 183 children qualified as eligible for the study, 121 completed the clinic screening visit, and 114 had positive skin tests to dust mites.

Procedures

During the initial clinic visit, parents and children gave written informed consent, the child was skin tested, and the primary caretaker answered baseline questions related to the child's previous health history. The baseline questionnaire gathered information on allergic rhinitis, asthma, medication use, and demographic information. All eligible families granted permission for home visits as they entered the study and visits were conducted within 1 month of the baseline evaluation. The home visit had three primary objectives: 1) completing a baseline home environment questionnaire by the primary caretaker concerning home characteristics; 2) collecting dust samples; and 3) evaluating the home using a home evaluation checklist.

The baseline home environment evaluation, conducted at the first home visit, consisted of 35 questions intended to gather information regarding the family's usual cleaning habits, knowledge of environmental control recommendations, and self-reported changes to their home to reduce their child's exposure to indoor allergens. The questions included items such as how often bedding is washed, whether dehumidifiers or air conditioners were used, and whether pets or smokers were present. For the purposes of this study, the questionnaire evaluated the family's knowledge of environmental control measures by the primary caretaker's response to the following open-ended questions: 1) has your family ever been advised to make changes in the home to reduce your child's allergen exposure? 2) If so, who offered the advice? 3) What was the advice? The primary caretaker was then asked if any changes had been made in the home, and if so, what changes were made to reduce the child's exposure to allergens.

An environmental technician conducted a home inspection during the first home visit, using a home evaluation checklist which included structural assessments of the home, such as the type of heating and air conditioning systems, the presence of a basement, the type and location of the dwelling, and the number of rooms. Other specific items were also documented, such as the use of mattress and pillow encasements, size of the child's bed, and the presence of carpeting, pet dishes, or ashtrays. A dust sample was collected and analyzed for indoor allergens using standardized methods.⁵

All the children in the study received standard skin testing (Multi-Test II, Lincoln Diagnostics, Decatur, IL) to 14 aeroallergens: dust mites (*Dermatophagoides farinae* and *pteronyssinus*), cat, mouse, dog, German and American cockroach, maple and oak trees, Kentucky blue/june, orchard, red top, and timothy grass mix, short ragweed, and *Penicillium*, *Alternaria*, *Helminthosporium*, and *Aspergillus* molds (Hollister-Stier Laboratories, Spokane, WA and Greer Laboratories, Lenoir, NC). Wheal reactions were compared with the positive histamine control and the wheals that were 50% or larger than the histamine response were considered positive.

Analyses

The study population consisted of 114 asthmatic children with a positive skin test to house-dust mite. They were divided into two groups based on whether they had seen an allergist or not. This study then compared whether the two groups had ever been advised to make changes in their homes to reduce dust mite exposure (knowledge) and if they had made any changes in their home to reduce dust mite exposure (practice). Dust mite-specific knowledge was defined as the ability to name at least 1 of the 4 objectively measured recommendations to reduce house-dust mite, which included mattress encasements, pillow encasements, carpet removal, or stuffed toy removal when asked in an open-ended format, ie, "What was the advice you received on environmental control to reduce your child's exposure to allergens?" If a parent reported having been advised to make changes in the home *and* could describe advice compatible with NHLBI guidelines¹ for dust mite control, he or she qualified as having knowledge.

Practice was defined as behaviors observed by study personnel in the home using the home evaluation checklist. Changes in the home commonly recommended for dust mite control, including the use of allergen-proof mattress encasements, pillow encasements, and absence of wall-to-wall carpeting and stuffed animals, qualified as practicing dust mite control behaviors.

Finally, we compared knowledge and practice of dust mite control measures only for the children who had seen an allergist. This offered an additional opportunity to compare knowledge of dust mite control recommendations within practice to determine the families' compliance to medical advice.

Fisher's exact test was used to compare the families who saw an allergist with those who did not, on knowledge and practice. A *P* value <0.05 was considered significant.

RESULTS

Participant Characteristics

The mean age was 11.2 ± 3.2 years (range, 6 to 17 years). Sixty percent were male. The study families were predominately Caucasian (50%) or African-American (35%), and of the 85 who answered, 35% reported an annual income of over \$75,000, 31% between \$30,000 and \$74,999, and 9% below \$30,000 (Table 1). All the children ($n = 114$) had a positive skin test to dust mite, 61% ($n = 69$) had been seen and skin tested by an allergist before enrolling in the study, and 4% were currently on immunotherapy.

The child's primary caretaker reported whether they had ever been advised to make changes in their home to reduce their child's exposure to allergens. Of the 69 families who had seen an allergist before enrolling in the study, 56 (81%) reported that they had received advice on indoor environmental control. Of the 45 families who had not seen an allergist, 22 (49%, $P < 0.001$) reported that they had received advice (Fig 1). These numbers represent all families in both groups who were given any indoor environmental control advice such as allergen reduction for dust mite, pet, or cockroach without regard to whether the advice was house-dust mite-specific.

With regard to dust mite recommendations, families who were evaluated by an allergist had significantly more dust mite knowledge (70% vs 18%, $P < 0.0001$). The families who had seen an allergist had a significantly higher frequency of knowledge of the need for mattress encasements (61% vs 13%, $P < 0.0001$) and pillow encasements (51% vs 11%, $P < 0.0001$) than the nonallergist group (Fig 1). Although not statistically significant, families who had seen an allergist had more knowledge regarding carpet (23% vs 11%, $P = 0.054$) and stuffed animal/toy removal (10% vs 2%, $P = 0.088$) compared with the nonallergist subjects.

Figure 2 represents the observations from the home inspection visits. Families who had seen an allergist demonstrated somewhat greater implementation of dust mite control recommendations than those who saw a pediatrician (Fig 2). Overall, 68% made some change in their home that reduces dust mite allergen exposure compared with 56% ($P = 0.063$) of the families who had not seen an allergist. The use of mattress and pillow encasements was significantly higher (38% vs 11%, $P = 0.001$ and 36% vs 16%, $P = 0.009$, respectively) in the allergist group than the pediatrician group. There was no difference in stuffed animal removal between the groups, although carpet removal was somewhat more likely in the pediatrician group (36% vs 26%, $P = 0.093$).

Several of the families made more than one change in their home. In some cases, changes observed in the home, such as not having carpeting, could have been done without the intention of controlling for dust mites. To evaluate adherence, it was necessary to compare each family's knowledge of a specific recommendation with the changes made in their home. This comparison showed that of the 69 families who saw an allergist, 48 (70%) had knowledge of dust mite control recommendations and 29 (60%) had made at least 1 of the 4 observable changes in their home to reduce dust mite allergen. Of the 45 families who saw a pediatrician, 8 (18%) had knowledge of dust mite control recommendations, and 5 (63%) of them had made changes in their homes.

A difference in income levels was noted between the two groups. The allergist group had more families in the highest income category, above \$75,000 (39%), compared with the pediatrician group (29%) and less families in the lowest income category, below \$29,999 (4% vs 16%). Logistic regression was conducted to evaluate whether or not income influenced the practice of environmental control methods to

Table 1. Characteristics of the Study Population

Characteristics	Total (n = 114)	Allergist (n = 69) 61%	Pediatrician (n = 45) 39%
Mean age (y) (range 6-17 y)	11.2 (SD 3.2)	11.3 (SD 3.1)	11.1 (SD 3.3)
Gender	Male 69 (60%) Female 45 (40%)	Male 46 (67%) Female 23 (33%)	Male 23 (51%) Female 22 (49%)
Race or ethnic group			
Caucasian	57 (50%)	44 (64%)	13 (29%)
African American	41 (36%)	15 (22%)	26 (58%)
Mixed race	13 (11%)	9 (13%)	4 (9%)
Other	3 (3%)	1 (1%)	2 (4%)
Annual income of those who reported	Total (n = 85)	Allergist (n = 48)	Pediatrician (n = 37)
Less than \$15,000	4 (4%)	0 (—)	4 (9%)
\$15,000–\$29,999	6 (5%)	3 (4%)	3 (7%)
\$30,000–\$49,999	15 (13%)	6 (9%)	9 (20%)
\$50,000–\$74,999	20 (18%)	12 (17%)	8 (18%)
\$75,000 or more	40 (35%)	27 (39%)	13 (29%)
Refused or missing	29 (25%)	21 (30%)	8 (18%)
Positive skin test to house-dust mite	114	69	45

SD, standard deviation.

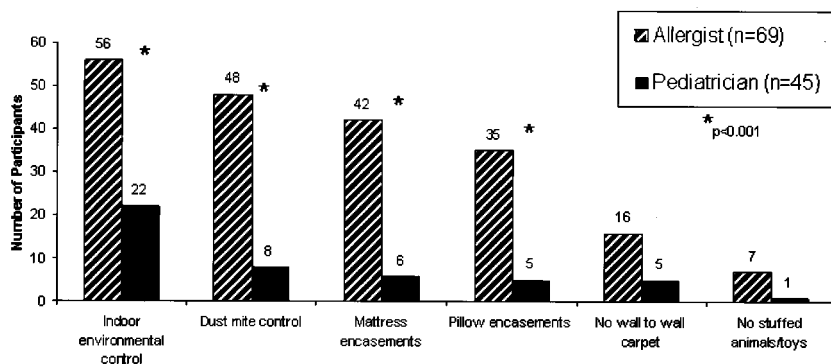


Figure 1. Knowledge of dust mite control recommendations. The first columns represent the number of families who reported being advised on indoor environmental control recommendations by group (allergist and pediatrician), followed by families with knowledge of any of the four observable dust mite control recommendations and each of the four dust mite control recommendations.

reduce dust mite allergen. After adjusting for income, the association between environmental control practices in the allergist group remained.

DISCUSSION

This is the first study to systematically compare environmental control practices with knowledge of house-dust mite control recommendations. Families of children who have seen and been skin tested by an allergist are more likely to have environmental control information for reduction of dust mite allergen than families who have not. There were significantly more families seen by allergists who reported being given indoor environmental control information and dust mite control education consistent with the National Asthma Education and Prevention Program (NAEPP) Expert Panel Report 2 guidelines.

However, despite increased knowledge among families who had visited an allergist, overall adherence to the practice of dust mite control recommendations was similar in both groups. Sixty-eight percent of the families in the allergist group were observed as having made at least 1 of the 4 changes in their homes and 56% of the pediatrician group had made changes in their homes. These comparable levels of adherence to the practice of dust mite control recommendations exceed the figures found in other research, which show that <30% of patients typically comply with allergen control recommendations they get from their physician.⁶ Two areas of environmental control that were significantly different between the groups however, were mattress encasements and

encasing pillows. The children seen by an allergist were more likely to have mattress (38% vs 11%, $P = 0.001$) and pillow (36% vs 16%, $P = 0.009$) encasements on their beds than children who had not seen an allergist. This difference may result because encasing bedding is a simple (one time), fast, and relatively inexpensive dust mite control practice compared with other recommendations, such as carpet removal and frequent vacuuming.

Children can have a variety of practitioners responsible for their asthma management. For any practitioner managing allergic asthma, patient education is of primary importance and should include teaching families ways to reduce exposure to indoor allergens as recommended by the NHLBI asthma guidelines. The effectiveness of education is reflected in both the families' knowledge of ways to reduce allergen exposure and the implementation of these recommendations. Although a significant number of families in the allergist group reported knowledge of dust mite control procedures, all families with knowledge made the same percent of changes in their home.

These results show that giving patients information about environmental control of dust mite allergens is an important step toward environmental change. Getting information to patients on the environmental control of dust mites is more important than the type of practitioner offering the information, although thus far, allergists appear to be significantly better at offering allergen control education. Therefore, it is important to continue to promote the use of the national asthma guidelines with all practitioners responsible for asthma management.

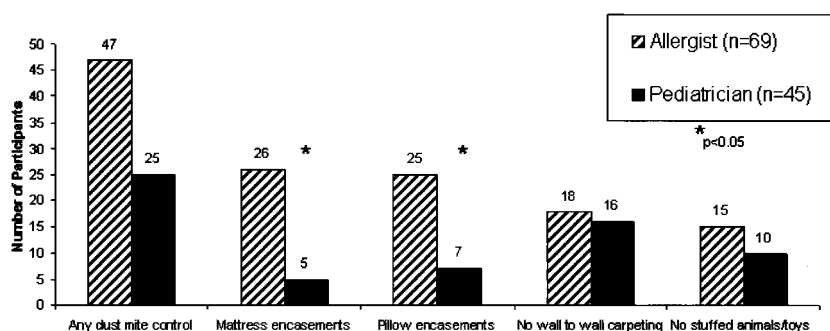


Figure 2. Home observations of dust mite control practices. The first column represents the number of families observed practicing any of the four recommendations in their homes and is followed by the number of families who were observed practicing each specific dust mite control recommendation by group (allergist and pediatrician).

Studies have shown that specialists are familiar with the NAEPP asthma guidelines and therefore follow them more closely than generalists.⁷⁻⁹ Recommendations from the NHLBI asthma guidelines are adhered to by allergists significantly and consistently more often than by generalists.¹⁰ Doerschug et al¹¹ developed a 31-question multiple-choice test of asthma knowledge using the NAEPP as the source of content and validity. This test measured knowledge of NAEPP content and showed that asthma specialists scored higher in total score in the pharmacology and prevention subscales than generalists.¹¹ According to this test, there were three areas that allergists consistently demonstrated better levels of adherence to the asthma guidelines over generalists: 1) allergen, environmental, and occupational triggers^{7,9}; 2) formal asthma education programs; and 3) written, home asthma management action plans that teach self-management skills.^{9,12} Larger studies have shown that when compared with the accepted guidelines, allergists use more appropriate pharmacology for individuals with asthma than generalists do. Specifically, generalists tended to underuse inhaled corticosteroids, overuse long-term corticosteroids, and underuse high-dose corticosteroids for acute exacerbations.^{13,14} This study found that allergists offer their patients more environmental control information on dust mite control measures than pediatricians. This may be related to a combination of better diagnoses of dust mite sensitization and a familiarity with the NHLBI guidelines, which leads to specific environmental control recommendations and increased patient adherence on dust mite control behaviors.

In a recent study by Diette et al,¹⁵ allergists were more likely to prescribe controller medications, give pulmonary function tests, and offer education about asthma triggers and avoidance in accordance with the asthma guidelines. A study by Vollmer et al,¹⁶ showed that allergists' patients were considerably more likely to use inhaled corticosteroids ($P < 0.01$), oral steroids ($P < 0.01$), and daily breathing medications to control their asthma ($P < 0.01$). Compared with generalists' care after an asthma emergency room visit or hospitalization, another study showed more comprehensive followup and treatment by the asthma care specialists.⁵ Asthma care specialists significantly reduced the incidence and number of asthma emergency room relapses, improved asthma status, and increased the long-term use of inhaled corticosteroids and cromolyn.¹⁷ In addition, studies have shown that quality of life measures are higher among asthmatic patients who see specialists than those who see generalists.^{15,18} Another study found that allergists' patients conform more closely to national asthma guidelines and reported better quality of life than did generalists' patients.¹⁶

This study had several limitations. The subjects in this study were predominantly middle-class children with mild to moderate asthma symptoms and with health insurance, so the findings may not be generalized to a different population. Subjects with severe asthma or of a lower socioeconomic status may have different outcomes. Depending on the type of

insurance, some families could self-refer to an allergist and others were dependent on the pediatrician for referrals.

CONCLUSION

Research suggests that allergists are more likely than pediatricians to follow the NHLBI asthma guidelines, which include appropriate use of inhaled corticosteroids, allergen avoidance, and patient education. This study is unique because it showed that families of children who were dust mite-sensitive and who saw allergists knew more about the environmental control of dust mite allergens. This study reinforces the need to promote the NHLBI asthma guidelines to all physicians who manage asthma and to encourage the provision and reinforcement of allergen control education to their patients. Referrals from pediatricians to allergists are useful when allergies are suspected in patients with asthma. Allergists can perform specific tests to determine allergies and offer important educational information on allergies and environmental control that can decrease asthma morbidity and severity.

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