

Asthma and allergy avoidance knowledge and behavior in postpartum women

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Objective: Based on family history, infants may be classified as “high risk” or “low risk” for the development of allergy or asthma. Failure to breast-feed and early exposure to cigarette smoke or aeroallergens increase the risk of developing asthma or allergy. Since we suspect that physicians seldom educate mothers on reducing environmental exposures in the postnatal period, we sought to determine the level of maternal knowledge as well as actual avoidance behaviors with respect to these risk factors in high risk and low risk families.

Design: Questionnaire administered by a research assistant.

Setting: Obstetrics unit of two tertiary care general hospitals.

Patients: A sample of 194 postpartum women with uncomplicated pregnancies, interviewed after 24-hours postpartum.

Main Outcome Measures: (1) Parental history of asthma, allergy or eczema; (2) potential for infant exposure to environmental risk factors for asthma and allergy, as indicated by history of avoidance practices in the home; (3) parental knowledge of risk factors for asthma or allergy; and (4) physician advice on avoidance.

Results: Of 194 women interviewed, a history of doctor-diagnosed asthma, allergy/allergic rhinitis or eczema in either parent was reported by 122 (high risk group). The remaining 72 patients had no history of atopy (low risk group). Of those in the high risk group, 10% of mothers smoked during pregnancy, and about 25% were exposed to second hand smoke on a daily basis. Most of the mothers in the high risk group planned to breast feed (89%). A large number of patients in the high risk group reported potential risk factors for allergy/asthma in their home environments. These included animals in the household (36%), dusty environments (10%), carpeting (47%), cigarette smoke (18%), and others. Despite these risks, only 13% of patients reported being educated by their physicians on improving their home environment. Exposures to environmental risk factors were not different between low and high risk groups. Similarly, knowledge of environmental risk factors and avoidance behaviors were not significantly different between low and high risk groups.

Conclusions: Many mothers whose infants are at high risk of developing asthma or allergies are not aware of and do not practice avoidance of risk factors. Physicians involved in prenatal care of women with a family history of atopy and asthma should offer advice on reducing exposure to potential risk factors and how to modify their environment in ways that can potentially decrease the risk of asthma or allergy prevalence and severity.

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INTRODUCTION

Asthma is one of the most common diseases of childhood.¹ Although the

etiology of asthma or allergies remains unclear, current opinion is that both genetic and environmental factors are involved. Some authors have suggested that identification of people with a family history of asthma or allergy may allow designation of that person as being at “high risk” of developing these conditions.^{2–4} Further, a large number of studies have identified social, environmental, and other fac-

tors that are associated with an increased prevalence of asthma, particularly in “high-risk” individuals.^{4–6} These factors may include preterm birth,⁷ parental smoking (antenatally and postnatally),^{4,8} low parental socioeconomic status,^{9,10} early respiratory tract infection,^{11,12} a history of atopic disease,¹³ and heavy aeroallergen exposure in early childhood.^{2,14} The exact relationship of these factors to the development of allergy and asthma remains controversial as several reports have failed to demonstrate significant associations.^{15–17}

Recent studies have emphasized the potential to decrease bronchial hyper-reactivity in childhood through avoidance of risk factors, particularly with respect to parental smoking and exposure to house dust mite allergen.^{2,4} From a primary preventive aspect, it appears that risk factor modification in “high-risk” infants may be effective in reducing the development or severity of asthma and allergy in childhood. We suspect, however, that parental knowledge of environmental risk factor modification, and practice of avoidance behavior is poor; this is perhaps the result of few physician-initiated identification or educational strategies. We therefore sought to ascertain the level of parental knowledge about environmental control as well as actual avoidance measures that are initiated.

METHODS

Subjects

The target population included 244 healthy postpartum women with uncomplicated deliveries who were at least 24 hours postpartum. All women with significant complications during or after delivery, or with infants requiring other than normal medical care were excluded from the study. A sig-

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nificant infant complication was defined as any preterm infant, infants weighing less than 2500 g, or infant requiring admission to higher level of nursery care (eg, level II nursery); significant maternal complications included any woman who required treatment with intravenous antibiotics, or women who had a medical or obstetrical disease which made their obstetrical care complicated (eg, diabetes mellitus and preeclampsia). Consecutive women, identified by nursing staff as not meeting exclusion criteria (which was confirmed by a brief chart review) were approached at The Toronto Hospital and Mount Sinai Hospital (Toronto, Canada) between the months of June and August 1995. Informed consent of participants was obtained before administration of the questionnaire.

Study Design

A questionnaire adapted from the American Thoracic Society's epidemiologic standardization project was administered by a trained research assistant.¹⁸ The questionnaire gathered information pertaining to demographic data and smoking history; personal and family history of asthma and other atopic disease (allergy, eczema), including whether there was confirmation of these conditions by a physician. Allergy was diagnosed in an individual reporting: (1) positively to the questionnaire definition of hayfever (defined as "... an allergic disease characterized by sneezing, running, stuffy nose and watery eyes, when you did not have a cold or flu ..."), (2) a positive allergy skin test in the past, (3) seasonal allergic symptoms, (4) drug allergies, or (5) allergic reactions to shellfish or other foods, or to insect stings. Maternal knowledge of and actual practice of avoidance of potential risk factors for the development of atopy and asthma were evaluated. Finally, it included several questions regarding specific and general information offered by their primary care physician during their pregnancy. The majority of questions involved simple yes or no answers, or direct quantifi-

cation (eg, number of cigarettes smoked per day). We included, however, some open-ended questions to evaluate knowledge or practices of subjects, eg, "Are you aware of any information about factors that can predispose babies to develop asthma, allergies or other lung diseases when they get older? If yes, specify them."

Data Analysis

Descriptive data for all subjects were initially tabulated. The frequencies of patients answering positively to each of the questions on behavior and knowledge, as well as physician education were calculated. Infants were then divided into two groups: those with a parental history of asthma, allergy, or eczema (high risk), and those without a parental history of asthma or allergy (low risk). The frequencies of positive and negative answers were compared between groups using the Chi-squared statistic. Student's *t* tests were used to compare differences in the mean age and pack year smoking history between subjects.

RESULTS

Of the 244 women approached, 194 completed the questionnaire. Of the 52 excluded, 15 patients refused to participate, 8 questionnaires were incomplete, and 29 patients could not participate due to a language barrier.

Family History of Asthma, Allergy, or Eczema

Of 194 women interviewed, a history of asthma was reported in 26 mothers (13%) and 13 fathers (7%). Thirty-four of the families (18%) had a history of asthma in either the mother or the father, and 5 (3%) had a history of asthma in both parents. Allergy was reported in either parent in 114 families (59%). Thirty-five families (18%) had a history of eczema in either parent. Nine families (5%) had a history of only eczema in either parent, but no history of asthma or allergy.

We divided subjects into two groups based on their history of allergy, eczema and asthma, and thus the risk level that their child would develop these conditions. Seventy-two patients

(36%) had no history of doctor-diagnosed asthma, allergy/allergic rhinitis, or eczema in either parent (low risk group). The remaining 122 patients (63%) had a history of doctor-diagnosed asthma, allergy/allergic rhinitis, or eczema (high risk group).

Demographics

Demographic variables did not differ significantly between high risk and low risk groups (see Table 1). The mean age of mothers was 31 ± 5 years in the high risk group and 30 ± 5 years in the low risk group ($P > .05$). All infants' Apgar scores were above a score 8 (out of ten), except for four patients with a score of 7 and one with a score of 6. Although all infants were identified initially by nursing staff as being "term" deliveries, twenty-two babies (11%) were born slightly before 37 weeks of gestation. Of these, 2 were reported on the intrapartum record as being 35.5 weeks, 4 were 36.5 weeks, and the remaining 16 were 36 weeks' gestational age. The most common ethnic race/origin of mothers in the high risk group was white (not of Hispanic origin) (66%), followed by individuals of Asian descent (16%) (Table 1). Although there was no evidence of ethnic difference among the two groups as a whole, mothers from the high risk group were more likely to be white Asian/Pacific Islanders than mothers in the low risk group ($P < .001$). The most commonly identified ethnic origins of the fathers of the high risk group were white (not of Hispanic origin) (25%) and Asian/Pacific Islander (25%). A large proportion of fathers (45%), however, reported not belonging to any of the ethnic groups listed.

Sixty-six infants (54%) in the high risk group were male compared with the low risk group in which 42 infants (58%) were male ($P > .1$).

Allergy and Asthma Risk Factor

Avoidance Knowledge and Behavior
Smoking. Fifty-four mothers in the high risk group (44%) reported being current or past smokers. Twelve mothers (10%) reported smoking during

Table 1. Demographic Data of Families Surveyed*

Characteristic	High Risk (N = 122)		Low Risk (N = 72)	
	Mother	Father	Mother	Father
Age, yr	31 ± 5	33 ± 6	30 ± 5	33 ± 6
Ethnic origin (N)				
White (not Hispanic)	81 (66%)	25 (20%)	24 (33%)	24 (33%)
Asian or Pacific Islander	19 (16%)	25 (20%)	28 (39%)	24 (33%)
Black (not Hispanic)	7 (6%)	7 (6%)	9 (13%)	6 (8%)
Hispanic	7 (6%)	0 (0%)	7 (10%)	8 (11%)
Native Canadian	2 (2%)	10 (8%)	0 (0%)	3 (4%)
Other	6 (5%)	55 (45%)	4 (6%)	7 (10%)
Formal education (N)				
High School	34 (28%)	41 (34%)	25 (35%)	31 (43%)
University/College	74 (61%)	64 (53%)	42 (58%)	33 (46%)
Postgraduate	14 (11%)	17 (14%)	5 (7%)	8 (11%)
Average yearly household income (N)				
<\$20,000	8 (7%)		13 (18%)	
\$20,000–40,000	21 (17%)		10 (14%)	
\$40,000–60,000	20 (16%)		11 (15%)	
>\$60,000	53 (43%)		18 (25%)	
Unknown	20 (16%)		20 (28%)	
Infant sex				
Male	66 (54%)		42 (58%)	
Female	56 (46%)		30 (42%)	

* Numbers rounded off to nearest decimal point.

pregnancy, and 9 mothers (7%) reported current smoking. Three mothers (3%) said that they planned on continuing smoking. There was no significant difference between the maternal smoking habits of low risk group and high risk group (Table 2).

Approximately half of all mothers in the high risk group reported being exposed passively to cigarette smoke during their pregnancy. A large proportion of these women, 23%, were exposed to passive cigarette smoke on

a daily basis. Twenty-two mothers (18%) in the high risk group reported paternal smoking. Again, similar patterns of passive exposure to smoke were seen in both low and high risk groups, although there was usually exposure to less than ten cigarettes per day (Table 2).

Feeding. The majority of women in the high risk group (89%) were breastfeeding their children (Table 3). Thirty-eight mothers (31%) in the high risk group indicated that they would be in-

roducing meats and vegetables before the child had reached 4 months of age.

Allergens/Environment. The responses to questions regarding control of environmental sources of allergens in the home are summarized in Table 3. There was no significant difference in the proportion of patients in both groups with respect to risk factors or risk factor avoidance, except that individuals in the low risk group were more likely to wash their sheets infrequently (less than once weekly) than were patients in the high risk group (36% versus 25%, $P < .05$).

Patient Knowledge and Physician Education On Risk Factors

The majority of patients in the high risk and low risk groups were followed regularly by a physician during their pregnancy (Table 4). Only a minority of patients in the high risk group (16 patients, 13%) were educated about not having smokers in the home before or after pregnancy. Likewise, only 13 patients in the high risk group (11%) were educated on avoidance of dust mites.

Table 2. Tobacco Smoke Exposure in Families Surveyed

Risk Factor Smoking	High Risk (N = 122)	Low Risk (N = 72)
Current		
Maternal	9 (7%)	5 (7%)
Paternal	22 (18%)	14 (19%)
Either	24 (20%)	18 (25%)
Current or past		
Maternal	54 (44%)	21 (29%)
Exposed to passive smoke		
Any	60 (49%)	33 (46%)
Daily	28 (23%)	14 (19%)
Educated by physician on avoidance	16 (13%)	13 (22%)
Knowledge of smoking as a risk factor	44 (36%)	23 (32%)

When asked about knowledge of factors that may predispose infants to asthma, allergy, or lung diseases, 42 mothers (34%) in the high risk group were unaware of any factor (Table 4). Of those who did respond, the most commonly identified predisposing factors by the high risk group were cigarette smoking (36%), allergen exposure (19%), infant diet (17%), and not breastfeeding (11%). There was no significant difference in individuals in the high risk group and the low risk group with respect to the proportion identifying any of the risk factors listed ($P > .05$).

We asked patients if they planned on making any changes in their home environment when their infant returned home. In the high risk group, 52 mothers (43%) said that they would make some change in their home environment (Table 4). The most common environmental change identified was cleaning and dust control ($N = 32$; 26%), followed by keeping a smoke-free environment in the home ($N = 14$; 12%).

As another way of assessing knowledge of risk factors, we also asked mothers with a family history of asthma or allergy (high risk group) to identify non-medication strategies that were used by the allergic/asthmatic individual in the household for control of symptoms. Sixteen (13%) said that dust control measures such as cleaning were used. Avoidance of triggers such as smoky areas, perfumes, animals, and going outdoors in certain seasons were identified by 38 subjects (31%). Other strategies used included vitamins/natural medicine, 3 (3%); relaxation/fitness, 4 (3%); breathing steam, 2 (2%); using an air conditioner, 1 (1%); and trying to avoid upper respiratory tract infections, 1 (1%).

To determine whether reported education by a physician-influenced knowledge of risk factors or avoidance behavior, we divided patients in the high risk group into two groups: those who reported education on avoidance ($N = 27$) and those who did not ($N = 95$). We found no evidence that avoid-

Table 3. Environmental Allergen Exposure and Avoidance in Surveyed Families

Risk Factor	High Risk (N = 122)	Low Risk (N = 72)
Feeding		
Breastfeeding	108 (89%)	54 (75%)
Age of introducing solids*		
<4 months	38 (31%)	26 (36%)
4–6 months	67 (55%)	37 (51%)
>6 months	17 (14%)	9 (13%)
Allergens/environment		
Animal(s) in household	44 (36%)	17 (24%)
Cockroaches	14 (11%)	19 (26%)
Very dusty home	12 (10%)	4 (6%)
Wall to wall carpet	57 (47%)	27 (38%)
Cleans less than once weekly	8 (7%)	4 (6%)
Uses humidifier	60 (49%)	29 (40%)
Cleans humidifier once yearly†	12 (10%)	3 (4%)
No air conditioning	37 (30%)	26 (36%)
Cleans sheets <1X/week	31 (25%)	26 (36%)
Does not use hot water	65 (53%)	48 (67%)
Does not vacuum mattress cover	84 (69%)	54 (75%)
No hypoallergenic mattress	103 (84%)	61 (85%)
Stuffed animals in child's room	99 (81%)	52 (72%)
Feathered materials in child's bed	10 (8%)	8 (11%)

* Mothers were asked, "At what age will you introduce meats and vegetables into your baby's diet?"

† 45 patients in the HR group and 14 in the LR group knew how often the humidifier was changed.

ance behaviors or knowledge of risk factors for allergy/asthma increased with reported education by physicians. The only significant difference between the groups was a slightly higher rate of current smoking in either parent in the physician-educated group as compared with the non-educated group (37% versus 15%, $P < .05$).

Similarly, we analyzed our data on the high risk group to determine whether presence of other siblings in the family who had doctor-diagnosed asthma, allergy, or eczema ($N = 17$) increased knowledge of risk factors or avoidance of these as compared with patients without affected siblings ($N = 105$). Families with affected siblings were less likely to have an animal in the home than those without atopic siblings (12% versus 40%, $P < .05$). There were no significant differences in rates of current or ever smoking, knowledge of smoking and allergen avoidance as risk factors, and avoidance of dust in the home.

DISCUSSION

Our survey of 194 postpartum women indicated that a large proportion (63%) of infants were at high risk of developing asthma or allergic disease based on family history. Furthermore, 11% of infants were preterm, which may increase the risk of developing asthma in later life.⁷ Of the high risk infants, many were exposed to "risk factors" for the development of asthma and allergy. Although only 10% of mothers smoked during pregnancy, half of all women were exposed to second hand smoke, and about half of these were exposed on a daily basis. Most mothers were breastfeeding their children, but approximately one-third planned on introducing meats and vegetables before the child reached 4 months of age. There was also potential for significant exposure to aeroallergens in infants at high risk of asthma and allergy. Of particular note, more than one-third of households had pets, the vast majority of infants had stuffed toys in their bed-

Table 4. Patient Knowledge and Physician Education on Risk Factors for Allergy and Asthma

	High Risk (N = 122)	Low Risk (N = 72)
Physician education		
Followed by physician regularly	114 (93%)	68 (94%)
Educated by physician on dust/dust mite reduction	13 (11%)	6 (8%)
Educated by physician on avoidance of smoke in home		
All Patients	16 (13%)	13 (22%)
Of patients with smoker in home	9/28 (31%)	9/18 (50%)
Parental knowledge		
Predisposing factors*		
Any	80 (66%)	37 (51%)
Cigarette smoke exposure	44 (36%)	23 (32%)
Infant diet†	21 (17%)	9 (13%)
Not breastfeeding	13 (11%)	1 (1%)
Air pollution/chemicals/toxins‡	20 (16%)	12 (17%)
Allergens (animals, dust, pollens)	23 (19%)	19 (26%)
Genetic/runs in families	15 (12%)	2 (3%)
Others	2 (2%)	0 (0%)
Changes when infant returns to home		
Any	44 (36%)	23 (19%)
More cleanliness	32 (26%)	12 (17%)
No smoking in home	14 (12%)	5 (7%)
Wash toys	3 (3%)	0 (0%)
Use air filter/air conditioner	3 (3%)	1 (1%)
Keep animals away from child	4 (3%)	0 (0%)
Use hypo-allergenic mattress cover	2 (2%)	0 (0%)
Use a humidifier	2 (2%)	0 (0%)
No plants in child's bedroom	0 (0%)	1 (1%)

* Responses to the question, "Are you aware of any factors that may predispose a baby to develop asthma, allergies or other lung problems?"

† For example, patients identified early introduction of eggs, dairy products, shellfish, peanut butter, etc.

‡ Includes aerosols, fumes, alcohol, medicines, and pollution.

rooms, and few used measures to control house dust mites in beds. Despite their family history and exposure to risk factors, few patients said that education on avoidance measures had been discussed by their physicians. Only 9 of 28 patients in the high risk group with a smoker in the home had been told by their physician that there should be no smoking in the home.

There is clear evidence that atopy is inherited, and conditions such as asthma, allergic rhinitis, and eczema tend to cluster in families.^{15,19} Hamburger found that children with one atopic parent have a 29% risk of developing atopy compared with a 13% risk in the general population.²⁰ This risk increased to 47% when both parents were atopic. Young and colleagues demonstrated an increase in

airway responsiveness in children with a positive family history of asthma.⁴ Using a family history is thus a reasonable means to identify infants at increased risk for allergic disease.

Although a family history of asthma/allergy increases the risk of disease, the expression may be associated with exposure to allergens at an early age. Sporik and colleagues have shown a strong relationship between wheezing at age 11 and exposure to house dust mite in the first year of life.² Other studies confirming this relationship have indicated new development of asthma in communities newly exposed to house dust mites,²¹ and demonstrated clinical improvements in patients removed from exposure.^{22,23} Murray and colleagues conducted a controlled trial that demonstrated that

the use of hypoallergenic covers on mattresses, pillows and box springs, and providing information on keeping clean bedrooms significantly reduced wheezing, need for medication, and bronchial reactivity to histamine.²⁴ Early exposure to cat dander has also been implicated in the later development of allergic diseases.²⁵ Since an infant's first exposures to allergens may be an important determinant of later respiratory symptoms, there is a strong case for early identification of risk and exposure.²⁶

Smoking has been considered a potential agent involved in the development of asthma in children.^{8,27} Young et al demonstrated that a history of parental smoking increased airway responsiveness in infants.⁴ Similarly, Martinez demonstrated that airway hyperresponsiveness in 9-year-old children was present in 70% of the children whose mothers smoked during pregnancy, but in only about 30% of children whose parents did not smoke during the pregnancy.²⁸ Gortmaker et al found a small but significant increase in the risk of asthmatic attacks in children from families in which parents smoked.⁸ Many have argued that the associations between smoking and asthma simply represent an increase in the risk of asthma attacks in individuals with asthma (ie, expression of asthma) and that there is no role for cigarettes in the etiology of asthma.¹⁵ A longitudinal study and a cohort study have demonstrated no effect of parental smoking on rates of asthma in children.^{15,29} This has led to speculation by some authors that although smoking does not increase the risk of asthma directly, it may increase the risk of early respiratory infection, which has also been suggested as a predisposing factor for asthma.³⁰ This issue is further complicated by the suggestion that viral respiratory infections may in fact be protective against the inception of asthma and allergy.³¹ Despite this controversy, it is reasonable to be prudent and err towards the argument that parental smoking influences the development of asthma.⁴

The risk of allergy, asthma, and eczema has been shown to be reduced in the offspring of women who exclusively breastfeed, as well as in those who avoid early introduction of solid foods.^{18,32-35} In our sample population, the majority of women breastfeed, suggesting that recent campaigns on the benefits of breast-feeding, along with physician education on this matter, have been effective. As with the other risk factors that have been discussed, there is controversy over the benefits of breast-feeding on allergic diseases.^{15,36}

We found some evidence that infants of white mothers were more likely to be at high risk of allergy/asthma than mothers of Asian/Pacific Islander descent. Although the incidence of hay fever and bronchial asthma is felt to be lower in China and Hong Kong than in Western countries,^{36,37} this relationship has not been consistently demonstrated. Leung and colleagues found no difference in the prevalence of hay fever between Australian born non-Asians and Asian immigrants under the age of 20 and in history of asthma in adults aged 20 to 40 years; however for adults (aged 20 to 40 years) hay fever was almost twice as prevalent in Asian immigrants.³⁷ Although our data may represent a lower prevalence of asthma and allergy prevalence in mothers of Asian/Pacific Island origin, there is evidence that rates of these allergic diseases increase with length of stay in the country of immigration.⁴⁰

Little has been written regarding the primary prevention of asthma or allergies. Kjellman et al reviewed literature on the development of asthma, and concluded that with the current state of knowledge, it should be recommended that pregnant women with high allergy-risk behavior be educated on environmental control measures, smoking cessation, and breastfeeding.³⁸ Despite these recommendations, our survey suggests that either few physicians engage in such educational measures, or there is a barrier to such education being put into practice.

A simple approach to primary prevention of allergic disease would be

for physicians involved in prenatal care to first identify those infants who may be classified as "high risk" based on a family and environmental history. This may involve the use of a questionnaire to assess genetic risk and avoidance practices.³⁹ The risk assessment may then be followed by simple educational sessions, conducted by a physician, nurse or other health care professional in which avoidance measures may be taught. Distribution of a brochure on avoidance measures may also be useful.

Education of patients with asthma in the recent past has been shown to be effective in asthma management, and studies have demonstrated that asthmatic patients are willing to take an active role in their care.⁴⁰ It has also been demonstrated that about 18% of smoking women will stop smoking by the time of their first prenatal visit.⁴¹ This value may be expected to increase with the delivery of further education and information; MacArthur and colleagues demonstrated that an anti-smoking campaign was effective among women who were primiparous, but not those who were multiparous.⁴²

Despite the demonstration of improvement in asthma or allergy symptoms following strict avoidance measures, success of education in settings in which avoidance was left up to patients has shown less success. Several studies have shown that even among known allergen-induced asthmatic patients compliance with avoidance measures can be poor.^{43,44} This has led some authors to conclude that avoidance measures be reserved only for individuals who currently have allergies.⁴⁵ In our study, asthmatic or allergic patients were no more likely to practice environmental control than the low risk group of patients; this may indicate that even perceived importance or severity of their disease does not affect behaviour. There are several limitations of our study. First, there is the potential for selection bias in our study population, as mothers with uncomplicated, term deliveries may be less likely to be smokers, asthmatic or have other co-morbidities.⁷ Second,

mothers may have given socially desirable responses regarding their home environment because of the presence of the investigator thereby causing us to underestimate the magnitude of the problem. Finally, in terms of identifying mothers whose infants are at "high risk," it is clear that although children with atopic parents are at increased risk of allergy, family history by itself has a low screening efficiency for atopy.⁴⁶ Nevertheless, the use of "physician-reported" asthma has a high sensitivity and specificity for identifying which parents have asthma.⁴⁷

In summary, our data indicate that many parents whose infants have a high risk for the development of allergy and asthma are not educated on environmental control measures. This lack of education is manifested by few families engaging in avoidance of risk factors in the home environment. Given the current knowledge of risk factors for asthma and allergy, it is reasonable to suggest that physicians identify and educate women whose infants are at high risk, with the goal of decreasing the burden of illness associated with allergy and asthma.

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