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Original article

Epidemiological study of risk factors in pediatric asthma

***Background**: Childhood asthma is a major public health problem in Egypt and worldwide. Epidemiologic, physiologic, and social factors appear to be associated with an increased risk of asthma.*
***Objective**: The aim of the study was to determine the most frequent risk factors of childhood asthma exacerbation and severity in our community.*
***Methods**: This cross sectional study involved 206 asthmatic children, 5 to 15 years old. They were enrolled from the School Students Health Insurance facility of El-Matareya Teaching Hospital and from the Pediatric Outpatient Clinic of Saint Mark Charity Hospital representing several social and residential classes. They were assessed clinically and by peak expiratory flow rate (PEFR). Parents of children were interviewed for symptoms and some demographic, social, environmental, housing and familial data as well as asthma triggers through a comprehensive detailed questionnaire.*
***Results**: Residential distribution and social status were significantly associated with asthma severity as most moderate persistent asthmatics lived in semi-urban areas (70.8%) and belonged to the low-level segment of social classification (47.9%). In the majority of the study population (69.9%), a family member or more had a positive history of bronchial asthma, and this was especially evident in moderate persistent cases (70.8%). Passive smoking and dust triggered exacerbations in 48.6% and 65% of the studied sample respectively and in most moderate persistent asthmatics (83.4% and 93.7%). Most houses of moderate asthmatics were infested with cockroaches (91.7%) and domestic animals were present in 56.2%. Recurrent chest infections and cold/flu attacks were strongly associated with asthma exacerbation and severity (93.8% and 93.7% of moderate persistent cases respectively). Most moderate persistent asthmatics (91.7%) reported exercise-induced asthma while 64.6% stated that emotional stress triggered their symptoms. Indoor pollutants such as insecticides, household chemicals and odors were strongly associated with asthma severity and exacerbation especially in moderate persistent cases (triggered symptoms in 66.7%, 52.1% and 58.3% of cases respectively).*
***Conclusion:** Smoking, emotional stress and dust were the most significant triggers of asthma exacerbation and severity in our series. Identification and avoidance of risk factors for persistent asthma, combined with early institution of pharmacologic and other intervention strategies, may lead to a better outcome.*

Keywords: asthma severity; asthma triggers; children; residence; risk factors; smoking; social status.

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INTRODUCTION

It is estimated that as many as 300 million people of all ages, and all ethnic backgrounds, suffer from asthma and the burden of this disease to governments, health care systems, families, and patients is increasing worldwid[1].

The rate of asthma increases as communities adopt western lifestyles and become urbanised. With the projected increase in the proportion of the world's population that is urban from 45% to 59% in 2025, there will likely be a marked increase in the number of asthmatics worldwide over the next two decades[1]. It is estimated that there may be an additional 100 million persons with asthma by 2025[1].

Asthma is by far the commonest of all chronic diseases of childhood and estimates from developed countries suggest that it affects between 11 and 20% of all school age children[2]. The prevalence of asthma among Egyptian children aged 3-15 years was estimated to be 8.2%. Of major concern is a

10% annual increase in mortality[3]. Asthma is a common cause of emergency room visits and hospital admissions. For example, in some areas of Egypt, asthma is the most common cause of hospital admission due to respiratory illness in adults. The burden of asthma is higher than generally recognised, particularly in children. For example, in Egypt up to one in four children with asthma is unable to attend school regularly because of poor asthma control[4].

It is estimated that asthma accounts for about 1 in every 250 deaths worldwide. Many of the deaths are preventable, being due to suboptimal long-term medical care and delay in obtaining help during deadly exacerbations. Barriers to reducing the burden of asthma include generic barriers like poverty, poor disease education, and poor health services infrastructure and environmental barriers like indoor and outdoor air pollution, tobacco smoking, and occupational exposures. Moreover, symptom-based rather than disease-based approaches to the management of asthma and tendency of care to be ‘‘acute’’ rather than “regular” are significant barriers. Patient barriers include; lack of information, under-use of self-management, over-reliance on acute care and cultural attitudes towards drugs and drug delivery systems like for example steroids and inhalers[1].

We, therefore, sought to investigate the major risk factors for asthma exacerbation and severity in Egyptian children in order to identify the targets for control efforts in our community.

METHODS

Subjects and study design

Two hundreds and six asthmatic children (206) were recruited into this study matching the inclusion criteria (both sexes were included, age between 5 to 15 years, asthma diagnosed since ≥ 1 year and free from other chronic illnesses rather than atopic diseases like nasal and or skin allergy). The majority of cases were enrolled from asthmatic school children covered by School Students Health Insurance at El-Matareya Teaching Hospital (Cairo North and East regions), and part of them were enrolled from Saint Mark Charity Hospital Pediatric Outpatient Clinic (Cairo North and City Center regions) representing different social and geographical classes and under different asthma therapeutic regimens.

Eligible children were enrolled into this cross-sectional study between January 2004 and January 2005. An informed consent was obtained from parents or caregivers.

Clinical Examination

Patients were clinically assessed by history taking and physical examination to confirm eligibility. Asthma severity was classified as mild intermittent, mild persistent, moderate persistent, or severe persistent, based on the criteria proposed by the Egyptian Guidelines for Asthma Management[5].

Peak Flowmetry

Peak expiratory flow rate (PEFR), was measured for every patient and used as a co-factor to determine asthma severity. The procedure is repeatable, but effort dependent; therefore, proper instructions on how to perform the forced expiratory maneuver were given to patients and the highest values of two or three recordings were taken.

Questionnaire

Parents of studied children as well as older children were asked about their disease and other relevant data through a comprehensive detailed questionnaire.

First part of the questionnaire focused on disease socio-demography including age, gender, residence, parent's occupation and parent's education.

Detailed family history of bronchial asthma, other allergic disorders and parental smoking were inquired about in the second part of the questionnaire in order to confirm any sort of relation between these factors and disease exacerbation and/or severity. The aggravation of symptoms by exposure to specific foods, dust, flu, exercise, emotional stress, insecticides, household chemicals, odors, perfumes or drugs was inquired about as well as the exacerbation of asthma during certain seasons or months. Home environment was investigated through questions about domestic animals and cockroach exposure.

The questionnaire also included associated conditions such as parasitic infestations, associated nasal and or skin allergy and history of recurrent chest infection.

Statistical Methods

Data were analyzed via a statistical SPSS software package (Statistical Package for Social Sciences, Inc, Chicago, Ill) version 12.

Frequency distribution of variables was performed for gender, residence, social status, parent's occupation, parent's education, family history of bronchial asthma and other allergic diseases, parent's smoking and seasonal exacerbation, as well as food, dust, cold/flu, exercise, emotional stress, insecticides, household chemicals, strong odors, drugs, parasitic infestation,

domestic animals, cockroaches, recurrent chest infection and associated nasal and skin allergy.

Chi-square testing "crosstabs" of the same variables was performed in association with asthma severity to obtain the effect of variables such as risk factors (both host and environmental factors), triggers, associated disorders and family history on asthma severity.

Multiple regression analysis was performed to find out the most significant risk factors associated with both asthma exacerbation and severity among the studied variables.

Multi-level frequency analysis was performed to determine the effect of multiple exposures to the studied variables and its impact on both asthma exacerbation and severity.

Quantitative variable analysis for age and PEFR was done exploring the mean, median and standard deviation.

For all tests, p values less than 0.05 were considered statistically significant and values less than 0.001 were considered highly significant.

RESULTS

The subjects recruited into the study were living in El-Matareya (n=66), El-Wayli (n=29), Ain Shams (n=26), Mostorod (n=24), El-Amireya (n=21), Ezbet El Nakhl (n=18), El-Marg (n=12) and other residential areas (n=10) of Cairo.

The majority of the study population (82.7%) presented with wheezy chest and diminished PEFR (mean = 150.9 L/min) while 17.3% were enrolled during disease quiescence. Also, 27.3% of children reported limitation of physical activity due to asthma. About one half of the studied sample had intermittent asthma (50.5%, n=104) while the rest had either mild (26.2%, n=54) or moderate (23.3%, n=48) persistent asthma (Table 1).

Demographic factor analysis revealed that gender was not related to (p=0.592) asthma severity which was comparable among males and females (Table 2).

Residence and social status showed highly significant association with asthma severity as 70.8% and 47.9% of cases of moderate persistent asthma were coming from semi-urban areas and belonged to the low-level segment of social class respectively (Table 2). Maternal illiteracy rate was 39.8% and the majority of mothers (42.2%) were housewives.

Family history of asthma had a major influence on wheeze and asthma in children as most of studied sample (69.9%) had a family member or more with history of bronchial asthma. Also the majority of moderate persistent asthmatics (70.8%) belonged to families with positive history of asthma (p=0.025) (Table 3). However, the family history of other allergic diseases (e.g. skin and nasal allergy) was weakly associated with the presence of asthma and/or its severity (p=0.841) (Table 3).

Table 1. Frequency of asthma symptoms, physical signs and severity

Physical Activity	Frequency	Percent
Not limited	149	72.7%
Limited	56	27.3%
Total	205	100%
Chest examination		
Normal	31	17.3%
Wheezy	148	82.7%
Total	179	100%
Asthma Severity		
Mild Intermittent	104	50.5%
Mild Persistent	54	26.2%
Moderate Persistent	48	23.3%
Total	206	100%

Risk factor analysis proved that parental smoking was detrimental to the children's respiratory health (p=0.000); about one half of the study population (48.6%) had one (37.4) or both parents (11.2) smoking (Table 4). This was especially evident in children with moderate persistent asthma [83.4% of children had one (54.2%) or both (29.2%) parents smoking]. Most smoker mothers (91.3%, n= 21/23) were smoking during pregnancy and after delivery.

Similarly, exposure to house dust was highly associated with asthma exacerbation; the majority of subjects (65%) had symptoms triggered by dust. Dust also showed highly significant relation to severity, the majority of cases of moderate persistent asthma (93.7%) reported that dust triggered their symptoms (Table 4).

Concerning common indoor allergens, our data revealed that the majority of study population had both cockroaches (80%) and domestic animals (38.3%), mainly dogs (46.8%) and cats (32.8%), in their houses. Both triggers showed highly significant relation with asthma severity; most moderate persistent asthmatics had cockroaches (91.7%) and domestic animals (56.2%) in their houses (Table 5).

Table 2. Demographic factor frequency distribution and association with asthma severity

Demographic Factors	Frequency	Percent	Asthma Severity			P
			Mild Intermittent	Mild Persistent	Moderate Persistent	
Gender						0.592
Male	100	48.5%	n=53 - 51%	n=23 - 42.6%	n=24 - 50%	
Female	106	51.5%	n=51 - 49%	n=31 - 57.4%	n=24 - 50%	
Total	206	100%	n=104 - 100%	n=54 - 100%	n=48 - 100%	
Residence						0.008
Urban	15	7.3%	n=5 - 4.8%	n=3 - 5.7%	n=7 - 14.6%	
Semi-urban	133	64.9%	n=60 - 57.7%	n=39 - 73.5%	n=34 - 70.8%	
Rural	57	27.8%	n=39 - 37.5%	n=11 - 20.8%	n=7 - 14.6%	
Total	205	100%	n=104 - 100%	n=53 - 100%	n=48 - 100%	
Social Status						0.000
Low level	55	26.7%	n=18 - 17.3%	n=14 - 25.9%	n=23 - 47.9%	
Middle level	100	48.5%	n=45 - 43.3%	n=36 - 66.7%	n=19 - 39.6%	
Upper middle level	51	24.8%	n=41 - 39.4%	n=4 - 7.4%	n=6 - 12.5%	
Total	206	100%	n=104 - 100%	n=54 - 100%	n=48 - 100%	

Table 3. Family history frequency and association with asthma severity

Familial Factors	Frequency	Percent	Asthma Severity			P
			Mild Intermittent	Mild Persistent	Moderate Persistent	
History of Asthma						0.025
Positive asthma history	144	69.9%	n=65 - 62.5%	n=45 - 83.3%	n=34 - 70.8%	
Negative asthma history	62	30.1%	n=39 - 37.5%	n=9 - 16.7%	n=14 - 29.2%	
Total	206	100%	n=104 - 100%	n=54 - 100%	n=48 - 100%	
History of Allergy						0.841
Positive allergy history	26	12.6%	n=12 - 11.5%	n=8 - 14.8%	n=6 - 12.5%	
Negative allergy history	180	87.4%	n=92 - 88.5%	n=46 - 85.2%	n=42 - 87.5%	
Total	206	100%	n=104 - 100%	n=54 - 100%	n=48 - 100%	

Table 4. Passive smoking and dust exposure frequency distribution and association with asthma severity

Risk Factors	Frequency	Percent	Asthma Severity			P
			Mild Intermittent	Mild Persistent	Moderate Persistent	
Family Smoking						0.000
One parent smoking	77	37.4%	n=26 - 25%	n=25 - 46.3%	n=26 - 54.2%	
Two parent smoking	23	11.2%	n=4 - 3.8%	n=5 - 9.3%	n=14 - 29.2%	
No parent smoking	106	51.4%	n=74 - 71.2%	n=24 - 44.4%	n=8 - 16.6%	
Total	206	100%	n=104 - 100%	n=54 - 100%	n=48 - 100%	
Dust						0.000
Asthma triggered by dust	134	65%	n=53 - 51%	n=36 - 66.7%	n=45 - 93.7%	
Asthma not triggered by dust	72	35%	n=51 - 49%	n=18 - 33.3%	n=3 - 6.3%	
Total	206	100%	n=104 - 100%	n=54 - 100%	n=48 - 100%	

Recurrent chest infection and cold/flu were strongly associated with asthma exacerbation and severity. Table 5 shows that recurrent chest infections were reported in 73.5% of the studied sample and 93.8% of cases with moderate persistent asthma. The corresponding values in relation to cold/flu were 75% and 93.7% respectively.

Both exercise and emotional stress were strong triggers of asthma exacerbations in our series; almost half of the study population (49.5%) had exercise-induced asthma and (25.7%) had symptoms triggered by emotional stress. In addition, the majority of moderate persistent asthmatics (91.7%) complained of asthma triggered by exercise and in 64.6% by emotional stress (Table 5).

Parasitic infestations were somewhat frequent in asthmatic children. 21.8% of the study population had parasitic infestations mainly pinworms (40%) and Ascaris (33.3%). Parasitic infestations were associated with asthma severity being present in 33.3% of moderate asthmatics (Table 5).

Our data suggest that food is to some extent associated with asthma exacerbation as 21.4% of subjects reported food-triggered asthma. Banana, milk, egg and chocolate were the most frequent foods reported (p= 0.031).

In our series, drugs were infrequently reported as asthma triggers (12.6%). Medications reported were aspirin and less frequently sulfonamides. Drugs did not demonstrate significant association with asthma severity in our series (p=0.067).

Our data revealed that winter followed by spring and autumn seasons had significant (p=0.000) relation with asthma exacerbation and severity; one third of cases of moderate persistent asthma (33.3%) were exacerbated during winter.

Concerning other allergic disorders, nasal allergy was more closely associated with asthma than skin allergy as 40% of the study population had allergic rhinitis compared to skin allergy in 19.3%. On the other hand, skin allergy was closely associated with asthma severity (p=0.048) unlike allergic rhinitis which had no such relation (p=0.96).

Table 5. Risk factors frequency distribution and association with asthma severity

			Asthma Severity			
Risk Factors	**Frequency**	**Percent**	**Mild Intermittent**	**Mild Persistent**	**Moderate Persistent**	**P**
Cockroach						0.000
Asthmatics had cockroach	165	80%	n=72 - 69.2%	n=49 - 90.7%	n=44 - 91.7%	
Asthmatics had no cockroach	41	20%	n=32 - 30.8%	n=5 - 9.3%	n=4 - 8.3%	
Total	206	100%	n=104 - 100%	n=54 - 100%	n=48 - 100%	
Domestic Animals						0.000
Asthmatics had domestic animals	79	38.3%	n=27 - 26%	n=25 - 46.3%	n=27 - 56.2%	
Asthmatics had no domestic animals	127	61.7%	n=77 - 74%	n=29 - 53.7%	n=21 - 43.8%	
Total	206	100%	n=104 - 100%	n=54 - 100%	n=48 - 100%	
Recurrent Chest Infection						0.000
Asthmatics had recurrent chest infection	150	73.5%	n=60 - 58.8%	n=45 - 83.3%	n=45 - 93.8%	
Asthmatics had no recurrent chest infection	54	26.5%	n=42 - 41.2%	n=9 - 16.7%	n=3 - 6.2%	
Total	206	100%	n=102 - 100%	n=54 - 100%	n=48 - 100%	
Cold/Flu						0.000
Asthmatics triggered by cold/flu	154	75%	n=66 - 63.5%	n=43 - 79.6%	n=45 - 93.7%	
Asthmatics not triggered by cold/flu	52	25%	n=38 - 36.5%	n=11 - 20.4%	n=3 - 6.3%	
Total	206	100%	n=104 - 100%	n=54 - 100%	n=48 - 100%	
Exercise						0.000
Asthmatics triggered by exercise	102	49.5%	n=29 - 28%	n=29 - 53.7%	n=44 - 91.7%	
Asthmatics not triggered by exercise	104	50.5%	n=75 - 72%	n=25 - 46.3%	n=4 - 8.3%	
Total	206	100%	n=104 - 100%	n=54 - 100%	n=48 - 100%	
Stress						0.000
Asthmatics triggered by stress	53	25.7%	n=9 - 8.7%	n=13 - 24.1%	n=31 - 64.6%	
Asthmatics not triggered by stress	153	74.3%	n=95 - 91.3%	n=41 - 75.9%	n=17 - 35.4%	
Total	206	100%	n=104 - 100%	n=54 - 100%	n=48 - 100%	
Parasitic Infestation						0.000
Asthmatics had parasitic infestation	45	21.8%	n=10 - 9.6%	n=19 - 35.2%	n=16 - 33.3%	
Asthmatics had no parasitic infestation	161	78.2%	n=94 - 90.4%	n=35 - 64.8%	n=32 - 66.7%	
Total	206	100%	n=104 - 100%	n=54 - 100%	n=48 - 100%	

Table 6. Indoor pollutants frequency distribution and association with asthma severity

			Asthma Severity			
Indoor Pollutants	**Frequency**	**Percent**	**Mild Intermittent**	**Mild Persistent**	**Moderate Persistent**	**P**
Insecticides						0.000
Asthma triggered by insecticides	50	24.3%	n=8 - 7.7%	n=10 - 18.5%	n=32 - 66.7%	
Asthma not triggered by insecticides	156	75.7%	n=96 - 92.3%	n=44 - 81.5%	n=16 - 33.3%	
Total	206	100%	n=104 - 100%	n=54 - 100%	n=48 - 100%	
Household Chemicals						0.000
Asthma triggered by household chemicals	40	19.4%	n=5 - 4.8%	n=10 - 18.5%	n=25 - 52.1%	
Asthma not triggered by household chemicals	166	80.6%	n=99 - 95.2%	n=44 - 81.5%	n=23 - 47.9%	
Total	206	100%	n=104 - 100%	n=54 - 100%	n=48 - 100%	
Odors						0.000
Asthma triggered by odors	49	23.8%	n=8 - 7.7%	n=13 - 24.1%	n=28 - 58.3%	
Asthma not triggered by odors	157	76.2%	n=96 - 92.3%	n=41 - 75.9%	n=20 - 41.7%	
Total	206	100%	n=104 - 100%	n=54 - 100%	n=48 - 100%	

We observed a significant association between indoor irritants such as insecticides, household chemicals and odors and asthma severity. This was evident in cases of moderate persistent asthma (Table 6).

The risk factor frequency analysis revealed that smoking, emotional stress and dust were the most significant risk factors for asthma exacerbation and severity in our series in the presence of less significant or insignificant other variables such as insecticides, parasitic infestation, history of recurrent chest infection, cold/flu, domestic animals, exercise, cockroach, household chemicals, drugs, odors and lastly food (Table 7).

Also, the multi-level frequency analysis revealed that asthmatic attacks in the majority of the study population (98.%) were triggered by one or more of the afore-mentioned three most frequent risk factors, while only 2% were not sensitive to any of them.

About 17.2% (n=35) of the study population reported symptoms on exposure to two triggering factors, 14.2% (n=29) to five triggering factors, 13.7% to three factors (n=28), and 13.7% (n=28) were intolerant to seven factors. A smaller sector of the study population was intolerant to four (9.3%, n=19), eight (9.3%, n=19), six (7.8%, n=16), one (6.9%, n=14) or nine (5.9%, n=12) triggers (Table 8).

All moderate persistent asthmatics (n=48) were intolerant to two or more risk factors, and a large sector of them (n=39) were triggered by seven to nine factors.

Table 7. Most common risk factors for asthma exacerbation by multiple regression analysis

Risk Factors	**P**
Smoking	0.000
Emotional Stress	0.020
Dust	0.033
Insecticides	0.066
Parasitic Infestation	0.120
Recurrent Chest Infection	0.178
Cold/flu	0.342
Domestic Animals	0.419
Exercise	0.436
Cockroach	0.478
Household Chemicals	0.574
Drugs	0.768
Odors	0.771
Food	0.861

Table 8. Multi-level frequency analysis of exposure to multiple risk factors

No of risk factors to which the child is exposed	**Freq.**	**%**
0	4	2.0%
1	14	6.9%
2	35	17.2%
3	28	13.7%
4	19	9.3%
5	29	14.2%
6	16	7.8%
7	28	13.7%
8	19	9.3%
9	12	5.9%

DISCUSSION

One of the hallmarks of asthma is its variability; individuals can have substantial variability in their respiratory symptoms, lung function, and other measures of disease activity from hour to hour[6]. Hence, it is not surprising that this study found a degree of variability as compared to relevant studies reporting incidence and risk factors for asthma.

Because this was a cross-sectional survey, we could not establish causal association of various risk factors with asthma. Being a questionnaire-based study, there could be differences in comprehension of questions by the respondents and our data depend on subjective self reporting rather than objective allergy testing methods.

Gender had no significant relation with asthma severity in our series unlike some relevant studies. In general, studies of children found males to be at higher risk[7], whereas studies of adolescents or adults found females to be at risk[8].

In our study, residence had a highly significant correlation with asthma severity as 70.8% of moderate asthmatics were coming from semi-urban "partly affluent" areas. The evolving "hygiene hypothesis"[9] has suggested that living in less urban areas (rural and semi-urban) conversely protect against allergy and asthma development. However, there is much debate currently in this domain.

Social status had a highly significant relation with asthma severity. This result is in accordance with studies in the US[10] and the UK[11] in which low-income and minority populations experienced a substantially higher prevalence of asthma, higher rates of asthma mortality, and greater morbidity as

measured by hospital admissions and emergency room visits.

A positive family history of bronchial asthma was significant among our series. This observation matches the findings of Sibbald[12]; who stated that the risk of having a child with asthma further increases with the presence of a family history of atopic asthma[12].

Our study revealed that the history of smoking within the family is highly associated with asthma exacerbation. Exposure to environmental tobacco smoke (i.e., passive smoking) increases the risk of lower respiratory tract illnesses in utero[13], in infancy[14], and in childhood[15].

Our results revealed a strong link between dust exposure and asthma exacerbation and severity. Many publications reported that working and living in an environment with dust, fumes or smoke led to a higher risk of asthma[16].

The presence of domestic animals was moderately associated with asthma. A Canadian study of adults reported that the cumulative incidence of asthma tended to be higher among those who owned pets[17].

The majority of our study population had cockroaches infesting their houses. Litonjua et al,[18] reported a significant association between exposure to elevated cockroach allergen levels and asthma, with a fairly strong dose response relation[18].

Our data suggest that recurrent chest infection and cold/flu were strongly associated with asthma, a finding which closely resembles other published data. In contrast, a large epidemiologic study conducted in Germany[19] has clearly shown a protective effect of frequent upper respiratory infections during the first year of life on the risk of later development of atopy and asthma, even in children with a family history of atopic diseases. These data are in accordance with the hygiene hypothesis but appear to contradict the positive associations between respiratory infections and asthma in our series.

Physical activity or exercise represented an important trigger of asthma exacerbation in the current investigation. For some patients, it was the only trigger. This condition, in which post-exertion airflow limitation resolves spontaneously within 30 to 45 minutes following physical activity, is referred to as exercise-induced asthma (EIA). Some forms of exercise, such as running, are more potent triggers[20].

Our study revealed that emotional stress was actually a trigger of asthma. Extreme expressions of laughing, crying, anger, or fear may lead to hyperventilation and hypercapnia that can cause airway narrowing[21].

Parasitic infestation was strongly associated with asthma severity. The available evidence neither refutes nor supports the theories that parasitic disease either protects against or causes asthma[22].

Some foods have a recognized influence on asthma exacerbations, but the relationship between food sensitivity and the initial development of asthma is uncertain. There is some evidence; however, that food allergy in infancy is followed by asthma[17].

Insecticides, household chemicals (phenol) and odors (perfumes) could be strongly linked to asthma exacerbation and severity. Some data suggest that indoor irritants may contribute to the development of asthma, but further studies are needed.

Although not amenable to public health prevention efforts, knowledge of host risk factors can help identify individuals who may benefit from future therapeutic intervention.

The incidence of asthma has been associated with maternal smoking. For the primary prevention of asthma, prospective evidence supports the recommendation[23] that mothers avoid both pre- and post-natal smoking.

One study from Canada[24] reported the effectiveness of a multifaceted program using dust mite, pet allergen, and ETS avoidance measures with breastfeeding encouragement to prevent asthma symptoms. A group of 545 high-risk infants were selected before birth and followed until 1 year of age to determine programmatic impact on possible or probable asthma, rhinitis, and sensitization to common aeroallergens. Participation in the intervention program resulted in a 34% reduction in asthma. Another prospective birth cohort study from Sweden[25] revealed that adherence to guidelines that advocated breastfeeding, reduced infant and child exposure to ETS and home dampness, and improved indoor ventilation, reduced the incidence of asthma by age 2 years.

Evidence emerging from such prospective, controlled intervention studies lends validity to known risk factors and indicates the necessity for identifying asthma risk factors in different communities and geographical locations and this was the stimulus for the current study.

We conclude that early identification of patients at risk for persistent asthma, combined with early institution of pharmacologic and non-pharmacologic intervention strategies, may lead to better outcomes[26].

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