

Letter to the Editor

Caregivers report a wide variety of early signs and symptoms of impending asthma exacerbations that are not different between preschool and school-aged children

To the Editor:

Despite advances in the treatment of asthma, exacerbations remain common.¹ A strategy to reduce exacerbations might be earlier recognition of an impending exacerbation coupled with earlier augmentation of treatment. The National Heart, Lung, and Blood Institute's National Asthma Education and Prevention Program Guidelines recommend early treatment of asthma exacerbation as "key in management"² but do not provide specific information or guidance about signs and symptoms that might present before lower respiratory tract symptoms. Parents report a vast number of symptoms observed in their children before an exacerbation.³⁻⁵ In a previous study³ parents of preschool children with intermittent wheezing reported a limited number of symptoms as occurring first within a respiratory tract illness. We now describe early signs and symptoms in an expanded population as reported by parents by age and asthma severity of the child, socioeconomic status, and parental education.

To collect and study these signs and symptoms, we performed 3 sequential studies. All the studies were approved by the Washington University School of Medicine Human Research Protection Office and performed after subjects signed the appropriate informed consent form. First, we conducted 6 focus groups of caregivers of children aged 1 to 12 years with physician-diagnosed persistent asthma for at least 1 year recruited from our pediatric asthma clinics. Sessions were led by a trained, lay asthma coach using a structured discussion guide. Three previously undisclosed open-ended questions were discussed: (1) What do you see in your child before she or he has an asthma attack? (2) What do you see in the 3 days before the asthma attack? (3) What changes in behavior do you notice? Sessions were audiotaped and transcribed verbatim. Data from these focus groups along with data from our literature review were used to develop the 57-item Asthmatic Child Early Signs and Symptoms inventory (see Fig E1 in this article's Online Repository at www.jacionline.org).

Our second step was a pilot study with 48 caregivers (same inclusion criteria as above) to refine the inventory for clarity of items.

Our third step was to administer the refined inventory to 200 caregivers (excluding those who participated in the pilot study) according to the same inclusion criteria. They were divided equally into 2 groups by age (1-5 and 6-12 years, respectively). The interviewer used the following sequence and instructions: the inventory was provided for caregivers to check all symptoms present during an asthma exacerbation; this copy of the inventory was then removed, and a second inventory was provided for caregivers to check all symptoms present 3 days before the asthma exacerbation to identify the very first symptom and describe how often this first symptom was reported as the first symptom noticed.

Descriptive statistics were used to examine the demographic characteristics of the participants and symptom reporting. Comparisons of categorical variables were made by using Fisher exact tests. Comparisons of continuous variables were made with Kruskal-Wallis tests.

TABLE I. First symptom category that caregivers recognize as the very earliest sign that their child might have an asthma exacerbation

Symptom category	1-5 y (n = 100)	6-12 y (n = 100)
Nonrespiratory/behavioral symptom	25%	24%
Upper respiratory tract	13%	16%
Lower respiratory tract	61%	58%
Parents not able to identify a sole first symptom	1%	2%

TABLE II. Frequency of first symptom occurrence across different illnesses as perceived by caregivers before their child has an asthma attack

	1-5 y (n = 100)	6-12 y (n = 100)
Always	53%	47%
Almost always	40%	37%
Sometimes	3%	9%
Rarely	2%	2%
Parents not able to define frequency	2%	5%

Caregivers were most often mothers (90%), white (70%), and non-Hispanic (99%); had a high school diploma or more (77%); were employed (65%); and had an income greater than the median income in the United States (53%). Median parental age was 35 years (interquartile range, 30-40 years). The median child age was 5.5 years (interquartile range, 3.5-9 years), and 63% were male, white (66%), and non-Hispanic (99%) and receiving moderate-to-high doses of inhaled corticosteroids (53%). Twenty-one percent of children had 1 or more emergency department visits in the past year, and 55% also had a diagnosis of allergic rhinitis. Of the children aged 4 years and older, 46% had controlled asthma per the Childhood Asthma Control Test criteria⁶ at the time of the visit.

A wide variety of symptoms were reported before an asthma exacerbation (see Tables E1-E3 in this article's Online Repository at www.jacionline.org). We categorized these into 3 main categories: nonrespiratory, upper respiratory tract, and lower respiratory tract. Nonrespiratory symptoms were further subdivided into changes in eating habits, appearance, activity, and behavior. The most common nonrespiratory symptoms included decreased activity (31%), decreased appetite (25%), irritability (20%), difficulty falling asleep (19%), and paleness (11%). A total of 25% of caregivers reported runny nose as an early symptom, and 68% reported cough. The very first symptom was nonrespiratory in 25%, an upper respiratory tract symptom in 15%, and a lower respiratory tract symptom in 60% (Table I). Ninety-seven percent of caregivers were able to identify a first symptom, and 89% reported that this first symptom was present always or almost always (Table II). There was no difference in symptom reporting or symptom-reporting category (nonrespiratory, upper respiratory tract, and lower respiratory tract symptoms) according to the child's age, sex, ethnicity, race, or use of asthma controller or the caregiver's age, sex, ethnicity, race, insurance type, income, and education (Table III).

TABLE III. Symptom reporting according to the children's and caregivers' characteristics

	Nonrespiratory (% reporting)	Upper respiratory tract (% reporting)	Lower respiratory tract (% reporting)
Age (child)			
1-5 y (n = 99)	25	13	62
6-12 y (n = 98)	25	16	59
Sex (child)			
Female (n = 71)	21	17	62
Male (n = 126)	27	13	60
Caregiver type			
Mother (n = 177)	26	15	59
Father (n = 12)	8	8	83
Other (n = 8)	25	13	63
Marital status			
Not married (n = 63)	30	11	59
Married (n = 134)	22	16	61
Employment			
Not employed (n = 67)	30	16	54
Employed (n = 127)	21	14	65
Race (caregiver)			
Nonwhite (n = 59)	19	10	71
White (n = 135)	27	16	57
Health insurance			
Private (n = 114)	21	17	62
Medicaid (n = 72)	31	10	60
Both (n = 9)	22	22	56
Education			
Less than college degree (n = 114)	26	12	61
College degree or higher (n = 82)	23	18	59
Income (family)			
<\$50,000 (n = 84)	31	12	57
≥\$50,000 (n = 105)	20	17	64
Asthma controller use			
Yes (n = 180)	26	16	59
No (n = 16)	13	6	81
CACT			
Controlled (n = 90)	19	18	63
Uncontrolled (n = 82)	32	12	56

Other variables that were examined but also determined to be nonsignificant included living area, child's race, smoking exposure, indoor pets, and presence of other chronic diseases. Numeric data are rounded for easier reading. Childhood Asthma Control Test (CACT) scores were obtained only for children 4 years or older. All comparisons between groups were nonsignificant ($P > .05$).

Eighteen percent of caregivers reported only lower respiratory tract symptoms as early symptoms. There was no difference among those caregivers who reported lower respiratory tract symptoms as sole symptoms in terms of income, employment, education, or race. Children whose caregivers reported upper respiratory tract symptoms as first symptoms were not more likely to have allergic rhinitis compared with those who reported nonrespiratory or lower respiratory tract symptoms.

Other studies³⁻⁵ have examined early symptoms of asthma worsening; however, we did not find a study that was as specific in asking caregivers to think back to the days preceding the asthma-worsening event guided by a comprehensive symptom inventory in this age group. Limitations to our study include recall bias and having sought care in an asthma subspecialty clinic where they have received asthma education and might have

been previously instructed about early signs and symptoms. Furthermore, our data are also limited to patients with persistent disease, who are more likely to experience symptoms, to minimize recall bias.

In conclusion, caregivers identify a wide variety of signs and symptoms as occurring before an asthma exacerbation. These include nonrespiratory symptoms and upper respiratory tract symptoms in addition to the typical lower respiratory tract symptoms of asthma. These symptom patterns are not different based on specific parental or child characteristics. Current asthma action plans focus mainly on lower respiratory tract symptoms to guide treatment change. We propose that this symptom inventory could be used as an educational tool for physicians and caregivers to initiate discussion on early treatment of respiratory tract illnesses with the goal of individualizing asthma management plans according to patient-specific early signs and symptoms and include clusters of nonrespiratory and upper respiratory tract symptoms as reported by their caregivers. This would help caregivers recognize symptoms of asthma worsening earlier and initiate treatment sooner. This in turn might decrease asthma morbidity and improve patients' and caregivers' overall quality of life. More data are needed before specific guidance on specific treatment-augmentation strategies using these signs and symptoms. A prospective clinical study is planned.

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Please mark below the signs and symptoms that describe your child **when he/she is sick with asthma**.

- ☐ Rubbing eyes
- ☐ Runny nose
- ☐ Throat gets itchy
- ☐ Watery eyes
- ☐ Clearing his/her throat
- ☐ Sneezing
- ☐ Nose congestion
- ☐ Deep cough
- ☐ Ribs sinking in when breathing
- ☐ Breathing fast
- ☐ Mild and dry cough
- ☐ Complaining of chest tightness
- ☐ Breathing heavy
- ☐ Mild and wet cough
- ☐ Breathing funny
- ☐ Necks starts sinking in when breathing
- ☐ Starts coughing in his sleep
- ☐ Complaining that the chest hurts
- ☐ Wheezing

[illegible]

FIG E1. Asthma signs and symptoms inventory.

- ☐ Always
☐ Almost always
☐ Sometimes
☐ Rarely
☐ Never

FIG E1. (Continued).

TABLE E1. Nonrespiratory symptoms reported by parents as occurring before an asthma exacerbation

Nonrespiratory	Before exacerbation (% reporting)
Eating habits	
Less appetite	25
Drinking less	9
Drinking more	5
More appetite	1
Behavior	
Gets irritable/cranky	20
Mood changes	16
Complaining/whining	14
Anxious	14
Crying	8
Emotional	6
Wants to be left alone	6
Gets an attitude	2
Short tempered	2
Acting scared	2
Gets mean	2
Hitting or fighting others	2
Bossy	2
Angry	2
Gets disrespectful	2
Talkative	1
Sleeping habits	
Difficulty falling asleep	19
Changes in sleeping position	10
Sleepwalking	1
Activity level	
Less active	31
Gets tired or sleepy	17
Gets more tense	4
Energetic	2
More active	2
Gets more relaxed	1
Appearance/allergic	
Gets pale	11
Eczema	10
Rubbing eyes	9
Red eyes	9
Eyes look swollen	9
Itchy skin	7
Gets hives	7
Gets a rash	6
Eyes look sunken	6
Skin gets ashy and dry	4

TABLE E2. Upper respiratory tract symptoms reported by parents as occurring before an asthma exacerbation

Upper respiratory tract	Before exacerbation (% reporting)
Runny nose	25
Nose congestion	18
Watery eyes	13
Clearing his/her throat	10
Throat gets itchy	8
Sneezing	6

TABLE E3. Lower respiratory tract symptoms reported by parents as occurring before an asthma exacerbation

Lower respiratory tract	Before exacerbation (% reporting)
Deep cough	32
Starts coughing in his/her sleep	29
Wheezing	23
Mild and dry cough	23
Complaining of chest tightness	18
Ribs sinking in when breathing	17
Breathing heavy	13
Breathing fast	12
Complaining that chest hurts	11
Mild and wet cough	10
Breathing funny	9
Neck starts sinking in when breathing	6