namely, respiratory syncytial virus, elevated immunoglobulin E levels, and cockroach allergy in the home, that were independently associated with hospitalizations within this group. Emergency department visits were associated with caregivers with a status of single parent or smoker (P = .037 for single parent and P = .034 for smoker).

Conclusions. The authors concluded that ethnic and immigrant status played significant roles in morbidity related to infant wheezing illness. In addition to respiratory infection, allergic processes and social variables played roles, as evidenced by health care utilization.

Reviewer’s Comments. Additional studies of this nature with larger populations, including suburban families, would be of interest to validate these findings. The relationships of ethnic, biological, and social factors to asthma morbidity are certainly consistent, however, with the paradigm of inner-city asthma that has been established for older children and adolescents.

Christopher Randolph, MD
Waterbury, CT

A LONGITUDINAL, POPULATION-BASED, COHORT STUDY OF CHILDHOOD ASTHMA FOLLOWED TO ADULTHOOD


Purpose of the Study. To describe risk factors that may predict the severity and duration of childhood asthma in adult life.

Study Population. A complete birth cohort of 1390 children born between April 1972 and March 1973 in Dunedin, New Zealand, was studied. Of those children, 1037 (91%) were present for the follow-up assessment at 3 years.

Methods. The children were examined every 2 years from 3 to 15 years of age and then at 18, 21, and 26 years. Respiratory questionnaire assessment and pulmonary function testing were performed at ages 9, 11, 13, 15, 18, 21, and 26 years and methacholine challenge testing was performed at all except the 18- and 26-year visits, when bronchodilator responses were studied. Allergic diathesis was measured with immunoglobulin E assays at 11 years, skin tests at 13 years, and both at 21 years.

Results. A total of 613 patients (59%) provided data at every assessment. Seventy-three percent reported ≥1 episode of wheezing, whereas 51% reported ≥1 episode of wheezing. At age 26 years, 27% of the cohort was currently wheezing, with 15% experiencing persistent symptoms and 12% relapsing after a symptom-free period. The predictors of persistent wheezing included severity of house dust mite sensitivity, increased bronchial hyperreactivity, smoking at 21 years of age, and earlier age of symptom onset. Pulmonary function test results were consistently lower for patients with persistent wheezing and those who experienced relapses. The degree of pulmonary function abnormality was measured as the forced expiratory volume in 1 second (FEV1)/forced vital capacity (FVC) ratio. Among male patients with persistent wheezing, those who experienced relapses began with a FEV1/FVC ratio of 82% at 9 years of age, which decreased to ∼75% by 26 years of age. Similar but less profound abnormalities were seen in the female cohort. Patients with no wheeze ever, intermittent wheezing, or transient wheezing maintained FEV1/FVC ratios at or just below 85% through the study.

Conclusions. More than 5% of children who wheezed experienced persistence of symptoms into adulthood. The abnormalities in pulmonary function among patients with persistent wheezing and relapse of wheezing occurred early in life (<9 years of age) and persisted throughout life. Patients with transient wheezing or resolved wheezing did not experience progressive loss of lung function.

Reviewer’s Comments. These data confirm that early airway damage attributable to infection, allergen exposure, or both may lead to abnormalities in pulmonary function that persist throughout life. The chance to intervene in asthma may well occur before our patients are able to tell us that they have any difficulty breathing.

Bradley E. Chippes, MD
Sacramento, CA

WHO GETS DIAGNOSED WITH ASTHMA?
FREQUENT WHEEZE AMONG ADOLESCENTS WITH AND WITHOUT A DIAGNOSIS OF ASTHMA


Purpose of the Study. To evaluate factors related to the failure to make an asthma diagnosis among children with frequent wheezing symptoms and to assess risk factors for frequent wheezing.

Study Population. The study included 122 829 children, 12 to 18 years of age, enrolled in 499 public middle schools in North Carolina during the 1999–2000 school year.

Methods. The study was based on results from the North Carolina School Asthma Survey, a self-reported questionnaire on respiratory disease adapted from the International Study of Asthma and Allergies in Childhood.

Results. Characteristics that were independently related to undiagnosed frequent wheezing, compared with asymptomatic children, included female gender (odds ratio [OR]: 1.45), current smoking (OR: 2.6), exposure to household smoke (OR: 1.6), low socioeconomic status (OR: 1.5), and African American (OR: 1.25), Native American (OR: 1.4), and Mexican American (OR: 1.3) race/ethnicity. There was a minimal negative association with urban residents, with an OR of 0.91. Documentation of allergies was less likely among frequent wheezers (70%), compared with diagnosed asthmatics (86%), but was much higher than among asymptomatic children (36%). Thirty-three percent of children with undiagnosed frequent wheezing reported ≥1 physician visits in the previous year for treatment of wheezing or breathing conditions, compared with 71% of children with diagnosed asthma and 74% of asymptomatic children. The prevalence of any inhaler therapy in the previous 12 months was 12% for undiagnosed frequent wheezers, compared with 78% for diagnosed asthmatics.

Conclusions. The authors concluded that undiagnosed frequent wheezing was independently related to female gender, current smoking, exposure to household smoke, low socioeconomic status, and African American, Native American, and Mexican American race/ethnicity. Children with undiagnosed frequent wheezing were not receiving sufficient health care for their asthmatic conditions.

Reviewer’s Comments. These are rather striking findings that clearly demonstrate the degree to which asthma is underdiagnosed in some populations.

Christopher Randolph, MD
Waterbury, CT

HEALTH CONSEQUENCES ASSOCIATED WITH FREQUENT WHEEZING IN ADOLESCENTS WITHOUT ASTHMA DIAGNOSIS


S U P P L E M E N T  5 3 3
**Purpose of the Study.** To evaluate the association between undiagnosed frequent wheezing and health consequences among adolescents.

**Study Population.** The North Carolina School Asthma Survey population of 122,829 children, 12 to 14 years of age, was studied. The target population was enumerated from 1999–2000 enrollment records maintained by the North Carolina Department of Public Instruction and included 565 public middle schools, with 192,248 children.

**Methods.** The questionnaire was adapted from the International Study of Asthma and Allergies in Childhood. Three mutually exclusive groups were compared, ie, 1) children with frequent wheezing symptoms and no diagnosis, 2) children who reported wheezing symptoms and a physician diagnosis of asthma, and 3) children with no symptoms or diagnosis ever. A fourth group, defined as infrequent wheezers (children with infrequent wheezing symptoms and no physician diagnosis, n = 38,424), was included for reference. Outcome variables were defined as the numbers of school absences, activity limitations, and sleep disturbances attributable to asthma-like symptoms.

Health care utilization variables included the numbers of physician visits, emergency department visits, and hospitalization admissions for treatment of asthma-like symptoms.

**Results.** The odds of wheezing-related sleep disturbances, limited activities, and missed school were higher among undiagnosed frequent wheezers, compared with diagnosed asthmatics. The frequencies of emergency department visits and hospitalizations did not differ substantially between the undiagnosed wheezing group and the diagnosed asthma group, although the undiagnosed group was less likely to have visited a physician for treatment of wheezing in the previous year. Undiagnosed frequent wheezers were more likely to experience sleep disturbances, limited activities, missed school, and greater health care utilization for treatment of wheezing, compared with asymptomatic children. Compared with asymptomatic children, diagnosed asthmatics were 10 to 24 times more likely to experience limited activities, sleep disturbances, and missed school. They were also 20 times more likely to visit a physician and ≥9 times more likely to report ≥3 emergency department visits or hospitalization for treatment of wheezing, compared with asymptomatic children.

**Conclusions.** Children with frequent wheezing symptoms but no asthma diagnosis experience substantial illness-related morbidity, similar to that of diagnosed asthmatics. Undiagnosed frequent wheezers require more recognition from primary care physicians and need active disease management to reduce health consequences.

**Reviewer’s Comments.** This study nicely evaluates multiple aspects of functional consequences and health care use among children with undiagnosed frequent wheezing from a population-based sample. This study suggests that undiagnosed frequent wheezers require better recognition by primary care physicians and need active disease management. It also suggests that the effects of asthma in the pediatric population may be underestimated, because of undiagnosed disease.

WANDA PHIPATANAKUL, MD
Boston, MA

**LOWER PHYSICIAN ESTIMATE OF UNDERLYING ASTHMA SEVERITY LEADS TO UNDERTREATMENT**


**HOSPITAL READMISSIONS FOR CHILDHOOD ASTHMA**


**Purpose of the Study.** To determine the magnitude of readmissions for children with asthma and to examine