

Asthma Among Homeless Children

Undercounting and Undertreating the Underserved

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Background: In the United States, children of color, children who live in urban medically underserved communities, and children whose families have limited economic resources have excessively high rates of asthma. The identification of high-risk subgroups of underserved children is crucial for understanding the determinants and scope of the childhood asthma epidemic and for developing successful interventions.

Objective: To determine the population prevalence of asthma among homeless children.

Design: Cross-sectional study.

Setting: Three family shelters in New York City.

Participants: A total of 740 children whose families entered 3 family shelters from June 30, 1998, to September 18, 1999.

Main Outcome Measures: Prior physician asthma diagnosis, current asthma symptoms using National Asthma Education and Prevention Program symptom criteria, cur-

rent medications, and emergency department use in the past year.

Results: Of the children, 26.9% had a prior physician diagnosis of asthma. In addition, 12.9% of the children without a prior physician diagnosis of asthma reported symptoms consistent with moderate or severe persistent asthma. Overall, 39.8% of homeless children in New York City are likely to have asthma. Few children with persistent asthma received any anti-inflammatory treatment. Almost 50% (48.6%) of children with severe persistent asthma had at least 1 emergency department visit in the past year; 24.8% of children with symptoms of mild intermittent asthma had at least 1 visit.

Conclusions: The prevalence of asthma among a random sample of homeless children in New York City is likely to be 39.8%—more than 6 times the national rate for children. Asthma in homeless children is also likely to be severe and substantially undertreated.

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THERE IS SUBSTANTIAL EVIDENCE that in the United States there are excessively high rates of asthma among children of color, especially among those who live in urban medically underserved communities and whose families have limited economic resources.¹⁻⁴ Within New York City (NYC), asthma has been identified as the leading cause of hospitalizations for children from birth to the age of 14 years.⁵ African American and Latino children have 3 to 5½ times the hospitalization rate of white children. Among NYC children 14 years and younger, those living in a ZIP code in the lowest 20th percentile of median income had 4 times the hospitalization rate of those living in a ZIP code in the highest 20th percentile of median income.

Within broad categories of socioeconomic status and ethnicity lie subgroups of children whose asthma may be especially severe and untreated, with significant consequences for the child's and fami-

ly's quality of life, including a high risk of asthma-related mortality.⁶⁻¹² Strategies that have been used to identify high-risk subgroups of children tend to confound the impact of race or ethnicity with socioeconomic status. To identify subgroups that are at high risk associated specifically with low socioeconomic status, ideally a relatively homogeneous population group with few economic resources should be identified. A study of asthma in the population of children whose families have become homeless offers a unique opportunity to investigate the impact of asthma specifically in relationship to low socioeconomic status across race and ethnicity.

In 1997, approximately 25% of homeless children seen as patients by the Division of Community Pediatrics at the Children's Hospital at Montefiore, the university hospital of the Albert Einstein College of Medicine, had asthma; this is one of the highest rates reported in any medically underserved population nationwide.¹³⁻¹⁵ No information was avail-

able, however, on the underlying population prevalence of asthma among homeless children in NYC. In response, the division, with support from the Children's Health Fund, launched the Childhood Asthma Initiative, a multilevel program incorporating clinical, educational, psychosocial, and environmental interventions. The program's initial target population was homeless children whose families were living in family shelters in NYC. The Childhood Asthma Initiative team (D.E.M., S.B., K.D., P.S., and I.R.) developed a brief screening instrument and implemented a screening protocol to identify the prevalence of asthma among homeless children in NYC. We hypothesized that the asthma prevalence rate would be high, that symptom severity would be high, that many children would be undertreated, and that many children would seek care in emergency departments.

METHODS

HOMELESS CHILDREN IN NYC

In NYC, the average monthly census released by the Department of Homeless Services in 1998 to 1999 reported approximately 5200 families living in homeless facilities (approximately 7600 adults and 9400 children at any one time). The population of homeless families with children is not a static one, however; new families are constantly cycling into the system as others leave. An average of 22 families a day moved into emergency housing, approximately 666 per month. More than 95% of the families were below the federal poverty level, 100% were Medicaid eligible, approximately 33% of the mothers were younger than 25 years, 65% were African American, and 32% were Latin American. The average length of stay in a shelter was 10 months; almost 25% remained in the shelter system for more than 1 year.¹⁶ Families entering homelessness face tremendous social and environmental disruption; many families are placed in shelters hours away by public transportation from friends, their children's schools, and, more important, prior connections to medical care.

DESIGN AND STUDY POPULATION

To obtain an unbiased estimate of the prevalence of asthma among homeless children in NYC, we took advantage of the mechanism through which families are assigned shelter placement after being certified as eligible for shelter placement. To place families as expeditiously as possible, the NYC Department of Homeless Services placement policy assigns families to the first available opening in any family shelter in the 5 boroughs. Placement location is not contingent on the health status of family members nor on their ties to medical care, social support, previous housing, reasons for homelessness, or any other factors that might introduce sample selection bias. A sample of children at any shelter is, thus, likely to provide a random selection of all children whose families enter the shelter system and are certified as eligible for shelter placement. We attempted to screen children in 3 family shelters on entry to the shelter during a 15-month period (June 30, 1998–September 18, 1999). The shelters were each in a different borough of NYC.

SCREENING INSTRUMENT AND SCREENING PROCESS

The screening instrument was a 1-page 11-item instrument that included questions on daytime and nighttime symptom frequency during the past month, the timing of nighttime symptoms, whether the child had been previously diagnosed as hav-

ing asthma by a physician, the child's current medications, the child's use of an emergency department for asthma or breathing problems during the past year, and demographic characteristics (child's age, date of birth, race, and ethnicity). The item on previous diagnosis was similar to that used in the National Health and Nutrition Examination Survey and the National Health Interview Survey ("Has a doctor ever told you that your child has asthma?") to allow comparison with national prevalence rates.

Asthma symptom frequency questions were coded to allow categorization of asthma symptoms according to the daytime and nighttime asthma symptom criteria for staging outlined in the Expert Panel 2 report on Guidelines on the Diagnosis and Management of Asthma.¹⁷⁻¹⁹ Parents were asked to report symptom frequency in the past month for 4 specific symptoms (cough, wheezing, shortness of breath, and fatigue). Parents were also asked the frequency in the past month that their sleep or their child's sleep was disturbed by coughing or asthma. Medications used were categorized either as anti-inflammatory agents (oral or inhaled corticosteroids, leukotriene pathway antagonists, or mast cell inhibitors) or bronchodilators. If it was unclear how to categorize the medication because of unorthodox spelling, the medication was assumed to be an anti-inflammatory agent. To assess the validity of the screening instrument, we compared the screening results for a sample of 117 children with those of a structured clinical assessment conducted within the following 3 months by a pediatrician or a pediatric nurse practitioner (D.E.M., S.B., K.D., A.R., P.S., S.S., and I.R.). By using a definition of a positive screening result that included children with a prior physician diagnosis and/or symptom frequency greater than twice per week, we found a sensitivity of 77% and a specificity of 92%.

Screening was a face-to-face 3- to 5-minute interview conducted by trained shelter case workers at the time of the family's entry to the shelter as part of the routine health screening done for every shelter resident. Asthma screening was considered an extension of the standard shelter evaluation procedures and as a tool to discuss the availability of access to medical services for shelter residents. Participation in the screening was voluntary; no incentives were offered. Consent procedures used by each shelter for their health screening were followed; in one shelter, an additional consent was added to the asthma screening form at the request of the shelter. All residents were invited to participate in the screening; thus, all children in each family were screened unless the family had previously participated in the screening during a prior stay at a participating shelter. Individual children were the units of analysis. Families may have been in the shelter system previously. No information was available on history of homelessness or previous shelter residence; thus, it was not possible to conduct an analysis of the relationship of shelter history to asthma symptoms or asthma management.

In most cases, the mother was the parent interviewed. For 6 months in one shelter, screening was also completed by a trained visiting nurse stationed at the shelter and a trained medical student volunteering with the project. No difference in characteristics of the children screened or results of the screening were apparent in the screenings completed by the case workers compared with those completed by the visiting nurse or medical student. Case workers and other screeners were given a 2-hour training session on the screening instrument. Training included an item-by-item review, with instructions to ask each item as written, to ask all items, to record the parent's responses verbatim, and to conduct a screening for each child. Trainees were instructed to read each item to the parent to ensure item comprehension across levels of parental literacy. A role-play exercise was performed to demonstrate the process of parental interview. Training sessions were repeated as needed in cases of case worker turnover. Staff were also available on an ongoing basis to answer questions as needed. All screening

Table 1. Estimated Asthma Prevalence in 740 Homeless Children in New York City

Symptom/Diagnosis Category	Homeless Children Screened, %
Total percentage of homeless children likely to have asthma (sum of subgroups listed below)	39.8
Prior reported physician diagnosis of asthma	26.9
No prior reported physician diagnosis of asthma but presence of current symptoms consistent with moderate or severe persistent asthma*	12.9
Total percentage of homeless children with current symptoms consistent with mild intermittent to severe persistent asthma*	50.3

*Using 1997 National Asthma Education and Prevention Program symptom criteria.

Table 3. Homeless Children With Current Asthma Symptoms and/or a Prior Physician Diagnosis of Asthma by Current Asthma Symptom Severity*

Symptom Severity	Homeless Children†		
	With Current Asthma Symptoms (n = 372)	With a Prior Physician Diagnosis of Asthma and Current Symptoms (n = 175)	With a Prior Physician Diagnosis of Asthma (n = 202)
No symptoms	NA	NA	13.4
Mild intermittent	39.0	26.3	23.3
Mild persistent	18.0	14.3	11.9
Moderate persistent	23.1	30.3	26.2
Severe persistent	19.9	29.1	25.3

Abbreviation: NA, data not available.

*Data were obtained by using the National Asthma Education and Prevention Program 1997 symptom criteria.

†Data are given as percentage of children in each group.

was approved by the shelter director as part of the shelter's routine admission health screening of all families. Institutional review board approval was covered under the general clinical services approval for the homeless health services of the division.

RESULTS

During the 15-month period, screening was conducted for 740 children, 75% of all children entering the 3 shelters. Children were included if they were younger than 18 years at the time of the screening (16 children were missing data on age); 43.9% (n=318) of the children screened were younger than 5 years at the time of the screening (mean age, 6.4 years), and included infants. The children included 55.9% who were male. Of the parents, 60.0% identified their child as black, 25.9% identified their child as Latin American, 10.0% did not define their child's race or ethnicity, and 3.9% considered their children to fit into other race or ethnicity groups. Most families (90.2%) were headed by single parents, almost always a mother. In NYC, all families eligible for shelter placement meet the eligibility criteria for Medicaid. This does not mean that all families were enrolled in Medicaid at the time of the screening.

Table 2. Homeless Children With Current Asthma Symptoms by Asthma Symptom Severity*

Symptom Severity	Homeless Children With Current Asthma Symptoms†	
	Those <5 y (n = 193)	Those ≥5 y (n = 163)
Mild intermittent	34.2	44.8
Mild persistent	9.8	17.2
Moderate persistent	30.1	17.8
Severe persistent	25.9	20.2

*Data were obtained by using the National Asthma Education and Prevention Program 1997 symptom criteria.

†Data are given as percentage of children in each age group.

The overall asthma prevalence in homeless children in NYC was 39.8% (**Table 1**): 26.9% of the children had a prior physician diagnosis of asthma, while 12.9% of the children had symptoms consistent with moderate or severe persistent asthma, yet did not have a prior physician diagnosis of asthma. According to the 1997 National Asthma Education and Prevention Program symptom criteria, 50.3% of homeless children have current symptoms consistent with mild intermittent to severe persistent asthma. The distribution of asthma severity by age was not statistically significant ($P = .34$) for children younger than 5 years compared with children 5 years and older (**Table 2**).

Half of all children screened had some current symptoms consistent with asthma (mild intermittent to severe persistent); this group serves as the primary population base for the remaining analyses. Many children with asthma symptoms had current daytime or nighttime symptoms with sufficient frequency to be classified as having moderate to severe persistent asthma (160 [43.0%]); 19.9% reported current symptoms consistent with severe asthma, and 23.1% reported current symptoms consistent with moderate persistent asthma (**Table 3**). Subgroup analyses were conducted on children who had received a prior physician diagnosis of asthma because these children would be known to have asthma and have at one point been in contact with the medical care system; this subgroup would be most likely to be taking appropriate medication and to have asthma that was better controlled. However, when the population of children was restricted to those who had a prior physician diagnosis of asthma (n=202), the proportion of children with moderate to severe symptoms was high. Of these children, 27 (13.4%) did not have current symptoms.

We were concerned that, although asthma is seasonal, when children were screened during fall and winter, when the prevalence of respiratory tract infections affecting children is high, symptoms reported could be due to those conditions and not asthma. To address this concern, we conducted an analysis restricted to children screened during a period in which respiratory tract infections are less frequent (June 30, 1998-September 18, 1998; n=372). The rates of overall prevalence in the restricted sample are not significantly ($P = .41$) different from those in the full sample: 113 (30.4%) reported a prior physician diagnosis of asthma, and 33 (8.9%) reported symptoms con-

sistent with moderate or severe persistent asthma, yet did not have a prior physician diagnosis of asthma, for a conservative estimate of asthma prevalence of 39.2%. Of the children overall, 176 (47.3%) reported current symptoms consistent with asthma. These rates are not statistically different from the rates for the full sample.

Few children with current symptoms consistent with persistent asthma received current treatment with any anti-inflammatory medications (**Table 4**). At the extreme, only 37 (9.6%) children with severe persistent asthma received any anti-inflammatory treatment. While the percentages of children with persistent asthma receiving anti-inflammatory treatment are slightly higher for those with a prior physician diagnosis of asthma, they are far below the recommended guidelines. They are also not statistically different from those of children without a prior physician diagnosis of asthma. In addition, more than 40.2% of children with persistent asthma symptoms were not taking any asthma medication whatsoever.

Many children had frequent visits to an emergency department for asthma or breathing problems (**Table 5**). Almost half of the children with severe persistent asthma had at least 1 emergency department visit in the past year; 24.8% of children with current symptoms of mild intermittent asthma had at least 1 emergency department visit in the past year. This percentage was even higher for children with a prior physician diagnosis of asthma. Between 54.9% and 68.0% of children, depending on level of severity, who had been previously identified by a physician as having asthma reported at least 1 visit to an emergency department in the past year.

COMMENT

We estimate that the prevalence of asthma among a random sample of homeless children in NYC is likely to be at least 39.8%—more than 6 times the national rate for children.⁴ It is also substantially higher than that reported for several of the highest-prevalence geographic areas within NYC.⁵ Our estimate of asthma prevalence is conservative; we elected to include only children with symptoms of moderate to severe persistent asthma in addition to those with a prior physician diagnosis so that the estimate is less likely to include children who might have had other conditions with symptoms that overlap with those of mild intermittent or mild persistent asthma.

The striking prevalence of asthma among homeless children offers strong evidence that there are high-risk subgroups of children that cut across geographic location. Not only is the prevalence of physician-diagnosed asthma high among homeless children, but 12.9% of children reported significant levels of symptoms that were undiagnosed. Of homeless children with asthma, 43.0% have symptoms likely to be moderate or severe, in contrast to the approximately 30% of children with asthma who are commonly described as having moderate to severe symptoms. Our data suggest that the introduction of screening using an asthma symptom checklist of daytime and nighttime symptoms, in addition to asthma history, for all children in homeless families entering the shelter system in NYC would identify many children likely to have asthma, and would be an

Table 4. Homeless Children Receiving Any Current Anti-inflammatory Treatment by Current Asthma Symptom Severity*

Symptom Severity	Homeless Children Receiving Any Current Anti-inflammatory Treatment†	
	Those With a Prior Physician Diagnosis of Asthma (n = 202)	Those With Current Asthma Symptoms (n = 372)
No symptoms	3.7	NA
Mild intermittent	10.9	2.8
Mild persistent	16.0	7.5
Moderate persistent	27.6	11.6
Severe persistent	19.6	9.6

Abbreviation: NA, data not available.
*Data were obtained by using the National Asthma Education and Prevention Program 1997 symptom criteria.
†Data are given as percentage of children in each group.

Table 5. Homeless Children With 1 or More Emergency Department Visits in the Past Year for Asthma or Breathing Problems by Current Asthma Symptom Severity*

Symptom Severity	Homeless Children With ≥1 Emergency Department Visits in the Past Year for Asthma or Breathing Problems†	
	Those With Current Asthma Symptoms (n = 372)	Those With a Prior Physician Diagnosis of Asthma (n = 202)
No symptoms	NA	18.5
Mild intermittent	24.8	58.7
Mild persistent	38.8	68.0
Moderate persistent	40.7	60.4
Severe persistent	48.6	54.9

Abbreviation: NA, data not applicable.
*Data were obtained by using the National Asthma Education and Prevention Program 1997 symptom criteria.
†Data are given as percentage of children in each group.

essential first step in providing them with needed and appropriate medical care.

Recent data (Charles Homer, MD, MPH, oral communication, January 11, 2001) from the Pediatric Research Outcomes Study, a network of primary care pediatric practices across the country, show that nationally, 60% of children with persistent asthma are treated with anti-inflammatory medications by primary care physicians. Thus, while homeless children with asthma in NYC are clearly in contact with the medical care system, evidenced by a history of prior physician diagnosis and frequent recent emergency department visits, the level of appropriate treatment is far below the level of usual care in primary care settings. The high rate of undertreatment among these children is of grave concern, given evidence that the chronic inflammation associated with untreated asthma can lead to irreversible and detrimental thickening of the alveolar basement membrane and permanent lung damage.^{1,16}

Education on the basic facts about asthma is crucial for this high-risk population.¹⁹⁻²³ Although a 1995 meta-analysis²⁴ does not show an impact of patient edu-

cation on patient outcome, many controlled studies²⁵⁻²⁷ of asthma education programs directed at patients or physicians have been successful in demonstrating a reduction of symptoms, emergency department visits, and hospitalizations in populations of color or low socioeconomic status. Such interventions are urgently needed for most homeless children with asthma.

There are several potential limitations to this study. The first is the potential for selection bias in selection of the study sample. Because the assignment of families to placement in specific shelters is unrelated to any factors related to a child's health status, access and use of medical care, potential asthma triggers, or prior access and use of emergency departments, however, it is reasonable to assume that the children in the shelters selected for screening are a random sample of homeless children in family shelters throughout NYC. Screening estimates reflect homeless families in shelters in NYC, however, and are not strictly generalizable to homeless children in families nationwide. Another possibility for selection bias is in the sample of children actually screened. Approximately 75% of all children entering the shelters during the screening period were screened. For the true prevalence of asthma among homeless children to be similar to the national rates, we would have to have missed 80% of children entering the shelter, none of whom could have had a history of asthma or current symptoms consistent with asthma. This is highly unlikely. Even for our rates to approach those of the high asthma rate of geographic areas in NYC (15%-20%), we would have to have missed approximately 50% of the children entering the shelters, none of whom could have had a history of asthma or current symptoms consistent with asthma.

A second potential limitation is inherent in the nature of screening itself. Clinical symptoms reported may be due to other conditions and not asthma. To address this possibility, we used a question to identify prior physician diagnosis of asthma that was similar to that used in 2 national surveys. While a positive answer to this question is not a guarantee that a child actually has asthma, its use allows comparison with national data that have the same potential for error. Thus, while it may be possible that our finding that 26.9% of homeless children had a prior physician diagnosis of asthma has a degree of error, it is still more than 4 times the national rate with the same potential for error. In addition, we were conservative in including only children with symptoms consistent with moderate to severe asthma who had not had a prior physician diagnosis in our overall prevalence estimate; there are few conditions in childhood that produce the same cluster of symptoms at a high frequency other than asthma. The high sensitivity and specificity of the screening instrument when compared with a structured clinical assessment by a trained pediatrician or pediatric nurse practitioner add support to the validity of the screening instrument.

A third potential limitation is the scheme used for classifying severity. The screening instrument attempted to be as close an approximation to the National Asthma Education and Prevention Program symptom criteria as possible, yet the criteria themselves combine different symptom profiles under the same category. For instance, a child may have symptoms on 4 days during 1 week but on only 1 day in the previous week. Parents were, thus, asked to give their

best estimate of the child's average symptom frequency during the past month. While this may overestimate the number of children likely to have mild persistent asthma by including children with a more intermittent pattern of symptoms, this should be less of a problem for estimates of moderate to severe symptoms. Another limitation of the severity classification scheme is that peak expiratory flow rate and β -agonist use are not incorporated into the assessment of severity; only the National Asthma Education and Prevention Program symptom criteria were used. Data were not collected on peak expiratory flow rate, because most children entering the shelters did not have a peak flow meter; data on β -agonist use were considered in analyses of treatment, rather than in assessment of severity.

A fourth potential limitation is the possibility for error in the recording of medications. To give every possible chance to work against our hypothesis that children were likely to be substantially undertreated, all medications with an unknown or unclear description were assigned to the anti-inflammatory category. Thus, the true rate of undertreatment with anti-inflammatory medications is likely to be even higher than our results demonstrate. While children within families are likely to have the same potential for medication use, the rate of anti-inflammatory medications was so low that no attempt was made to analyze it using family as the unit of analysis. A fifth potential limitation is error in the reporting of emergency visits for asthma. It is possible that parents reported all visits to emergency departments, not just those for asthma or breathing problems, although these were specifically asked about on the screening instrument. Data were not collected on recent hospitalizations for asthma.

Speculation on factors likely to contribute to the high rates of asthma prevalence, severity, undertreatment, and emergency department use among homeless children is useful, because it may point to routes of intervention. Lack of access to a medical home and to continuity of care is likely to contribute strongly to severity, lack of appropriate treatment, and heavy emergency department use. Factors on the physician side may also play an important role—whether it is lack of knowledge of the standards of asthma treatment or a hopeful (but misplaced) perspective on the part of emergency department physicians that the child's chronic asthma management will be taken care of somewhere else. High levels of exposure to allergens and irritants found in poor housing before homelessness may play a role, yet the housing of families who become homeless is of similar housing composition, with a similar allergenic burden, as the housing of families who are poor but do not become homeless. It is possible that overcrowding due to living "doubled up" before becoming homeless might be associated with increased exposure to respiratory tract infections that could contribute to current asthma symptom severity.

It has long been recognized that psychosocial factors play an important role in asthma management; there is growing evidence that these factors may play a role in triggering and maintaining asthma exacerbations,^{17,28} through behavioral and physiologic mechanisms. The recent study by Weil et al²⁹ reporting an association of maternal depression and hospitalization in inner-city children with asthma offers important evidence that maternal mental health status is directly related to asthma-

What This Study Adds

The identification of high-risk subgroups of underserved children is crucial for a better understanding of the determinants and scope of the childhood asthma epidemic and for the development of successful interventions. A study of asthma in the population of children whose families have become homeless offers a unique opportunity to investigate asthma specifically in relationship to low socioeconomic status across race and ethnicity. To our knowledge, this study is the first to document a high rate of asthma (likely 39.8%) among a randomly selected population of homeless children whose families entered the shelter system in a major urban area. To our knowledge, it also is the first to document the extent of asthma severity, undertreatment, and frequent emergency department visits in this population of children. Systematic screening for current asthma symptoms and asthma history is recommended for all families entering a homeless shelter system to identify high-risk children in need of appropriate medical care.

related morbidity in children. Homeless children are particularly likely to have high levels of exposure to stressors, trauma, and mental health issues.^{15,30} Families that become homeless often do so after experiences of domestic violence, loss of jobs, and loss of social support. While adverse psychosocial factors occur at every level of socioeconomic status, the degree of exposure may be substantially greater among families that become homeless. High levels of exposure to adverse psychosocial factors may play a critical role in determining the high levels of severity and undertreatment found among homeless children.

The striking prevalence of asthma among homeless children speaks to the substantial burden of illness due to asthma faced by these children and their families. Unfortunately, no information was available on asthma history, outpatient visits for asthma, lost school days due to asthma, or other health burdens, such as the need for additional use of health services or the presence of comorbid conditions. A recent study³¹ by the Children's Health Fund, however, documents that the rates of incomplete immunizations, undiagnosed vision and hearing problems, and mental health problems among homeless children follow a similar pattern to the findings for asthma. The investigation of asthma among homeless children, thus, provides a broader view of the health situation of children whose families are on the edge, and are at levels of economic and social difficulty that require urgent attention and action, in the arenas of health care policy and delivery of medical care.

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