Restructuring Asthma Care in a Hospital Setting to Improve Outcomes*

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Study objectives: To restructure asthma care as the pilot program in hospital-wide redesign aimed at providing better and more standardized care. We chose asthma care to begin our reorganization because it is the highest-volume diagnosis at our hospital and it involves a broad spectrum of services.

Design: Key elements of our restructuring included the following: (1) establishing a pulmonary unit with expanded bed capacity from 8 to 22 beds for asthma patients; (2) standardized treatment protocols; (3) availability of direct admission by primary care physicians who maintained management of their patients with the option of consultation with a specialist; and (4) use of case managers who helped patients and their families overcome obstacles to optimum care.

Setting: A hospital serving a high proportion of Medicaid patients.

Patients/participants: Children with asthma and their families.

Interventions: Standardized care for asthma; use of case managers to facilitate adherence to treatment.

Results: With the restructured asthma care program, parent satisfaction with treatment was sustained; the average length of stay and use of the emergency department (ED) were reduced; observation unit use increased; and there were fewer readmissions to both the inpatient unit and the ED.

Conclusions: We conclude that an inner-city hospital can provide optimum care for asthma patients by standardizing treatment, aggregating asthma patients in one location, and providing education and follow-up through the use of case managers. The protocol shifts some costs from expensive services such as the pediatric ICU and the ED to less costly case management and outreach personnel. In the long run, this allocation of resources should help to lower costs as well as improve quality of care.

(CHEST 1999; 116:210S–216S)

Abbreviations: ALOS = average length of stay; CMH = Children’s Memorial Hospital; ED = emergency department; PAL = patient assistance liaison; PCP = primary care physician; PFM = peak flowmeter; PICU = pediatric ICU

In recent years, financial pressures brought about by the proliferation of managed care have forced physicians and provider institutions to reexamine their care delivery practices as they strive to provide optimum care at the lowest possible cost. Most physicians and hospitals have already made some changes to reduce costs while still providing high-quality care. Notably, there has been a movement—mandated in some cases by insurance providers—toward more standardized care for specific diagnoses.

Ironically, while standardized care is deemed desirable by managed-care insurers, another of their policies often works against it. This is the practice of establishing primary care physicians (PCPs), the mainstays of managed health-care delivery, as gatekeepers who decide when referral to a specialist is necessary. Managed-care providers often discourage PCPs in their groups from making such referrals or even penalize them for doing so, and PCPs themselves may be reluctant to make referrals for fear that they will lose access to their patients. Although numerous studies show that specialists’ care for asthma is cost-effective, it is also important that PCPs maintain overall management of their patients. The best care for the patient will not emerge from a “turf war” environment. Rather, high-quality care results when all providers who have something to contribute to the patient’s improvement integrate their services seamlessly.

With these considerations in mind, we at Children’s Memorial Hospital (CMH) in Chicago, IL, decided to restructure our health-care delivery system to provide top-quality care more efficiently. Asthma care delivery was chosen as the pilot area for early redesign because it represented the highest-volume diagnosis at admission, and also because asthma care involves a wide spectrum of sites and services, including primary care, emergency department (ED), observation unit, acute-care unit, pediatric ICU (PICU), and the home. Appropriately integrating all these services for a high volume of patients could
provide cost savings and, at the same time, rigorously test the new reorganization process.

INTRODUCTION

Objectives

We sought to design a model of care delivery for children and families living with asthma that would permit direct admission of the patient to the ward. Before redesign, we had only eight beds for asthma patients. As the average length of stay (ALOS) in the hospital was 3.4 days, these beds were often filled. When we had to place asthma patients on other patient-care units, there was a logistical problem in providing the level of specialized nursing and education necessary for our asthma patients. To standardize care, we developed a model that all care providers would use at each point of delivery. The attending physician, residents, nurse practitioners, clinical nurse specialists, staff nurses, respiratory therapists, social workers, medical psychologists, patient therapies staff, support services staff, pharmacists, and any other related staff would all use the same protocols.

Our specific objectives were the following: (1) to implement a process that could be integrated with other core processes as redesign progressed to other areas of patient care, (2) to restructure asthma care to treat acute asthma on the ward instead of in the PICU, (3) to design outcome measures to test the restructuring plan, and (4) to develop a mechanism to allow physicians to admit their patients directly to the hospital and to manage their care while in hospital. We also sought to improve and systematize our relationship with community-based physicians through better communication.

By having an integrated plan, we hoped to (1) reduce the ALOS by ≥ 1 day, (2) decrease reliance on the use of the ED, (3) improve patient/family adherence to the patient’s specific medical plan, (4) increase productivity of the clinical staff at each stage of the continuum, (5) reduce the recidivism rate for hospitalization, and (6) develop discharge criteria for each point on the continuum.

Outcomes Measurement

We measured changes and improvements in asthma care delivery by comparing the 1996 asthma season (before redesign) with the 1997 asthma season (after redesign) in several key areas. We compared the overall ALOS and the length of stay on the inpatient pulmonary unit and the PICU; the use of observation status (defined as a stay of < 24 h on the ward) vs the use of the ED; inpatient and observation readmissions within 2 weeks and within 2 months; the number of admissions from the ED; and the average total charge and average total costs.

Initial measurements were made for the quarter including August through October (peak asthma season) for 1996 and 1997. Thereafter, data were collected and analyzed for each quarter. Ongoing measurement monitored care delivery on the inpatient pulmonary unit and overall to ensure a single standard of care for all asthma patients throughout the hospital.

Materials and Methods

Project Teams

We assembled a multidisciplinary Asthma Redesign Team directed by the Division Head of Allergy and the Director of the Inpatient Pulmonary Unit. This team was charged with evaluating the current process of asthma management, beginning with the entry point in the ED and following the patient up to and including outpatient management. Other members included the Administrator of Critical Care, the ED Director, and two care managers.

A second team, the Asthma Outcomes Management Team, evaluated the effects of redesign on the patient with asthma. This team was directed by the Division Head of Allergy and the Director of the Statistical Sciences and Epidemiology Program/Outcomes Initiative. Other members of the Outcomes Team included six interviewers and a data analyst.

Redesign

To increase efficiency and streamline patient care, we developed standardized orders and patient-care protocols and coordinated asthma patient care among all providers. We also established a pulmonary unit with dedicated allergy/pulmonary coverage. Bed capacity was increased from 8 to 22 beds, with each able to serve all levels of asthma severity.

We established a Command Control Center through which community physicians could admit their asthmatic patients directly to the pulmonary unit. Patients are triaged over the telephone by a nurse. Community physicians continue to manage their own patients, but an asthma-care specialist is available on the floor.

Two asthma nursing case managers follow all asthmatic inpatients and coordinate their care. Case managers monitor the patient through treatment, coordinate discharge planning, and follow up on home health evaluations. They also work with nurses from the pulmonary unit and the allergy clinic to ensure that patients and families receive standardized asthma education. In addition, we have added a certified pediatric nurse practitioner and an asthma respiratory specialist to the staff.

Survey

To track family satisfaction with the changes in protocol, we approached families as they presented for treatment and obtained informed consent for their participation in a survey. The goal was to obtain 50 completed interviews from each site (the inpatient unit, the ED, and the allergy clinic), both before and after redesign. The sample was limited to English-speaking families with at least one custodial parent. Children < 18 months of age were excluded. Families presenting at CMH for asthma care from April through June of 1997 were eligible for inclusion in the baseline group. Families presenting from August through October of 1997 were eligible for inclusion in the post-redesign group. The project was approved by the CMH Institutional Review Board. Table 1 lists the background characteristics of the survey participants.

Survey Instrument

The survey included questions about care delivery, specifically focused on aspects affected by redesign, and outcome measures. Where possible, we used questions from existing surveys with established reliability and validity.6-8 These items covered demographics, functional status, health-care utilization, medical risk,
adherence, parent and child knowledge of asthma, environment, and satisfaction with care. We developed questions involving redesign elements and evaluated them for test-retest reliability. The questionnaire took approximately 30 min to complete. (The questionnaire is available from the corresponding author.)

<table>
<thead>
<tr>
<th>Table 2—Eligibility, Contact, and Response Among Survey Prospects</th>
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<tbody>
<tr>
<td>Prospect Information</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>No. identified with asthma</td>
</tr>
<tr>
<td>No. ineligible (%)</td>
</tr>
<tr>
<td>Reason for ineligibility</td>
</tr>
<tr>
<td>Age, No.</td>
</tr>
<tr>
<td>Non-English language, No.</td>
</tr>
<tr>
<td>Guardianship, No.</td>
</tr>
<tr>
<td>Miscellaneous, No.</td>
</tr>
<tr>
<td>No parent at encounter, No.</td>
</tr>
<tr>
<td>Already enrolled/interviewed about sibling, No.</td>
</tr>
<tr>
<td>No. eligible</td>
</tr>
<tr>
<td>No. missed</td>
</tr>
<tr>
<td>Total no. contacted (%)</td>
</tr>
<tr>
<td>No. who refused</td>
</tr>
<tr>
<td>No. who completed interviews (%)</td>
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</table>
CMH and exported to computer software (SigmaStat, version 6.1.4; SPSS Inc; Chicago, IL) for analysis. For statistical analysis, $\chi^2$, $t$ tests, analyses of variance, and one-sample $\chi^2$ tests were applied as appropriate. This was true for both survey and hospital data. A $p$ value of $< 0.01$ was considered significant, while $p$ values of $< 0.05$ approached significance.

**Results**

**Comparability of Survey Groups**

Demographic characteristics of the baseline and postredesign samples were similar overall and at each of the three interviewing sites (clinic, ED, and pulmonary floor), as seen in Table 1.

In the pre- and postredesign groups, children had similar exposure to asthma triggers. There were no significant differences in the proportion living in homes with forced-air heat, gas stoves, dogs, cats, or smokers in the home. Neither were there differences in the average number of reported mold sources or average number of different asthma triggers.

More than one third of families from each site had at least one smoker in the household. Other commonly reported triggers included mold in the home (23% in the baseline group; 26% in the post-redesign group), and use of a gas stove (81% in both groups).

Symptom days/functional status were similar in the baseline and post-redesign groups at each site (Table 1).

Groups were comparable overall and by site for the following: the proportion of children who had a PCP or a physician for asthma; asthma medication use, including inhaled medications, oral steroids, and albuterol; understanding instructions; and number of problems affecting compliance with asthma treatment.

The number of inpatient hospitalizations, unscheduled physician visits, or hospitalizations in the Asthma Care Unit for the prior 2 months did not differ between the baseline and post-redesign groups, either overall or by site.

**Results Related to Redesign**

**Implementing an Integrated Clinical Care Pathway**: We aimed to increase the use of the observation unit, rather than the ED, for the provision of nebulizer treatments. The number of asthmatic children admitted to the observation unit increased from 14 in 1996 to 69 in 1997, an almost fivefold increase.

Another key element was the creation of a pulmonary unit to treat asthma. Before this unit was established, 48% of children hospitalized for asthma were treated on the pulmonary floor. After redesign, the proportion rose to 88%.

Redesign introduced the use of case managers, home health care, and patient assistance liaisons (PALs) to supplement nursing services. These personnel were primarily involved with patients in the inpatient unit, so survey responses reflect the perceptions of parents of 49 inpatients after redesign. Parents did not recognize case managers as a new kind of provider: only four (9%) recalled having someone introduce herself as a case manager. Eleven parents (25%) reported that someone talked about home health care. Thirteen (29%) reported contact with a PAL, whose principal duties were changing bedding, taking vital signs, feeding, talking, and playing with the child. Of those who identified care provided by a PAL, nearly all (92%) were pleased with the care.

Most parents reported having an assigned nurse. After redesign, 67% of parents reported that a nurse visited them more than eight times a day, compared with 8% of inpatients’ parents interviewed at baseline ($p < 0.001$).

Survey results found no significant differences in the number of parents reporting contact with their child’s PCP during their CMH visit, either overall or by site. At baseline, 93% of parents reported that their child had a PCP. After redesign, the proportion rose slightly, to 96%. However, more parents reported contact with the PCP during the hospital stay after redesign (60% vs 50%).

Another goal of the redesign was to reduce the amount of time spent in the ED to $\leq 2$. Parents interviewed in the inpatient unit who reported waiting in the ED $> 2$ h before transfer to the pulmonary floor decreased from 48% at baseline to 18% after redesign ($p < 0.05$).

**Increasing Physician Satisfaction**: We hoped that allowing the PCP to directly admit his or her patients to the pulmonary floor would increase physician satisfaction and lead to more referrals. Such admissions were noted on the hospital record. However, data from these records indicate that the proportion of admissions coming from physician referral or self-referral remained stable.

**Adherence**: We hoped to reduce recidivism by increasing and systematizing asthma education and counseling about adherence. After redesign, there was no significant difference in the proportion of parents reporting adherence problems, but significantly more parents reported discussing these problems overall ($p < 0.001$) and in the allergy clinic ($p < 0.001$). See Table 3 for data on education.

The survey included eight topics related to asthma education. Overall ($p < 0.01$) and in the clinic setting ($p < 0.01$), parents reported a significant increase in the average number of educational topics discussed.
Families of children hospitalized on the pulmonary floor reported an average of 4.5 educational topics discussed after redesign, which was similar to the number reported by those interviewed in the clinic after redesign. Families interviewed in the ED reported discussing the fewest educational topics. Overall, topics that parents reported discussing significantly more often after redesign included ways to decrease airway obstruction (p \( < 0.001 \)) and the importance of having a PCP (p \( < 0.01 \)). Asthma triggers (p \( < 0.05 \)), ways to avoid triggers (p \( < 0.05 \)), and steps to take in an emergency (p \( < 0.05 \)) were discussed more often than before redesign, but not significantly so.

Parents and children completed an asthma knowledge test on the survey. Parental asthma knowledge was relatively high both before and after redesign, with half the parents answering \( \geq 75\% \) of questions correctly. An analysis of variance showed that in either time period, the proportion of parents correctly answering \( \geq 75\% \) of the questions was significantly higher among families interviewed in the clinic.

Among children able to respond to the survey (40%), asthma knowledge was also relatively high, regardless of the site where the child was interviewed. About 63% of respondents answered \( \geq 75\% \) of questions correctly. There were no significant differences in asthma knowledge before and after redesign.

After redesign, survey responses indicated an overall increase in the proportion of children aged \( \geq 5 \) years who reported using a peak flowmeter (PFM) during their CMH visit (p \( < 0.05 \)). Significantly more parents reported receiving instruction in the use of a PFM (p \( < 0.01 \)) and in interpreting PFM measurements (p \( < 0.001 \)). This was particularly true in the clinic setting, where knowledge and use had significantly lagged behind those observed in the ED and the inpatient unit at baseline. In fact, education in the clinic approached the level of the inpatient unit after redesign.

At baseline, 19% of parents overall reported that their children aged \( \geq 5 \) years received a pulmonary function test. After redesign, the proportion rose to 40% overall (p \( < 0.01 \)). Again, the increase was primarily among clinic patients (17% before vs 75% after redesign; p \( < 0.001 \)). There were no significant changes in the ED or inpatient groups.

Returns to the ED and Readmissions: We were concerned that decreases in the ALOS might result in early returns to the hospital if the child had been discharged too early. However, hospital data showed that among 275 discharges in 1996, 11 patients made ED visits within 2 weeks after discharge, compared with two ED visits after 287 discharges in 1997. The proportion of discharges resulting in returns to the ED in 1996 was used as the expected value for ED returns in 1997 in a single-sample \( \chi^2 \) test, which showed a significant decrease in returns to the ED within 2 weeks (p \( < 0.01 \)). Returns within 2 months also decreased, from 31 of 275 in 1996 to 20 of 287 in 1997 (p \( < 0.05 \)).

There were eight readmissions within 2 weeks in 1996 and three readmissions in 1997 (p \( < 0.1 \)). In the 1996 period, there were 27 inpatient readmissions within 2 months vs 18 in 1997 (p \( < 0.05 \)). Although these results were not significant, it appears that reducing the ALOS did not result in increased readmissions.
Parents completed six survey questions about satisfaction with asthma care during their current encounter and rated the quality of their child’s asthma care at CMH during the previous year (Table 4). There were no significant differences either in the number of items rated excellent or very good, or in the proportion rating individual items highly. Furthermore, there was no significant difference before vs after redesign in the rating of quality of asthma care during the previous year.

**DISCUSSION**

**Study Findings**

Overall, the results indicate that redesign improved the efficiency and quality of asthma care delivery. We feel that moving patients quickly from the ED to the observation unit was an important factor in the improvement. In our experience, young children with asthma seem to do better in rooms with their own beds than in the ED.

The ALOS dropped significantly, yet ED returns and early readmissions also declined, an indication that patients were well when they left and remained so.

We believe that the use of case managers played a key role in these results. In the past, adherence has been a problem in our patient population. The case managers helped families establish patterns of adherence by scheduling appointments, arranging transportation when necessary, and helping with other problems after the patients went home.

Since we had no control group with which to compare changes, we did not complete a definitive cost analysis, but the available data indicate that the addition of case managers reduced the use of high-priced services. Therefore, as families learn what it takes to keep their children well, the redesign should be cost-effective over the long term.

We are relatively unconcerned that many parents could not identify the case manager as such. Parents were pleased with their child’s care and worked well with the case managers, whether or not they understood the role.

**Study Limitations**

Because we compared the ALOS in two different asthma seasons, it is possible that factors other than redesign could have influenced the outcome. Comparing our asthma ALOS changes with the ALOS for asthma at other institutions might help to clarify the situation.

We were disappointed that more PCPs did not take advantage of the opportunity for direct admission of their patients. However, we actively recruited only a small sample of PCP practices. In the future, we plan to establish relationships with other community-based PCPs and offer them the opportunity for direct admission. It is also possible that some PCPs were unwilling to try direct admission simply because it was a new protocol with which they were unfamiliar. An upcoming survey of PCPs who did use direct admission should help identify areas for improvement.

**Future Plans**

To build on the results from this study, we plan to establish a quality-improvement team to identify barriers to adherence to medications; add the use of a spirometer to the current asthma management protocol to facilitate treatment adjustments; and establish a child-advocacy asthma team to bring asthma education and prevention to high-risk children and school nurses. In addition, we plan an 18-month follow-up on the functional status and hospital and ED utilization of our study patients.

**Table 4—Parental Satisfaction With Treatment Pre- and Post-redesign**

<table>
<thead>
<tr>
<th>Item</th>
<th>Overall</th>
<th>Clinic</th>
<th>ED</th>
<th>Inpatient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average No. of items rated very good or excellent (range, 0 to 6)</td>
<td>4.1  3.9</td>
<td>4.1  4.2</td>
<td>3.8  3.8</td>
<td>4.2  3.8</td>
</tr>
<tr>
<td>Average rating of satisfaction (5 = excellent) with:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wait time</td>
<td>4.2  4.0</td>
<td>4.3  3.9</td>
<td>4.2  4.1</td>
<td>4.0  4.2</td>
</tr>
<tr>
<td>Ability to reach MD/RN by telephone during stay</td>
<td>4.1  3.6</td>
<td>4.0  3.6</td>
<td>3.9  3.4</td>
<td>4.2  3.9</td>
</tr>
<tr>
<td>MD communication</td>
<td>4.3  4.3</td>
<td>4.4  4.3</td>
<td>4.2  4.3</td>
<td>4.3  4.3</td>
</tr>
<tr>
<td>RN communication</td>
<td>4.3  4.2</td>
<td>4.5  4.3</td>
<td>4.1  4.0</td>
<td>4.1  4.3</td>
</tr>
<tr>
<td>MD skills</td>
<td>4.2  4.2</td>
<td>4.4  4.3</td>
<td>4.0  4.1</td>
<td>4.2  4.2</td>
</tr>
<tr>
<td>Quality of asthma care at CMH in last year</td>
<td>4.5  4.3</td>
<td>4.6  4.5</td>
<td>4.4  4.3</td>
<td>4.3  4.1</td>
</tr>
</tbody>
</table>

*MD = physician; RN = registered nurse. See Table 1 for other abbreviations.

†p < 0.01
SUMMARY

Our findings showed asthma redesign met a substantial number of our objectives. Overall ALOS declined significantly without increasing either early ED visits or early readmissions. We were able to shift some patients from the PICU and the ED to the observation unit. Although the ED remained the primary source of admissions, the modest decline in ED admissions represents a trend in the right direction. In our institution, redesign was a positive step toward treating asthma in a more appropriate and cost-effective setting. We believe that our model can be replicated for other specialties and in other institutions for standardized, high-quality, and more-efficient treatment of patients.

REFERENCES

4 Mayo PH, Richman J, Harris HW. Results of a program to reduce admissions for adult asthma. Ann Intern Med 1990; 112:864–871

Chicago Community-Based Asthma Intervention Trial*

Feasibility of Delivering Peer Education in an Inner-City Population

Victoria Persky, MD; Lenore Coover, MSN; Eva Hernandez, MSN; Alicia Contreras, MA; Julie Slezak, MS; Julie Piorkowski, MPH; Luke Curtis, MS; Mary Turyk, MPH; Viswanathan Ramakrishnan, PhD; and Peter Scheff, PhD

The most effective means of educating children with asthma and their families has not been clearly demonstrated in previous studies. Peer education is uniquely suited to the complex problems encountered in underserved populations. The purpose of this study was to show the feasibility of delivering a peer education program for children with asthma and the effect of the program on indoor allergen levels in an inner-city population in Chicago. Overall, the program was well received. Baseline allergen levels were consistent with some previous studies in showing low levels of mite allergens and high levels of cockroach allergens, with 79.6% of samples having levels > 8 U/g. A total of 28.2% of samples had cat allergen levels > 2 μg/g, although only 9.7% of homes had cats, confirming previous reports that cat allergen is ubiquitous. Mold levels were seasonal, with the highest levels in the summer. Results from this study suggest that intervention programs should focus more on elimination of cockroaches than was previously appreciated, while minimizing the use of pesticides, and on identification of the sources of cat allergen. Structural and psychosocial issues in homes need to be addressed in future studies. This study has demonstrated the feasibility of delivering peer education in an inner-city population and highlighted the need for comprehensive intervention strategies addressing complex issues facing underserved neighborhoods. (CHEST 1999; 116:216S–223S)

Abbreviations: ANOVA = analysis of variance; Der f1 = Dermatophagoides farinae allergen; Der p1 = Dermatophagoides pteronyssinus allergen; ELISA = enzyme-linked immunosorbent assay; NCICAS = National Cooperative Inner City Asthma Study

Previous studies have suggested that asthma morbidity is affected by the level of indoor allergens in the home. Several groups have noted that dust mite sensitivity is related to the prevalence of asthma1–3 and that the levels of mite allergens in the environment are related to skin test positivity.4–6 as well as symptoms.7–8 Sporik et al9 found that exposure to > 10 μg/g of Dermatophagoides pteronyssinus at the age of 1 year was significantly associated with the development of asthma by 11 years of age. Prevalence of asthma has also been associated with greater skin test sensitivity to cat and mold allergens,1,2 with self-reported exposure to dampness and molds,10,11 and with exposure to in utero, as well as to passive, smoke.12–14 The National Cooperative Inner-City Asthma Study (NCICAS) noted generally low levels of mites and high

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levels of cockroaches in inner-city homes. They found increased asthma symptoms and hospitalizations in children who were both allergic to cockroaches and whose homes had high levels of cockroaches.15

The effects of various interventions that have been used for the control of indoor environmental asthma triggers are unclear. Frequent dusting, carpet removal, and use of plastic mattress covers have been used to decrease exposure to mites, as well as to cat and cockroach allergens.16,17 In addition, repair of water leaks and use of air conditioning and dehumidifiers have been used to reduce mold levels. Additional intervention strategies have included vacuuming mattresses weekly, laundering blankets at least once a fortnight and sheets weekly in hot water, replacing feather pillows with synthetic filling, removing quilts and eider downs, vacuuming carpets several times a week and upholstery fortnightly, and removing soft toys and pets.18,19

The most effective means of educating children with asthma and their families in underserved populations is not well established. Most of the previous intervention programs used professionals to educate20,21 and case-manage22 families with asthmatic children. Few of the studies have targeted modification of the home environment. Changes of factors in the home are often complicated, necessitating on-site assessment and creative solutions to complex social problems that affect the ability of families to make suggested modifications. There is an increasing body of evidence supporting the role of peer educators in health promotion. Peer educators are culturally sensitive and more efficient in transmitting the necessary knowledge, and therefore more cost-effective.23,24 There are only a few studies, however, examining the role of peer education in asthma management.23,24 The limited data from those studies suggest that they are more effective in education than in medication management. Families of asthmatic children are frequently responsive to peer educators in their own homes and feel comfortable discussing the real issues facing them regarding modification of asthma risk factors. The purpose of this study was to show the feasibility of a peer educator program and the effectiveness of peer education on modifying levels of indoor allergens in an inner-city Chicago population previously shown by our group to have high rates of asthma prevalence, morbidity, and mortality.25–28 Data collection is almost complete in the study. This paper describes the overall methods and baseline allergen data. Subsequent papers will present the results of the intervention.

**Materials and Methods**

**Recruitment, Training, and Supervision of Educators**

Peer educators were recruited from parents of children with asthma who were enrolled in the 20 Head Start sites and community agencies in the West Town and Humboldt Park communities served by Erie Family Health Center on the West Side of Chicago. The Directors of the Head Start programs were asked to recommend parents who were responsible and interested in asthma. Ten women were referred for the training. At that time, we discussed the benefits of the learning experience, and the fact that we would hire only three persons for the first study. Participants were not reimbursed for the initial training. One of the women we initially hired withdrew during the first year for personal reasons, and over the next year we held two more training sessions for a total of 13 women. From those 13, we hired 2 women, 1 of whom also withdrew for personal reasons. The initial training consisted of 5 half-day sessions over a 1-week period. The curriculum focused on asthma knowledge, environmental triggers, how to approach families, and basic information about the interventions. During the initial training, candidates were assessed by the project staff for their commitment and ability to work with other families in a home visit setting. At completion of the initial training, all women who attended were given certificates. Potential educators were asked to provide resumes, letters of recommendations, and a statement of their goals before undergoing interviews by the study investigators. Those who were hired then underwent several more weeks of training specific to the project. This included how to assess environmental triggers in the home environment, the availability and accessibility of community resources, how to work with families in a nonthreatening fashion, role playing, the importance of confidentiality and children’s rights, how to handle acute psychosocial issues that might arise, how to give asthma presentations in the community and schools, methods of collecting dust and air samples for allergen measurements, and methods of randomization and additional data collection. Personal growth and professional goals were also included and continue to be part of the project. During the study, the educators had ongoing training and support. They have been supervised daily by an on-site master’s degree level coordinator, as well as with weekly and biweekly meetings with three of the study investigators (including the principal investigator, a physician, and two co-principal investigators, an asthma nurse educator and a psychiatric nurse). All three of these investigators have also been available through 24-h beepers to assist with unexpected emergencies when they arise.

**Overall Study Design**

The project was designed as a randomized trial of 60 families residing in a low-income neighborhood on the West Side of Chicago. Half of the families received intensive intervention during the first 6 months of the study and half during the second 6 months of the study. Home assessments were made at baseline, at the 6-month visit, and after 1 year. Recruitment and intervention occurred during a 2.5-year period. The initial dropout rate was somewhat higher than anticipated, primarily because of families that moved or had unanticipated time constraints. As a result, a total of 70 families were recruited, of whom 62 completed the first visit and 52, the second visit, and 49 families so far have finished the trial.

**Intervention**

The intervention program consisted of a minimum of four visits, each with clearly delineated goals. The first visit was primarily to establish a rapport with the family and explain the purpose of the study. For families randomized to receive early intervention, the major issues in asthma prevention were discussed. The second visit comprised a detailed home assessment, collection of air and dust samples, and a chance to answer any questions that may have arisen in the interim. The educator and caretaker walked through each room noting the presence or absence of potential allergens or irritants, such as presence of pets, form of ventilation, amount of dust, type of heating and stove, type of carpets and rugs, upholstered furniture, stuffed...
toys, mattress and furniture covers, presence of air conditioning and dehumidifiers, airflow, smokers in the home, humidity, molds, and use of pesticides and other chemicals in the house. Educational material was left after the second visit. Between the second and third visits, the peer educator developed a management plan for the family, taking into consideration the strengths of the family system. The objectives of each plan were generally similar. Differences in implementation reflected variations in social and family support structures. It was understood that the plan had to be realistic and cost-effective and that it might be instituted in stages over several months. The plan was reviewed by the nurse and, rarely, revised if there was a problem.

Intervention strategies included dust control, removal of pets, elimination of carpets, if possible, washing of bedding, decreasing humidity and molds, removal of feather pillows and stuffed toys, covering of mattresses and upholstered furniture, general cleaning practices, and the use of Integrated Pest Management for cockroach control. This approach emphasized aggressive insect control through housekeeping, identification of sources of roaches, selective use of boric acid under refrigerators and baits, such as Combat, and cost-effective structural changes, such as caulking around leaky faucets and repair of areas that allow access of insects and rodents. In cases in which families had difficulty removing pets and stuffed toys from the house, they were encouraged to remove them from the child’s room or to keep the toys in plastic bags. Behavior modification was strongly encouraged, and parents were active partners during the intervention period. In two cases, the educators were effective in working with parents to convince landlords to institute more extensive repairs where needed. All families were given mattress covers and peak flowmeters, along with instructions for their use. For families containing smokers, the smokers were encouraged not to smoke in the home. The plan was discussed with the family at the third visit, and modifications were developed and implemented between the third and fourth visits. During the fourth visit, the importance of emergency medical plans, as well as communication with health-care providers and school staff, was addressed. Repeat home assessments and collections of air and dust samples were made at 6 and 12 months.

Families randomized to serve as controls for the first 6 months received a detailed home assessment and collection of air and dust samples at the second visit, and were then contacted monthly by telephone until they entered active intervention at 6 months. From that point, they followed the intervention program from the second intervention visit, as described above.

Families for the program were recruited from the Head Start sites in West Town and Humboldt Park, as well as from Erie Family Health Center, a community-based health center serving the area. Before the initiation of the trial, the program was piloted with 17 Head Start families. Before randomization, families met with the educator at the site of recruitment to establish rapport before going into the home; the study was explained and they signed informed consent. Subsequent visits by the educator were in the family’s home. The results were shared with the participants and with their health-care providers, with the participants’ permission.

Dust and Air Collection and Analysis

Dust samples were collected at baseline, 6 months, and 12 months from the child’s mattress, living room floor, and bedroom floor using standardized data collection methods. These were collected with a handheld portable vacuum cleaner with disposable vacuum bags for a 1.0-m² area for the living room and bedroom floor samples, and a 0.25-m² area of the mattress. Dust was transferred from the disposable bags to plastic bags, frozen at −20°C and stored for subsequent measurement of allergens. Analyses of dust mites Dermatophagoides pteronyssinus and Dermatophagoides farinae (Der p1 and Der f1), cockroach (Blatella germanica), and cat (Fel d1) allergens were performed under the supervision of Dr. Peter Scheff at the University of Illinois School of Public Health. Dust was screened with a 650-μm filter. The samples were extracted in phosphate-buffered saline solution and analyzed with the sandwich–enzyme-linked immunosorbent assay (ELISA) method of Chapman et al.20–21 and Pollart et al.22 Monoclonal antibodies and allergens were purchased from the University of Virginia. Standard allergen dilution curves and blanks were run on each day of ELISA analysis. For each sample, allergen concentrations were determined from interpolation of the standard allergen absorbance curves. For each panel of ELISA dust assays, four blank samples were run to determine blank and detection limit absorbance values. The detection limit varied with each batch and was set at two SDs of the blank absorbance values. Surface dust concentrations are presented as a bulk dust concentration (micrograms per gram or units per gram). For quality control, two types of split samples were obtained. The first involved separating dust samples into two separate samples for analysis. Mean coefficients of variation were 0.230 (n = 6) for Der f1, 0.448 (n = 5) for Der p1, 0.347 (n = 6) for cat antigen, and 0.242 (n = 5) for cockroach antigen. The second type of split sample involved different aliquots for the same dust–phosphate-buffered saline solution test tube; this measured variation in the ELISA itself. Mean coefficients of variation for these samples were 0.059 (n = 9) for Der f1, 0.095 (n = 5) for Der p1, 0.117 (n = 13) for cat antigen, and 0.087 (n = 5) for cockroach antigen.

Airborne fungi were collected outdoors, and in the kitchen and bedroom with one-stage bioaerosol samplers (N-6; Andersen; Atlanta, GA), containing 400 air-jet holes and having a cut point of 0.8 μm. Air pumps connected to the Andersen samplers had a calibrated flow of 35 L/min. The Andersen samplers were loaded with malt extract agar media. After collection, the fungal plates were incubated at 25°C for 5 to 7 days and counted for viable fungi with a magnifying glass. A preliminary 2- to 3-day count was made and used as an estimate of total fungi in cases in which the plates were badly overgrown at 4 to 6 days. The colony forming units per cubic meter was calculated by taking an average of the two bioaerosol counts divided by the volume of air sampled. On samples containing ≥20 viable colonies per plate, a count correction factor was used to account for undercounting of spores caused by two or more fungal propagules entering the same hole.33 Fungal colonies were then examined with a 100 to 400× microscope and classified to genera with the help of standard fungal references.34–35 On plates for which the correction factor was used, it was assumed that all of the fungal genera were equally viable and able to compete for space in cases in which two or more spores were entered into the same Andersen hole.33

Data Analysis

Dust antigens and fungi distributions were transformed to a natural log scale for statistical analysis. Geometric mean dust antigen and fungi values were calculated for each collection location (kitchen, bedroom, bed) and each binmonthly period. Because no samples were obtained in September, averages for September-October include samples from October only. For analysis, zero values for fungi were assumed to be the lowest observed value in the data set. For fungi, zero values were therefore assumed to be 20 cfu/m³; for dust samples, zero values were assumed to be 0.001 μg/g for cat, 0.001 μg/g for Der p1, 0.0004 μg/g for Der f1, 0.0004 μg/g for total mite, and 0.12 U/g for cockroach antigen. Multiple pairwise differences between mean values were examined using analysis of variance (ANOVA) with the least significance difference method. Percentages were
generated for dust antigen values above thresholds thought to increase risk for symptoms (2) (2 μg/g for Der p1, Der f1, and cat antigen and 8 μg/g for cockroach antigen) and for whether fungal cultures produced identifiable colonies. Differences between collection locations were examined using χ² tests.

Results

The basic demographics of the 62 families who completed baseline visits are given in Table 1. Approximately half of the families were recruited from Erie Family Health Center and half from the neighborhood Head Start sites. Forty-one of the children with asthma were boys and 21 were girls. Ethnicity and race were mixed, with 12 African-American, 24 Puerto Rican, 25 Mexican, and 1 non-Hispanic white families. Twenty-one families had pets; 6 had cats. Twenty-six families had one or more smokers in the home, with 9 families having more than one smoker. Baseline allergen measurements are given in Tables 2, 3 and Figures 1–3. Levels of mite allergens were low: geometric mean was 0.023 μg/g for Der f1 and 0.047 μg/g for Der p1 with 3.3% of samples > 2 μg/g for Der f1 and 5.5% of samples > 2 μg/g for Der p1. Levels of cockroach antigen, however, were quite high, with 79.6% of samples > 8 μg/g. A total of 28.2% of the samples had cat allergen > 2 μg/g, with 45.9% of homes having at least one sample > 2 μg/g, although only six, or 9.7%, of the homes had cats. Mean levels of Der p1 and total mite antigens were significantly higher on the bed than on the living room floors. Total mite antigens were also significantly higher on the bed than on the bedroom floor. There were no other significant differences by site for the dust antigen levels. Total mean fungi levels varied from 385 cfu/m³ in the kitchen to 445 cfu/m³ in the bedroom. The most common fungi were Penicilium, Cladosporium, and Aspergillus. Overall cockroach allergen peaked in May and June (p < 0.05 for differences in mean levels for May-June vs all other seasons), cat levels peaked in May and June (p < 0.05 for May-June vs January-February, March-April, and October), and mold levels peaked in July-August (p < 0.05 for mean levels in July-August vs January-February, March-April, and November-December). Der p1 peaked in January-February and May-June, but there were no significant seasonal variations in Der f1 or in total mite antigens (not shown).

Data collection is still continuing in the study, and the results of the intervention will be presented in a subsequent paper. Overall, the study has been well received by the participants. Dropouts since the first visit have been few and primarily related to families moving. To date, in 16 of the 26 families that have smokers, the smokers are no longer smoking in the child’s home. One person has quit completely and one decreased to less than one cigarette a day. Many of the families feel that their child’s symptoms have improved as a result of the intervention. The study has also been personally beneficial to the educators. One of our peer educators recently left to attend nursing school. Another, without previous employment or high school diploma, has obtained her general equivalency diploma during employment with us and has proved to be such a strong leader that she has been promoted to supervisor on two recently funded trials. Three of the families who finished this study were identified by the study staff as potential educators. They also found the process so rewarding for their families that they volunteered for the training for a more recent trial, and two are now hired as peer educators for that study. Health-care providers whose patients were in the study have benefited from increased communication with their patients and greater understanding of factors affecting their management. In several instances, psychosocial issues, as well as unusual exposure, such as the existence of several birds in the home, were identified and addressed by the educators working with the provider.

Discussion

Allergen levels demonstrated here are similar to those seen in the NCICAS study of inner-city United States populations and different from those seen in other populations. A high percentage of homes had cockroach antigen and a low percentage had mite antigen above NCICAS thresholds. The fact that cat allergen was above the NCICAS threshold in a large number of families that did not have cats also is consistent with previous literature and suggests that the allergen may be transmitted on clothing and therefore may be difficult to eradicate.

Table 1—Demographic Characteristics of Families in the Study

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>No. of Families</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site of recruitment</td>
<td></td>
</tr>
<tr>
<td>Erie Family Health Center</td>
<td>33</td>
</tr>
<tr>
<td>Head Start Sites</td>
<td>29</td>
</tr>
<tr>
<td>Sex of children with asthma</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>41</td>
</tr>
<tr>
<td>Female</td>
<td>21</td>
</tr>
<tr>
<td>Pets</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>21</td>
</tr>
<tr>
<td>No</td>
<td>40</td>
</tr>
<tr>
<td>No. of smokers in the home</td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>36</td>
</tr>
<tr>
<td>One</td>
<td>17</td>
</tr>
<tr>
<td>Two</td>
<td>8</td>
</tr>
<tr>
<td>Three</td>
<td>0</td>
</tr>
<tr>
<td>Four</td>
<td>1</td>
</tr>
<tr>
<td>Race/ethnicity</td>
<td></td>
</tr>
<tr>
<td>African American</td>
<td>12</td>
</tr>
<tr>
<td>Puerto Rican</td>
<td>24</td>
</tr>
<tr>
<td>Mexican</td>
<td>25</td>
</tr>
<tr>
<td>Non-Hispanic white</td>
<td>1</td>
</tr>
<tr>
<td>Age of child with asthma, yr</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>11</td>
</tr>
<tr>
<td>5</td>
<td>19</td>
</tr>
<tr>
<td>6</td>
<td>9</td>
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<td>7</td>
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<td>12</td>
<td>1</td>
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<td>13</td>
<td>2</td>
</tr>
</tbody>
</table>
The higher levels of mite antigens on beds is also consistent with previous literature\(^{37}\) and suggests that mattress covers should be effective.

Conclusions about the effects of season on allergen levels must be viewed with caution in light of the relatively small number of samples collected each month. The seasonal nature of molds, with peaks in the late summer, however, has been reported in other studies\(^{39–41}\). The suggestion that cockroach allergen may peak in May and June has not been found before and warrants further study. Our failure to find consistent seasonal effects on mites is not consistent with our previous study\(^{42}\) nor with some of the previous literature\(^{36}\) and may reflect the very low levels of mites found in the study.

These data imply that intervention strategies in inner city populations need to focus more than has been previously appreciated on cockroach control, on minimizing the use of pesticides, and on identifying possible sources of cat allergen. During the course of the study, it has also become apparent that, in a subset of homes, substantial structural problems in the housing unit may limit the effectiveness of traditional intervention approaches. When possible, families have adopted cost-effective strategies, such as caulking around leaks. In some cases, however, more extensive changes are necessary. The program was successful in convincing at least two landlords to institute changes, but this is not always feasible, and several of our families have moved to improve the environment for their children and are applying the knowledge gained in this project to their new living arrangement. As we gain more experience with housing conditions in the inner city, more extensive legislative and political action may be necessary to decrease exposure to asthma triggers.

Several issues have become apparent in this project that deserve mention. Half of the families that dropped out of the study did so before the first visit, in part...
because they moved, but in part because they did not appreciate the length of time involved in the intervention. Neither demographics (age, sex, years with asthma, language spoken at home), nor overall indexes of severity, such as lifetime asthma hospitalization rates or asthma-related emergency department visit rates in
the last year, predicted who would drop out of the study. As a result of the early dropouts, we are delaying randomization in our current trials until the second visit, with more success. The mobility of our population was anticipated at the beginning of the study and, to some extent, was addressed by the overrecruitment. This issue is less important in our current trials in which the primary end points are asthma morbidity rather than home allergen levels. Finally, the seasonality apparent in the allergen levels was controlled in part by the randomized study design, but will also be addressed in the final data analysis.

Overall, the project has demonstrated that peer education focused on modification of the home environment in inner-city populations is feasible. The program has been well received by educators and families and has demonstrated that education through community residents can be beneficial both for the educators and participants. The upward mobility of our educators suggests that programs like these may be useful transitions from unemployment to other job opportunities.

The involvement by our participants has generally been positive, with two of the participants currently peer educators in other studies. Presentations in the community have also been well received and have alert residents to issues related to asthma, not just environmental. The project has involved many Head Start and community agencies in the area and has contributed to overall awareness and knowledge about the disease in the targeted community.

In conclusion, this project has shown the feasibility of a peer educator program focused on modification of the home environment in an inner-city population. The baseline allergen levels presented here suggest that intervention programs must focus more than previously appreciated on elimination of cockroaches while minimizing the use of pesticides and on identification of the sources of cat allergen. Structural and psychosocial issues in homes need to be addressed in future intervention programs.

ACKNOWLEDGMENT: We are grateful to Ms. Cheryl Byers and the Head Start Programs in Chicago for their help in designing and implementing this project.

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Validation of the Brief Pediatric Asthma Screen*

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Study objectives: The purpose of this study was to confirm the validity of a brief screen for pediatric asthma in schools.

Background: Asthma is the most common chronic disease of childhood, yet the frequency with which this condition is recognized among school-aged children varies widely. Several methods are used to increase the accuracy of detection of asthma, but many are cumbersome and difficult to apply on a large scale.

Design: We elected to validate a five-question instrument, the Brief Pediatric Asthma Screen (BPAS), to screen for the presence of asthma among children attending school in Region 5 of the Chicago school district, where the schools report a 2.7% frequency of asthma. The questionnaire was distributed to the parents of grade-school children at the time of report-card pick-up.

Setting: A clinical assessment was performed on a selected group of children whose parents completed the questionnaire in a school and in a hospital outpatient clinic.

Participants: Of 4,147 questionnaires that we distributed, 1,796 (43%) were returned. We excluded 341 children (19% of the total sample) whose parents reported that they had been diagnosed with asthma. The remaining pool indicated that the children of 183 respondents (10%) had symptoms suggestive of asthma, while 1,272 parents (71%) indicated that their children did not have symptoms of asthma.

Measurements and results: We selected 90 of the respondents who did not indicate that their children had a diagnosis of asthma. Of this group, 81 completed the validation, in which their responses suggested symptoms of asthma (n = 34) or no asthma symptoms (n = 47). The children of these respondents were given a blinded clinical evaluation consisting of history, physical examination, and spirometry. The survey demonstrated a sensitivity of 75% and a specificity of 81.2% for the presence of asthma among those who were unaware of the diagnosis.

Conclusions: The BPAS is brief, can be filled out by parents, and appears accurate in detecting asthma.

(ASTHMA 1999; 116:224S–228S)

Abbreviations: BPAS = Brief Pediatric Asthma Screen; ED = emergency department

*Asthma is the most common chronic disease of childhood, yet the frequency with which this condition is recognized among school-aged children varies widely.1–3 Schools often report a low number of asthmatics, perhaps because of inadequate diagnosis or incomplete record keeping. Several methods are used to increase the accuracy of detection of asthma, but many are difficult or costly to apply on a large scale.4–6 Many reports are based on children with established diagnoses of asthma that were explored in more detail, usually by pulmonary function studies or exercise challenge.1,2,7 Questionnaires are often administered to known asthmatics in an attempt to assess the impact of asthma on school attendance and performance, such as the studies by Doull et al8 and Williams et al.9 Several authors have commented on the serious consequences that can result from underestimating the number of asthmatic children in schools.7,9 Asthma is given as the reason for a school absence in a high percentage of children.9,10–12 Weitzman et al13 presented a review of the severe effects in subsequent years on children who frequently miss school. The school-based study on asthma symptoms by Doull et al8 further showed that asthma was more likely to remain undiagnosed in children with chronic cough than in children who wheezed. These authors also confirmed that asthma was the most frequent reason for children missing school for > 5 days. In a similar study, Joseph et al1 demonstrated that 17.4% of the children in their survey had received a diagnosis of asthma, while 14.3% met criteria for undiagnosed asthma. These patients were more likely to have sleep disruption and problems keeping up in school. They were also more likely to miss physical instruction.

It is evident from these studies that there are problems inherent in evaluating asthma on a large scale in schools. Many authors have shown that there are significant consequences to missing school days on a large scale. To address this problem, we undertook to validate a short, five-point asthma questionnaire that called only for “yes” or “no” answers.

The instrument, the Brief Pediatric Asthma Screen (BPAS), was designed so that parents could complete it in a short time without supervision. The best currently available “gold standard” to validate the survey consisted of history, physical examination, and spirometry performed by an expert in the diagnosis of pediatric asthma. We therefore elected to validate the survey against this “gold standard”. We distributed the instrument to elementary school children in Region 5 of the Chicago school district, comprising 108 elementary schools where the schools report a 2.7% frequency of asthma.

The schools are located in impoverished neighborhoods with predominantly African-American populations. The school personnel in this region appreciated the need for greater awareness of asthma. The most frequent request from the elementary schools where we are involved had been for a simple method to determine the number of asthmatics in school. This request was a strong motivating factor in pursuing the validation. Current reporting methods in Chicago seriously underestimate the number of affected children, leading to many of the problems inherent in underdiagnosed asthma.
In this paper, we describe the results of testing the validity of the questionnaire against a “gold standard.”

**Materials and Methods**

This study was approved by the Internal Review Board of the University of Chicago.

**Questionnaire**

We used an abbreviated questionnaire excerpted from the International Study of Asthma and Allergies in Childhood. This modified tool was initially developed for use in clinical screening by Dr. Evalyn Grant (personal communication, February 1998).

The BPAS contained five questions:

1. Has your child ever been diagnosed by a doctor as having asthma?
2. Has your child ever had episodes of wheezing (whistling in the chest) in the last 12 months?
3. In the last 12 months, have you heard your child wheeze or cough during or after active play?
4. Other than a cold, in the last 12 months, has your child had a dry cough at night?
5. In the last 12 months, has your child been to a doctor, an emergency room, or a hospital for wheezing?

Parents completed the BPAS without supervision.

**Cohort**

As a first phase of the validation, copies of the questionnaire were distributed in eight elementary schools in the target region, Region 5.

School personnel gave forms to the parents of 4,147 children at the time of report-card pick-up, and completed forms were returned to the school. The return rate was 43% (1,796/4,147). For this aspect of the study, no attempt was made to increase the return rate by follow-up of nonrespondents or by adding incentives for completing the surveys. The surveys were classified into three categories: (1) negative; (2) positive; and (3) possible asthma, based on a prior classification scheme developed by the authors.

The negative group answered in the negative to questions 1 (prior diagnosis of asthma) and 5 (emergency department [ED] visit) and to two of the three symptom questions. We made a decision that one symptom alone was insufficient evidence of undiagnosed asthma, but were able to test this decision empirically in the analyses.

The positive group had answered “yes” to question 1, indicating that a physician had diagnosed asthma. Responses to the other four questions were irrelevant for this group.

The possible asthma group had answered “no” to question 1, but “yes” to question 5 or two or more of the remaining symptom questions.

All participants who completed a survey were sent a letter informing them that the survey was negative or that there was a possibility that their child had asthma. In this instance, the parents were advised to follow up with their physician, or to visit our clinic for the reason. Evidence of atopy and triggering events for respiratory symptoms were other criteria used to evaluate the history.

Physical examination focused on upper and lower airway. We noted evidence of atopy and the presence and degree of airflow obstruction.

Patients were classified according to a schema that categorized the children as (1) asthma (at least two symptoms and clinical evidence of airway obstruction, such as reduced airflow, prolonged exhalation); or (2) probable asthma (two symptoms or clinical evidence of airway obstruction).

Pulmonary function testing consisted of spirometry, which was performed on a portable spirometer (Jones Medical Instrument Co; Oak Brook, IL) that was calibrated before each session. A certified pediatric pulmonary function technician who is skilled at obtaining reproducible flow/volume loops from young children performed the test. The flow parameters were assessed for reduced flow rates and a flow-loop contour that was indicative of airflow obstruction. Reversibility was not assessed. The spirometry was graded as (1) asthma (reduced peak flow, FEV1 < 75%, FEV1/FEV < 75%, concave volume-flow loop); or (2) suggestive of asthma (reduced midexpiratory flow, mild reduction in peak flow, normal to flattened flow loop); or (3) normal.

We combined the history, clinical assessment, and spirometry, and categorized each child as having definite asthma, no asthma, or probable asthma. For purposes of analysis, we collapsed the definite and probable categories into a single positive category.

**Evaluation of Data/Validation of the BPAS**

We compared the BPAS results with the assessment from the composite clinical and spirometric evaluation by two criteria: sensitivity (the ability to detect positives) and specificity (the ability to exclude negatives). Sensitivity is calculated by dividing the number of true-positives by the sum of the true-positives and false-negatives, and then multiplying by 100. Specificity is computed by dividing the number of true-negatives by the sum of the true-negatives and false-positives, and then multiplying by 100.

**Results**

**Screen Validation**

We compared the results of the BPAS (no asthma or possible asthma) with the results of the medical evaluation assessment, 47 of whom were in the negative group and 34 of whom were in the possible asthma group according to the BPAS. The parents who completed the assessment were each given a gift certificate to a local supermarket. The responses to questions 2 to 5 were correlated with whether or not the medical assessment indicated that the child had asthma.
(no asthma or possible/definite asthma) and assessed the sensitivity and specificity of the BPAS results. First, we compared the results of our \textit{a priori} scoring method (a positive response to the ED question or a positive to response to any two of the three symptom questions) to the medical evaluation. In addition, we assessed the sensitivity and specificity of each of the three symptom questions and the ED question alone, as well as combinations of the items (ie, any one positive response, any two positive responses, etc). The results of these analyses are found in Table 1. Table 2 illustrates a two-by-two table assessment of the \textit{a priori} scoring method of two symptoms or an ED visit, showing the derivation of the specificity and sensitivity analysis.

Our \textit{a priori} scoring scheme demonstrated a good balance of sensitivity (74%) and specificity (82%). The best single item was “wheezing after play,” with results equivalent to the scoring scheme. Wheezing episodes and ED visits were highly specific single items (88 and 91%, respectively), but lacked sensitivity. In other words, children whose parents reported affirmative response to these two items were highly likely to have asthma, as indicated by medical examination, but the two items missed many other children who had asthma.

The \textit{a priori} scheme was, in a sense, a weighted scoring. The ED question was given greater weight than the three symptom questions. We tried unweighted combinations, such as any one affirmative response to the four questions, any two affirmative responses, etc. Any one item provided the most sensitive scoring (84%), but was not specific enough (65%). Three affirmative responses was specific (94%), but not sensitive (60%). Two affirmative responses was slightly less sensitive than our weighted scheme (73%), but slightly more specific (83%).

\textbf{Analysis of Results for Individual Schools}

A breakdown of the results of applying the validated screen to 4,147 students from eight Region 5 elementary schools, varying in size from 115 to 850 students, is given in Table 3. The response rate ranged from 36 to 55% (mean, 43%). Between 63 and 78% (mean, 71%) of the respondents did not have evidence of asthma. Between 5 and 13% (mean, 10%) had possibly undiagnosed asthma, while 16 to 24% (mean, 19%) reported a previous diagnosis of asthma by a physician. These data are representative of the respondents only, and are not indicative of prevalence data.

\textbf{Logistic Regression}

We conducted a simultaneous logistic regression to further assess the contribution of individual items on the BPAS to the correct classification of patients. The responses to all three symptom questions and the response to the ED question were entered simultaneously as predictors of the dichotomous result of the medical evaluation. In the multivariate equation, only wheezing after play was a significant predictor ($p < 0.05$) of the medical examination results.

The odds ratio for wheezing after play was 3.9. The odds ratios for coughing and ED visit were both close to 1. The odds ratio for episodes of wheezing was 2.5, but it was not statistically significant ($p > 0.05$).

\textbf{DISCUSSION}

We present the results of validating a brief screen for asthma in schools. To our knowledge, a validation of an interview tool to detect asthma has not been performed against the criterion of a clinical diagnosis of asthma by an experienced clinician. Demissie et al specifically note the absence of a “gold standard” in their comparison of exercise tolerance and a questionnaire in the assessment of asthma. Those authors further noted that exercise challenge did not add to a well-designed questionnaire. To establish the validity of a brief, pencil-and-paper screen, we tested it against the “gold standard” of asthma diagnosis—a clinical assessment by an expert in the area of asthma. The clinical criteria for the validation thus closely mimicked an assessment for asthma in a clinical setting.

The BPAS correlated well with the clinical standard. Very similar sensitivity and specificity were achieved by using any three “yes” responses to questions 2 through 5 in

\begin{table}[h]
\centering
\caption{Results of Weighted Scoring of the Asthma Screen (n =181)*}
\begin{tabular}{|l|c|c|}
\hline
Asthma Screen Score & Specificity, \% & Sensitivity, \% \\
\hline
Single item & & \\
Wheezing episode & 88.0 & 64.9 \\
Wheezing after play & 81.5 & 75.0 \\
Night cough & 72.1 & 69.8 \\
ED visit & 91.1 & 54.0 \\
Unweighted scoring & & \\
\approx\text{symptoms/ED visit} & 64.7 & 84.1 \\
\approx\text{2 symptoms/ED visit} & 83.0 & 72.5 \\
\approx\text{3 symptoms/ED visit} & 93.6 & 59.7 \\
Weighted scoring & & \\
2 symptoms or ED visit & 81.5 & 74.0 \\
2 symptoms/ED visit or wheeze after play & 77.2 & 71.1 \\
\hline
\end{tabular}
\footnotesize{*The parameters of questions 2 to 5 were assessed and compared with the medical assessment for reliability. ED visit was the most specific, but least sensitive. The most reliable weighting was found with using two symptoms or an ED visit.}

\footnotesize{†These methods provide the best sensitivity and specificity.}
\end{table}

\begin{table}[h]
\centering
\caption{Results From Comparison of the BPAS With the Medical Assessment*}
\begin{tabular}{|l|c|c|c|}
\hline
 & Asthma Screen & No Asthma & Asthma \\
\hline
BPAS results & & & \\
No asthma & 34 (true-negatives identified by BPAS) & 13 (false-negatives) & 47 \\
Possible asthma & 10 (false-positives) & 24 (true-positives identified by BPAS) & 34 \\
Total & 44 (true-negatives) & 37 (true-positives) & 81 \\
\hline
\end{tabular}

*These data were derived using the weighting of the presence of two symptoms or an ED visit for wheezing.

The correlation between asthma symptoms and objective signs is not always clear. Chang et al. indicated that patients with asthma who have a predominant cough presentation were more sensitive to capsaicin challenge. On the other hand, Faniran et al., using a validated survey of chronic cough, questioned whether persistent cough is synonymous with asthma. Bai et al. examined the grouping of asthma symptoms and the predictive power of symptom questions. They noted that questions that predicted asthma “syndrome” differed from those that predicted cough. The significance of reduced pulmonary function measures in predicting asthma control or severity is not clear. Teeter and Bleecker did not demonstrate a correlation among six asthma symptoms and the degree of obstruction as measured by FEV1, and Marabini et al. noted that FEV1 was not a reliable guide for reducing steroid dose. One third of children who have asthma-like symptoms but no objective signs will develop asthma. From a broader perspective, McCowan et al. also noted that school absence alone was insufficient as a marker of asthma severity. Thus, it seems that there is a need for an objective detection tool for undiagnosed asthma.

The data collection was not designed to determine the prevalence of asthma in the schools. The purpose of the screening we did in public schools was to provide screening as a direct service to schools to help them identify children with asthma. We made no systematic attempts to boost response rates through follow-up efforts, unless the individual school requested that we do so or helped us in follow-up. We have no reason to believe there was any systematic bias from nonresponse. We conducted the validation study with a random sample of children whose parents had completed the survey for possible asthma. Others have noted similar numbers from the United States and other countries. These children have problems in school, and the
source of their difficulty may be unrecognized. As a result, the seriousness of their condition is often not appreciated. A simple tool such as the BPAS is helpful in identifying these children.

CONCLUSION

We have validated the BPAS, a simple pencil-and-paper questionnaire, against the currently available “gold standard” of asthma diagnosis, an evaluation by an asthma expert. There are many advantages to the BPAS. It is brief, with only five questions that require simple “yes” or “no” answers. It can be distributed to parents at the time of report-card pick-up and returned later. While the return rate in this study was fair without follow-up, we have subsequently increased the return rate to 90% by the use of simple incentives. This tool thus provides a simple means of identifying children with asthma and potential asthma that can readily be used on a large scale, for either research or clinical purposes.

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A Pilot Study Describing Local Residents' Perceptions of Asthma and Knowledge of Asthma Care in Selected Chicago Communities*

Terrence Conway, MD; Tzyy-Chyn Hu, RN, MSPH; Susan Bennett, RN, MSN; and Maria Niedos, MPH

Study objectives: To understand inner-city Chicago residents' perception of the prevalence and severity of asthma as well as their knowledge of asthma control and management.

Design: Cross-sectional survey using a random digital telephone dialing method.

Settings: Five inner-city Chicago communities where a high prevalence and mortality of asthma have been recognized.

Participants: All the residents in the selected communities with a residential telephone had an equal opportunity to be surveyed.

Measurements and results: The unit of measurement was the household. Only one adult member (age 18 or older) in any randomly selected household was interviewed. The survey included questions modified from the Chicago Asthma Surveillance Initiative study. A total of 2,322 phone calls with 527 successful contacts were made over 1,938 distinct phone lines, resulting in a response rate of 175 of 527 calls (33.2%). Seventy-nine of the participants (45.1%) reported that at least one of their family members (including themselves) has asthma. Eight persons (4.6%) reported asthma as one of the top three health concerns in their community. Of the top three health reasons mentioned for children's being absent from school, only seven persons (4%) mentioned asthma. Participants were unlikely to perceive that the problems with access to asthma care and environmental triggers for asthma in their communities were any worse compared with other communities. Participants having family members with diagnosed asthma scored no better when asked general-knowledge questions about asthma or its signs and triggers than those without a family member having asthma.

Conclusions: The participants' knowledge and beliefs about the seriousness of asthma revealed in this study appeared unlikely to enhance or support compliance with the challenging requirements of the National Asthma Education and Prevention Panel guidelines. The study was conducted with a small sample, and the results should be carefully interpreted.

Abbreviations: NAEPP = National Asthma Education and Prevention Program

There has been a startling increase in the prevalence of and mortality from asthma in the United States and worldwide.1,2 Persons living within the inner city of Chicago suffer disproportionately from this increase, as do those living in other poor urban neighborhoods.3–6 To reverse the trend, the 1997 National Institutes of Health National Asthma Education and Prevention Program (NAEPP) guidelines emphasize the importance of building a partnership between health-care providers and patients in the management and control of asthma.7

The goal of the NAEPP guidelines is to manage asthma to a degree that a normal life can be maintained. To achieve this, other family and community members, in addition to the patients themselves, must play critical roles. For example, the parents of an asthmatic child need to be aware of the early signs and symptoms of an asthma attack. Relatives and visitors must not smoke in the house of the person with asthma, a beloved pet may have to be given away, the school teacher must allow and even supervise the administration of medications, and an employer may have to accommodate the need of a person with asthma to avoid occupational triggers even if no one else is affected. Local residents' perceptions and awareness of the impact of asthma and their understanding of asthma care have a real influence on the overall level of asthma care in that community.

We conducted a telephone survey to understand the residents' perceptions of the importance and impact of asthma, as well as their knowledge of asthma care, in five community areas where high prevalence and mortality of asthma have been recognized.8,9 The following specific questions were answered through this study: (1) Do the local residents believe that asthma is a prevalent and important health issue in their community? (2) Do they understand the implications of asthma on attendance of children in their neighborhood schools? (3) Do they feel that access to and quality of asthma care are adequate in their community? (4) Do they know the common signs and environmental triggers for asthma, and (5) Do they know the basic elements of asthma control and management consistent with the NAEPP guidelines?

This study was sponsored by the Chicago/Cook County Community Health Council—a coalition of community organizations, individuals, government agencies, and health-care organizations. The Community Health Council seeks to improve the health status of community residents by changing health-care providers' practice behavior, by encouraging patient involvement in their own health care, and by empowering local residents to ensure that all the health care delivered within their local communities is of good quality.
Materials and Methods

From June 1, 1998, to August 7, 1998, we conducted a telephone interview in five Chicago inner-city communities (Englewood, Greater Roseland, Northeast, District Five, and West) using random digital dialing. All the residents in the selected community with a residential telephone had an equal opportunity to be a participant. The unit of measurement was the household; therefore, only one adult member (≥18 years of age) in any randomly selected household was interviewed.

The interview took about 10 to 15 min to complete and was conducted by two trained interviewers. Twenty percent of the randomly selected interviews were recorded and monitored for cross-validation. An informed consent was obtained for each of the participants. A list of computer-generated random digital dialing telephone numbers was used (Survey Sampling; Fairfield, CT). A minimal sample size of 30 was required for parametric analysis; therefore, 35 completed interviews in each of the five communities were determined to be sufficient to provide meaningful descriptive parameters.

The survey questionnaire was developed from the 1997 NAEPP guidelines and included questions taken from the Chicago Asthma Surveillance Initiative survey that were modified and validated for content. The questionnaire consisted of five different sections: (1) perceived impact of asthma, (2) knowledge about asthma care, (3) specific knowledge relevant to the 1997 NAEPP guidelines, (4) simple demographics, and (5) history of selected health screenings received during the past 12 months.

Descriptive analysis was performed to answer all the abovementioned research questions. A $\chi^2$ test was applied to compare the group of participants who had a family member with asthma or who themselves had asthma with those who did not have a family member with asthma or did not themselves have asthma. A p value of 0.05 was defined as statistically significant.

Results

A total of 2,322 phone calls were made to satisfy the predetermined 35 completed interviews for each of the five selected communities. The number of calls for Englewood, Greater Roseland, Northeast, District Five, and West were 560, 419, 435, 482, and 426, respectively. The 2,322 phone calls represent 1,938 distinct telephone lines. Of the 1,938 phone lines, 486 (25.1%) were disconnected, 277 (14.3%) were fax or answer machines, 449 (23.2%) had no answer, and 199 (10.3%) were commercial lines. Of 527 successful contacts, 289 (54.8%) refused to participate, 44 did not speak English, and 19 had no adult at home. Therefore, the response rate of successful contacts was 175 of 527 (33.2%).

Seventy-six percent (n = 134) of participants have been living in the zip code area for >3 years. Sixteen of the participants (9.1%) had asthma diagnosed, and 79 (45.1%) reported to at least one of their family members (any members including themselves) had asthma diagnosed. Table 1 outlines the characteristics of community residents who completed the survey. The majority of residents who completed the survey were women (70.7%), individuals with a high school (44%) or college (43.4%) level of education, and individuals 30 to 45 years old (41.7%) or <30 years old (22.3%).

Table 2 displays participants’ perceptions of the top three health concerns in their communities. Eight persons (4.6%) reported asthma as one of the top three health concerns in their communities. Heart disease, cancer, and HIV were the most frequently reported concerns. Only seven persons (4%) mentioned asthma within the top three perceived health reasons for a child’s absence from school (Table 3).

More than half of the participants perceived that the problems with access to asthma care and environmental triggers for asthma in their communities were about the same compared to other communities (Fig 1). When asked to think of all the health conditions in their communities today and to compare how much of a problem they considered asthma to be using a 10-point scale (where 1 was “not a problem” and 10 was a “very large problem”), a central tendency distribution to the answer was noticed (Fig 2).

Table 3 displays a post hoc comparison of the knowledge of asthma between those who had a family member with diagnosed asthma and those who did not, in a true/false format (the correct answer is in italics). In most of the listed knowledge attributes (Table 4), the group of

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Frequency</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>52</td>
<td>29.3</td>
</tr>
<tr>
<td>Female</td>
<td>123</td>
<td>70.7</td>
</tr>
<tr>
<td>Age, yr</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;30</td>
<td>39</td>
<td>22.3</td>
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<tr>
<td>30–45</td>
<td>73</td>
<td>41.7</td>
</tr>
<tr>
<td>46–60</td>
<td>29</td>
<td>16.6</td>
</tr>
<tr>
<td>61–75</td>
<td>20</td>
<td>11.4</td>
</tr>
<tr>
<td>&gt;75</td>
<td>5</td>
<td>2.9</td>
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<tr>
<td>Did not answer</td>
<td>9</td>
<td>5.1</td>
</tr>
</tbody>
</table>

Highest level of education

<table>
<thead>
<tr>
<th>Education Level</th>
<th>Frequency</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>High school/GED</td>
<td>77</td>
<td>44.0</td>
</tr>
<tr>
<td>Some college</td>
<td>46</td>
<td>26.3</td>
</tr>
<tr>
<td>College graduate</td>
<td>30</td>
<td>17.1</td>
</tr>
<tr>
<td>Some graduate study</td>
<td>2</td>
<td>1.1</td>
</tr>
<tr>
<td>Master’s degree</td>
<td>5</td>
<td>2.9</td>
</tr>
<tr>
<td>Post-master’s degree study</td>
<td>1</td>
<td>0.6</td>
</tr>
<tr>
<td>Professional degree</td>
<td>1</td>
<td>0.6</td>
</tr>
<tr>
<td>Did not answer</td>
<td>13</td>
<td>7.4</td>
</tr>
</tbody>
</table>

*GED = graduate equivalent diploma.

<table>
<thead>
<tr>
<th>Health Concern</th>
<th>Frequency</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heart disease</td>
<td>52</td>
<td>29.7</td>
</tr>
<tr>
<td>Cancer</td>
<td>50</td>
<td>25.6</td>
</tr>
<tr>
<td>HIV</td>
<td>34</td>
<td>19.4</td>
</tr>
<tr>
<td>Diabetes</td>
<td>32</td>
<td>18.3</td>
</tr>
<tr>
<td>Hypertension</td>
<td>24</td>
<td>13.7</td>
</tr>
<tr>
<td>STDs*</td>
<td>16</td>
<td>9.1</td>
</tr>
<tr>
<td>Asthma</td>
<td>8</td>
<td>4.6</td>
</tr>
<tr>
<td>URI*</td>
<td>7</td>
<td>4.0</td>
</tr>
<tr>
<td>Substance abuse</td>
<td>5</td>
<td>2.9</td>
</tr>
<tr>
<td>Arthritis</td>
<td>5</td>
<td>2.9</td>
</tr>
</tbody>
</table>

*STD = sexually transmitted disease; URI = upper respiratory infection.
participants that did not have a family member with diagnosed asthma had a higher percentage of correct answers than the participants who had at least one family member with asthma.

Table 5 compares knowledge about signs and triggers of asthma (the correct answer is in italics) between those who had a family member with diagnosed asthma and those who did not. More than half of the participants answered correctly on most of the items.

## Discussion

Asthma is an important health condition in the communities we surveyed. Mortality from asthma in these communities is among the highest in the nation for persons 5 to 34 years old. The estimated prevalence of asthma may be as high as 16%. Asthma is believed to have a significant impact on quality of life, lost wages, and high medical care costs. However, our study revealed that local residents were not aware that asthma is more prevalent or severe in their communities than in other Chicago communities.

The National Institutes of Health NAEPP has developed and published guidelines that initiate a new approach to asthma care and control. The guidelines encourage a partnership between provider and patient for asthma self-monitoring, patient-initiated treatment decisions, and recognition and removal of the environmental triggers. Asthma patients as well as their guardians and families must understand and cooperate in this approach and be willing to change behaviors.

The success of the NAEPP guidelines rests on improved patient and health-care provider education. However, discrepancies between asthma self-management knowledge and the actual self-management behavior of patients with acute severe asthma have been reported. This is not surprising. Patient education alone has long been recognized as insufficient to change health behavior. One approach to explain health behavior that has a substantial empirical basis is the health belief model. The foundation of the health belief model is that individuals will take action if they perceive themselves as susceptible to an ill-health condition, and if they believe the condition will lead to serious consequences and that a beneficial course of action is available to them. Community-wide perceptions and norms also influence whether individuals will access and use health services. The perception of the individual and the community that asthma is prevalent, serious, and can be controlled will determine how likely it is that the NAEPP recommendations will actually be followed.

Although asthma prevalence, severity, and mortality are excessive in the communities we surveyed and almost half (n = 79; 45.1%) of our participants reported that at least one of their family members or themselves were asthmatic, only a fraction of the participants (n = 5; 2.9%) perceived asthma as one of the top three health concerns in their communities. Nationwide in the United States, children with asthma averaged 7.6 days absent from school per year compared with 2.5 days for the well group.

Figure 1. Perceived problems with access to asthma care and environmental triggers for asthma.
Table 4—Comparison of Asthma Knowledge Between Those Who Have a Family Member Diagnosed With Asthma and Those Who Do Not*

<table>
<thead>
<tr>
<th>Knowledge Attribute</th>
<th>Family Member With Asthma (n = 79)</th>
<th>True</th>
<th>False</th>
<th>DK</th>
<th>No Family Member With Asthma (n = 74)</th>
<th>True</th>
<th>False</th>
<th>DK</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asthma cannot be cured</td>
<td>44.9</td>
<td>55.1</td>
<td>0.0</td>
<td></td>
<td>56.8</td>
<td>43.2</td>
<td>0.0</td>
<td></td>
<td>0.142</td>
</tr>
<tr>
<td>A vaporizer is a good treatment for asthma</td>
<td>79.7</td>
<td>13.9</td>
<td>6.3</td>
<td></td>
<td>79.7</td>
<td>13.5</td>
<td>6.8</td>
<td></td>
<td>0.992</td>
</tr>
<tr>
<td>During an asthma attack, wheezing is caused by swelling in the lining of the air passages in the lungs</td>
<td>65.4</td>
<td>9.0</td>
<td>25.6</td>
<td></td>
<td>83.8</td>
<td>8.1</td>
<td>8.1</td>
<td></td>
<td>0.014†</td>
</tr>
<tr>
<td>Asthma is the No. 1 reason for school absences</td>
<td>31.6</td>
<td>57.0</td>
<td>11.4</td>
<td></td>
<td>56.8</td>
<td>37.8</td>
<td>5.4</td>
<td></td>
<td>0.007†</td>
</tr>
<tr>
<td>The best way to measure the severity of a person’s asthma is for the doctor to listen to his or her chest</td>
<td>75.9</td>
<td>11.4</td>
<td>12.7</td>
<td></td>
<td>78.4</td>
<td>18.9</td>
<td>2.7</td>
<td></td>
<td>0.043†</td>
</tr>
<tr>
<td>Chicago has an unusually high number of people who die of asthma</td>
<td>45.6</td>
<td>35.4</td>
<td>19.0</td>
<td></td>
<td>59.5</td>
<td>24.3</td>
<td>16.2</td>
<td></td>
<td>0.207</td>
</tr>
<tr>
<td>About one of three asthma patients should receive information on asthma triggers</td>
<td>71.8</td>
<td>24.4</td>
<td>3.8</td>
<td></td>
<td>64.9</td>
<td>32.4</td>
<td>2.7</td>
<td></td>
<td>0.524</td>
</tr>
<tr>
<td>Inhaled steroids should be used by only a small number of children and adults with active asthma</td>
<td>55.7</td>
<td>31.6</td>
<td>12.7</td>
<td></td>
<td>66.2</td>
<td>14.9</td>
<td>18.9</td>
<td></td>
<td>0.045†</td>
</tr>
<tr>
<td>Asthma patients should make a written treatment plan with the doctor for emergencies</td>
<td>93.7</td>
<td>3.8</td>
<td>2.5</td>
<td></td>
<td>94.6</td>
<td>2.7</td>
<td>2.7</td>
<td></td>
<td>0.929</td>
</tr>
<tr>
<td>Asthma patients should avoid air conditioning to decrease environmental triggers for asthma</td>
<td>27.8</td>
<td>55.7</td>
<td>16.5</td>
<td></td>
<td>37.0</td>
<td>52.1</td>
<td>11.0</td>
<td></td>
<td>0.386</td>
</tr>
</tbody>
</table>

Data are reported as percentages.
*The correct answer is in italics. DK = do not know.
†Statistically significant at p < 0.05.
Other studies also report asthma as the major cause of school absences. Nonetheless, only 4% of participants (n = 7) listed asthma as one of the top three health reasons for the absences of children from school. Other conditions (e.g., chicken pox) were much more likely to be perceived as causing school absences.

The local residents we surveyed believed that the impact of asthma on their communities was no worse than on other communities. Previous studies have identified poor access to asthma care and high levels of potential environmental triggers as coexisting in the communities we surveyed. A great majority of the respondents in this survey ranked both access to asthma care and environmental triggers as “about the same” compared with other Chicago communities (Fig 1).

Residents’ knowledge about proper treatment of asthma was low overall (Table 4). They provided the correct answer to true/false questions less than half the time. Those who had at least one family member with asthma did not express better knowledge of asthma and asthma care than those who had no family members with asthma.

This telephone survey may have certain selection bias. Residents with a residential telephone are likely to be of higher socioeconomic status than those who do not have a telephone, but this is unlikely to have seriously affected results. The demographic profile of respondents does reflect higher educational achievement than the overall community. Women are also overrepresented in our sample. The percentages of persons with asthma we surveyed directly (9.1%) and of those who reported asthma in the family (45.1%) are not prevalence figures and may be an overrepresentation in the sample. The definition of “family” was self-determined by the respondents, perhaps making a comparison with other families imprecise.

The results of our study represent an initial effort to describe local residents’ understanding of asthma in inner-city neighborhoods of Chicago. Knowledge and attitudes about asthma have often been studied in patients with asthma, but the overall knowledge and beliefs of the community members who reside in inner-city neighborhoods have not been described. What emerges from this survey is a picture of communities with perceptions, levels of concern, and knowledge about asthma that do not match the findings of epidemiologic studies of poor urban areas or recommendations to control the impact of asthma.

Community-wide health knowledge and attitudes are acquired through education as part of personal health care, from the media, in schools, through mass public education, and over time from other community residents. The failure of our study to demonstrate an increase in knowledge in persons having family members with asthma may represent the inadequacy of educational initiatives from area health-care providers. Within the NAEPP guidelines, the local health-care providers play a key role as asthma educators and should greatly influence local residents’ perceptions of asthma self-management. However, in our study, a higher level of knowledge about asthma did not exist in families that had a member afflicted with asthma. Programs to enhance the skills and change the practice behaviors of community-based providers are needed.

The results of our study indicate the need for interventions at the community level for persons with asthma, health-care providers, and the larger community. Since 1980, asthma rates have increased 75%, with cases among very young children up 160%. Our data suggest that knowledge and beliefs of the serious impact from asthma have not been widely recognized in inner-city Chicago communities where a high prevalence of and mortality from asthma exist. The 1997 NAEPP guidelines include a component of “education for a partnership in asthma care,” which focuses on the individual patient and encourages family involvement. We recommend that the partnership be further expanded to change the attitude and
beliefs about asthma at the community level if excellent asthma control and outcomes are to be achieved.

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