Home-Based Asthma Education of Young Low-Income Children and Their Families

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Objective: To conduct a controlled trial of a home-based education program for low-income caregivers of young children with asthma.

Methods: Participants were randomized to treatment—eight weekly asthma education sessions adapted from the Wee Wheezers program (n = 49)—or usual care (n = 46). Baseline and 3- and 12-month follow-up data were gathered from caregivers and from children’s medical records.

Results: Treatment was associated with less bother from asthma symptoms, more symptom-free days, and better caregiver quality of life at follow-up for children 1–3, but not those 4–6, years of age. Treatment and control groups did not differ in caregiver asthma management behavior or children’s acute care utilization.

Conclusions: This home-based asthma education program was most effective with younger children; perhaps their caregivers were more motivated to learn about asthma management. Targeting psychosocial factors associated with asthma morbidity might also enhance the efficacy of asthma education for these families.

Key words: pediatric asthma; young children; low-income; African American; home visiting; asthma education.

Asthma is the most common chronic disease of childhood. Nearly 6% (5.8%) or 3.7 million children have asthma in the United States (White, Etzel, Wilcox, & Lloyd, 1994). Although the prevalence of asthma in persons of all ages has increased since the early 1980s, the greatest increase has occurred in children between the ages of 1 and 4 years (National Heart, Lung, and Blood Institute, 1999).

African American children, relative to European American children, exhibit an earlier onset of asthma and suffer higher asthma morbidity and mortality rates (Wissow, Gittelsohn, Szklo, Starfried, & Mussman, 1988). African American families are overrepresented in low-income, inner-city areas, and the social and environmental conditions associated with poverty are also associated with increased risk for asthma morbidity and mortality (Weiss, Gergen, & Crain, 1992). Data from the first wave of the National Cooperative Inner-City Asthma Study (NCICAS; e.g., Kattan et al., 1997) indicate that the increased morbidity of these children is likely due to such factors as lack of continuity of care, medication regimens that do not correspond to current asthma treatment guidelines, exposure to indoor allergens, or poor adherence to treatment.

Asthma education programs can improve parents’ and children’s asthma management skills (e.g.,
Clark et al., 1986) and decrease asthma morbidity (e.g., Hindi-Alexander & Cropp, 1984). Such programs typically target parents and their school-age children (e.g., Clark et al., 1986). Only one published program, Wee Wheezers, targets parents and children under 7 years of age (Wilson, Fish, Page, & Starr-Schneidkraut, 1994). Wilson et al. conducted a randomized, controlled trial of Wee Wheezers. At the 3-month follow up, children in the intervention group showed improved morbidity and their parents demonstrated greater gains in asthma management skills as compared to those in the control group.

Asthma education programs directed at low-income parents are often plagued by low parental attendance (Kaplan et al., 1986). To overcome this problem, some programs have targeted children in school settings (e.g., Evans et al., 1987). Whereas school-age children are sufficiently mature to benefit from asthma education offered outside of the context of their families (Evans et al., 1987), preschool children learn new skills best within the context of their families (Bronfenbrenner, 1979), and parents must be the primary targets of the education if the children are to benefit. Low-income parents are confronted with many barriers to participation in clinic- or school-based asthma education programs, such as lack of transportation or lack of child care for siblings of the target child (Evans et al., 1987; Kaplan et al., 1986).

Home visiting is an intervention strategy that has been effective with pregnant and postpartum women, families with young children deemed at risk for health and developmental problems, and hard-to-reach populations (see Gromby, Culross, & Behrman, 1999, for a recent review). Only one home-based asthma intervention program for school-age children has been described in the literature (Baxmann & Klimo, 1989). These authors found increases in children’s asthma management knowledge from baseline to completion of the program and a decrease in the number of hospitalizations and emergency department visits. However, the generalizability of these findings is limited by the uncontrolled experimental design, the small sample, and the absence of tests of statistical significance.

Given the evidence for the efficacy of home-based programs in improving parenting skills of low-income parents of preschool children (e.g., Olds et al., 1999), a home-based program may be the most developmentally appropriate and ecologically valid method of delivering asthma education to low-income, inner-city families.

The goal of our study was to extend the work of a previous, successful asthma education program to an understudied population. We evaluated whether home-based asthma education of African American low-income parents and their preschool children with asthma would be feasible (in terms of parental participation) as well as effective (in terms of decreasing the children’s morbidity and improving the families’ asthma management skills). Additionally, we assessed whether our program would result in an improvement in the quality of life of the caregivers, who are frequently limited in their daily activities and experience anxiety and stress as a result of their children’s asthma (Juniper et al., 1996b). Finally, we included children in the 1–3-year-old age range. The greatest increase in the prevalence of asthma has occurred in this age group (National Heart, Lung, and Blood Institute, 1999), yet recent studies of inner-city children with asthma (e.g., Kattan et al., 1997) did not include children in this age range. Typically, 1–3-year-olds and 4–6-year-olds differ qualitatively with respect to their cognitive, social, and linguistic development. This, in turn, may differentially affect the nature of their caregivers’ asthma management behaviors. Thus, we also assessed whether program participation yielded different effects for the younger than for the older children.

Specifically, we tested whether families in the home-based asthma education treatment group, relative to those in the control group, would (1) demonstrate significantly greater reduction in the children’s asthma morbidity, (2) show significantly greater improvement in self-reported caregiver quality of life, and (3) report significantly greater gains in asthma management behaviors. For each of these questions, we examined whether treatment effects would vary as a function of the child’s age group (1–3 vs. 4–6 years old).

Method

Participants

Participants were 95 low-income, primarily African American children and their families recruited from three asthma specialty clinics and a few primary care pediatricians serving low-income children with asthma in metro Atlanta. Eligibility criteria were as follows: (1) child was 1–6.99 years of age at study entry; (2) child had made a health care visit for asthma in the preceding year; (3) child had been prescribed
medication for asthma on a daily basis; (4) primary caregiver spoke English; and (5) primary caregiver had no known involvement with illegal drugs. Between September 1997 and June 1999, 144 eligible children and their families were identified and invited to participate. Of these, 33 caregivers (23%) refused and 10 (7%) could not be contacted for the baseline data collection visit.

### Procedure

**Recruitment, Enrollment, and Randomization.** Eligible children and their families were recruited during clinic visits or via letters and telephone calls. Caregivers gave written informed consent at the onset of the baseline visit; they were given $25 for this visit and promised $25 for each of two additional data-collection visits. Procedures were approved by the Institutional Review Boards of Georgia State University, Emory University School of Medicine, Grady Memorial Hospital, and the Palo Alto Medical Research Foundation when the study was initiated. Following baseline assessments, families were randomized to either T (n = 55) or UC (n = 46). Groups were balanced by medical site and season of enrollment (to control for potential seasonal related group differences in asthma morbidity; Wilson et al., 1996). Families were informed of their group assignment via a letter; those assigned to UC were offered one educational home visit following the completion of the data collection. Following assignment, six families withdrew, all from the T group, leaving 49 T families. These families differed from other T families on only one background variable (i.e., all of their children were male) and on none of the baseline variables given in Table I.

### Education Intervention

**Wee Wheezers at Home (WWH) program** (Wilson, Fish, Page, & Starr-Schneidkraut, 1994; Wilson, Mitchell, Rolnick, & Fish, 1993) by modifying the teaching script for use with individual families, tailoring the handouts to a low-literacy (5th grade level) and child audience, ensuring cultural appropriateness of the materials, distributing the content over eight rather than four sessions, and emphasizing specific content areas, such as the developmentally appropriate level of participation of young children in asthma management (Brown, Avery, Mobley, Boccuti, & Golbach, 1996). Following our adaptations, we piloted WWH (Demi, Brown, & Jones, 1998).

WWH consists of eight 90-minute educational sessions, provided at weekly intervals. Although educational objectives are specified for each session, home visitors are encouraged to adapt their teaching

### Table I. Sample Characteristics

<table>
<thead>
<tr>
<th>Variable</th>
<th>Usual care (n = 46)</th>
<th>Treatment (n = 49)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Child's age (years)</td>
<td>4.2 (1.1–7.0)</td>
<td>4.3 (1.3–6.9)</td>
</tr>
<tr>
<td>Age at 1st symptoms (months)</td>
<td>9.2 (0–36)</td>
<td>9.4 (0–48)</td>
</tr>
<tr>
<td>Child is male</td>
<td>70</td>
<td>55</td>
</tr>
<tr>
<td>Race/ethnicity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>African American</td>
<td>89</td>
<td>90</td>
</tr>
<tr>
<td>European American</td>
<td>7</td>
<td>6</td>
</tr>
<tr>
<td>Other</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Severity of asthma*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mild intermittent</td>
<td>22</td>
<td>16</td>
</tr>
<tr>
<td>Mild persistent</td>
<td>54</td>
<td>57</td>
</tr>
<tr>
<td>Moderate persistent</td>
<td>20</td>
<td>22</td>
</tr>
<tr>
<td>Severe persistent</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Medicaid</td>
<td>80</td>
<td>84</td>
</tr>
<tr>
<td>Caregiver's age</td>
<td>31 (20–65)</td>
<td>31 (17–65)</td>
</tr>
<tr>
<td>Caregiver is mother</td>
<td>85</td>
<td>86</td>
</tr>
<tr>
<td>Caregiver's education</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No HS diploma</td>
<td>26</td>
<td>29</td>
</tr>
<tr>
<td>HS diploma</td>
<td>50</td>
<td>51</td>
</tr>
<tr>
<td>Some college</td>
<td>24</td>
<td>20</td>
</tr>
<tr>
<td>Caregiver employed</td>
<td>57</td>
<td>51</td>
</tr>
<tr>
<td>Other adult in household (HH)</td>
<td>60</td>
<td>73</td>
</tr>
<tr>
<td>Father in HH</td>
<td>22</td>
<td>45</td>
</tr>
<tr>
<td>Others with asthma in HH</td>
<td>41</td>
<td>53</td>
</tr>
<tr>
<td>Secondary caregivers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>28</td>
<td>25</td>
</tr>
<tr>
<td>1</td>
<td>61</td>
<td>55</td>
</tr>
<tr>
<td>2 or more</td>
<td>11</td>
<td>20</td>
</tr>
</tbody>
</table>

Except for ages, scores are percentages; ranges for ages are in parentheses; secondary caregivers are those who provide child care 4 hours per week or more.

*As implied by the medication regimen; see text for details.
strategies to the specific needs of the families and to teach the caregiver and the child together with the use of developmentally appropriate educational activities. Others present in the household at the time of the visit are also invited to participate. At the end of each session, home visitors use a set of prepared questions, which are based on the educational objectives, to assess caregivers’ and children’s understanding of the material. The caregivers’ responses are used to guide the instruction in subsequent sessions but are not intended for use as evaluation data. Families receive printed materials and homework at each session and videotapes at some sessions. A description of the program can be found in the Appendix.

Home visitors were registered nurses who were trained in WWH prior to conducting any sessions. To ensure the integrity of the intervention, objectives were specified for each session and nurses were required to document the extent to which session objectives were met. In addition, nurses attended semi-monthly supervisory sessions that focused on their current cases and received ongoing training. The same nurse conducted all eight sessions with a given family.

Data-Collection Visits. The project social worker collected data from caregivers at baseline and at 3- and 12-month follow-up visits, each lasting approximately 90 minutes; despite her best efforts, one UC and three T families could not be contacted at 3 months, and two UC families could not be contacted at 12 months. The social worker read all questionnaire items to the caregivers; at 3 and 12 months, she also inspected the home to verify the caregiver report. In case of disagreement between caregiver report and observational data, the latter were used in data analysis. The 3-month follow-up for T families was scheduled once they finished treatment; for comparability, a UC family with a similar baseline date was then scheduled. Thus, what we term the 3-month follow-up actually occurred, on average, at 18.9 and 19.4 weeks (*p* = .27) for T and UC groups, respectively. Twelve-month follow-ups were scheduled as close to the anniversary of the baseline visit as possible.

Baseline data collection was carried out by the social worker prior to randomization. However, at follow-ups, the social worker may have become aware of group assignment in certain instances; some families mentioned the name of the nurse, left educational materials in view, or seemed more knowledgeable. Still, the social worker was trained to follow the standardized data collection protocol in a uniform manner.

Medical Data. Medical records from all health care providers, emergency departments, and hospitals identified by the caregivers were abstracted from baseline through the 12-month visit.

Table II. Asthma Morbidity, Quality of Life, and Asthma Management Practices: Means and Effect Sizes

<table>
<thead>
<tr>
<th>Variable</th>
<th>Usual care mean</th>
<th>Treatment mean</th>
<th>3-mo effect size</th>
<th>12-mo effect size</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Base 3-mo 12-mo</td>
<td>Base 3-mo 12-mo</td>
<td>Group A G Time</td>
<td>Group A G Time</td>
</tr>
<tr>
<td>Asthma symptoms</td>
<td>2.47 2.36 1.74</td>
<td>2.50 1.80 1.63</td>
<td>.06*** .04** .078***</td>
<td>.01 .04** .22***</td>
</tr>
<tr>
<td>Symptom-free days</td>
<td>33 40 91</td>
<td>42 57 101</td>
<td>.01 .00 .01</td>
<td>.00 .05** .18***</td>
</tr>
<tr>
<td>Acute asthma visits</td>
<td>4.52 — 2.80 5.04</td>
<td>2.71 — —</td>
<td>— — —</td>
<td>.00 .02 .19***</td>
</tr>
<tr>
<td>Caregiver quality of life</td>
<td>1.83 1.77 1.50</td>
<td>1.77 1.35 1.35</td>
<td>.09*** .03** .09***</td>
<td>.01 .03* .13***</td>
</tr>
<tr>
<td>Adherence, regimen</td>
<td>.57 .47 .41</td>
<td>.55 .41 .43</td>
<td>.00 .00 .03</td>
<td>.00 .02 .04*</td>
</tr>
<tr>
<td>Meds given for URI</td>
<td>.31 .56 .39</td>
<td>.31 .56 .42</td>
<td>.00 .00 .13***</td>
<td>.00 .01 .02</td>
</tr>
<tr>
<td>Cough, etc., as 1st signs</td>
<td>.22 .56 .36</td>
<td>.29 .59 .33</td>
<td>.00 .00 .22***</td>
<td>.00 .00 .03</td>
</tr>
<tr>
<td>Prevention/treatment</td>
<td>4.26 4.37 4.25</td>
<td>4.34 4.46 4.42</td>
<td>.00 .00 .04**</td>
<td>.02 .00 .01</td>
</tr>
<tr>
<td>Tobacco in house</td>
<td>.39 .40 .34</td>
<td>.35 .28 .31</td>
<td>.01 .01 .01</td>
<td>.00 .00 .02</td>
</tr>
<tr>
<td>Mildew in house</td>
<td>.39 .44 .55</td>
<td>.39 .48 .39</td>
<td>.00 .01 .01</td>
<td>.02 .00 .01</td>
</tr>
<tr>
<td>Cockroaches in house</td>
<td>.33 .24 .23</td>
<td>.44 .50 .39</td>
<td>.04** .00 .00</td>
<td>.01 .01 .02</td>
</tr>
<tr>
<td>SM; medication</td>
<td>2.24 2.25 2.44</td>
<td>2.14 2.33 2.53</td>
<td>.01 .00 .03</td>
<td>.01 .02 .19***</td>
</tr>
<tr>
<td>SM; prevention</td>
<td>1.97 1.90 2.26</td>
<td>1.90 2.09 2.19</td>
<td>.03** .01 .01</td>
<td>.00 .00 .18***</td>
</tr>
</tbody>
</table>

For the six binary variables, no was coded 0 and yes was coded 1: thus, means for these variables represent the proportion of participants coded yes. Some data were missing: UC means were based on 46 families at baseline (but 45 for meds for URI and cockroaches in house), 45 at 3 months (but 44 for SM medication), and 44 at 12 months (but 46 for acute asthma visits); T means were based on 49 families at baseline (but 48 for cockroaches in house and SM medication), 46 at 3 months (but 45 for meds for URI and SM medication), and 49 at 12 months (but 48 for meds for URI and SM medication). Effect sizes statistics are *R* 2, *R* 2 L, or η 2, as described in the text; the Group and A × G effects are derived from multiple or logistic regressions and the Time effects from repeated measures analyses of variance.

*p* < .10.

**p < .05.

***p < .01.
by a graduate student in nursing who was blind to group assignment.

**Measures**

Demographic data were obtained at the baseline interview, using a form modified from Wilson et al. (1996). NAEPP criteria (National Asthma Education and Prevention Program, 1997) were used to rate the severity of asthma implied by the medication regimen that was documented in the child’s medical record for the most recent routine or acute medical visit for asthma prior to the baseline, 3-month, or 12-month data collection visit (Wilson et al., in press).

**Asthma Morbidity.** Asthma morbidity was assessed with three measures: a rating of how much children were bothered by asthma symptoms, the number of symptom-free days, and the number of medical visits for acute asthma exacerbations. At each visit, we administered the 10-item asthma symptom subscale from the Paediatric Asthma Quality of Life Questionnaire (Juniper, 1996a); caregivers were asked to rate the extent to which the child was “bothered” by each of 10 asthma symptoms in the previous week on a 7-point scale (1 = not bothered, 7 = extremely bothered; the coefficient alpha values were .92 at baseline and 3 months, .90 at 12 months). At each visit, caregivers were also asked for the approximate date when the child exhibited her or his most recent asthma symptoms; this information was used to calculate the number of symptom-free days immediately preceding that visit. The number of medical visits (regardless of site) for acute asthma exacerbations was derived from the child’s medical record for two periods: the year prior to baseline and the year from baseline to the 12-month visit.

**Caregiver Quality of Life.** We used the mean score on the Paediatric Asthma Caregiver’s Quality of Life Questionnaire (adapted from Juniper et al., 1996b) to assess the caregiver’s quality of life. This questionnaire consists of 14 items on which caregivers rate how much they have been bothered by or worried about the child’s asthma in the previous week (1 = not at all, 5 = every day or very much; the coefficient alpha values were .89, .88, .90 at baseline, 3 months, and 12 months, respectively).

**Asthma Management Practices.** Guided by Wilson et al. (1996), we selected a number of key caregiver asthma management practices: (1) adherence to the prescribed medical regimen for asthma on the previous day; (2) administration of asthma medication promptly with the signs of an upper respiratory infection (URI); (3) identification of coughing, stuffy, or runny nose among the earliest signs of asthma (as opposed to viewing wheezing or difficulty breathing as the earliest signs); (4) caregiver report of the frequency of 16 symptom management and prevention practices (1 = rarely, 5 = almost always; the coefficient alpha values were .70, .63, and .69 at baseline, 3 months, and 12 months respectively); (5) whether a household member smokes tobacco; (6) problems with mildew; and (7) problems with cockroaches. Caregivers were also asked to rate the level of child participation in each of the tasks required in asthma self-management (1 = does not do this task; 2 = does this task with help; 3 = does this task with supervision; 4 = does this task independently). The level of child participation in asthma management increases gradually with development (Brown, Avery, Mobley, Boccuti, & Golbach, 1996; Golbach, 1997). Thus, a 1-year-old might be expected to sit still through nebulizer treatment on the caregiver’s lap or take liquid medicine from a spoon when the caregiver presents it (both scored = 2, with help), whereas a 3-year-old would be expected to sit still through the treatment or put the spoon with medicine in his or her mouth (both scored = 3, with supervision). Scores for each task were averaged for two areas: (8) administration of medication (SM medication) and (9) symptom prevention and treatment (SM prevention).

**Data Analysis**

To test for group effects and age by group interactions (i.e., treatment effects and treatment effects moderated by age), multiple regression was used for interval-scaled variables and logistic regression for binary ones. Outcome variables were either 3- or 12-month scores; predictor variables were the baseline measure for the variable, the coded variable for group (UC = 0, T = 1), a coded variable for age (1–3 = 0, 4–6 = 1), and a term representing the age by group interaction, entered in this order (Cohen & Cohen, 1983). Effect sizes were the increase in variance accounted for (ΔR²) by multiple regression or the analogous ΔR² by logistic regression when a predictor variable was added to the equation. To test for time effects for the entire sample (baseline vs. 3 months and baseline vs. 12 months), a repeated measures analysis of variance (ANOVA) was used for interval-scaled variables and McNemar’s (1969) test for paired samples for binary ones; effect sizes were estimated in both cases with η² as computed by SPSS’s general linear model (GLM) procedure. Following
Cohen (1988), we refer to these effect sizes as weak when .01–.09, moderate when .09–.25, and strong when .25 or greater.

**Results**

Means for asthma morbidity, caregiver quality of life, and asthma management practice variables are given in Table II along with effect sizes for group, age by group (A × G), and time effects.

**Asthma Morbidity**

In general, analyses of the asthma morbidity variables showed a decrease over time for all children and intervention effects primarily for younger children (see Table II). For the total sample, the mean rating of how much children were bothered by asthma symptoms during the past week decreased from 2.49 at baseline to 1.68 at 12 months (where 1 = not bothered, 2 = hardly at all bothered, and 3 = a bit bothered; $\eta^2 = .22$). Age significantly moderated the treatment effect at both 3 and 12 months; thus, the treatment effect at 3 months was qualified by the age by group interaction. Follow-up analyses showed an intervention effect only for the younger children ($\Delta R^2 = .15$ and .13 for 3 and 12 months, $p < .01$ for both). Baseline and 3- and 12-month means for younger T children were 2.79, 1.87, and 1.39; the comparable means for younger UC children were 2.65, 2.82, and 1.90. In contrast, for older children there was essentially no treatment effect ($\Delta R^2 = .00$ and .01 at 3 and 12 months). The 12-month interaction is shown in Figure 1.

For the total sample, the mean number of symptom-free days prior to the visit increased from 37 at baseline to 96 for the 12-month visit ($\eta^2 = .18$). The intervention did not affect the mean number of symptom-free days immediately preceding the 3-month visit, but there was a significant age by group interaction at the 12-month visit. Follow-up analyses showed a significant increase for the younger T children (from 37 at baseline to 154 at 12 months, $\eta^2 = .29$, $p < .01$), for younger UC children (from 23 to 83 days, $\eta^2 = .26$, $p < .05$), and for older UC children (from 44 to 99 days, $\eta^2 = .20$, $p < .05$), but not for older T children (from 45 to 58, $\eta^2 = .05$, $p = .275$). Thus, the intervention appeared to have the desired effect on the younger children but an opposite effect on older children.

The number of medical visits for acute asthma care declined significantly from a mean of 4.79 for the 12 months preceding baseline to 2.76 for the period between baseline and the 12-month visit (a decrease of 42%). No treatment effects were noted, but younger children made more visits in the 12 months preceding baseline than older children, 6.04 versus 2.61 ($p < .01$, $\eta^2 = .09$). No other differences between younger and older children in asthma morbidity at baseline were significant.

**Caregiver Quality of Life**

For the total sample, the average caregiver’s quality of life rating was better at both 3 and 12 months ($M = 1.56$ and 1.42) than at baseline ($M = 1.80$, where 1 = never bothered and 2 = bothered 1–2 days per week or very little; see Table II). Age moderated the treatment effect at 3 months ($p < .05$) and marginally at 12 months ($p = .096$); thus, the treatment effect at 3 months was qualified by the age by group interaction. Follow-up analyses showed an intervention effect only for the younger children ($\Delta R^2 = .16$ and .12 for 3 and 12 months, $p < .01$ for both). Baseline and 3- and 12-month means for younger T children were 1.90, 1.37, and 1.17; the comparable means for younger UC children were 1.83, 1.98, and 1.54. In contrast, for older children there was essentially no treatment effect ($\Delta R^2 = .02$ and .00 at 3 and 12 months).

![Figure 1. Caregiver ratings of how much children were bothered by asthma symptoms in the previous week for younger (1–3 years, indicated with a black line) and older (4–6 years, indicated with a gray line), treatment (T, indicated with a triangle), and usual-care children (UC, indicated with a circle).](image-url)
Asthma Management Practices

In general, analyses of the asthma management practice variables showed improvement with time but few effects of the intervention (see Table II). The percentage of all caregivers who adhered to the prescribed medical regimen on the day preceding the assessment decreased marginally ($p = .058$) from 56% at baseline to 42% at 12 months. The percentage of all caregivers who reported administering asthma medication at the first signs of a URI increased significantly from 31% at baseline to 56% at 3 months, and the percentage of caregivers who listed cough and other early warning signs as being among the three earliest asthma signs increased significantly from 25% at baseline to 57% at 3 months, but other effects were not significant.

The mean frequency ratings of various symptom management and prevention practices increased significantly from 4.30 at baseline to 4.42 at 3 months (where 4 = quite often and 5 = almost always), but no other effects were significant. Reports of the presence of any smoker, mildew, or cockroaches in the house did not change significantly over time. The intervention was associated with a significantly greater increase in reports of cockroaches in the house at 3 months. The percentage reporting cockroaches declined from 33% to 24% for the UC group but increased from 44% to 50% for the T group.

Mean caregiver ratings of the level of child participation in asthma management increased significantly in both management areas. SM medication increased from 2.19 at baseline to 2.49 at 12 months, SM prevention increased from 1.94 at baseline to 2.22 at 12 months (where 1 = does not do this task, 2 = does task with help, 3 = does task with supervision). Intervention was significantly associated with SM prevention at 3 months: Mean ratings decreased from 1.97 at baseline to 1.90 at 3 months for UC children but increased from 1.90 to 2.09 for T children.

Intercorrelations

To determine the degree of redundancy in the analyses reported in Table II, we examined the pairwise correlations among these variables at baseline and at 3 and 12 months. In general, few correlations were sizeable. Only six of the correlations examined were greater than .50 absolute, a level Cohen (1988) refers to as strong. Ratings for how much asthma symptoms bothered the child correlated .57, .63, and .75 with caregiver quality of life ratings at baseline and 3 and 12 months; the level of child participation in medication (SM medication) and symptom prevention and treatment (SM prevention) correlated .68, .71, and .73 at the three time periods. Another six correlations were .32–.50 absolute, which Cohen terms moderate. Asthma symptoms correlated –.39 and –.36 with symptom-free days at baseline and 3 months; symptom-free days correlated –.30 with caregiver quality of life at baseline (i.e., the more symptom-free days, the better the quality of life, because lower scores indicate better quality of life); mold and roaches in the home correlated .30 at baseline; and cough, etc., as first signs correlated –.32 and –.31 with SM medication and SM prevention at 12 months. Another 79 correlations were weak (.10–.30 absolute per Cohen), and the remaining 131 were less than .10 absolute. We concluded that, except for asthma symptoms and caregiver quality of life, and the level of child participation in medication and in symptom prevention and treatment, there is little redundancy in the analyses reported.

Feasibility of Educational Program

Of the original 55 treatment group families, 39 (71%) completed all eight sessions. Of the remaining 16 families, 6 (11%) completed part of the program (1 family completed five, 1 completed four, 3 completed three, and 1 completed one), and 4 families (7%) did not complete any sessions. An additional 6 families (11%) originally assigned to the treatment group withdrew from the program (1 each after six, five, and one session[s], and 3 after no sessions). For the 39 families who completed eight sessions, the median number of weeks needed to complete the eight sessions was 10: one family completed the eight sessions in 1.9 weeks (this mother was anxious to finish before the due date of her baby), one took 24.4 weeks, but the range for the remaining families was 6.0 to 21.3 weeks. Mothers of younger children may have been more motivated to learn about asthma management. They were rated higher on homework completion by the home visitor than were mothers of older children; on a 5-point scale, means were 4.24 versus 3.40 ($\eta^2 = .14, p < .05$).

Discussion

Low-income families with very young children with asthma are a population at high risk for asthma mor-
bidity and mortality (e.g., Kattan et al., 1997), yet we are not aware of any other randomized controlled trials of home-based asthma education with this population. Two unique features of our study are (1) about half of the children (48%) were 1–3 years of age, an age group neglected by most other studies of children with asthma (see Wilson et al., 1996, for an exception); and (2) families had relatively good access to specialty care, as most (84%) were recruited through specialty asthma clinics rather than primary care physicians.

Our sample is both similar to and different from other samples of low-income children with asthma. For example, our sample is similar to the sample of 1,528 children in the NCICAS (Kattan et al., 1997) with respect to demographics, health care utilization, and asthma morbidity, but differs in terms of medication regimens. A much higher percentage of children in our sample (81%) had been prescribed an anti-inflammatory medication than the percentages reported in other studies (e.g., 24% in the NCICAS sample, Kattan et al., 1997; see also Warman, Silver, McCourt, & Stein, 1999).

Did Caregivers Participate in the Home-Based Asthma Education Program?

Overall, 30% of caregivers invited to participate either refused or could not be contacted after agreeing to participate (passive refusal). This refusal rate is consistent with those reported for other asthma education programs targeting low-income families (Lewis et al., 1984; Kaplan et al., 1986), and lower than the 41% refusal rate reported for the Wee Wheezers program targeting families with somewhat higher income and education and their young children (Wilson et al., 1996). We would expect the refusal rate to be somewhat lower outside the context of a research study with its data collection requirements. After randomization to the T group, 71% of caregivers (of the 55 initially assigned to the T group) completed the program. Our completion rate is similar to that reported for the Wilson et al. (1996) study and considerably higher than those reported for clinic-and school-based asthma education programs (Kaplan et al., 1986; Lewis, Rachelefsky, Lewis, de la Sota, & Kaplan, 1984) for low-income families. We conclude, therefore, that home-based asthma education for low-income families with young children with asthma is feasible in terms of securing caregiver participation.

Was the Home-Based Asthma Education Program Effective?

Asthma Morbidity. We found partial support for our hypothesis that our intervention would result in differential improvement in morbidity. For children ages 1 to 3 years, but not children ages 4 to 6 years, caregivers reported that T children were less bothered by asthma symptoms, at both 3 and 12 months, and experienced more symptom-free days before the 12-month visit, than UC children. The effect of intervention on how much young children were bothered by asthma symptoms was moderate (13%–15%). However, the number of acute asthma visits in the period from baseline to the 12-month follow up, as derived from medical records, was not significantly different for T and UC children.

Caregiver Quality of Life. The hypothesis that our intervention would yield differential gains in caregiver quality of life was partially supported. At 3 and 12 months, the caregiver quality of life scores improved for younger T children, whereas those of the older children were not affected by treatment. As with treatment related changes in the morbidity measures, the effect sizes for younger children were moderate (13%–18%).

Asthma Management Behaviors. There was virtually no support for the hypothesis that the intervention would produce greater improvement in asthma management behaviors as compared to the control condition. Of the seven caregiver and two child variables tested, only one child variable showed a weak differential treatment effect in the expected direction (SM prevention at 3 months). Treatment families reported more (rather than fewer) problems with cockroaches at 3 months than UC families, but this finding might have resulted from the fact that T families were more sensitized to the problem of cockroach allergens for children with asthma or more willing to acknowledge this problem following the home visits.

In summary, we demonstrated some treatment effects on asthma morbidity and on caregiver quality of life, especially for younger children, but on none of seven caregiver asthma management behaviors and on one of two measures of the child’s participation in asthma self-management. In general, intervention was effective only for children ages 1 to 3 years. This leaves open a question: If asthma morbidity was affected by the intervention but caregiver asthma management practices were not, does this in-
Diagnose that there is not a link, or perhaps only a weak link, between the caregiver’s asthma management practices we measured and asthma morbidity?

Changes Over 12 Months. The three measures of asthma morbidity (and the caregiver’s quality of life, which was correlated with asthma symptoms) all showed improvements during the year from baseline to the 12-month follow-up visit for both UC and T children. The effect sizes for changes over time, when significant, were moderate (9%–22% at 12 months). Others have reported similar improvements in a cohort of children ages 3–7 years from diverse socioeconomic backgrounds (Wilson et al., 1996; Wilson, Starr, Lu, & Fish, 1997) and in a cohort of low-income African American and Latino children ages 3–12 years at the outset of follow-up (Wilson et al., in press). Finally in a birth cohort study, Martinez et al. (1995) described the early natural history of wheezing. They found that 59% of the children who wheezed prior to age 3 years no longer wheezed at 6 years.

Two points seem worth making. First, if the asthma of young children tends to improve over time, then it becomes more difficult to demonstrate differential outcomes for educational interventions. This underscores the need for controlled studies of any intervention designed to improve asthma control in children. Second, further study is needed to determine the source of this improvement. Diagnostic uncertainty in the very youngest group (under the age of four) may play a role in some studies. In our sample, however, 84% of the children had a specialist diagnosis of asthma. Changes in asthma medication regimens during the study could also play a role. However, 81% of the children in our study had been prescribed an anti-inflammatory medication at the onset of the study, and this percentage did not change significantly over the 12-month study period.

The mean level of child participation in asthma management increased over the 12-month period in both groups; this increase was expected since the child’s level of participation is related to development (Golbach, 1997).

Limitations of the Study

The primary limitations of our study are the relatively small sample and the variable intensity of the education program as delivered (20% of the remaining 49 T families completed no or only some lessons). The fact that a much higher percentage of children in our study than in those of others (e.g., Farber, John-son, & Beckerman, 1998; Kattan et al., 1997) had access to specialty medical care is both a limitation and a strength. It limits the generalizability of the study to young low-income children with asthma who receive asthma care that conforms to the current NAEPP guidelines. The intervention might have been more effective among children treated by primary care providers who may have less time and less access to asthma-specific information. We were not able to test this hypothesis, as too few children in our study received their asthma care from primary care physicians. Because the majority of participating children were cared for by asthma specialists, we are able to suggest, however, that poor caregiver adherence to a preventive medical regimen may not reflect poor access to quality medical care, but rather a more reactive, less proactive approach to asthma management in this population (e.g., 93 children in our study had documented medical visits for asthma at baseline and 78 did at 12 months; for 43% of those children at baseline and 44% at 12 months, all visits were acute and none routine).

Implications for Practice

Our results suggest that a home-based asthma education program may be effective in decreasing asthma morbidity and improving caregivers’ quality of life for low-income families with very young children with asthma (ages 1 to 3 years). The greater success of the program for families with younger children (ages 1 to 3 years) than for families with older children (ages 4 to 6 years) may have been due to several factors. As judged from the rate of homework completion, caregivers of younger children may have been more motivated to learn about asthma, perhaps because the diagnosis was relatively recent or because their participation in the program was consistent with their parental role expectations. Younger and older children did not differ with respect to asthma symptoms, yet younger children had made more medical visits for acute asthma prior to the baseline. This suggests that caregivers of younger children may also have been motivated by fears about breathing problems causing death in very young children. Additionally, the relative success of the program for families with 1- to 3-year-old children may be related to age-based differences in caregiver experience in asthma management, the availability or efficacy of clinic-based asthma education, or both. All younger children as well as 92% of the older children exhib-
ited their first asthma symptoms prior to age 2 years. As a result, caregivers of older children had more experience with asthma management than those of younger children. At the same time, health care providers may have provided more asthma education to the families with 4- to 6-year-old children than to those with the youngest children. Either one or both of these factors could have minimized differential treatment effects for the families with older children.

Home-based asthma education is ideally integrated with the treatment efforts of the child’s medical care providers. The home-based nurse educator can serve as a liaison between the family and the physician to enhance communication about asthma management and environmental control practices and provide continuity of care, a valuable service in teaching hospitals in which resident physicians change frequently.

Any effort to improve asthma management in a low-income, urban sample is complicated by the multiple adversities associated with poverty in urban centers. The causes of asthma morbidity among this population are multifaceted and likely include contextual and psychosocial issues not targeted by WWH, such as caregiver and child mental health problems (e.g., Weil et al., 1999). Anecdotal reports from our nurse home visitors suggest that some caregivers’ depression, lack of availability to their children, or poor limit-setting skills contributed to their difficulties in managing their children’s asthma. Therefore, the efficacy of an educational intervention aimed at increasing caregivers’ knowledge and skills might be enhanced by also targeting contextual and psychosocial factors affecting treatment adherence and asthma morbidity.

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Appendix

Content of the 8 Sessions

Session 1: Basic concepts of asthma.

Session 2: Developmentally appropriate involvement of child in asthma self-management; asthma cues (part of Action Plan).

Session 3: Asthma medication and nonmedication techniques for managing asthma symptoms (part of Action Plan); working together with child to administer medicines.

Session 4: Symptoms of acute asthma episodes; review of Action Plan; children with chronic health problems.

Session 5: Symptom prevention (trigger identification, environmental control of triggers, use of preventive medication).

Session 6: Communication about asthma to teachers, physicians, and family members.

Session 7: Review of asthma management concepts.

Session 8: Review of communication about asthma.

Structure of Individual Sessions

Each 90-minute session consisted of the completion (jointly by caregiver and nurse) of a checklist of the child’s asthma symptoms for the previous week (5 minutes), a discussion of the previous week’s homework assignment (5 minutes), an overview of the day’s session (5 minutes), the session topics (60 minutes), a review of concepts learned today (10 minutes), and the assignment of homework (5 minutes).

Examples of Caregiver and Child Activities Included in Sessions

Examples of caregiver and child activities include tracing the airflow on a picture of a child with the lungs drawn, identifying and coloring asthma cues and environmental triggers in a coloring book, practicing belly breathing, keeping an asthma diary, watching videos about asthma management, and practicing the use of a peak flow meter.
References


Effective and ineffective management behaviors of parents of infants and young children with asthma. *Journal of Pediatric Psychology, 18*, 63–81.

