

Original Investigation

Prompting Asthma Intervention in Rochester–Uniting Parents and Providers (PAIR-UP) A Randomized Trial

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IMPORTANCE A disproportionate number of impoverished and minority children have asthma and receive suboptimal preventive care.

OBJECTIVE To evaluate whether the Prompting Asthma Intervention in Rochester–Uniting Parents and Providers (PAIR-UP) intervention, administered in primary care offices, improves the delivery of preventive care and reduces morbidity for urban children with asthma.

DESIGN, SETTING, AND PARTICIPANTS Cluster randomized trial in which 12 urban primary care practices were matched based on size and type and randomly allocated to the PAIR-UP intervention or usual care (UC). We enrolled 638 children aged 2 to 12 years with persistent or poorly controlled asthma in the waiting room prior to a visit with a clinician for any reason from October 2009 to January 2013. Blinded interviewers called caregivers within 2 weeks to inquire about preventive measures taken at the visit and called them 2 and 6 months later to assess symptoms.

INTERVENTIONS Children enrolled at PAIR-UP practices received prompts for the caregiver and clinician at the time of the visit that outlined the child's asthma severity or control as well as specific guideline-based recommendations to enhance preventive care. These practices also received educational resources and periodic feedback on their asthma care performance. The UC practices received copies of the asthma guidelines.

MAIN OUTCOMES AND MEASURES The primary outcome was symptom-free days (SFDs) per 2 weeks at the 2-month follow-up.

RESULTS We enrolled 638 children (participation rate of 80%; 36% were black, 36% were Hispanic, and 68% had Medicaid insurance). Groups were similar in demographic characteristics and asthma severity at baseline. At the index visit, more children in the PAIR-UP group received a preventive medication action (new medication, increased dose, recommendation to restart preventive medication) than in the UC group (58% vs 33%; odds ratio [OR] = 2.8; 95% CI, 1.9 to 3.9). More children in the PAIR-UP group than in the UC group received an asthma action plan (61% vs 23%; OR = 8.3; 95% CI, 3.7 to 18.7), discussions regarding asthma (93% vs 78%; OR = 4.5; 95% CI, 2.8 to 7.2), and secondhand smoke counseling (80% vs 63%; OR = 2.6; 95% CI, 1.2 to 5.5). At the 2-month follow-up, children in the PAIR-UP group had more SFDs per 2 weeks than those in the UC group (mean difference, 0.78 days; 95% CI, 0.29 to 1.27). At 6 months, the improvement in SFDs was no longer statistically significant (mean difference, 0.56; 95% CI, −0.14 to 1.25).

CONCLUSIONS AND RELEVANCE The PAIR-UP intervention improved the delivery of preventive asthma care and reduced asthma morbidity for high-risk urban children with persistent asthma at 2 months, but the improvement in SFDs was no longer significant at 6 months.

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Much of the morbidity caused by childhood asthma could be prevented if the disease was managed according to established guidelines.^{1,2} Unfortunately, guideline-based care is not delivered consistently in the primary care office.³⁻⁶ Care is particularly suboptimal for poor urban children, who have the greatest morbidity from asthma.⁷⁻¹¹ For example, clinicians frequently misclassify asthma severity, resulting in inadequate prescription of effective preventive medications.¹² Action plans and asthma education are not delivered consistently.^{13,14} Even if preventive medications are prescribed, many children continue to have poor asthma control.^{9,15} Further, many parents underestimate their child's asthma severity¹⁶ and do not notify physicians about frequent symptoms.¹⁷

This study builds on our experience with a prior study in 2 urban continuity clinics in which we found that prompting clinicians about asthma severity and care guidelines at the time of an office visit resulted in improved preventive care delivery to inner-city children.¹⁸ In the current study, we sought to establish whether these findings could be replicated with a larger sample of urban children from different practice types and whether the positive effects could be enhanced by more specific prompting directed toward both the clinician and caregiver and by providing practice-level supports and feedback. Further, we tested the impact of the intervention on clinical outcomes as well as preventive care delivery.

The Prompting Asthma Intervention in Rochester-Uniting Parents and Providers (PAIR-UP) program was designed to improve preventive care for urban children with asthma by improving symptom awareness and promoting preventive care in the context of active discussions between clinicians and caregivers. It also was designed to ensure that clinicians have the information and resources needed to provide guideline-based care and to prevent missed opportunities by including children who present to the office for reasons unrelated to their asthma.

We hypothesized that children receiving the PAIR-UP intervention would experience less asthma-related morbidity (defined by symptom-free days [SFDs] at the 2-month follow-up) compared with children receiving usual care (UC). Our secondary hypothesis was that children in the PAIR-UP group would receive improved preventive asthma care (defined by guideline-based corrective actions taken at the index visit) compared with UC.

Methods

Setting and Participants

Enrollment occurred in 12 urban primary care practices in Rochester, New York, from October 2009 to January 2013. Caregivers of children aged 2 to 12 years with asthma documented in their medical record were approached in the waiting room prior to the child's appointment with a clinician. Research assistants administered a structured screening tool to caregivers to assess eligibility. Children with persistent or poorly controlled asthma based on the National Heart, Lung, and Blood Institute (NHLBI) guidelines were eligible.

Children were visiting a physician or nurse practitioner (staff and social work visits were ineligible) for any reason, including well-child care visits and illness visits. Children were excluded if they had another significant health issue that might interfere with the assessment of asthma, if the family had no access to a telephone for follow-ups, and if they were enrolled previously.

We obtained written informed consent from the primary caregiver and oral assent from children aged 7 years or older. Spanish-speaking research assistants were available; consents, surveys, and prompts were translated into Spanish and back translated to English. All caregivers received grocery store gift certificates after each survey. The University of Rochester Institutional Review Board and the Rochester General Health System Institutional Review Board approved the protocol.

Randomization and the PAIR-UP Intervention

We performed a cluster randomized trial with 12 urban primary care practices, including 6 pediatric practices, 4 family medicine practices, and 2 medicine-pediatric practices. Prior to the start of enrollment, each of the 12 practices were matched based on size, type, and demographic characteristics and were randomly allocated by an independent statistician to either PAIR-UP or UC. Based on our prior data,^{18,19} we planned to enroll 638 participants to have greater than 80% power for primary and secondary outcomes. Enrollment in each practice occurred throughout the study period, with monthly goals for matched practices to ensure even recruitment across seasons and practices.

PAIR-UP Intervention

The PAIR-UP intervention consisted of 3 key components. First, for each participant, we generated a prompt for the clinician at the time of the visit with information regarding the child's symptom severity or level of control, preventive medication use, exposure to smoke, and specific tailored recommendations for guideline-based preventive care, a simplified prompt for the caregiver, and a blank asthma action plan for use at the visit. Second, practice-level supports including brief interactive seminars, resource guides, and access to free-of-charge asthma education programs were given to support guideline-based preventive care. Third, biannual practice-level feedback was given regarding performance on key outcomes.

Prompts

The prompts were generated using standardized forms on a tablet computer with specified algorithms to generate individualized reports based on the information provided by caregivers. For children with persistent asthma and no use of preventive medication, we recommended starting an inhaled corticosteroid. For children with poor asthma control despite use of preventive medications, we recommended that the clinician consider evaluation of adherence and inhaler technique, treatment of potential comorbidities, evaluation for triggers, and step up of medications (new preventive medication or dose increase). The prompt also included information regarding medication adherence (if applicable), the child's ex-

posure to smoke, and other environmental exposures. Lastly, the prompt included a recommendation for the clinician to inquire about caregiver concerns and establish treatment goals (eFigure 1 in the Supplement).

The caregiver prompt included specific preventive care issues to discuss with the clinician during the visit (ie, triggers, medication concerns) and outlined the family's treatment goals (ie, be able to participate in activities) based on caregiver responses to the waiting room survey (eFigure 2 in the Supplement).

Both prompts were printed on a portable color printer and given to the caregiver in the waiting room, along with a blank asthma action plan. The research associate instructed the caregiver to deliver the clinician prompt and the action plan to the clinician when the child was called back for the visit. Caregivers were specifically instructed to hand the prompt to the clinician in the examination room rather than to the nurse or aide who might be initiating the visit with the child. They also were asked to refer to their own prompt during the visit.

Practice-Level Supports

We provided support to practices to assist clinicians in implementing the approach outlined in the NHLBI guidelines and to help remove clinician-level barriers to guideline implementation.^{6,20} These supports, developed using principles of physician behavior change,²¹ included brief interactive seminars tailored to clinicians' needs, a summary of the 2007 NHLBI asthma guidelines,¹ information regarding free-of-charge asthma education programs, links to local asthma resources, and educational packets for use in patient care. The seminars, led by the principal investigator (J.S.H.) and study nurse (P.J.T.), occurred at the beginning of each intervention year.

Practice-Level Feedback

All PAIR-UP practices received biannual feedback regarding the proportion of patients receiving appropriate guideline-based preventive actions during the study period and the proportion of patients meeting goals of therapy (limited symptoms, no acute care visits or hospitalizations, no absenteeism). The information was shown graphically, with a display of all intervention practices (indicated by code) for comparison. Key components of guideline-based care were represented, with tips for the clinicians.

The UC practices received copies of the NHLBI guidelines but did not receive performance feedback. Families enrolled at UC sites completed baseline assessments in the waiting room prior to their visit but did not receive the prompting intervention. At the conclusion of the study, all 12 practices received \$500 to thank them for participating.

Assessments

Assessment of Asthma Severity and Symptoms at Baseline

After informed consent was obtained, a brief baseline assessment was completed in the waiting room prior to the child's visit. We assessed asthma severity using structured questions adapted from NHLBI guidelines. Caregivers reported the number of days their child experienced any cough,

wheeze, shortness of breath, or chest tightness during the day, frequency of nighttime symptoms, activity limitation, and rescue medication use for symptom relief in the prior 4 weeks. The number of SFDs in the prior 14 days (defined as the number of days the child remained symptom free with no wheezing, coughing, chest tightness, or shortness of breath within a 24-hour period) was also recorded. Caregivers were asked the number of asthma exacerbations that required use of oral prednisone in the past year. As required by the eligibility criteria, all children had persistent or poorly controlled symptoms.

Initial Outcome Assessment

Within 2 weeks following the health care visit, caregivers were contacted via telephone and study staff used a structured interview tool to inquire about specific preventive care actions the child received at the office visit. Caregivers were asked about any changes to their child's asthma medications and treatment plan, including whether the clinician prescribed a new controller medication, stepped up the dose of a previously prescribed controller medication, or recommended restarting a previously prescribed medication that the family had discontinued (any affirmative response was defined as a preventive medication action). We asked caregivers whether the clinician specifically inquired about the frequency of the child's daytime and nighttime symptoms, counseled on reducing exposure to triggers including smoke, and discussed proper medication use. We also inquired whether the clinician delivered an asthma action plan or recommended a specialist referral or follow-up asthma visit.

Using a structured medical record abstraction tool, we reviewed medical records to assess the same preventive measures based on clinician report. Any documentation of asthma care was recorded by a research assistant blinded to treatment group. We considered that a preventive action was taken during the visit if either the caregiver or medical record review indicated an action had occurred. Medical record review data agreed with caregiver report 78% of the time ($\kappa = 0.52$).

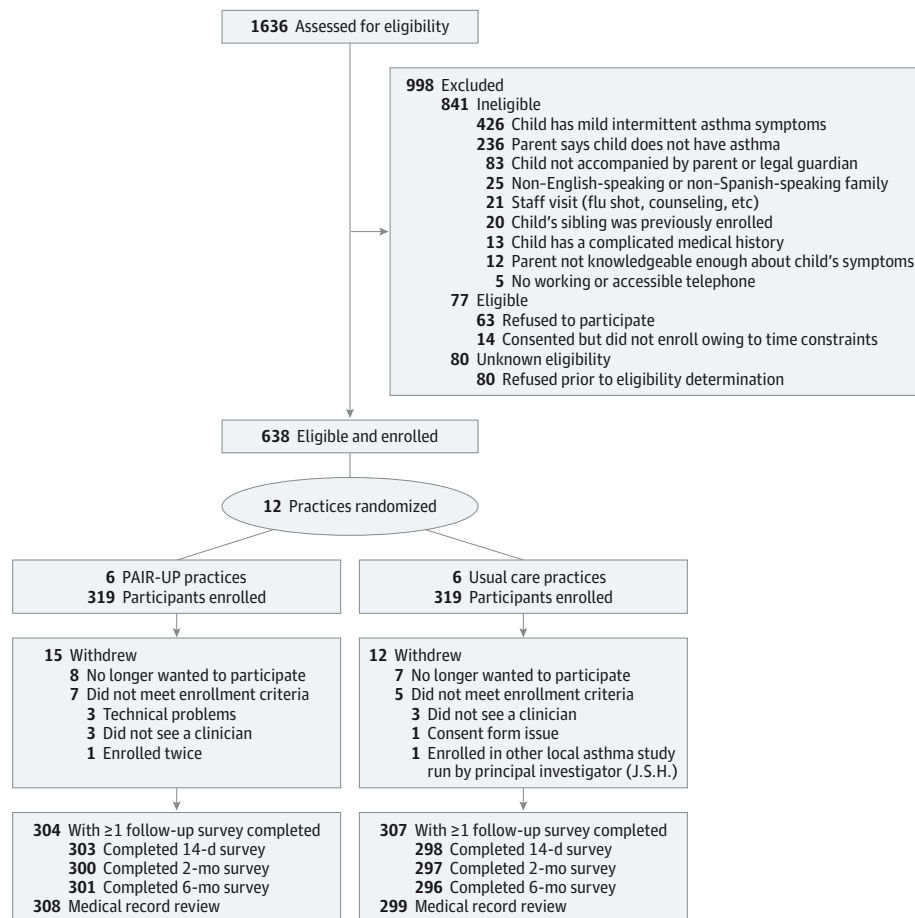
Assessment of Asthma Symptoms and Health Care Utilization at 2 and 6 Months

Caregivers were contacted by telephone 2 and 6 months after enrollment to assess asthma symptoms and health care utilization. At each follow-up, research assistants asked the number of days per 2 weeks the children experienced daytime symptoms, nighttime symptoms, activity limitation, and requiring rescue medication to relieve symptoms. Caregivers also reported acute visits to the clinician as well as emergency department visits and hospitalizations related to the child's asthma since the index visit. The primary outcome was SFDs per 2 weeks at the 2-month follow-up. All follow-up telephone calls were administered by trained research assistants blinded to treatment group allocation.

Assessment of Covariates

We inquired about demographic characteristics, including child's age, race (white, black, or other), ethnicity (Hispanic or

Figure. Prompting Asthma Intervention in Rochester–Uniting Parents and Providers (PAIR-UP) CONSORT Flow Diagram



not Hispanic), Medicaid insurance (yes or no), language spoken at home (English or Spanish), caregiver age (<30 or ≥30 years), caregiver education (<high school graduate or ≥high school graduate), caregiver marital status (married/domestic partner or single), and primary caregiver smoking status (yes or no). The reason for the health care visit was categorized as either asthma visit (acute and follow-up) or non-asthma visit (well-child care visit, nonasthma sick visit or follow-up, and other).

Statistical Analysis

We performed analyses using SAS version 9.3 statistical software (SAS Institute, Inc). Baseline characteristics were compared between groups using 2-sample *t* tests (continuous variables) or using χ^2 or Fisher exact tests (categorical variables). Multiple regression models were fitted for SFDs (dependent variable) and study group (independent variable) after adjusting for baseline SFDs, sex, race, asthma severity, and language. We estimated regression coefficients and standard errors using generalized estimating equations to account for the clustering data structure within practices. We used the same approach for secondary outcomes and 6-month measures. Logit-link function and binomial errors were specified for binary outcomes (emergency department visits or hospitaliza-

tions). Analyses also adjusted for actual duration that events were observed. Missing data analysis evaluated whether missingness was associated with observed covariates and outcomes. If the missing-completely-at-random assumption was not satisfied, we used inverse probability-weighted generalized estimating equations.^{22,23}

Results

We assessed 1636 children for eligibility; 841 were ineligible, 143 refused, and 14 were not enrolled owing to lack of time in the waiting room (Figure). The remaining 638 children were enrolled, for a participation rate of 80%. Table 1 describes demographic characteristics for the children and caregivers as well as baseline asthma-related variables. The mean (SD) age of the children was 6.71 (3.0) years, and 58% were male. Among the participants, 36% were black, 36% were Hispanic, and 68% had Medicaid insurance. Most of the caregivers (75%) had at least graduated from high school, 32% smoked, and 27% spoke Spanish at home. Demographic characteristics were not different between treatment groups, with the exception that fewer Spanish-speaking caregivers had children in the PAIR-UP group than in the UC group (24% vs 31%, respectively).

Table 1. Baseline Characteristics

Characteristic	Overall (N = 638)	PAIR-UP (n = 319)	UC (n = 319)
Demographic			
Children			
Age, mean (SD), y	6.71 (3.0)	6.72 (3.0)	6.70 (2.9)
Male, No. (%)	368 (58)	175 (55)	192 (60)
Hispanic, No. (%)	229 (36)	103 (32)	126 (40)
Race, No. (%)			
White	151 (24)	74 (23)	77 (24)
Black	230 (36)	127 (40)	103 (32)
Other	251 (39)	113 (35)	138 (43)
Medicaid insurance, No. (%)	431 (68)	217 (68)	214 (67)
Caregivers, No. (%)			
Married	248 (39)	119 (38)	129 (41)
≥High school graduate	481 (75)	238 (75)	243 (76)
Primary caregiver smokes	202 (32)	100 (32)	102 (32)
Spanish spoken at home, No. (%)	173 (27)	74 (24)	99 (31)
Pediatric practice, No. (%)	494 (77)	247 (77)	247 (77)
Asthma			
Severity level, No. (%)			
Mild persistent	239 (37)	114 (36)	125 (39)
Moderate persistent	220 (34)	111 (35)	109 (34)
Severe persistent	179 (28)	94 (29)	85 (27)
Symptom-free days, mean (SD), No.	7.53 (4.9)	7.25 (4.9)	7.80 (4.9)
Preventive medicine, No. (%)	371 (58)	195 (61)	176 (55)
ED visit in prior year, No. (%)	264 (41)	126 (40)	138 (43)
Hospitalization in prior year, No. (%)	64 (10)	30 (9)	34 (11)
Reason for visit was asthma related, No. (%)	158 (25)	83 (26)	75 (24)

Abbreviations: ED, emergency department; PAIR-UP, Prompting Asthma Intervention in Rochester-Uniting Parents and Providers; UC, usual care.

Table 2. Asthma Care Actions During Index Visit

Asthma Care Action	No. (%)		Adjusted OR (95% CI) ^a
	PAIR-UP (n = 319)	UC (n = 319)	
Preventive medication action	84 (58)	105 (33)	2.8 (1.9-3.9)
New medication	104 (33)	50 (16)	2.5 (1.9-3.3)
Changed dose of previous medication	39 (12)	29 (9)	1.2 (0.8-1.8)
Recommendation to restart preventive medication	115 (36)	69 (22)	1.9 (1.0-3.6)
Any discussion about asthma	296 (93)	249 (78)	4.5 (2.8-7.2)
Secondhand smoke counseling	254 (80)	201 (63)	2.6 (1.2-5.5)
Asthma action plan provided	193 (61)	72 (23)	8.3 (3.7-18.7)
Clinician asked about symptoms	240 (79)	176 (59)	2.8 (2.0-4.0)
Clinician suggested follow-up or specialist referral	193 (61)	131 (41)	2.2 (1.4-3.4)
Clinician asked about triggers	183 (57)	110 (34)	2.6 (1.7-3.9)
Clinician discussed proper medication use	174 (55)	123 (39)	2.0 (1.3-3.3)

Abbreviations: OR, odds ratio; PAIR-UP, Prompting Asthma Intervention in Rochester-Uniting Parents and Providers; UC, usual care.

^a Statistics were based on logistic regressions with standard errors estimated by generalized estimating equation to account for the clustering data structure within practices. Covariates including asthma severity, child's sex, child's race, and language spoken at home were controlled in the analyses. Primary caregiver smoking was also adjusted in the analysis of secondhand smoke counseling.

Based on NHLBI classifications, 37% of caregivers reported that their child had mild persistent symptoms at the time of the visit, 34% had moderate persistent symptoms, and 28% had severe persistent symptoms. Caregivers reported a mean (SD) of 7.53 (4.9) SFDs over 2 weeks, 41% reported an emergency department visit for asthma in the prior year, and only 58% reported having a preventive asthma medication. Only 25% were being seen at the office for an asthma-related

visit. There were no differences in baseline asthma severity, medication use, or reason for visit between the groups.

Table 2 indicates asthma care actions that occurred during the index visit. Overall, asthma care actions were low for this group of children with current persistent symptoms. Fewer than half of the children received a preventive medication action (new medication, increased dose, recommendation to restart preventive medication), an asthma action plan, or an as-

Table 3. Caregiver-Reported Symptoms and Health Care Utilization at 2 and 6 Months

Variable	Mean (SD), No.		Adjusted Mean Difference (95% CI) ^a
	PAIR-UP (n = 300)	UC (n = 297)	
2-mo follow-up ^b			
Symptom-free days	10.2 (4.8)	9.5 (5.1)	0.78 (0.29 to 1.27)
Days with symptoms	2.5 (3.7)	3.0 (4.1)	−0.65 (−1.01 to −0.29)
Nights with symptoms	1.6 (3.2)	2.0 (3.6)	−0.39 (−0.74 to −0.03)
Days with activity limitation	1.8 (3.4)	2.0 (3.5)	−0.20 (−0.50 to 0.11)
Days with rescue medication use	2.5 (4.0)	3.0 (4.4)	−0.48 (−1.08 to 0.13)
6-mo follow-up ^c			
Symptom-free days	11.0 (4.4)	10.5 (4.4)	0.56 (−0.14 to 1.25)
Days with symptoms	2.1 (3.5)	2.4 (3.6)	−0.30 (−0.85 to 0.24)
Nights with symptoms	1.4 (3.0)	1.8 (3.2)	−0.43 (−0.77 to −0.09)
Days with activity limitation	1.6 (3.2)	1.8 (3.2)	−0.26 (−0.65 to 0.13)
Days with rescue medication use	2.3 (3.9)	2.5 (4.0)	−0.26 (−0.98 to 0.49)
Any ED visits or hospitalizations since enrollment, %	11	11	1.00 (0.54 to 1.87)

Abbreviations: ED, emergency department; PAIR-UP, Prompting Asthma Intervention in Rochester—Uniting Parents and Providers; UC, usual care.

^a Statistics were based on weighted generalized estimating equation to account for the clustering data structure within practices. Covariates including asthma severity, child's sex, child's race, and language spoken at home were controlled in the analyses.

^b Slightly more participants with missing data at 2 months were Spanish

speaking compared with those with complete data. Therefore, we modeled the probability of dropout via logistic regression with group and Spanish language as predictors and used the inverse probabilities to weight observations.

^c The 6-month follow-up outcome dropouts were not found to be significantly correlated with any covariates; therefore, the results were based on the unweighted generalized estimating equation.

assessment of asthma triggers. However, at the time of the health care visit, significantly more children in the PAIR-UP group than in the UC group received a preventive medication action (58% vs 33%, respectively; odds ratio [OR] = 2.8; 95% CI, 1.9 to 3.9). Further, more children in the PAIR-UP group than in the UC group received an asthma action plan (61% vs 23%, respectively; OR = 8.3; 95% CI, 3.7 to 18.7), discussions regarding their asthma (93% vs 78%, respectively; OR = 4.5; 95% CI, 2.8 to 7.2), and secondhand smoke counseling (80% vs 63%, respectively; OR = 2.6; 95% CI, 1.2 to 5.5).

Parent-reported asthma symptoms and health care utilization at the 2- and 6-month follow-ups are shown in Table 3. For the primary outcome, we found that children in the PAIR-UP group had more SFDs per 2 weeks at 2 months than in the UC group (mean difference, 0.78 days; 95% CI, 0.29 to 1.27). Children in the PAIR-UP group also had fewer days and fewer nights with asthma symptoms compared with those in the UC group. At 6 months, the improvement in SFDs was no longer significantly different from UC (mean difference, 0.56; 95% CI, -0.14 to 1.25), but children in the PAIR-UP group had significantly fewer nights with symptoms per 2 weeks (mean difference, -0.43; 95% CI, -0.77 to -0.09). Very few children had an emergency department visit or hospitalization for asthma within the 6-month period after enrollment, and this did not differ between the PAIR-UP and UC groups (11% vs 11%, respectively; OR = 1.00; 95% CI, 0.54 to 1.87).

Discussion

The PAIR-UP intervention, which included clinician prompting, practice-level supports, and performance feedback, sig-

nificantly improved the delivery of preventive asthma care at the time of an office visit for high-risk urban children with persistent asthma. More children in PAIR-UP practices received a preventive medication action, an asthma action plan, and discussions regarding asthma and secondhand smoke than children in UC practices. We also demonstrated an improvement in asthma morbidity at the 2-month follow-up assessment. This suggests that the intervention improved not only the delivery of care but also short-term clinical outcomes.

Other studies have tested clinician prompts as a successful method to stimulate action regarding clinical issues and improve preventive care,^{4,24-31} and some have also assessed patient prompting in addition to clinician prompting to optimize preventive treatment programs.^{32,33} Similarly, performance feedback on specific practices has been extensively used in health maintenance organizations for quality improvement³⁴⁻³⁸; however, this is not standard practice in health care settings, and information rarely is relayed at the time of a patient visit. Multifaceted interventions such as PAIR-UP appear to yield the greatest success in improving asthma care.³⁹⁻⁴⁵

The goal of PAIR-UP was to reduce asthma morbidity by implementing a conceptually simple system change in primary care practice. By prompting clinicians and caregivers at the time of the office visit and empowering them with immediate and relevant information and resources based on national guidelines, we facilitated the delivery of optimal care. We included a large sample of children from representative practices in an urban community who were in greatest need of assistance. We specifically chose a cluster randomized design with practice-level randomization to lessen the risk of ex-

perimental contamination that occurs with individual-level randomization, allow for incorporation of practice-level supports and feedback, and allow for synergy and diffusion within practices. To help ensure equivalent treatment groups, we incorporated a priori matching of practices based on key variables and accounted for intracluster correlation estimates in the analytic plan.

There are some potential limitations of this study. First, despite prompting, delivery of preventive care for these high-risk children remained suboptimal, likely owing to a variety of factors including the competing demands of an office visit. Second, our intervention required the financial commitment for staff members to perform symptom screening in the waiting room, and we used printed prompts rather than electronic medical record systems because many of the practices (approximately half) were still using paper records at the time of the study. However, many more practices are now equipped with electronic medical record systems and screening information could easily be entered by caregivers into tablet computers or waiting room kiosks and electronically translated to prompts in the electronic medical record system, requiring very little expense. Further, we did not incorporate formal asthma education or reinforcement after the index visit. Our goal was to develop a system that could be easily replicated, thus requiring the intervention to be simple and inexpensive. While the improvement in SFDs at 2 months is considered clinically meaningful,^{46,47} we suspect that not having program rein-

forcement over time may have contributed to our lack of a statistically significant difference in SFDs at 6 months.

It is important to note that the interview process with the families in the waiting room could have caused families in UC practices to focus on asthma more than they would have without the baseline interview process, thus triggering enhanced care. Additionally, outcome measures obtained by caregiver interview may be subject to recall errors or recall bias. To minimize this possibility, the recall period was short, the assessments were blinded, and we included medical record review data. Lastly, because the program was multifaceted by design, we cannot determine the effectiveness of individual components.

Conclusions

Asthma continues to disproportionately affect impoverished children and preventive care is suboptimal.⁷⁻¹⁰ Missed opportunities to provide optimal preventive asthma care in the primary care setting are common and likely contribute to preventable morbidity. We found that a multifaceted prompting intervention in the primary care office improved the delivery of preventive asthma care and reduced asthma morbidity for high-risk children with persistent asthma. This project has the potential to serve as a model for improved asthma care in urban communities.

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Supplementary Online Content

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eFigure 1. Sample Provider Prompt

eFigure 2. Sample Caregiver Prompt

This supplementary material has been provided by the authors to give readers additional information about their work.

eFigure 1. Sample Provider Prompt

Sample prompt for the provider. This prompt was used for children with persistent asthma severity but no reported use of a preventive asthma medication at the time of the visit. The main recommendation, indicated at the bottom, is for the provider to start an inhaled corticosteroid at the time of the visit.



PAIR-UP for children!
Prompting Asthma Intervention in Rochester - Helping Parents & Providers

ASTHMA SEVERITY

Date: **02/19/2011**

Asthma Report for Today's Visit for: **John Smith**

Information from a brief survey we conducted today suggests that your patient has Persistent Asthma. Highlighted sections indicate key recommendations based on information obtained from the family.

PLEASE CONSIDER ALL THE FOLLOWING GUIDELINE-BASED ACTIONS AT THIS VISIT

Assessment of Asthma Severity	
DAY	NIGHT
During the past four weeks, this child has had coughing, wheezing or shortness of breath during the day: Twice a week	During the past four weeks, this child has had coughing, wheezing or shortness of breath during the night: Frequently / Every Night
Acute episodes of asthma 0 times during the last 12 months. Activity Limitation: ☐ Extremely Limited ☐ Somewhat Limited ☒ Minor Limitation ☐ No Limitation Preventive Asthma Medications Reported: None Exposure to Cigarette Smoke: No	

Check ✓ each Guideline-Based Asthma Action Delivered at This Visit:

- ☐ **Start an INHALED CORTICOSTEROID:** Demonstrate proper technique for medication administration
- ☐ **Assess Exposure to Smoke**
 - **Assess and Discuss Caregiver Smoking Status:** Encourage cessation and provide resources
 - **Discuss "Other" Smokers in Home:** Suggest ways to decrease the child's exposure, recommend rules for no smoking in the home or car with no exceptions
- ☐ **Assess Exposure to Triggers:** Educate Caregiver about eliminating triggers
- ☐ **Evaluate for Possible Co-Morbid Condition:** Consider evaluation and treatment of a co-morbid condition (sinusitis, reflux, allergies) or sub-specialist referral
- ☐ **Schedule Follow-Up Appointment in 2 - 6 Weeks**
- ☐ **Discuss Concerns / Treatment Goals with Caregiver**

Provider Signature: _____ Date: _____

eFigure 2. Sample Caregiver Prompt

Sample prompt for the caregiver. This prompt was given to caregivers to refer to at the visit. The prompt indicates their self-reported top topics to discuss with the provider, as well as their treatment goals for their child.



PAIR-UP for children!
Prompting Asthma Intervention in Keshenka - Uniting Parents & Providers

Tips for Today's Visit with Your Child's Doctor

Child Name: **John Smith**

Date: **02/19/2011**

You reported asthma symptoms that suggest your child could be healthier.

Top 3 Topics to Discuss at This Visit	Details
☒ Your child's asthma triggers (molds/mildew, pets)	<i>3 cats in home</i>
☒ Nighttime symptoms	<i>Coughs all night long</i>
☐ Increased symptoms	
☐ How to use an inhaler with a spacer or diskus	
☐ How cigarette smoke can affect your child's asthma and what you can do	
☐ Preventive medications that might help	
☐ How to recognize when your child is sick and when to call the doctor	
☐ A written asthma plan for you to take home	
☒ Medication concerns (example: dependency, long-term side effects)	<i>He's hyper!</i>
☐ Change in medication	
☐ Refill of medication	
☐ A follow-up visit to talk about your child's asthma more	
☐ Other issues:	
☐ No issues to report at this visit	

These Are Your Top Treatment Goals:

- ☒ Be free from severe symptoms, including sleeping through the nights
- ☒ Use asthma medicines with as few side effects as possible
- ☒ Be able to participate fully in any activities of his/her choice
- ☐ Not miss work or school because of asthma symptoms
- ☐ Not need emergency visits or hospitalizations for asthma
- ☐ Have the best possible lung function
- ☐ Other: _____