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Factors Associated with Completion of a Behavioral Intervention for Caregivers of Urban Children with Asthma

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Abstract

Background—Rates of preventive follow-up asthma care after an acute emergency department (ED) visit are low among inner-city children. We implemented a novel behavioral asthma intervention, Pediatric Asthma Alert (PAAL) intervention, to improve outpatient follow-up and preventive care for urban children with a recent ED visit for asthma.

Objective—The objective of this article is to describe the PAAL intervention and examine factors associated with intervention completers and noncompleters.

Methods—Children with persistent asthma and recurrent ED visits ($N = 300$) were enrolled in a randomized controlled trial of the PAAL intervention that included two home visits and a facilitated follow-up visit with the child's primary care provider (PCP). Children were categorized as intervention completers, that is, completed home and PCP visits compared with noncompleters, who completed at least one home visit but did not complete the PCP visit. Using chi-square test of independence, analysis of variance, and multiple logistic regression, the intervention completion status was examined by several sociodemographic, health, and caregiver psychological variables.

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Declaration of Interest

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of this article. This study was supported by the National Institute of Nursing Research, NIH (NR010546), and is registered with clinicaltrials.gov, registration number NCT00860418.

Results—Children were African-American (95%), Medicaid insured (91%), and young (aged 3–5 years, 56%). Overall, 71% of children randomized to the intervention successfully completed all home and PCP visits (completers). Factors significantly associated with completing the intervention included younger age (age 3–5 years: completers, 65.4%; noncompleters, 34.1%; $p < .001$) and having an asthma action plan in the home at baseline (completers: 40%; noncompleters: 21%; $p = .02$). In a logistic regression model, younger child age, having an asthma action plan, and lower caregiver daily asthma stress were significantly associated with successful completion of the intervention.

Conclusions—The majority of caregivers of high-risk children with asthma were successfully engaged in this home and PCP-based intervention. Caregivers of older children with asthma and those with high stress may need additional support for program completion. Further, the lack of an asthma action plan may be a marker of preexisting barriers to preventive care.

Keywords

asthma; children; controller medications; inner city; preventive care

Introduction

Asthma, the leading chronic illness in childhood, is the number one cause of emergency department (ED) visits in young children (1–4) and has a substantial impact on health-care costs (5–7). Low-income and minority children have the highest asthma morbidity (3), are the least likely to receive adequate preventive therapy (8–11), and are more frequently exposed to environmental triggers than non-poor children, resulting in acute exacerbations and increased ED use (12–16). Although the ED is often the point of contact for urban children with asthma for both acute and chronic asthma management (17), regular preventive care is the most effective way to establish long-term control of asthma and reduce morbidity (18, 19). Follow-up asthma care in a primary care provider (PCP) setting after an acute asthma exacerbation is central to the National Asthma Education and Prevention Program (NAEPP) national guidelines for asthma (20) and is recommended to occur within 4 weeks after an ED visit (20). However, follow-up rates with a PCP after an asthma ED visit among inner-city children are low, ranging from 20% to 64% (17, 21, 22). Bridging ED and primary care for asthma renews the link between the PCP and caregiver and provides the opportunity for reassessment of the asthma management plan, prescription or adjustment of controller medication, and education regarding asthma management and medication adherence (23).

Barriers to routine preventive asthma care among inner-city populations include lack of childcare and transportation, loss of motivation to bring the child to a visit when the child is asymptomatic, caregiver beliefs about asthma as an intermittent rather than a chronic disease, loss of work days, increased caregiver burden and depression (22–24), and stressful life events that reduce the priority for preventive asthma care (25). One consequence of poor preventive care is overuse of the ED (22). Several behavioral interventions including school-based screening, PCP prompting, or a parent web-based feedback intervention have shown modest improvement in preventive asthma care (17, 18, 26–28). Further, ED-based interventions have been designed to address barriers to preventive care with only modest improvement in rate of PCP follow-up (17, 18, 26). However, few of these studies describe characteristics of intervention completers and noncompleters or examine characteristics associated completion status.

We conducted a randomized controlled trial of a PCP–caregiver feedback intervention or the Pediatric Asthma Alert (PAAL) intervention delivered in the home and the PCP office that was designed to facilitate PCP follow-up, improve PCP/caregiver communication, and

subsequently improve overall preventive care in urban children with frequent asthma ED visits. The Chronic Care Model (CCM) (29) served as the conceptual framework for the intervention targeting the self-management support and community linkages elements of the model. This study has completed recruitment and intervention delivery and outcomes are currently being assessed. The objective of this randomized controlled trial was to determine the efficacy of a PCP and caregiver feedback behavioral intervention (PAAL) in decreasing symptom days and nights and ED visits in inner-city children with asthma. This article describes the child and caregiver characteristics that were associated with completers and noncompleters of the intervention. Completers were defined as the children randomized to the intervention and successfully completing all home and PCP visits and remaining families were considered noncompleters.

Methods

All participants were enrolled in a prospective, randomized controlled trial, received either a physician–caregiver feedback intervention or asthma education only (control group), and were followed over 12 months. Prior to study enrollment, the trial was approved by the Institutional Review Boards of the Johns Hopkins University Medical Institution and the University of Maryland, School of Medicine. Children were recruited from two urban pediatric hospital EDs from December 2008 to January 2010 by review of daily records of ED attendance. Through a Health Insurance Portability and Accountability Act (HIPAA) waiver, contact information was obtained from ED records and letters were sent to families of children with an asthma ED visit requesting permission to conduct a home visit to recruit participants. Families who did not decline to participate by returning a letter or calling to opt out were contacted by the study team.

Eligibility criteria were ages 3–10 years, physician diagnosed asthma, persistent asthma based on national guidelines (20), controller medication use during the prior 6 months, and two or more ED visits or one hospitalization during the prior 12 months of the index ED visit. After obtaining written informed consent from each child's primary caregiver and verbal assent from children over age 8 years, the Project Coordinator assigned children to the intervention or control groups using a series of numbered opaque envelopes that had been pre-randomized in blocks of two by child's age (3–5 vs. 6–10 years). All interviewers and research assistants were blinded to group assignment. Baseline interview and child saliva samples for cotinine analysis were collected during face-to-face caregiver interviews and pharmacy refill records were obtained for each child. Cotinine samples served as biomarkers of child secondhand smoke (SHS) exposure. Caregivers received \$30.00 payment for completion of the baseline survey.

Description of the Intervention Protocol

The PAAL intervention was developed based on the CCM (29) and patient centered care. The CCM is a primary care-based framework aimed at improving care of patients with chronic disease and is designed to foster interactions between informed health-care providers and motivated patients. This intervention encouraged productive PCP and caregiver interaction about preventive asthma care for the child by having a nurse (1) facilitate a follow-up visit for the child to the PCP, (2) provide feedback letters to the PCP and caregiver signed by an allergist and pediatrician to convey specific health information about the child's asthma, and (3) advocate for an anti-inflammatory prescription and asthma action plan during the clinic visit. The goal was to encourage PCPs to either initiate or adjust the dose of anti-inflammatory medications and sign an asthma action plan. Additionally, the nurse provided care-givers home education about asthma self-management targeting the use of preventive asthma medication, awareness of the child's exposures to asthma triggers, and importance of asthma preventive care visits.

PAAL Intervention—Families received two home visits by a trained nurse/health educator (nurse) for asthma education targeting asthma triggers, use of prescribed asthma medications, device training for peak flow meter and inhaler and spacer, completion of a written asthma action plan, and assistance in arranging a follow-up appointment with the child's PCP for preventive care. Additionally, the nurse accompanied the family to the PCP visit in order to deliver the feedback letter that was signed by the study pediatric allergist and pediatric primary care physician, and advocate for preventive care based on the health information in the feedback letter. In order to enhance child attendance to the PCP visit, bus tokens were provided to families who lacked transportation to the PCP office and several calls were made to remind the caregiver of the PCP visit.

Prior to the PCP visit, families were given a written letter that included specific information about their child's asthma and coaching on how to communicate with the child's PCP about their child's asthma health. Controller medication fills, based on pharmacy records collected at baseline, were represented in the letter by pictures indicating good or poor number of controller fills over the past 12 months. The letter was used by the nurse to teach caregivers regarding the appropriate use of controller medications and how to prevent overuse of rescue medication. The letter also included a graph depicting the child's cotinine level with brief tips on how to implement a total home smoking ban (Figure 1).

At the follow-up PCP visit, the nurse delivered a separate feedback letter to the child's health-care provider. This letter included information regarding the child's symptom frequency over the past 4 weeks, the number of ED visits and hospitalizations over the past 6 months, the level of asthma control, and the number of controller and rescue medication fills over the past 12 months and the child's cotinine level. Based on national guidelines (20), the intention of this health information was to provide concise recommendations for preventive care to the PCP. Delivering the letter to the PCP with the child's health information was the only provider component of the PAAL intervention (Figure 2). Prior to the PCP visit, all letters and recommendations were reviewed by a pediatric allergist (MB) and pediatric primary care physician (JH) and modifications to the recommendations were made if indicated. During the visit, the nurse was instructed to review the letter with the PCP and caregiver, and to highlight the recommendations and advocate for a prescription for controller medication or NAEPP guideline-based (20) step-up therapy when indicated and advise the PCP of any caregiver concerns that may interfere with controller medication use. Step-up therapy was carefully worded in the feedback letter with recommendations such as "You may want to consider a step up in inhaled steroid medication based on the frequency of daytime wheeze." The nurse suggested a step-up in therapy for any child currently using controller medications whose symptoms were poorly controlled. With parental permission and when the parent did not discuss medication use with the child's PCP, the nurse led a discussion with the PCP about initiating or adjusting anti-inflammatory medication for the child. Further, the nurse requested the PCP's completion and signature on the child's asthma action plan for use in the home and school. To promote fidelity of the intervention, 10% of home and clinic visits were supervised in person (AB, JK).

Measures at Baseline

Asthma Control and Health-Care Utilization—Asthma control was based on caregiver report of the number of symptom days and nights in the past 2 weeks, rescue medication use and activity limitation frequency over the past 30 days, and the number of ED visits and hospitalizations over the past 6 months based on national asthma guideline categories. We then categorized asthma control as well controlled, not well controlled (partial), or very poorly controlled (20). Limitation of activity over the past 4 weeks was measured using the Asthma Control Test (30) that employs a Likert scale of day categories

per month and then aligns the categories with national guidelines for asthma control, that is, completely controlled (0 days), well controlled (1–3 days), somewhat controlled (4–10 days), poorly controlled (11–18 days), and not controlled at all (>18 days). Number of school/daycare days missed and controller medication use were based on caregiver self-report of counts of days over the past 30 days. Reliability of self-reported medication use in adults with asthma is moderate to high based on comparison with medical record documentation (inhaled steroid use within 30 months: percent agreement of 87%, kappa: 0.7) (31).

Asthma Self-management Behavior—Asthma medication adherence was measured using the 5-item Medication Adherence Report Scale (MARS) (32). Using a 5-point Likert scale, caregivers report the frequency of forgetting, altering, missing, or stopping a dose of their child's asthma medication or administering less medication, ranging from 1 (very often) to 5 (never). Total scale scores range from 5 to 25; scores of 20 points or higher indicate "high" adherence (32). Children were categorized with high (MARS score > 20) versus moderate/low (MARS score < 20) adherence to medication. The scale has good reliability in adults with chronic illness (Cronbach's $\alpha = 0.60\text{--}0.83$) (32), adults with asthma (33), and parents of children with asthma (Cronbach's $\alpha = 0.78$) (34). Spacer and peak flow meter use and the presence of an asthma action plan at home were based on caregiver report.

Caregiver Depressive Symptoms—The Center for Epidemiologic Studies Depression Scale (CES-D) (35) was used to measure caregiver depressive symptomatology. The 20-item CES-D 20 determines the frequency of a variety of depressive symptoms experienced by the caregiver over the past week. Scores range from 0 to 60, with higher scores indicating greater symptomatology. A threshold of >16 has been used to indicate detection of moderate depressive symptomatology and >24 for detection of severe symptomatology in minority women populations (36–38). CES-D scores >16 were used in this study to indicate clinically significant depressive symptomatology. Reliability for the CES-D was acceptable with Cronbach's α of 0.74.

Caregiver Stress—Caregiver daily life and daily asthma stress over the past month were measured using a visual analog scale (VAS). Anchors included "0," defined as no stress at all, and "10," reflecting the highest level of stress. Caregivers were asked to select the number between 0 and 10 to indicate their level of routine daily life and daily asthma stress. Daily asthma stress was defined as the level of stress related to asthma care for their child. Previous validity of VASs indicated moderate correlations with objective measures of pain ($r = 0.88\text{--}0.98$) (39). Correlation between daily and asthma stress at baseline was moderate (Pearson $r = 0.40$, $p < .0001$).

SHS and Indoor Pest Exposures—Child saliva samples were collected at baseline for cotinine analysis as a bio-marker of SHS exposure over the prior 24 hours. Two small sorbettes with mini sponges (size of a small Q-tip) were placed under the child's tongue and then inserted in a small microcontainer and stored at -20°C . All samples were analyzed at Salimetrics Laboratory, State College, PA, USA, using enzyme immunoassay (EIA) analysis. The lower limit of cotinine sensitivity was 0.05 ng/ml and average intra- and inter-assay coefficients of variation were less than 5.8% and 7.9%, respectively. We used 1.0 ng/ml as the cutoff point to define SHS exposure based on prior studies of comparable participants (40). Caregiver report of cockroach, mice, and furred pets in the home were recorded systematically as part of the standardized home environment survey.

Communication Content of PCP Visit Recorded by the Nurse—A checklist of communication content items observed by the nurse during the PCP visit was completed at

the end of the PCP visit. Items ascertained “Yes” or “No” to if (1) the parent talked with the PCP about child’s symptoms, (2) the parent discussed what medicines the child was taking, (3) the parent and PCP agreed on asthma action plan, (4) the nurse discussed the feedback letter with PCP, and (5) if the nurse/health educator asked the PCP to review and sign the asthma action plan.

Statistical Analysis

We limited the analysis to children assigned to the intervention arm of the study ($n = 151$). Standard frequencies were used to describe demographic and health-related baseline variables for children in the intervention group. Baseline demographic data were examined by intervention completion status. Intervention completers ($n = 107$) were defined as completing at least one nurse home visit and the follow-up PCP visit, the remaining subjects were defined as non-completers ($n = 44$). Several child and caregiver characteristics were examined by intervention completion status using chi-square test of independence for categorical variables and t -test and analysis of variance for continuous variables. Logistic regression models were used to predict intervention completers adjusting for baseline characteristics of child age, medication adherence, caregiver depressive symptoms, daily asthma stress, having an asthma action plan, and controller medication use. Two-sided tests were used and p values $< .05$ were considered statistically significant. All analyses were conducted using procedures in SAS V.9.0 (41) and SPSS Version 19 (42) software.

Results

Baseline Characteristics for All Intervention Children

We identified 1630 children who attended a pediatric ED for asthma; however, 1081 (66%) had incorrect contact information (Figure 3). Of the remaining 549 children, 121 were ineligible and 128 refused participation resulting in 300 (70%) eligible children enrolled and randomized. Anecdotally, the primary reasons for refusal to participate were lack of interest and/or time for participation in a research study. Children were primarily male (61%), African-American (95%), Medicaid insured (91%), and over half were aged 3–5 years (Table 1). Most caregivers were the child’s biological mother (93%), achieved at least a high school education (72%), and were unmarried (56%). Overall, caregiver daily life stress levels were high (mean: 6.1, SD 3.0), but somewhat lower for daily asthma stress (mean: 4.6, SD 3.8). Clinically significant depressive symptomatology was noted in 33% of all caregivers. Depressive symptoms (CES-D) and stress scores were moderately correlated (daily life stress and CES-D, $r = 0.58$, $p < .0001$; daily asthma stress and CES-D, $r = 0.25$, $r = < 0.0001$).

Asthma morbidity was moderate with a mean of 9.7 (SD 4.7) symptom-free days and 10.6 (SD 4.3) symptom-free nights out of 14 days. Mean ED visits over past 6 months were high (mean: 3.3 (SD 3.3) visits); mean preventive care visits were 2.8 visits over the same time period. When assessing self-reported preventive asthma self-management behavior, we found that most caregivers (76%) reported their child used controller medication and 81% reported high medication adherence. However, only 34% of children had an asthma action plan in the home. SHS exposure was prevalent with over half (56%) of the children residing with at least one smoker in the home and 60% of caregivers were the primary smoker in the home. More than half of families (57%) reported exposure to mice in the home and 28% reported exposure to cockroach.

Intervention Completion

Out of the 151 children randomized to the intervention group, 71% ($n = 107$) completed at least one home visit and the PCP clinic visit (completers) and 44 (29%) completed home

visits only without any PCP clinic visit (non-completers). Almost all (98%) received at least one home visit regardless of PCP clinic visit completion, with 87% completing the intended two home visits. Home visits were conducted during the day, evening, and weekends. A mean of eight contacts, including phone and drive-by visits, were required to complete the home and PCP visits (mean contacts: 8.26, SD 3.5).

Analysis of the communication content checklists for the PCP visit indicated that at the time of a visit, most parents discussed the frequency of the child's symptoms (79%), the child's current asthma medications (72%), and agreed with the PCP on an asthma action plan (74%). During almost three-quarters (73%) of visits, the PCP reviewed and signed the asthma action plan. The nurse completed a review of the feedback letter with the PCP less often (60% of visits); nonreview was primarily due to time restraints of the PCP visit.

For noncompleters, the nurse systematically tracked barriers that likely inhibited the caregiver's ability to complete the PCP visit. These barriers included stressful life events in that family, such as hospitalization or death of a family member and family mental health and substance abuse issues, lapses in health insurance coverage, and scheduling difficulties including conflicts with the child needing to attend school and with the caregiver's work schedule and reluctance to attend the PCP visits due to caregiver's lack of belief in preventive asthma care.

Health and Caregiver Psychosocial Characteristics of Intervention Completers Versus Noncompleters

There were no differences at baseline between the intervention completers and noncompleters, with the exception of a significantly higher proportion of younger age children among completers (child age 3–5 years: completers: 65.4%; noncompleters: 34.1%, $p < .001$) and a higher number of completer families reporting the use of an asthma action plan at baseline (completers: 40%; noncompleters: 21%; $p = .02$; Table 1). There were no differences noted in all other baseline sociodemographic, child health, and self-management behavior or indoor SHS or pest exposure characteristics between groups. Controller medication use over the last 6 months was reported by three-quarters of the children, yet the mean number of ED visits over the same time period was high (3.25 visits, SD 3.3), indicating poorly controlled asthma. Caregiver daily stress was moderate at a mean score of 6 out of 10 with no difference between completers and noncompleters. Indoor environmental exposures were high with over half (56%) of children residing with a smoker or having mice in the home (57%) and over one-quarter exposed to cockroaches (28%).

Multivariate Analysis of Factors Associated with Completion of Intervention (INT) Visits

Several multivariate models were analyzed based on univariate analysis and theoretical considerations for predicting intervention completion status. Based on the results of preliminary models, a final multiple logistic model was created using child's age, asthma action plan in the home, medication adherence, caregiver depression and stress, controller medication use, caregiver education level, cockroach and mice home exposure, and caregiver smoking status to assess their independent effects on completion status. In the final logistic regression model, younger children age of 3–5 years (OR: 4.71, 95% CI: 2.07, 10.73), having an asthma action plan at baseline (OR: 3.0, 95% CI: 1.2, 7.5) and lower daily asthma stress (OR 0.89, 95% CI: 0.79, 1.0), were significantly associated with caregivers and children who successfully completed the intervention, while adjusting for medication adherence, caregiver depression level, and controller medication use (2).

Discussion

Overall, we demonstrated a high completion rate for a complex feedback behavioral intervention that resulted in the majority of subjects successfully attending a PCP follow-up visit and discussing guideline-based preventive asthma care. The intervention was based on the CCM (29) to enhance preventive care following an asthma ED visits by communicating individualized clinical information to the child's PCP with guideline-based recommendations, provide caregivers self-management support, and facilitate proactive PCP and caregiver communication during a follow-up clinic visit. The individualized clinical data and specific recommendations provided to the PCP were designed to prompt initiation or adjustment of anti-inflammatory medication based on similar successful feedback interventions (27, 43). The PCP was asked to review and sign an asthma action plan at the visit, likely accounting for the high rate of caregiver report of discussion about asthma symptoms and medication and agreement with the asthma action plan instructions.

Our 71% PCP visit completion rate exceeds the 20–64% rate found in prior ED follow-up intervention studies with comparable populations (17, 18, 21, 22, 44, 45), or the 57% rate of high-engagement noted in a web-based asthma management intervention (28). In the multi-city National Cooperative Inner-City Asthma Study (NCICAS), only half (52%) of enrolled children completed a PCP follow-up visit despite an intensive social worker and asthma education intervention targeting a comparable population as in our study (46, 47). Our 71% follow-up rate is more consistent with rates reported in ED interventions that scheduled a primary care appointment during the ED visit (64%) (17), or provided transportation vouchers and reminder calls for follow-up visits (65%) (18), or a onetime ED follow-up visit for asthma education/management (71%) (26). Despite this high completion rate, it is concerning that one out of four children did not attend a scheduled PCP appointment. High engagement in a pediatric web-based asthma intervention was associated with increased controller medication use and medication adherence (28) in contrast to our data, indicating no difference in controller medication use or medication adherence between completers and noncompleters. Failure to complete the PCP visit resulted in a missed opportunity for the nurse to advocate for the PCP to start or step up controller medication and to counsel the caregivers of children residing with a smoker to institute a total home smoking ban.

Several challenges in implementing the intervention warrant comment. First, many inner-city families experience barriers to accomplishing preventive care visits. Younger children were significantly more likely to attend the PCP follow-up visits than older children, possibly due to competing obligations of older children in school that impeded attending a PCP appointment for preventive care. Alternately, caregivers may be more concerned about recurrent symptoms and exacerbations in younger children who are less able to communicate their asthma symptoms and need for medication compared with older children or allowing older children to self-manage their asthma. We standardized the intervention protocol for caregivers across age groups without using a distinct protocol for older children. Second, lack of child care, transportation costs, or caregiver fear of missing work or school may have influenced the caregiver's ability to complete the PCP visit. Although we subsidized transportation costs with bus tokens, this may have been insufficient to overcome barriers to attendance at the PCP visit for some families. Most children (91%) had medical assistance health insurance coverage; thus, health-care insurance should not have been a barrier to access to care. Third, caregiver asthma stress was lower in the group of children who completed PCP visits, suggesting non-completers may be more psychologically distressed. Alarming, the overall rate of reported general life stress in this sample was high and consistent with prior studies in comparable populations (48, 49). The presence of psychological stress may compromise the caregiver's ability to recognize their child's symptoms, weaken their problem-solving skills, and leave the caregiver feeling

overwhelmed to perform essential asthma self-management behaviors (50) or divert attention and resources away from the child (51). Caregiver depression did not independently predict completion status, in contrast to a study of adults enrolled in a behavioral medical symptom reduction program that reported lower depression scores were associated with higher completion rates (52), and pre-existing depression associated with failure to complete treatment for hepatitis C disease (53). Stresses associated with residing in the inner city (e.g., housing and utilities instability, exposure to community violence, and poverty) increase caregiver stress and may outweigh their perception of need for preventive asthma care.

Understanding factors associated with study completion may help identify modifiable factors to improve completion rates and clinical outcomes. In our study, having an asthma action plan in the home at baseline was associated with completing the intervention and attending the PCP visit. The presence of an action plan indicates a previous connection to preventive care that may make follow-up with PCP more likely. Further, having an asthma action plan may serve as a reminder of the need for asthma follow-up. This is consistent with a recent study, finding substantially higher medical follow-up after an asthma ED visit in children who received an asthma action plan and a prescription for controller medication in the ED (54). Interestingly, frequency of day and night symptoms was not independent predictors of intervention completion, suggesting that intervention completion is not substantially different by asthma severity or asthma control.

Prior to the PCP visit, the intervention involved home visits and almost all children completed this component of the intervention. The home may be the ideal location to teach asthma self-management, that is, appropriate controller medication use or inhaler device technique in the context of the child's own environment and particularly for older children. While home visits can be more time-intensive, they may be more favorable to families with high stress because they reduce structural barriers to care such as transportation or family disorganization. For the guideline-based care to be achieved, the family must have a strong link to the PCP for medication and symptom management (27). Alternate methods to assure access to PCP follow-up could include nurse-staffed call centers for nonacute asthma decisions (55), community or school-based asthma care (56), or the use of technology such as telemedicine to make appropriate preventive health care more accessible to high-risk populations.

Several lessons were learned from implementing this complex behavioral intervention. First, caregivers of older children may need further attention and require more accessible and flexible appointments after school hours to accomplish preventive care visits and not compete with school demands. Second, caregivers with high stress represent a particularly high-risk group for inadequate follow-up care. These caregivers should be identified and would benefit from referral to appropriate mental health and asthma care resources pre-intervention. Third, the lack of an asthma action plan in the home may be a marker of poor access to preventive care and indicates the need for increased monitoring of follow-up. Last, new models of care for frequent ED utilizers should be considered, such as a short ED follow-up visit within 1 week after an ED asthma visit to transition high-risk children from an acute to primary care setting.

There are several limitations to this study that should be considered. First, we did not specifically collect data regarding the reasons for non-attendance of PCP visits. Second, we did not collect or examine PCP characteristics, that is, provider age, years in practice, type of practice, and communication style, that may influence caregiver decision to engage in preventive care and complete the intervention versus only seeking emergency care. Finally, findings from this study can only be generalized to similar high-risk populations. We

purposely recruited high-risk children with frequent ED visits to maximize our chances to determine effectiveness of our intervention when all outcome data are available.

Conclusions

In conclusion, a PCP–caregiver feedback behavioral intervention for high-risk children with asthma was successfully delivered to 71% of assigned families. Completion of the intervention was associated with younger child age, having an asthma action plan and lower caregiver stress related to daily care of their child with asthma. Further research will be necessary to identify modifiable factors that could facilitate full participation in behavioral interventions in order to optimize the potential for improved outcomes.

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Dear Parent,

This is a summary of the amount of medicine John filled for his asthma in the past year.

May	June	July	August	September	October
Controller Medicine Flovent 🤢	Controller Medicine Flovent 🤢	Controller Medicine Flovent 🤢	Controller Medicine Flovent 🤢	Controller Medicine Flovent 🤢	Controller Medicine Flovent 🤢
Rescue Medicine 1 Prednisone 1 Albuterol MDI					Rescue Medicine 1 Prednisolone
November	December 2009	January 2010	February	March	April
Controller Medicine Flovent 🤢	Controller Medicine Flovent 😊	Controller Medicine Flovent 🤢	Controller Medicine Flovent 🤢	Controller Medicine Flovent 🤢	Controller Medicine Flovent 🤢
	Rescue Medicine 1 Albuterol Neb 1 Albuterol MDI			Rescue Medicine 1 Prednisolone

= Filled medicine that month/Very Good

= Did not fill medicine/ Try to do better

Rescue Medicine: In the past year, you have filled 3 Albuterol refills (total number of albuterol refills) for your child.

Controller Medicine: Most kids need Flovent everyday and therefore, this medicine needs to be filled each month. In the past year you had 1 refill of Flovent.

*Adapted from Halterman JS .

Your child's cotinine level was 2.07 ng/ml. This means that he was around a high level of smoke.

- ☐ Ask people to smoke outside of your home away from your child.
- ☐ Call the Maryland Smoking Quitline at 1-800-784-8669
- ☐ Post "No Smoking" signs in your home.

Figure 1.
Caregiver letter.

Dr. Smith
200 N. Wolfe St
Baltimore, MD 21287

Dear Dr. Smith,

Your patient, John Mitchell, has enrolled in an asthma study that provides you with health information about John. We have enclosed a summary of his pharmacy refills for the past 6 months. Based only on the data available to the nurse here is a summary of his asthma health data from 5/21/10.

Parent and Nurse Report

Symptoms in the last 4 weeks: 1-3 days, 1-3 nights woke up, everyday limited play

ED visits in last 6 months: 6 (last visit 5/2010)

Hospitalizations in last 6 months: 0

MDI Technique: ☐Excellent ☐Good ☒Fair ☐Poor

Spacer use ☒Yes ☐No

Asthma Control: ☐ Well controlled
☐ Not well controlled
☒ Very poorly controlled

Pharmacy Report

Long term controller medication refills last 12 months: Flovent 110 mcg 1 refill

Quick Relief Medication refills last 12 months: Albuterol MDI 0 refills
Albuterol Neb 0 refills
Prednisolone 0 refills

You may want to consider:

1. Consider stepping up the dose of inhaled corticosteroid therapy due to frequent ED visits.
2. Discuss John's high exposure to second hand smoke as indicated by his very high cotinine results. **Strongly encourage a total home smoking ban for the household.**
3. Encourage John to receive his flu immunization.
4. Review his inhaler + spacer technique.
5. Monitor John's asthma symptoms every month until his asthma is well controlled.

These suggestions are based on the National Asthma Education and Prevention Program 2007 guidelines at <http://www.nhlbi.nih.gov/guidelines/asthma/index.htm>

If you have any questions about our recommendations or this study please feel free to call us.

The Pediatric Asthma Advocate Leader Study Team

Arlene Butz, RN, ScD 410-614-5963
Principal Investigator-Nurse

Dr. Bollinger 410-706-2443
Pediatric Allergist

Your patient's cotinine level was 4.2 ng/ml. This means that John was exposed to cigarette smoke.

Q. What is Cotinine?

A. Cotinine is a chemical that is made by the body from nicotine. Since nicotine enters the body with cigarette smoke, cotinine measurements can show how much cigarette smoke someone has been exposed to and has entered their body. Currently cotinine is regarded as the best biomarker for exposure of nonsmokers to environmental tobacco smoke.

Q. What are typical cotinine levels? How do I interpret the results?

A. People who do not smoke or who are not exposed to other people's smoke should have no measurable cotinine in their saliva. In children, cotinine levels of 0.5 ng/ml or less show very little to no exposure to cigarette smoke. Levels above 0.5 ng/ml are associated with passive smoke exposure.

Q. How long can cotinine be detected in the body?

A. Cotinine is typically detectable for 24-48 hours in saliva.

Figure 2.

Physician/health-care provider feedback letter.

Figure 3.
Progress of participants through trial (flow diagram).

Table 1

Sociodemographic, health, and caregiver psychosocial characteristics by group (INT vs. INT-No PCP visit) at baseline. $N = 151$.

	INT-completers, <i>N</i> = 107, <i>N</i> (%)	INT-noncompleters, <i>N</i> = 44, <i>N</i> (%)	Total <i>N</i> = 151, <i>N</i> (%)	Statistic
Baseline characteristics				
Sociodemographic and caregiver psychosocial characteristics				
Child age				
3–5 years	70 (65.4)	15 (34.1)	85 (56.3)	$X(2) = 12.4, df = 1, p < .001$
6–10 years	37 (34.6)	29 (65.9)	66 (43.7)	
Child gender				
Male	68 (63.6)	24 (54.5)	92 (60.9)	$X(2) = 1.06, df = 1, p = .30$
Race/ethnicity				
African-American	102 (95.3)	41 (93.2)	143 (94.7)	$X(2) = 5.73, df = 3, p = .13$
Hispanic/Latino	2 (1.9)	0 (0.0)	2 (1.3)	
White	1 (0.9)	3 (6.8)	4 (2.7)	
Other	2 (1.9)	0 (0.0)	2 (1.3)	
Health insurance type				
Medicaid	99 (92.5)	38 (86.4)	137 (90.7)	$X(2) = 2.36, df = 2, p = .31$
Private	7 (6.5)	6 (13.6)	13 (8.6)	
Self-pay	1 (1.0)	0 (0.0)	1 (0.7)	
Caregiver				
Biological mother	102 (95.3)	38 (86.5)	140 (92.7)	$X(2) = 6.26, df = 3, p = .10$
Biological father	0 (0.0)	2 (4.5)	2 (1.3)	
Grandmother	3 (2.8)	2 (4.5)	5 (3.3)	
Legal guardian/stepfather	2 (1.9)	2 (4.5)	4 (2.7)	
Caregiver age				
Mean (SD)	33.62 (8.8)	34.22 (10.1)	33.90 (9.6)	$F = .08, p = .92$
Caregiver education				
<High school	28 (26.2)	14 (31.8)	42 (27.8)	$X(2) = 0.49, df = 2, p = .78$
High School Grad or General Education Development (GED)	42 (39.3)	16 (36.4)	58 (38.4)	
Some college/college grad	37 (34.5)	14 (31.8)	51 (33.8)	
Marital status				

	INT-completers, <i>N</i> = 107, <i>N</i> (%)	INT-noncompleters, <i>N</i> = 44, <i>N</i> (%)	Total <i>N</i> = 151, <i>N</i> (%)	Statistic
Baseline characteristics				
Single	62 (58.5)	22 (51.2)	84 (56.4)	$\chi^2(2) = 0.67, df = 1, p = .41$
Married	44 (41.5)	21 (48.8)	65 (43.6)	
CES-D > 16	34 (32.1)	15 (34.1)	49 (32.7)	$\chi^2(2) = 0.066, df = 1, p = .81$
Caregiver daily life stress				
Mean (SD)	6.00 (3.1)	6.20 (2.6)	6.06 (3.0)	$F = 0.14, p = .70$
Caregiver daily asthma stress				
Mean (SD)	4.25 (3.8)	5.28 (3.7)	4.55 (3.8)	$F = 2.24, p = .14$
Child health characteristics				
Symptom-free days				
Mean (SD)	9.90 (4.5)	9.18 (5.1)	9.70 (4.7)	$F = 0.69, p = .41$
Symptom-free nights				
Mean (SD)	10.57 (4.4)	10.53 (4.1)	10.56 (4.3)	$F = 0.00, p = .95$
Number of ED visits past 6 months				
Mean (SD)	3.15 (3.0)	3.51 (3.9)	3.25 (3.3)	$F = 0.38, p = .54$
Asthma control past 4 weeks				
YES	56 (52.3)	27 (61.4)	83 (55.0)	$\chi^2(2) = 2.44, df = 1, p = .30$
ED visits for asthma past 6 months				
Mean (SD)	3.15 (3.0)	3.51 (4.0)	3.25 (3.3)	$F = 0.38, p = .54$
Hospitalized for asthma past 6 months				
0	76 (71.7)	34 (77.3)	110 (73.3)	$\chi^2(2) = 0.49, df = 1, p = .48$
1 or more	30 (28.3)	10 (22.7)	40 (26.7)	
Routine preventive asthma care visits past 6 months				
Mean (SD)	2.81 (2.9)	2.66 (2.9)	2.77 (2.9)	$F = 0.09, p = .77$
Self-management behavior				
Controller medication use last 6 months (caregiver report)				
Yes	83 (77.6)	31 (70.45)	114 (75.5)	$\chi^2(2) = 0.85, df = 1, p = .36$
Medication adherence				
High	89 (83.2)	33 (75.0)	122 (80.8)	$\chi^2(2) = 1.34, df = 1, p = .25$
Moderate/low	18 (16.8)	11 (25.0)	29 (19.2)	
Asthma action plan in home				

	INT-completers, <i>N</i> = 107, <i>N</i> (%)	INT-noncompleters, <i>N</i> = 44, <i>N</i> (%)	Total <i>N</i> = 151, <i>N</i> (%)	Statistic
Baseline characteristics				
YES	41 (39.8)	9 (20.5)	50 (34.0)	$\chi^2(2) = 5.14, df = 1, p = .02$
Home SHS and other indoor exposures				
Smoker in the home				
Yes	62 (57.9)	23 (52.3)	85 (56.3)	$\chi^2(2) = 0.41, df = 1, p = .55$
Caregiver smoker in the home (<i>N</i> = 85 smokers)				
Yes	36 (58.1)	15 (65.2)	51 (60.0)	$\chi^2(2) = 0.36,$
Child cotinine level				
Mean (SD)	2.96 (4.1)	2.40 (2.86)	2.80 (3.82)	$F = 0.62, p = .43$
Cockroaches in home				
YES	29 (27.4)	13 (29.6)	42 (28.0)	$\chi^2(2) = 0.07, df = 1, p = .79$
Mice in home				
YES	60 (56.1)	25 (56.8)	85 (56.7)	$\chi^2(2) = 0.0006, df = 1, p = .98$

Note: SHS, secondhand smoke.

Table 2

Logistic regression model predicting intervention group completers (attended PCP visit).

Baseline characteristic	OR (95% CI)	
Child age group		
3–5 years	0.77	4.71 (2.07, 10.73)
6–10 years	Ref	$p = .0002$
Asthma action plan in the home		3.0 (1.2, 7.5)
YES	0.55	$p = .02$
Daily asthma stress level (mean)		0.89 (0.79, 1.001)
	–0.11	$p = .05$
Medication adherence		
High	0.13	1.30 (0.49, 3.47)
Moderate/low	Ref	$p = .60$
CES-D at baseline (mean)		1.02 (0.98, 1.06)
	0.017	$p = .38$
Controller medication use (caregiver report)		0.88 (0.36, 2.11)
Yes	0.07	$p = .77$

Note: Likelihood ratio chi-square = 23.42, df = 6, $p = .0007$