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Title

Impact of physician asthma care education on patient outcomes.

Permalink

<https://escholarship.org/uc/item/7qf5f0nm>

Journal

Pediatrics, 117(6)

ISSN

0031-4005

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Publication Date

2006-06-01

Peer reviewed

Impact of Physician Asthma Care Education on Patient Outcomes

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The authors have indicated they have no financial relationships relevant to this article to disclose.

ABSTRACT

OBJECTIVE. We evaluated the effectiveness of a continuing medical education program, Physician Asthma Care Education, in improving pediatricians' asthma therapeutic and communication skills and patients' health care utilization for asthma.

METHODS. We conducted a randomized trial in 10 regions in the United States. Primary care providers were recruited and randomly assigned by site to receive the program provided by local faculty. The program included 2 interactive seminar sessions (2.5 hours each) that reviewed national asthma guidelines, communication skills, and key educational messages. Format included short lectures, case discussions, and a video modeling communication techniques. We collected information on parent perceptions of physicians' communication, the child's asthma symptoms, and patients' asthma health care utilization. We used multivariate regression models to determine differences between control and intervention groups.

RESULTS. A total of 101 primary care providers and a random sample of 870 of their asthma patients participated. After 1 year, we completed follow-up telephone interviews with the parents of 731 of the 870 patients. Compared to control subjects, parents reported that physicians in the intervention group were more likely to inquire about patients' concerns about asthma, encourage patients to be physically active, and set goals for successful treatment. Patients of physicians that attended the program had a greater decrease in days limited by asthma symptoms (8.5 vs 15.6 days), as well as decreased emergency department asthma visits (0.30 vs 0.55 visits per year).

CONCLUSIONS. The Physician Asthma Care Education program was used in a range of locations and was effective in improving parent-reported provider communication skills, the number of days affected by asthma symptoms, and asthma health care use. Patients with more frequent asthma symptoms and higher health care utilization at baseline were more likely to benefit from their physician's participation in the program.

www.pediatrics.org/cgi/doi/10.1542/peds.2005-1055

doi:10.1542/peds.2005-1055

Key Words

asthma knowledge, pediatric providers, educational intervention

Abbreviations

CME—continuing medication education

ED—emergency department

PACE—Physician Asthma Care Education

IQR—interquartile range

OR—odds ratio

CI—confidence interval

Accepted for publication Nov 15, 2005

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ALTHOUGH FEW MODELS of continuing medical education (CME) have been evaluated rigorously regarding outcomes for patients,¹ some studies have shown that well-designed CME can have a significant effect on patients' health status and/or health care utilization.^{2,3} Given the increasing national priority placed on translational research,⁴ an important question concerning successful CME models is whether they can be replicated in new venues with different instructors and thus be applicable for widespread use.⁵

In earlier work,^{2,3} we reported on an efficacy trial of an innovative seminar in 2 communities that was designed to enhance pediatricians' asthma-related therapeutic and communication skills. Results showed improved communication skills and use of written asthma action plans. In addition, patients who had high levels of baseline asthma health care utilization and whose physicians provided education and prescribed anti-inflammatory medications had decreased asthma-related emergency department (ED) visits and hospitalizations compared with patients whose physicians only prescribed appropriate medications.^{2,3}

We now report on a separate effectiveness trial of the interactive seminar, the Physician Asthma Care Education (PACE) program. The purpose was to determine whether local faculty throughout the United States could use the model program and generate similar results. This article provides the 1-year follow-up results from this effectiveness trial.

METHODS

Using a randomized, controlled design, we evaluated the PACE program for pediatric primary care providers in 10 cities around the United States as provided by local faculty. We measured changes in physician attitudes, practices, and patient outcomes related to asthma. The institutional review board of the University of Michigan approved the study protocol.

Physicians

Using yellow-page listings and membership lists from local professional societies and asthma coalitions, we targeted our recruitment at pediatricians from 10 different regions. The regions included Corpus Christi, TX; Fresno/Bakersfield, CA; Nashville, TN; Jacksonville, FL; Omaha, NE; St Paul, MN; Kent County, MI; New Castle County, DE; Columbus, OH; and Indianapolis, IN. During a 4-month period, up to 3 letters and brochures were sent to primary care providers to invite them to participate in the study.

The providers had to be involved in direct primary care for children, be able to provide a registry of their patients with asthma, and be willing to take part in the educational seminar if randomly assigned to the treatment group. We targeted our recruitment to pediatricians, in general, and contacted 1219 primary care pro-

viders. A total of 101 (8%) of the 1219 primary care providers (99 pediatricians, 1 family physician, and 1 nurse practitioner) agreed to participate.

Although the participants were a convenience sample and not necessarily representative of all practicing primary care providers, they were likely to be similar to other clinicians who would avail themselves of continuing education and who would be open to participation in practice-based research. The clinicians were told that the purpose of the study was to evaluate the effectiveness of a physician asthma educational seminar in improving asthma outcomes. Participating clinicians received 5 CME credits for attending the program, a certificate, and \$50.00 honorarium per year for participating in the study.

Randomization

Because physicians who are exposed to the intervention might disseminate new information to other physicians, we randomized by site versus randomizing by physician to prevent the possibility of contamination. We matched each of the 10 sites into 5 similar pairs on the basis of population, asthma prevalence, percentage of the population that is Hispanic and/or black, climate, and managed care penetration in the health care market. Within each pair, using a coin toss, we randomly selected 1 site as a control and 1 site for the intervention.

Patient Sample

To be eligible for the study, children met the following criteria: a diagnosis of asthma; between 2 and 12 years of age; a patient of a study physician; and no other diseases associated with pulmonary complications, such as tuberculosis, sickle cell disease, or cystic fibrosis. We excluded children who were younger than 2 years, because the diagnosis of asthma can be difficult to establish before this age. Participation was limited to children with active asthma. Active asthma was defined as a patient with at least 1 hospitalization, ED visit, or emergent office visit for asthma within the previous 2 years. An emergent visit was defined as any visit for asthma that required the administration of epinephrine subcutaneously or a β_2 -agonist bronchodilator for nondiagnostic purposes.

Each study physician provided a list of their pediatric asthma patients. From these lists, we developed a registry of 3368 patients. On the basis of previous experience from similar studies,^{2,3} we assumed that only 40% of patients would both be eligible and consent for participation. From the 3368 patients, using a random-number generator, we randomly selected 2300 patients (only 1 child per family) to be contacted to recruit a final sample of ~1000 patients.

Figure 1 describes the patient assignment and flow. A total of 882 patients were not eligible. Reasons for ineligibility included no diagnosis of asthma ($n = 140$), no visit for asthma in the previous 2 years ($n = 225$), no

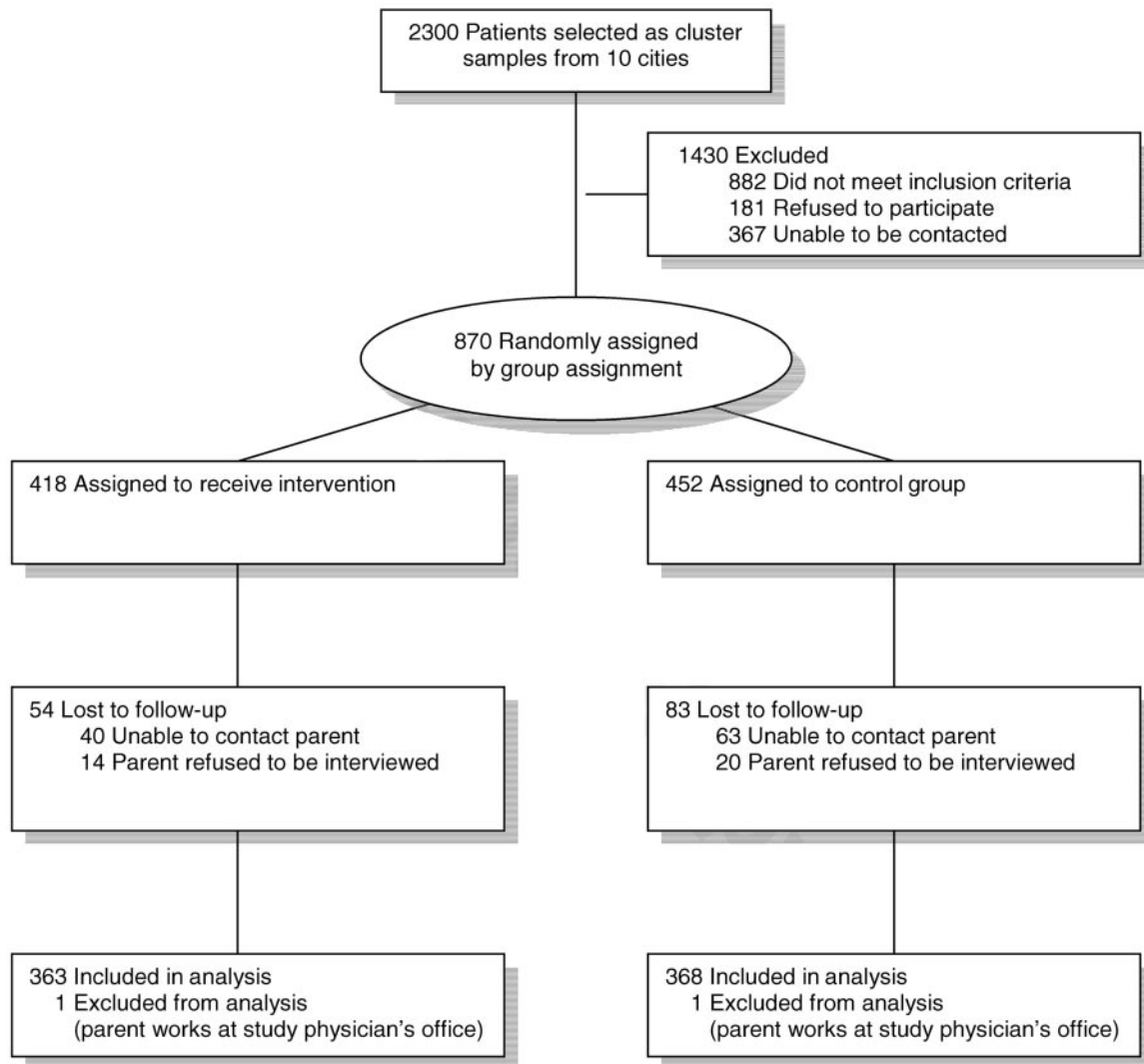


FIGURE 1
Profile of patient enrollment and assignment.

visit with the study physician ($n = 139$), not between 2 and 12 years of age ($n = 153$), parent works for study physician ($n = 5$), sibling of current study patient ($n = 3$), other major disease ($n = 3$), and a combination of the above ($n = 214$).

Between July 2001 and June 2002, we completed baseline interviews with the parents of 870 of the 1418 potentially eligible patients (61% response rate). One-year follow-up was completed with 731 of 870 parents (84% response rate).

The patients comprise a random sample of children from the practices of 101 clinicians (48 control and 53 intervention) who participated in the study. The median number of patients for each provider was 7 (interquartile range [IQR]: 4–12). Patients and their parents were blind to physicians' involvement in the intervention. Physicians were blinded to which patients were selected for the survey.

Intervention

Faculty Training

In each of the 5 intervention cities, a primary care pediatrician, pediatric subspecialist (board-certified pulmonologist or allergist), and behavioral scientist/health educator were invited to become the PACE faculty team in their area. The leaders were identified through local institutions and organizations, including children's hospitals, professional groups, and medical societies. Each team received a 1-day training in the model that included a run-through of the program, identification of tasks, suggestions for successful implementation, and teaching materials.

Subsequently, the 5 teams conducted training for the study physicians in their communities. Control community physicians received training once collection of evaluation data was completed.

Training Primary Care Physicians

The theory and details of the educational intervention have been described in previous publications.^{2,3,6} Briefly, the intervention consisted of interactive seminar sessions to review asthma guidelines, specific communication techniques, and key asthma educational messages. Instructional methods included a standardized lecture on clinical practice guidelines from a local pediatric pulmonologist or an allergist, a video depicting effective clinician teaching and communication behavior, case studies presenting troublesome clinical problems, a protocol for patient communication self-assessment, examples of long-term asthma action plans, and a review of topics to cover and materials to use when teaching patients. These topics are what happens in an asthma attack, how medicines work, responding to changes in asthma severity, how to take medicines, safety of medicines, goals of therapy, criteria of successful treatment, managing asthma at school, and identifying and avoiding triggers.

The program was updated from the original study to include information from the 1997 National Heart, Lung, and Blood Institute asthma guidelines. Furthermore, because 1 of the barriers for physician counseling is the perceived lack of reimbursement for counseling,⁷ additional content for proper asthma documentation, coding, and reimbursement was added.

The seminar consists of 2 face-to-face group meetings that last ~2.5 hours each and are held during a 1-week period. The intervening days between sessions give participants an opportunity to try new skills that are introduced in the first session. The time frame and format were designed to be similar to conventional CME programs that are provided by professional societies and health care facilities so that it could fit easily into postgraduate CME systems.

Data Collection

All parents were interviewed by telephone at baseline (before the seminar date) and 1 year after the seminar. Trained interviewers contacted the households to administer the questionnaires in a standardized manner. Before the telephone contact, the participating pediatricians sent a letter that explained the study to each household of potential study participants. Parents of patients could contact the physician's office to have their names removed from the list of potential participants.

Consent was obtained from the parent or legal guardian. The interview was conducted in English. An interviewee was the person that "is usually responsible for the child's health-related care and takes him/her to the doctor."

To assess changes in physician practice and opinions, physicians completed a self-administered mailed survey before and 12 months after the educational intervention. Of the 101 physicians, 94 returned baseline ques-

tionnaires (94% response rate) and 76 (76%) returned questionnaires for the 1-year follow-up.

Variables

We measured changes in physician self-efficacy, physician communication practices, patient health status and health care utilization for asthma, and visit time for asthma primary care visits. Changes in self-efficacy were measured by a physician self-administered survey. Self-efficacy is a pediatrician's confidence in his or her ability to perform a specific skill.⁸ For these analyses, the outcome of interest was self-efficacy for the skills related to encouraging asthma self-management by patients. We asked physicians to "rate your confidence in your ability to . . ." perform each of the skills with regard to their patients with asthma. The questionnaire used a 6-point scale to indicate their level of self-efficacy (1, not at all confident; 6, extremely confident). We defined pediatricians as having high self-efficacy when they answered 5 or 6 on the 6-point Likert-like scale (ie, "very" or "extremely" confident for each skill in question). We also used a similar scale (1, not at all likely; 6, extremely likely) to determine whether the clinician believed that the skill would produce the desired outcome (outcome expectancy).

For assessment of changes in physician communication and counseling behavior, interviews with parents were conducted using a 5-point scale and asking respondents to indicate agreement about the physician's performance of PACE communication skills (1, strongly disagree; 5, strongly agree). We defined pediatricians as performing the skill when parent respondents answered 5 on the 5-point Likert-like scale for each skill in question.

To assess changes in asthma symptoms, interviewers used an open-ended question format and asked parents to indicate the number of days in a season (a specified 3-month period) that the child had limited activity as a result of asthma. To assess changes in patient health care utilization for asthma, we also interviewed parents of asthma patients; parents indicated the number of ED visits, hospitalizations, and urgent office visits for asthma that were made in the previous 12 months. Urgent office care was defined as any visit for asthma that required the administration of epinephrine subcutaneously or a bronchodilator by aerosol for nondiagnostic purposes. Because analysis was based on parent reports of asthma events, we conducted a medical chart review of a sample of ~6% of the patients ($n = 50$) to verify these reports. The mean difference between documented versus reported hospitalizations was 0.02 events (median: 0; IQR: 0–0); for asthma ED visits was 0.62 events (median: 0; IQR: 0–1); and for asthma office visits was 1.12 events (median: 0; IQR: –1 to 2). The small median differences (all 0) suggest that although the individual parent re-

ports may differ from the medical charts, the aggregate parent reports were similar to medical charts.

Finally, because changes in asthma counseling practices may affect the duration of the office visit, we assessed changes in the length of the visit time. We asked physicians to indicate the amount of time they spend on average for asthma visits in a variety of situations (new versus established patient; well-child visit versus urgent visit).

Analysis

We used *t* tests, χ^2 tests, and Fisher's exact test to detect differences on demographic and practice variables between control and intervention groups. Adjusted comparisons between the control and intervention groups were performed using multivariate regression techniques.

Separate analyses of physicians' confidence (self-efficacy) regarding each of the communication and counseling skills were conducted. Because the dependent variable (physician self-efficacy) was dichotomous, we used multivariate logistic regression for each analysis with group assignment as an independent variable. Because gender has been associated with differences in preventive counseling,⁹ we controlled for physician gender.

Analyses of the parent interviews were conducted to assess outcomes that are related to 3 categories of variables: (1) changes in parents' views of physician communication and counseling, (2) changes in the child's symptom status, and (3) changes in health care use for asthma. For changes in parents' views of physician counseling, because our dependent variable of interest (parent description of physician performing the skill versus not performing the skill) was dichotomous, we used multivariate logistic regression for each analysis with group assignment as an independent variable. We controlled for patient age and gender, severity of illness, tobacco exposure, and patient insurance (private, Medicaid, or self-pay status).

Poisson regression analyses were conducted to compare treatment and control groups controlling for baseline on the analyses of the following outcomes: number of hospitalizations, ED visits, and physician office visits for asthma up to 12 months after the seminar program. Poisson regression is suitable for count variables of such events. Baseline scores and group assignment were included as predictors in these models. The model outcome is based on follow-up measures during the observation period, controlling for baseline values, centered to its mean. An interaction term between baseline scores and group assignment was included to capture any moderating effect of baseline scores on the effect of the intervention.

We were concerned about the possibility of "clustering" of patients who received treatment by the same

physician.¹⁰ We calculated the intraclass correlation and found that the values were close to 0 (0.024 at the physician level; 0.003 at the site level), suggesting negligible clustering. However, because there may be clustering at other levels simultaneously, we included an overdispersion parameter in the logistic and Poisson regression analyses to allow for more robust estimates. The overdispersion parameter accounts for individual observations' not being independent at different levels simultaneously.¹¹

We used SAS 8.02 (SAS Institute, Cary, NC) for the analyses. In all analyses, postintervention data were controlled for baseline scores. Statistical significance is defined as $P < .05$.

RESULTS

Study Participants

The characteristics of the providers, the patients, the survey respondents, and households in the control and intervention groups were similar (Tables 1 and 2) and suggest that the randomization was successful. Of the 870 patients, 61% reported use of a daily controller medication. There was a smoker present in 216 (24%) of the households, and the survey respondent was a smoker in 112 (13%) of the households. At baseline, the respondents reported being under the care of the study physician for an average of 55 (± 38) months.

Changes in Health Care Provider Attitudes

Changes in provider perceptions regarding their confidence (self-efficacy) and expectations (outcome expect-

TABLE 1 Patient, Respondent, and Household Characteristics

Characteristic	Control (n = 452)	Intervention (n = 418)
Male, n (%)	284 (65)	270 (65)
Mean age, y (SD)	7 (2.9)	7 (2.9)
Persistent asthma, n (%)	172 (38)	153 (36)
Asthma subspecialist involved, n (%)	174 (38)	142 (34)
Under physician care, mean mo (SD)	56 (37)	55 (38)
Health care utilization		
Hospital admissions per year, mean (SD)	0.12 (0.47)	0.14 (0.54)
ED asthma visits per year, mean (SD)	0.66 (1.8)	0.85 (2.0)
Emergent doctor visits per year, mean (SD)	1.7 (2.5)	1.8 (3.3)
Respondent age, y (SD)	36 (7)	36 (7)
Relationship, n (%)		
Mother	418 (93)	395 (95)
Father	21 (5)	14 (3)
Other	11 (3)	7 (2)
Insurance type, n (%)		
Private	376 (83)	307 (73)
Medicaid	48 (11)	71 (17)
CHIP	8 (2)	23 (6)
Government (non-Medicaid)	7 (2)	7 (2)
Self-pay	9 (2)	5 (1)
Other	4 (1)	5 (1)

CHIP indicates Children's Health Insurance Plan. All $P > .05$ based on χ^2 tests, *t* tests, or exact tests.

TABLE 2 Physician and Practice Characteristics (n = 94)

Physician Characteristics	Control (n = 43)	Intervention (n = 51)
Male, n (%)	22 (51)	28 (55)
Years since medical school graduation, mean (SD)	19.8 (9.7)	16.1 (9.2)
Race, n (%)		
White	31 (74)	39 (77)
Black	0	1 (2)
Hispanic/Latino	2 (5)	2 (4)
Other	9 (21)	9 (18)
Private practice, n (%)	32 (76)	34 (69)
Practice setting, n (%)		
Solo physician	5 (12)	6 (12)
Small group (2–5 physicians)	13 (30)	26 (52)
Large group (>6 physicians)	20 (47)	15 (29)
Hospital or government clinic	3 (7)	3 (6)
No response	2 (5)	1 (2)
No. of asthma patients in practice, mean (SD)	171 (143)	168 (194)

All $P > .05$ based on χ^2 tests, t tests, or exact tests.

ancy) for asthma counseling were assessed. Participation in the seminar was not associated with any decrease in self-efficacy, and self-efficacy improved for some skills. Compared with providers in the control group, intervention physicians were more likely to have increased confidence in their ability to develop a short-term plan for asthma (odds ratio [OR]: 3.79; 95% confidence interval [CI]: 1.34–10.8), as well as review with patients the long-term plan for care (OR: 3.72; 95% CI: 1.17–11.7). Participation in the seminar was not associated with any changes (positive or negative) in outcome expectancy.

Changes in Provider Behavior

Parents reported that intervention group physicians were significantly more likely than control group physicians to “find out the parent’s biggest asthma concern” (OR: 1.73; 95% CI: 1.17–2.58), “inform the parent that the child can be fully active” (OR: 1.71; 95% CI: 1.13–2.59), and “ask if the child met specific goals including no daytime symptoms, no nighttime symptoms, and no limitation in activity” (OR: 1.50; 95% CI: 1.02–2.24).

Changes in Patient Symptoms and Health Care Utilization

In both groups, the number of days that were affected by asthma symptoms was decreased (Table 3). Controlling for demographic characteristics and severity of illness, we found that for children whose physicians attended the educational seminar, changes in number of days for which activity was limited by asthma were significantly improved compared with children whose physicians did not participate in the seminar (8.5 vs 15.6 days; $P < .05$). This finding was consistent for each of the separate analyses for each season. The interaction term in the model (for all analyses) was significant and suggests that the magnitude of the improvement in symptoms is greater as the baseline symptoms increase. This effect is illustrated in Fig 2; with higher patient baseline symp-

TABLE 3 Comparison of Symptoms Days and Asthma Health Care Utilization

	Baseline Year	Follow-up Year	Change
Mean days affected by asthma symptoms per year ^a			
Control	28.5	20.0	–8.5
Intervention	30.2	14.6	–15.6
Mean urgent asthma office visits per year			
Control	1.67	0.77	–0.90
Intervention	1.83	0.75	–1.07
Mean ED asthma visits per year ^a			
Control	0.65	0.35	–0.30
Intervention	0.86	0.31	–0.55
Mean hospitalizations for asthma per year			
Control	0.13	0.07	–0.06
Intervention	0.12	0.06	–0.06

^a $P < .05$, after controlling for baseline values, patient age, patient gender, insurance type, asthma severity, and household smoking. The model also includes an interaction term for (group assignment) \times (baseline value), with baseline values centered to its mean.

oms, the impact of physician participation in the program is more apparent.

In both groups, there was a decrease in health care utilization for asthma, overall (Table 3). However, we found that for children whose physicians attended the educational seminar, the changes in ED asthma utilization were significantly lower compared with those for children whose physicians did not participate in the seminar, controlling for demographic characteristics and severity of illness ($P < .05$). The interaction term in the model was significant, which suggests that the magnitude of the improvement in ED use is greater as the baseline ED use increases. Similar to the effect on asthma symptoms, patients with more frequent ED utilization at baseline are more likely to benefit from their physician’s participation in the program. There were no differences in hospitalizations or urgent office visits for asthma.

Changes in Office Visit Length

We assessed whether the intervention affected the time that a physician spent with a family during an asthma visit by comparing mean time spent on asthma office visits that was reported by the control and intervention physicians. No differences were found during the initial visit for the diagnosis of asthma (24 minutes for both groups). There were no differences in the time spent for children with an established diagnosis of asthma for acute asthma visits (24 minutes for both groups), well-child visits (13 minutes for both groups), or “well” asthma visits without urgent issues (18 minutes vs 20 minutes).

DISCUSSION

The PACE program as provided by local physicians in various regions of the United States was effective in

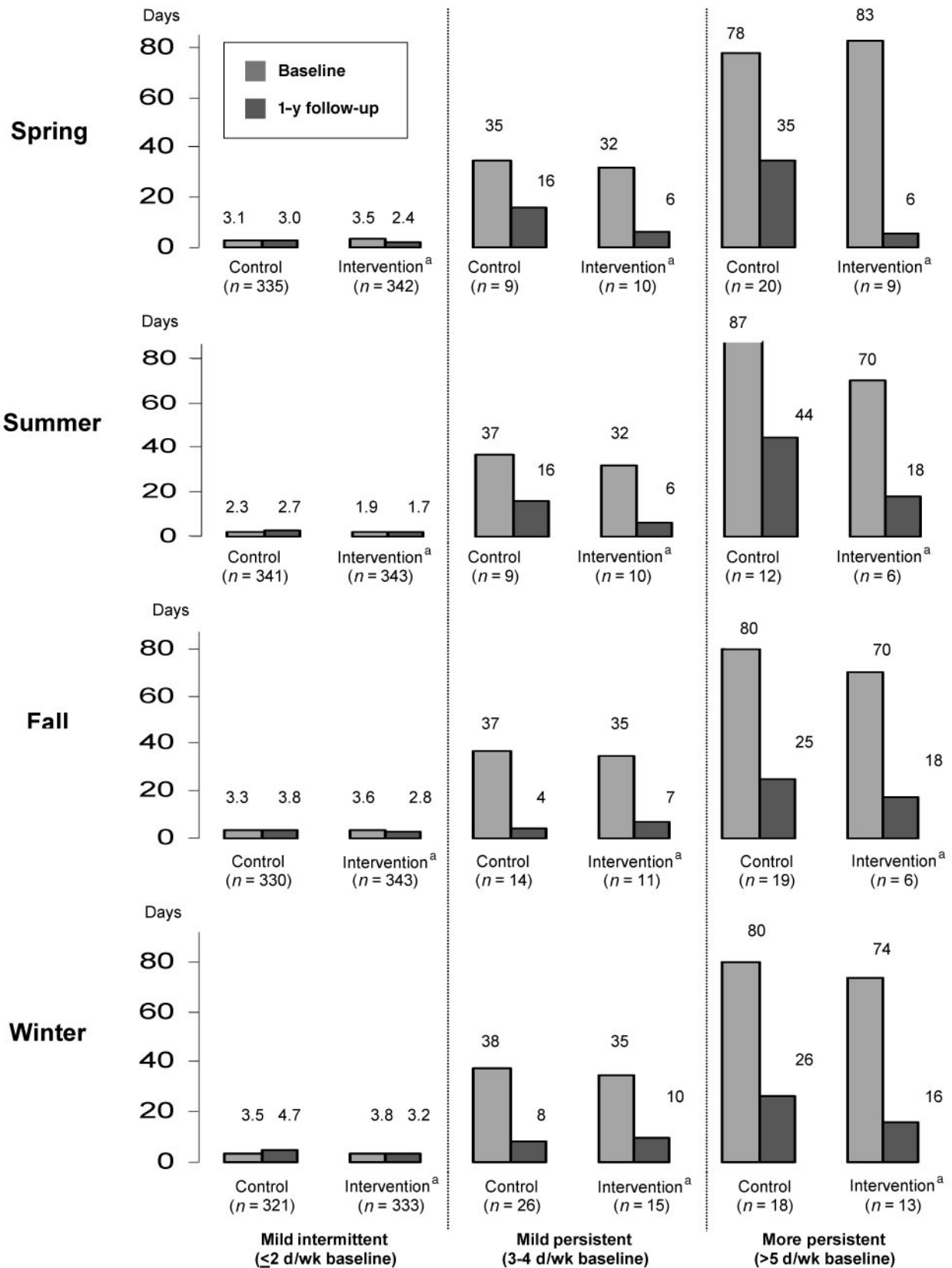


FIGURE 2

Total days of limited activity as a result of asthma, by season and severity. Severity is based on frequency of baseline symptoms: <2 days of symptoms per week; 3 to 4 days of symptoms per week; and >5 days of symptoms per week. ^a*P* < 0.05 for group assignment, controlling for baseline values, patient age, patient gender, insurance type, asthma severity, and household smoking. The model also includes an interaction term for (group assignment) × (baseline value), with baseline values centered to its mean.

changing physician behavior and patient outcomes up to 1 year after the intervention. Physicians felt more confident in their ability to discuss both short- and long-term management plans with patients. Parents reported that physicians were more likely to use the communication skills learned, as well as set goals and encourage their children to be more active. During the follow-up period, patients had fewer days of limited activity and fewer ED visits.

As noted, the analysis of the impact of the PACE program on patient outcomes (eg, frequency of asthma symptoms and ED utilization) included an interaction term for intervention exposure and baseline frequency. Findings suggest that patients who have more frequent asthma symptoms and higher health care utilization at baseline are more likely to benefit from their physicians' attending the educational program.

The improved clinician performance was notable, although, on average, the clinician did not report spending additional time with the patient. The educational seminar emphasized using a focused, sequenced, and tailored approach to meeting families' needs. The findings suggest that the asthma counseling during the office visits may have been more efficient for the intervention group.

Few studies have examined the impact of physician CME on actual patient outcomes.¹ Interventions to change physician practice are more likely to be successful when they are interactive, multifaceted, and consistent with the perceived needs of the learner.¹ The PACE intervention was designed to address barriers to asthma education described by primary care physicians (eg, perceived poor reimbursement for patient education, low outcome expectancy regarding patient performance).⁷ The format of the program allows physicians to interact with the faculty and introduce cases and questions that are highly relevant to their practice. The video demonstrating communication techniques models specific communication behaviors, and the follow-up dialogue allows clinicians to discuss communication failures and successes in a nonthreatening context. In addition, although the focus of this seminar was on asthma self-management, many of the communication skills can be applied to the self-management of other chronic diseases.

The study was undertaken to determine the effectiveness of a proven intervention when provided by local physicians to their colleagues in locales across the United States. The findings of the study indicate that the results are very similar to those produced in the original evaluation, when a single group of faculty provided instruction to all clinicians.^{2,3} Both health status and health care use were improved in this effectiveness study, as was the case in the efficacy trial. In all communities, local faculty were able to provide the seminar after participating in a standardized training program.

The most difficult aspect of implementation in the various sites was securing the participation of behavioral scientist/health educator instructors. Health care professionals with this type of training and experience still are not common among medical community leaders, although the situation is changing as interest in the social and behavioral aspects of health care increases.¹² In all study sites, the means of implementation as required by the model (trained faculty with access to the curriculum, a meeting venue, and an organization to provide CME accreditation) were fully met. A large part of the success of implementation was the willingness of the local instructors to see themselves as asthma "champions" and to apply their leadership within their medical community.

Limitations

Because there were multiple components to the educational intervention, it is not clear which component of the seminar (eg, communication techniques, reviewing specific asthma message) was most crucial for the success of the educational program. The intervention also attracted physicians who were more likely to be interested in asthma and practice-based research and, as a result, may not represent primary care providers in general. However, participating physicians who are more likely to attend CME programs that focus on asthma care may represent the early adopters of best practices who subsequently influence their practice colleagues. Attracting such physicians to attend the program may be a means to diffuse innovations in asthma practice.¹³

Although no differences were found in the time spent for families, this measure was based on physician self-report and there may not have been adequate power to detect any differences. However, differences in perceptions related to time spent are expected to be distributed randomly across treatment and control groups. Finally, follow-up results were measured only after 1 year, and it is not clear how long such results can be sustained. A longer term follow-up is under way and may clarify whether additional education (ie, a follow-up review seminar) is needed to sustain changes in physician practices over time.

Implications

The PACE program is an interactive physician education program that is based on underlying theory and is sensitive to the needs of primary care providers. In addition to being efficacious, this study demonstrates that such education provided by local faculty is effective in improving asthma care, the frequency of days of asthma symptoms, and ED utilization in a variety of locales. This physician asthma care education model can be applied successfully in other communities to improve health care quality and patient outcomes.

ACKNOWLEDGMENTS

The effectiveness trial was funded by the Robert Wood Johnson Foundation (Princeton, NJ) and based on an earlier efficacy trial (MD/Family Partnership: Education in Asthma Management; grant HL-44976) funded by the Lung Division of the National Heart, Lung, and Blood Institute of the National Institutes of Health. The funding organizations were not involved in the design or conduct of the study; data collection, management, analysis, and interpretation; or preparation, review, or approval of the manuscript.

We acknowledge the following physicians who participated in the seminars or served as faculty: Tennessee: Gail M. Addlestone, MD, James R. Hanley, MD, Thomas Hazinski, MD, M. Heather Johnson, MD, Joel Pedigo, MD, Elizabeth Pierce, MD; California: Joseph Bakhoun, MD, AE-C, Lilith Idea, MD, Patrick Leung, MD, Stephanie Moen, RCP, RRT, Aftab Naz, MD, Bharati Shah, MD; Nebraska: Madhu Bhogal, MD, Jane M. Carnazzo, MD, Amy E. LaCroix, MD, Paul J. Nelson, MD, Charles Rush, MD, Larry Shepherd, MD, Donald M. Uzendoski, MD; Michigan: William L. Bush, MD, Ronald M. Hofman, MD, Kurt J. Meppelink, DO; Ohio: William H. Cotton, MD, Dennis M. Doody, MD, M. Jane Goleman, MD, Morissa Ladinsky, MD, Donna J. McDonald, MD, Joann Villamarin, MD; Delaware: Theresa D'Amato, MD, David Marc Epstein, MD, Edward W. McReynolds, MD, Albert A. Rizzo, MD; Texas: Uduak Etuknwa, MD, Luisa Lira, MD, Celia Go-Maliwanag, MD, Girish Patel, MD, Daniel Vijjeswarapu, MD, Peggy Wakefield, MD; Indiana: Benjamin S. Gilmore, MD, Frederick E. Leickly, MD, James Leland, MD; Florida:

Jeffrey Goldhagen, MD, Amy W. Hardman, MD; Minnesota: Timothy D. Johanson, MD, Vicki Oster, MD, Stephen M. Scallon, MD, Sara McGlynn, MD.

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