

Training Pediatricians to Adhere to Asthma Guidelines

Gerald B. Lee, MD,¹ and Tao T. Le, MD, MHS²

Despite the proven efficacy of the National Heart, Lung, and Blood Institute asthma guidelines, adherence to these recommendations is suboptimal among primary care physicians. Knowledge, skills, and attitudes among pediatricians influence adherence to the asthma guidelines. Workshop-based provider education interventions demonstrate short-term improvement in knowledge, but do not lead to long-term changes in patient outcomes. Comprehensive quality improvement interventions that integrate education and process changes yield the best results in improving asthma care in children.

Introduction

ASTHMA IS A chronic inflammatory lung condition characterized by repeated episodes of reversible airway obstruction. Asthma afflicts ~7.1 million children and is the third leading cause of hospitalization for children under 15 years of age.^{1,2} The guidelines for the diagnosis and treatment of asthma have been maintained by the National Heart, Lung, and Blood Institute since 1991.³ The core components of asthma management according to these guidelines are assessing asthma severity and control, providing asthma education in partnership with patients, controlling environmental triggers and comorbid conditions, and providing appropriate pharmacotherapy to control asthma. Clinical trials have demonstrated the effectiveness of guideline-based management in controlling pediatric asthma.⁴ Despite this proven efficacy, Centers for Disease Control and Prevention data since 1992 have demonstrated that the rate of childhood asthma emergency department (ED) visits has decreased only 0.8%, and the rate of hospitalizations has not changed.⁵

A potential reason for the lack of impact of the asthma guidelines is suboptimal adherence to the guidelines by primary care providers. A cross-sectional chart review of primary care pediatric offices found that only 34% of charts documented asthma severity.⁶ Similarly, only 52% of primary care physicians who treat pediatric asthma stated that they used spirometry in their practice and only 21% routinely used spirometry as recommended by the guidelines.⁷ Asthma education of patients during primary care visits actually decreased from 50% to 38% of asthma-related visits from 2001 to 2006 according to a national medical care survey.⁸ A study of communication skills of pediatric residents using unannounced, unobserved standardized patients found that only 55% of pediatric residents performed asthma teaching and only 44% performed inhaler teaching.⁹ The

American Board of Family Medicine analyzed a virtual patient simulator used in their maintenance of certification (MOC) process to measure adherence to asthma guideline recommendations among family practice diplomats.¹⁰ Elements of asthma history with the lowest adherence were environmental tobacco smoke (32%), chest tightness (50%), nocturnal cough (51%), frequency of short-acting beta-agonist use (52%), dyspnea on exertion (64%), and dyspnea (68%). Elements of the asthma management plan also had low levels of adherence, including ordering an influenza vaccination (61%), having an asthma action plan (61%), or using long-term asthma control medication (68%). Thus, there is a need to address the lack of adherence to asthma guidelines among primary care providers and its impact on clinical outcomes.

This review will summarize the current barriers to adherence to asthma guidelines in children among primary care providers. Next, educational interventions that have addressed these needs will be described. Finally, best practices for future provider educational initiatives will be reviewed.

Barriers Preventing Adherence

Major barriers to asthma guideline adherence have been demonstrated in provider knowledge, skills, and beliefs (Table 1). Knowledge gaps among primary care physicians about asthma guidelines have been shown in questionnaires and formal assessments. In a 2004 survey of primary care physicians, 91% of the respondents were aware of the latest update of the asthma guidelines. However, only 71% of the respondents were actually familiar with the content of the guidelines.¹¹ An online survey of primary care physicians found that 22% felt their patients with moderate to severe asthma should reduce their controller use as their

Section of Allergy and Immunology, Departments of ¹Pediatrics and ²Medicine, University of Louisville School of Medicine, Louisville, Kentucky.

TABLE 1. BARRIERS TO ADHERENCE TO ASTHMA GUIDELINES BY PROVIDERS

<i>Barrier</i>	<i>Examples</i>
Knowledge gaps	Lack of familiarity with guidelines
Performance gaps	Difficulty with asthma severity classification
Provider attitudes	Low outcome expectancy for successful behavior change in patients
Self-efficacy	Lack of time to educate patients

symptoms improve and 14% felt they could completely discontinue controller medication if their symptoms resolve.¹² Similarly, residents in training also have knowledge gaps regarding the asthma guidelines. An assessment of medical knowledge among internal medicine residents found the lowest performance in differentiating asthma from other diagnoses, classifying asthma severity and control, naming long-term controller medications, and choosing the appropriate management based on the level of asthma severity or control.¹³

Physicians may know the content of the guidelines, but lack the skills to execute them correctly. Asthma severity classification has been shown to be discordant even among board-certified allergists and pulmonologists.¹⁴ The subjective nature of severity assessments is one source of variability. This subjectivity is particularly pronounced in the pediatric population, where a parent often acts as the primary source, but may not accurately represent the true status of the child's severity.¹⁵ In addition, providers who treat asthma often overestimate the improvement in asthma control on follow-up visits, when compared with objective measures such as the Asthma Control Questionnaire.¹⁶ Finally, although objective measures of asthma control such as spirometry are available, they are often not used appropriately.^{7,17} In a study that provided clinical vignettes containing spirometry data, half of the primary care pediatricians underestimated the severity of asthma. In this study, only 35% of the physicians were comfortable in interpreting spirometry.⁷ Therefore, competency issues can influence the ability of providers to accurately assess asthma severity.

Provider attitudes and beliefs can also influence adherence to guidelines. Cabana et al. used focus groups¹⁸ and questionnaires¹⁹ to explore barriers to adherence to asthma guidelines. They found that pediatricians faced external barriers to performing asthma education because of constraints on time, lack of education materials, lack of support staff, and lack of reimbursement. In addition, they had a low outcome expectancy for certain types of patient education such as medication adherence, smoking cessation, and the importance of preventative care.^{18,19} More recent follow-up surveys found similar barriers such as doubt regarding patient adherence and other external barriers.²⁰ Vaccine or medication concerns or beliefs may be another barrier. A survey of primary care pediatricians who did not administer the influenza vaccine to their patients with intermittent asthma indicated that the providers believed the vaccine was only for persistent asthma. In addition, the lack of availability or refusal by the parent or child were barriers to influenza vaccination.²¹

In summary, providers who treat asthma not only have gaps in asthma guideline knowledge, but they also need

reinforcement in asthma assessment skills such as severity and control classifications or spirometry interpretation to execute the recommendations. Providers also have barriers in self-efficacy and outcome expectancy that should be addressed in educational or system-based interventions. These and other factors can lead to a lack of performance in practice.

Interventions to Improve Adherence

Workshop-based interventions

Typical educational interventions have used continuing medical education (CME) workshops that address gaps in knowledge, skills, and attitudes in asthma care. However, demonstrating measurable improvement in educational or patient outcomes has been challenging. The University of Michigan has published several articles detailing the evolution of the Physician Asthma Care Education (PACE) program, an interactive workshop that reviewed the content of the asthma guidelines as well as practiced asthma education skills using mixed media such as didactics, discussions, videos, and handouts.²²⁻²⁵ The initial intervention in 2 cities resulted in a significant decrease in hospital admissions and ED visits for children with high healthcare utilization after 2 years.²³ In addition, the improved communication skills learned during the seminar did not appear to increase the length of the visit.²³ The PACE program was later disseminated to 10 regions by using physician and nurse educator champions to deliver the intervention to their local sites.^{24,25} A total of 101 pediatricians were trained by these educator teams and 693 children with asthma had outcome data available 2 years after the intervention. The study found that compared to control patients, the intervention patients rated their physician's performance higher. In addition, significant decreases in ED visits, hospitalizations, urgent office visits, and phone calls were observed in patients with high baseline healthcare utilization.²⁵

However, not all workshop interventions have been as successful in improving asthma outcomes. An Italian study randomized 180 general practitioners to receive an education intervention to improve adherence to the Global Initiative for Asthma guidelines and the Allergic Rhinitis and its Impact on Asthma guidelines.²⁶ Physicians in the intervention arm participated in a single 8-h educational course, but investigators found no significant change in adherence to guidelines with regard to appropriate asthma medications according to severity and control. An Australian study that provided a small group-based educational program improved asthma knowledge, but did not increase the use of asthma action plans²⁷ or improve clinical outcomes.²⁸

This lack of efficacy in educational workshops may be partially due to a lack of reinforcement following the intervention. A study of a case-based workshop that allowed providers to practice writing asthma action plans found no improvement in knowledge 12 months after the workshop using a structured clinical examination. However, if the providers underwent both a 6-month and 12-month examination, then there was a significant improvement in knowledge at the 12-month examination. The authors hypothesized that the 6-month assessment served as reinforcement of the original content and thereby increased the effectiveness of the original workshop.²⁹

E-learning interventions

E-learning interventions use information technologies such as video, audio, computers, and the Internet to deliver educational content. Overall, most practitioners rate these interventions positively in terms of satisfaction.³⁰ A small pilot study using a Web- and CD-ROM-based CME program with teleconferences, case studies, and multimedia improved familiarity with inhaled corticosteroid recommendations for asthma 1 to 3 months after the intervention, but did not maintain these differences with long-term follow-ups.³¹ A larger study of an Internet-based asthma case-based learning course demonstrated improvement on post-test knowledge scores, although long-term knowledge retention was not studied.³² Finally, a meta-analysis of 201 e-learning interventions found superiority over no intervention in knowledge and skill outcomes, but no difference when compared to traditional teaching methods.³³ Therefore, e-learning in itself does not enhance learning beyond traditional methods, but provides a different method to deliver the content.

In summary, both workshop- and technology-based interventions have the potential to improve knowledge and patient outcomes, but demonstration of long-term efficacy is challenging.

Enhanced education interventions

Educational interventions to providers can be enhanced by incorporating process-level changes in the workflow or organization rather than focusing solely on individual competency gaps. The Pediatric Asthma Care Patient Outcomes Research Team trial was a randomized control trial that utilized physician asthma champions, or practice-based physician peer leader education to disseminate educational and process-level changes.^{34–36} Each of the 42 practice sites had an asthma education peer leader who was charged with enacting change in that site by providing support and education to the other physicians in the group. A second intervention augmented the peer education intervention with an experienced asthma nurse educator who assisted with care coordination and standardized assessments, and provided self-management tools for the patients with asthma. When compared with usual care, the study demonstrated that there was a significant increase in symptom-free days of 6.5 days in the peer education group and 13.3 days in the peer education plus nurse intervention group. However, the incremental cost similarly was more expensive. The cost was \$18 per symptom-free day for the peer education group and \$68 per symptom-free day for the peer education plus nurse group. There was no significant reduction in the total cost of health care utilization and prescriptions in the intervention groups.

Provider education can also be enhanced by clinical decision support tools. A prospective cluster randomized trial examined the effect of pediatric asthma management tools integrated into an electronic health record system.³⁷ These tools facilitated asthma guideline recommendations such as assessing asthma control and severity, prescribing appropriate controller medications, ordering spirometry, and writing asthma action plans. After undergoing a provider education session modeled after the PACE program, the practice sites were randomized to receive alerts to use these support tools or to only have them available passively. The

study found modest increases in controller prescriptions, spirometry use, and use of asthma action plans. However, patient-level outcomes were not analyzed in the study.

Cabana and Coffman³⁸ recently performed a systematic review of interventions to change provider prescribing practices that included both workshop-based and enhanced educational interventions. The authors classified interventions into 3 major categories: (1) individual interventions focused only on the provider, (2) supplemental interventions that improved existing organization processes, and (3) structural interventions that enacted organizational change. The most successful interventions enacted structural changes and used a multifaceted approach to address multiple knowledge gaps and barriers. Similarly, systematic review of quality improvement strategies for childhood asthma found that interventions that included organizational changes were associated with greater changes in clinical outcomes.³⁹ Taken together, interventions to optimize physician behavior integrate individual education with system-wide organizational changes.

Conclusion

The burden of pediatric asthma continues to be a significant problem due to the challenges that primary care pediatricians have in adopting asthma guidelines. Knowledge, skill, and self-efficacy barriers need to be overcome to enact a change in behavior. Due to these multiple barriers, many educational interventions have been inconsistent in their ability to demonstrate a long-term improvement in knowledge or an impact on clinical outcomes.

What are best practices when designing physician education programs to improve asthma guideline adherence? First, the content should reflect the components of the asthma guidelines with the best efficacy (Table 2). Second, the content and the delivery of the intervention are also significant. Education initiatives should incorporate adult learning theories relevant to medical professionals.⁴⁰ Third, the educational intervention should also include repeated exposures. Learning objectives should be reinforced to ensure transfer of knowledge. Finally, provider education alone might only be a piece of a larger quality improvement intervention required to improve outcomes. Measures that supplement provider education could include modification to electronic medical records such as clinical decision support reminders. Proper implementation of clinical decision support

TABLE 2. FEATURES OF SUCCESSFUL ASTHMA EDUCATION INTERVENTIONS FOR PEDIATRICIANS

-
- Incorporate adult learning theory into instructional design
 - Include multimedia and varied educational techniques
 - Reinforce learning objectives repeatedly after initial intervention
 - Track and provide feedback on performance indicators to assess current asthma care quality and efficacy of change interventions
 - Go beyond individuals and integrate organizational-level interventions
 - Standardized assessments of asthma control
 - Process changes
 - Integrate practice alerts into electronic health records that encourage adherence to asthma guidelines
-

reminders should strike a balance between enforcing adherence to guidelines without overly hampering efficiency or disrupting physician autonomy.⁴¹ Electronic medical records also can provide feedback on a provider's adherence to asthma guidelines to facilitate practice-based learning and improvement. These practice improvement initiatives with education have now been integrated into MOC by the specialty boards. One example of electronic clinical decision support and feedback is ASTHMA IQ,⁴² a set of web-based performance tools and education resources that help physicians manage patients with asthma. Participation in ASTHMA IQ is accepted by the American Board of Allergy and Immunology and the American Board of Internal Medicine for credit toward MOC, Part IV. The utility of ASTHMA IQ as a guideline-based Internet tool to monitor asthma patients in the primary care setting is currently under study. In conclusion, a multifaceted approach that integrates best practices for teaching and quality improvement is more likely to translate the proven efficacy of asthma guidelines into the real-world setting.

Acknowledgments

We thank Michael D. Cabana, MD, MPH, and Emma D. Underdown, MA, for their review of the manuscript.

Funding Support

Institutional funding provided by the University of Louisville School of Medicine.

Author Disclosure Statement

Dr. Gerald B. Lee and Dr. Tao T. Le have nothing to disclose.

References

- Sondik EJ, Madans J, Gentleman JF. Summary health statistics for U.S. children: National Health Interview Survey, 2011. Hyattsville, MD: National Center for Health Statistics. Vital Health Statistics, 2012.
- Asthma & Children Fact Sheet. (Accessed December 20, 2012, at www.lung.org/lung-disease/asthma/resources/facts-and-figures/asthma-children-fact-sheet.html).
- Expert Panel Report 3 (EPR-3): Guidelines for the Diagnosis and Management of Asthma-Summary Report 2007. *J Allergy Clin Immunol* 2007; 120:S94-S138.
- Szefer SJ, Gergen PJ, Mitchell H, Morgan W. Achieving asthma control in the inner city: do the National Institutes of Health Asthma Guidelines really work? *J Allergy Clin Immunol* 2010; 125:521-526; quiz 7-8.
- Akinbami LJ, Moorman JE, Garbe PL, Sondik EJ. Status of childhood asthma in the United States, 1980-2007. *Pediatrics* 2009; 123 Suppl 3:S131-S145.
- Cabana MD, Bruckman D, Meister K, Bradley JF, Clark N. Documentation of asthma severity in pediatric outpatient clinics. *Clin Pediatr* 2003; 42:121-125.
- Dombkowski KJ, Hassan F, Wasilevich EA, Clark SJ. Spirometry use among pediatric primary care physicians. *Pediatrics* 2010; 126:682-687.
- Hersh AL, Orrell-Valente JK, Maselli JH, Olson LM, Cabana MD. Decreasing frequency of asthma education in primary care. *J Asthma* 2010; 47:21-25.
- Ozuah PO, Reznik M. Residents' asthma communication skills in announced versus unannounced standardized patient exercises. *Ambul Pediatr* 2007; 7:445-448.
- Sumner W, 2nd, O'Neill TR, Roussel G, et al. Family physicians' completion of scoring criteria in Virtual Patient encounters. *Proc AMIA Symp* 2011; 2011:1355-1360.
- Cabana MD, Abu-Isa H, Thyme SM, Yawn B. Specialty differences in prescribing inhaled corticosteroids for children. *Clin Pediatr* 2007; 46:698-705.
- Panettieri RA, Jr., Spector SL, Tringale M, Mintz ML. Patients' and primary care physicians' beliefs about asthma control and risk. *Allergy Asthma Proc* 2009; 30:519-528.
- Hemnes AR, Bertram A, Sisson SD. Impact of medical residency on knowledge of asthma. *J Asthma* 2009; 46:36-40.
- Baker KM, Brand DA, Hen J, Jr. Classifying asthma: disagreement among specialists. *Chest* 2003; 124:2156-2163.
- Yawn BP, Brennenman SK, Allen-Ramey FC, Cabana MD, Markson LE. Assessment of asthma severity and asthma control in children. *Pediatrics* 2006; 118:322-329.
- Juniper EF, Chauhan A, Neville E, et al. Clinicians tend to overestimate improvements in asthma control: an unexpected observation. *Prim Care Respir J* 2004; 13:181-184.
- Finkelstein JA, Lozano P, Shulruff R, et al. Self-reported physician practices for children with asthma: are national guidelines followed? *Pediatrics* 2000; 106:886-896.
- Cabana MD, Ebel BE, Cooper-Patrick L, Powe NR, Rubin HR, Rand CS. Barriers pediatricians face when using asthma practice guidelines. *Arch Pediatr Adolesc Med* 2000; 154: 685-693.
- Cabana MD, Rand CS, Becher OJ, Rubin HR. Reasons for pediatrician nonadherence to asthma guidelines. *Arch Pediatr Adolesc Med* 2001; 155:1057-1062.
- Wisnivesky JP, Lorenzo J, Lyn-Cook R, et al. Barriers to adherence to asthma management guidelines among inner-city primary care providers. *Ann Allergy Asthma Immunol* 2008; 101:264-270.
- Dombkowski KJ, Leung SW, Clark SJ. Physician perspectives regarding annual influenza vaccination among children with asthma. *Ambul Pediatr* 2008; 8:294-299.
- Clark NM, Gong M, Schork MA, et al. Impact of education for physicians on patient outcomes. *Pediatrics* 1998; 101:831-836.
- Clark NM, Gong M, Schork MA, et al. Long-term effects of asthma education for physicians on patient satisfaction and use of health services. *Eur Respir J* 2000; 16:15-21.
- Cabana MD, Sligh KK, Evans D, et al. Impact of physician asthma care education on patient outcomes. *Pediatrics* 2006; 117:2149-2157.
- Clark NM, Cabana M, Kaciroti N, Gong M, Sleeman K. Long-term outcomes of physician peer teaching. *Clin Pediatr* 2008; 47:883-890.
- Baldacci S, Maio S, Simoni M, et al. The ARGAS study with general practitioners: impact of medical education on asthma/rhinitis management. *Respir Med* 2012; 106:777-785.
- Liaw ST, Sulaiman ND, Barton CA, et al. An interactive workshop plus locally adapted guidelines can improve general practitioners asthma management and knowledge: a cluster randomised trial in the Australian setting. *BMC Fam Pract* 2008; 9:22.
- Sulaiman ND, Barton CA, Liaw ST, et al. Do small group workshops and locally adapted guidelines improve asthma patients' health outcomes? A cluster randomized controlled trial. *Fam Pract* 2010; 27:246-254.
- Labelle M, Beaulieu M, Renzi P, Rahme E, Thivierge RL. Integrating clinical practice guidelines into daily practice: impact of an interactive workshop on drafting of a written action plan for asthma patients. *J Contin Educ Health Prof* 2004; 24:39-49.
- Sly JL, Lombardi E, Kusel M, Sly PD. Piloting a web-based continuing professional development program for asthma education. *Int J Med Inform* 2006; 75:708-713.
- Le TT, Rait MA, Jarlsberg LG, Eid NS, Cabana MD. A randomized controlled trial to evaluate the effectiveness of a dis-

- tance asthma learning program for pediatricians. *J Asthma* 2010; 47:245–250.
32. Fleet LJ, Fox G, Kirby F, Whitton C, McIvor A. Evaluation outcomes resulting from an internet-based continuing professional development (CPD) asthma program: its impact on participants' knowledge and satisfaction. *J Asthma* 2011; 48:400–404.
 33. Cook DA, Levinson AJ, Garside S, Dupras DM, Erwin PJ, Montori VM. Internet-based learning in the health professions: a meta-analysis. *JAMA* 2008; 300:1181–1196.
 34. Lozano P, Finkelstein JA, Carey VJ, et al. A multisite randomized trial of the effects of physician education and organizational change in chronic-asthma care: health outcomes of the Pediatric Asthma Care Patient Outcomes Research Team II Study. *Arch Pediatr Adolesc Med* 2004; 158:875–883.
 35. Sullivan SD, Lee TA, Blough DK, et al. A multisite randomized trial of the effects of physician education and organizational change in chronic asthma care: cost-effectiveness analysis of the Pediatric Asthma Care Patient Outcomes Research Team II (PAC-PORT II). *Arch Pediatr Adolesc Med* 2005; 159:428–434.
 36. Finkelstein JA, Lozano P, Fuhlbrigge AL, et al. Practice-level effects of interventions to improve asthma care in primary care settings: the Pediatric Asthma Care Patient Outcomes Research Team. *Health Serv Res* 2005; 40:1737–1757.
 37. Bell LM, Grundmeier R, Localio R, et al. Electronic health record-based decision support to improve asthma care: a cluster-randomized trial. *Pediatrics* 2010; 125:e770–e777.
 38. Cabana MD, Coffman JM. Analysis of Published Trials Examining Methods to Change Provider Prescribing Behavior and Child Health Outcomes. 2009. (Accessed April 28, 2013 at www.who.int/childmedicines/progress/Published_trials.pdf).
 39. Bravata DM, Gienger AL, Holty JE, et al. Quality improvement strategies for children with asthma: a systematic review. *Arch Pediatr Adolesc Med* 2009; 163:572–581.
 40. Hodges BD, Kuper A. Theory and practice in the design and conduct of graduate medical education. *Acad Med* 2012; 87: 25–33.
 41. Tierney WM, Overhage JM, Murray MD, et al. Can computer-generated evidence-based care suggestions enhance evidence-based management of asthma and chronic obstructive pulmonary disease? A randomized, controlled trial. *Health Serv Res* 2005; 40:477–497.
 42. ASTHMA IQ. American Academy of Allergy, Asthma, & Immunology, 2011. (Accessed April 28, 2013, at www.asthmaiq.org).

Address correspondence to:

Gerald B. Lee, MD

Section of Allergy and Immunology

Department of Pediatrics

University of Louisville School of Medicine

571 S. Floyd St.

Suite 432

Louisville, KY 40202-3830

E-mail: gerald.lee@louisville.edu

Received for publication June 14, 2013; accepted after revision August 7, 2013.