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Integrating Environmental Management of Asthma into Pediatric Health Care: What Worked and What Still Needs Improvement?

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Abstract

The National Environmental Education Foundation (NEEF) launched an initiative in 2005 to integrate environmental management of asthma into pediatric health care. This study, a follow-up to a 2013 study, evaluated the program's impact and assessed training results by 5 new faculty champions. We surveyed attendees at training sessions to measure knowledge and the likelihood of asking about and managing environmental triggers of asthma. To conduct the program evaluation, a workshop was held with the faculty champions and NEEF staff in which we identified major program benefits, as well as challenges and suggestions for the future. Trainee baseline knowledge of environmental triggers was low, but they reported robust improvement in environmental triggers knowledge and intention to recommend environmental management. The program has a broad, national scope, reaching more than 12 000 physicians, health care providers, and students, and some faculty champions successfully integrated materials into health record. Program barriers and future endeavors were identified.

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Author Contributions

JRR critically reviewed the data, drafted the manuscript, and critically reviewed the final manuscript. MAS analyzed the data and critically reviewed the final manuscript. All other authors contributed original text to the manuscript and critically reviewed the final manuscript.

Declaration of Conflicting Interests

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Keywords

asthma; environmental triggers; environmental health; education; pediatric

Exposure to known environmental triggers (ETs) of asthma is common among children with asthma.[1–3] Strategies to reduce exposure to many individual ETs have been demonstrated to improve patient outcomes.[4–10] This evidence base underlies current clinical practice guidelines, which recommend assessment of environmental triggers and education for exposure reduction as an integral part of disease management.[11,12] A careful exposure history is often sufficient to identify the major triggers that may be clinically relevant to an individual patient. Allergy testing may be useful in confirming suspected allergens, as well as in identifying additional relevant exposures.

Approaches focused on a single trigger typically show reduction in exposure but not consistent effects on measures of disease status. Multifaceted home environmental interventions that are tailored to individual susceptibility have been shown to successfully reduce allergen levels and numbers of symptom days in multiple studies. Examples include integrated pest management for those with cockroach allergy, dust mite covers, and other dust mite and indoor air allergen controls such as a *high-efficiency particulate air (*HEPA) vacuum, HEPA filters, and safe sleeping zones, as well as controls for animal dander.[9,10,13] A systematic review by Centers for Disease Control and Prevention (CDC) scientists and the Task Force on Community Preventive Services supports these multitrigger approaches as effective in improving overall quality of life and productivity in children with asthma.[14] These multifaceted interventions have also been shown to be cost-effective.[14,15] Despite these evidence-based recommendations, translation to clinical practice has been poor. Many patients with asthma do not retain or even receive instructions about controlling ETs.[16–18] Retention of information by parents of children treated by pediatricians is considerably worse than by parents of children who were treated by allergists.[19]

Recognizing this need, in 2004 the National Environmental Education Foundation (NEEF) launched an initiative in partnership with the National Institute of Environmental Health Sciences (NIEHS) to integrate environmental management of asthma into pediatric health care. NEEF convened an expert steering committee to develop the NEEF Environmental Management of Pediatric Asthma: Guidelines for Health Care Providers (http://www.neefusa.org/health/asthma/asthmaguidelines.htm), which was released in 2005. In order to facilitate the integration of the NEEF Guidelines into medical and nursing school curricula and clinical practice, NEEF launched the Pediatric Asthma Faculty Champions (hereafter referred to as “faculty champions”) Initiative in 2006, involving 5 of the 10 US EPA/HHS (Environmental Protection Agency/Health and human Services) regions (Table 1). These faculty champions at academic medical centers used a train-the-trainers model.[20,21] to deliver a brief, structured Grand Rounds style presentation in their regions. By training their academic clinician colleagues, trainees, and community clinicians, these initial faculty champions, referred to as group 1, sought to improve the fidelity of environmental interventions for the management of pediatric asthma among patients in their regions. Findings demonstrated Grand Rounds attendees reported a significant improvement and

retention of the knowledge and practice intentions regarding environmental trigger management compared with their baseline knowledge.[22] The program expanded to include a faculty champion in the remaining 5 US EPA/ HHS regions in 2011, referred to as group 2. All faculty champions are leaders in pediatric environmental health and have served in various roles with the American Academy of Pediatrics (AAP), the Academic Pediatric Association (APA), and/or the Pediatric Environmental Health Specialty Units (PEHSUs) and have positively affected children's environmental health issues.

The objectives of this article are (1) to provide an evaluation of the impact of the faculty champions' trainings on physicians' knowledge and intention to treat in the 5 new regions (group 2) that were not reported previously and (2) to describe the overall program's tangible benefits, the barriers to implementation that the faculty champions encountered, and outline possible future directions for this program.

Methods

Objective 1: Impact on Physician Knowledge and Intentions in Pediatric Environmental Management

Surveys were conducted with a convenience sample of attendees at trainings conducted by the "newer" asthma faculty champions (group 2) in the US EPA/HHS regions of program expansion in 2011 (regions 1, 3, 5, 7, and 8). Table 1 lists the states that belong to each US EPA region. This methodology was published in a previous article describing the program experience in the initial 5 regions.[22] Briefly, the survey consisted of a series of Likert-type scale questions designed to identify clinicians' knowledge of environmental asthma triggers, their current environmental history taking skills, and their current practice of recommending ET management. Following the educational intervention, the survey was repeated to obtain immediate posttraining presentation responses. A follow-up survey was also requested 3 to 6 months later. Data were collected through paper and online surveys (Constant Contact and Survey Monkey).

Data were manually entered into a Microsoft Excel spreadsheet. After assessing Likert variable distributions, responses were collapsed to compare the responses between matched pretest and immediate posttest as well as matched pretests and 3- to 6-month follow-up tests. The McNemar's chi-square test was used evaluate matched paired responses. STATA 13 was used for univariate analysis and descriptive statistics (StataCorp 2013, Stata Statistical Software: Release 13, College Station, TX).

Objective 2: Review of the Program's Strengths and Weaknesses

Nine of the 11 faculty champions met in Washington, DC on December 15, 2014 for a 1-day face-to-face workshop, which included focus group activities to reflect on the 10-year experience of the Asthma Faculty Champion Program and discuss the successes, challenges, and next steps. Prior to convening, all faculty champions met via several conference calls to discuss themes of program activities and accomplishments. This informed the workshop agenda that comprised of separate discussions of the following 3 themes: (*a*) experience with conducting the asthma trainings, (*b*) integration of the training materials into electronic

health record (EHR) systems, and (*c*) development of program national partnerships. For each theme, the group identified successful accomplishments and deficiencies/ barriers.

Based on these discussions, the group identified major steps for improvement and addressing the challenges to sustaining the program. These were termed as top "Bold Next Steps". In order to identify the highest ranking Bold Next Steps, a crowdsourcing activity called "25 will get you 10" was used. This validated method generates a set of ideas or purposeful steps, and utilizes the group to determine the top choices (http://www.open.hqsc.govt.nz/assets/Open-for-better-care/Surgery/PR-files—images/AS2-Crowdsourcing-June-2014.pdf). Briefly, each participant (the 9 faculty champions and 3 NEEF staff in attendance) wrote down one idea on an index card framed as an "I will …" action statement. Next, the cards were shuffled and distributed among members and scored by that member on a scale of 1 to 5, with a "5" rating denoting the most important idea. We scored each card 3 times for a top possible priority score of 15 and compiled the highest scoring ideas.

Results

Impact Evaluation

From March 2011 through October 2014, group 2 faculty champions delivered 30 educational sessions across the new faculty champion regions and 491 pretests, 432 posttests, and 184 follow-up tests were collected from training participants. The follow-up response rate exceeded that of our prior study.[22] After matching, there were 420 matched pre- and posttests, 157 matched post-and follow-up tests, and 152 matched sets of all 3.

The baseline knowledge of ETs of asthma based on the participant's self-report is shown in Table 2. Data describing the results from the trainee participants from the group 1 faculty champion regions were compared with that of the current sample, group 2. Overall, trainee self-report of asthma ET knowledge was low at baseline. Of note, the most recent trainees from group 2 reported lower baseline knowledge for all ETs compared with the trainees from group 1 faculty champions. In both surveyed groups, tobacco was the trigger with the highest reported baseline knowledge (43% vs 59%), and was the only trigger for which there was a statistical difference between groups 1 and 2 at baseline. Indoor chemical use is the trigger for which trainees were least likely to report "very good" or "expert" knowledge (23%).

Table 3 displays the environmental history taking practices, recommendations, and management abilities of the more recent trainees (March 2011 to October 2014). Baseline reports of environmental history taking skills were even lower than that of overall baseline knowledge of the topics shown in Table 2. There was substantial improvement after receiving the training in the intentions to ask about ETs and willingness to incorporate recommendations to mitigate environmental exposures into their routine practice. The 3- to 6-month follow-up surveys showed sustained improvement, albeit more modest than on immediate posttesting. Improvement was observed, from baseline in environmental history taking for all exposures and willingness to incorporate environmental interventions into practice compared with data from the previous manuscript.

Program Review: Summary of "Wins"

Since the program inception in the fall of 2007, the faculty champions have trained approximately 12 000 health professionals using the structured presentation. In addition to the regional trainings by the faculty champions, additional trainings were offered at several national and international conferences. More than 30 000 copies of program-related training materials, including the NEEF Guidelines, have been distributed at various other venues including conferences, trainings, and outreach efforts. Additionally, the materials have been viewed and/or downloaded tens of thousands of times either through NEEF's or other partners' websites, including NIEHS, CDC, EPA, Agency for Healthcare Research and Quality's National Guideline Clearinghouse, AAP, and others.

The faculty champions reported mixed success in integrating the NEEF Guidelines into clinical practice. Several of the faculty champions were successful in integrating the NEEF Guidelines in some fashion into their own institution's EHR.[23] Most were able to incorporate components of the materials (eg, patient environmental history form and patient education guidance) into their clinical documentation by revising standardized templates, or, in the case of Epic, a common EHR used in the academic setting, the use of Smart Phrases/ Auto-Texts. For some of the faculty champions, a computerized version of NEEF's Environmental History Form used during the project facilitated standard patient screening and cataloging of responses for review at future visits and by other providers.[24] Another strategy used by some faculty champions consisted of using the standard patient education materials available from NEEF for patients to review. Some recreated copies of this information in their EHRs for patients and their families, while others were able to hyperlink to the source documents warehoused by NEEF. The faculty champions felt these modalities facilitated understanding of the information provided to patients while standardizing the delivery of that information.

Program Reviews: Summary of Barriers

Noted barriers were associated with 4 primary themes: (1) the limited focus on physicians as opposed to all health care providers, (2) inability to characterize the program's impact in terms of improved patient outcomes, (3) the difficulty in some settings of integrating the NEEF Guidelines into the EHR, and (4) the limited association with other national partners, specifically insurance companies or other organizations that could incentivize clinician involvement in trigger management. The trainees in the initiative were predominantly physicians (66.4%) and most were pediatricians (55.6%), including pediatric residents. Some medical students were present at the presentation, however, were not included in the survey data. Other health professionals, such as nurses, respiratory therapists, and health educators, may be well suited for facilitating environmental management of asthma due to their potential to impact many patients. While we have demonstrated impact via the number of trainings and change in knowledge, attitudes, and intentions, the program was unable to objectively quantify behavioral change or patient outcomes, which are ultimately the program outcome goals.

Faculty champions discussed that the current format of the NEEF guidelines does not provide facile integration into the EHR. The documents can be readily linked in the EHR, so

that a hard copy of a patient handout may be printed for the patient. However, this requires easy access to printers and may be inefficient. In addition, materials are not “live” documents, and therefore cannot be individualized for the patient needs. The materials are also not available on a mobile platform. Templates can be built for common EHRs such as Epic; however, the process of building the templates is time consuming and likely would require support from the information technology professionals at each institution/practice. Finally, while many institutions are beginning to consolidate to a few, major EHR systems, there are a vast number of smaller EHR programs used by many private practices.

This program had limited substantive collaborations with insurance companies, although nationally there are efforts for asthma programs to work with insurers for reimbursement related to ET management. Some interactions of program faculty consisted of panel discussions in which an insurance company representative was a participant where fledgling efforts and ideas were developed.

The Prioritized Next Steps

The prioritized next steps are listed in Table 4, along with their assigned score. The clear top priority was based on improving Medicaid reimbursement for environmental home visits for patients with asthma. Other ideas that scored highly reflected continuing the educational programs in a sustained fashion, additional tracking of program effectiveness, and the use of the EHR to facilitate ET management in asthma care.

Discussion

We have consistently identified a low baseline of knowledge of ET management among pediatricians in this and a previous evaluation earlier in the program. We have also shown some effectiveness of a brief educational session to assess this knowledge gap, through evaluation of trainee knowledge and practice surveys described previously and again here with additional expansion of the program.[22] The number of trainees reached was high and covered all regions of the country with the program providing a faculty champion in each of the US EPA/HHS regions.

While our educational intervention involves a modest and traditional approach, we observed substantial improvement in trainee practice behaviors and attitudes for up to 6 months after attendance. This may, in part, be related to the low baseline level of knowledge and practice for many of the environmental history questions and recommendations. However, even after the training, less than one-third of the trainees would regularly ask about dust mite exposure. While this may somewhat reflect differences in dust mite prevalence in various areas of the country, quality improvement efforts may help result in permanent change in practice.

White et al[25] compared a problem-based learning method to a didactic lecture approach and found there was no difference in change in knowledge about general asthma concepts and guideline management for either method. In their study, both educational methods were associated with a significant increase in knowledge following baseline assessment. This study also noted that there was a drop-off in knowledge at a 3-month interval, yet remained greater than at baseline.[25]

Future Improvements for Trainings/Ways to Use the NEEF Guidelines

The faculty champions recommended a case-based framework to supplement the materials. This process has already begun as one of the faculty champions integrated the asthma PowerPoint teaching tool into a comprehensive environmental health education training manual being assembled for the Children's Environmental Health Network. The addition of the case-based learning provides a more patient focused approach that is felt to be more acceptable in some educational environments.

The format of the NEEF Guidelines could also be improved by integrating with mobile technology. Currently, the NEEF Guidelines are either paper-based or a static PDF that is not interactive. Development of a smart phone application to be used as a patient/parent interface, in which suggestions from the NEEF Guidelines can be easily accessed by the family, may be considered. Developing a webpage interface would allow parents to use a link to complete the environmental history.

Future Improvements for Integration to EHRs

The EHR holds continued promise for standardizing and guiding asthma care in the form of clinical decision support. While standardized clinical documentation templates and electronic forms can serve as prompts and are considered forms of clinical decision support, ultimately they still rely on human action to complete the necessary tasks. This may produce a wide margin of error. With the increasing amount of patient-specific discrete data EHR's acquire, they now contain enough information to suggest both timely diagnoses and personalized interventions. In fact, when the EHR is designed and utilized to suggest and facilitate these aspects of a patient's care, clinicians are more likely to adhere to guidelines and recommend best options.[26]

In the case of environmental asthma management, the EHR could be programed to include standard environmental interventions for all patients diagnosed with persistent asthma and targeted interventions for identified specific allergens and other triggers. Another improvement could be a prompt to test for specific allergens if a patient is documented to have increasing asthma medication needs—especially in the setting of a documented change in residence, new environmental exposure, or addition of a pet to the environment. Although a major advantage realized with all strategies is incremental education over time while reducing unnecessary duplication or missed opportunities for new information, the overall standardization in processes and information given is most important, as standardization has been shown to increase provider utilization of any particular tool.[27]

In order for the NEEF Guidelines to be integrated into EHRs at a population level, it will need to occur at the system level. For this to happen, major EHR vendors would need to include the basic components of ET management into the initial build of the medical record for all clients. The ultimate goal would be customizable patient self-management materials. Asthma action plans are another major component of comprehensive asthma management, and the faculty champions would like to see the modification of the EHR to include environmental recommendations.

Future Improvements for Developing National Partnerships

Several insurance programs have, in the past 10 years, begun paying for home environmental assessments. Unlike some of the private insurance companies, most Medicaid programs do not pay for in-home environmental assessments for patients with asthma. This could be an area for future emphasis given the high burden of asthma in children in low-income households and the role of housing quality in ET exposure. Integrating this as a standard, reimbursable asthma service remains a long-term goal for comprehensive asthma care and would reinforce the clinician role in environmental management.

Summary

The NEEF Pediatric Asthma Faculty Champion Initiative has national scope, reaching more than 12 000 physicians, medical students, and other health care providers. The training materials have been shown to substantially improve knowledge from a low baseline among clinical providers. Since development of the program, increasing use of EHRs and case-based medical education provides opportunities for refinement for increased uptake and sustainability. Potential improvements include expanded attention of the program to other health care professionals and collaboration with insurance companies to support a home environmental assessment and intervention for patients with asthma to complement the clinically based environmental management activities.

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Table 1.

States and Territories That Make Up Each of the US Environmental Protection Agency (EPA) Regions.

US EPA Region	States
1	Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut
2	New York, New Jersey, Puerto Rico, US Virgin Islands
3	Delaware, Pennsylvania, West Virginia, Virginia, Washington, DC, Maryland
4	Kentucky, Tennessee, South Carolina, North Carolina, Georgia, Florida, Alabama, Mississippi
5	Wisconsin, Michigan, Ohio, Indiana, Illinois, Minnesota
6	Texas, Louisiana, Arkansas, Oklahoma, New Mexico
7	Missouri, Iowa, Kansas, Nebraska
8	Colorado, Utah, Wyoming, South Dakota, North Dakota, Wyoming, Montana
9	Arizona, Nevada, California, Hawaii, Guam, Trust Territories, American Samoa, Northern Mariana Islands
10	Idaho, Oregon, Washington, Alaska

Table 2.

Pediatrician Self-Reported Baseline Knowledge of Environmental Asthma Triggers.

Responses described as "Expert" or "Very Good"			Pearson χ^2
	Group 1 Faculty Champions US EPA Regions 2, 4, 6, 9, 10[a] 09/2007–09/2009	**Group 2 Faculty Champions US EPA Regions 1, 3, 5, 7, 8 03/2011–10/2014**	***P***
Tobacco smoke exposure	59%	43%	<.05
Animal allergens	41%	34%	NS
Mold exposure	38%	27%	NS
Cockroach exposure	34%	24%	NS
Dust mites	34%	24%	NS
Outdoor air pollution	33%	28%	NS
Indoor chemical use	27%	23%	NS

Abbreviations: EPA, Environmental Protection Agency; NS, nonsignificant.

[a]Adapted from Roberts et al.[22]

Table 3.

Participant Self-Reported Environmental Management of Asthma Practice Behaviors and Attitudes Pre, Post, and 3 to 6 Months After a Brief Educational Intervention (Data From March 2011 to October 2014).

	Pre (%)	Post (%)[b]	3- to 6-Month Follow-up (%)[b]
"Always ask about"[a]			
Dust mites	7	49	31
Tobacco smoke	32	69	68
Animal allergens	20	61	48
Cockroach exposure	5	45	23
Mold exposure	6	47	28
Outdoor air pollution	8	42	28
Indoor chemical use	5	40	25
Wood smoke	4	36	22
"At least most of the time"[a]			
Recommend dust mite covers	13	85	61
Advise family to quit smoking	66	87	83
Refer to asthma specialist	15	51	40
Provide written asthma action plan	33	83	70
"Strongly agree"[c]			
I am comfortable advising patients about decreasing secondhand smoke exposure	23	49	52
I am comfortable teaching patients about environmental influences on asthma	12	45	37
I know where to find patient information about managing environmental asthma triggers	15	49	42

[a] Scale: 1 = Always, 2 = Most of the Time, 3 = Fairly Often, 4 = Occasionally, 5 = Rarely, 6 = Never.

[b] McNemar's χ^2 (all values compared to "Pre" with $P < .001$).

[c] Scale: 1 = Strongly Agree, 2 = Agree, 3 = Disagree, 4 = Strongly Disagree.

Table 4.

Top “Prioritized Next Steps.”

“What Bold Next Step Can I Take?”	**Points**
I will work with State Partners to gain Medicaid reimbursement for home visits throughout my state.	15
I will give a NEEF lecture on case-based adaptation to every third-year medical student rotating in my department.	12
I will create a new simplified Asthma Plan Visit EPIC Template that incorporates the NEEF Environmental Asthma History and Exposure-Specific Tools and monitor their use as part of QI project in our resident teaching practice.	12
I will measure the number of patient encounters where the provider assessed environmental triggers.	12
I will implement the QI Project at my institution regarding Environmental Asthma Triggers. This QI project will take place in my community clinic. We will receive MOC 4 credit for this.	11
I will approach Cerner + Zynx to integrate our questionnaire and education broadly not just at our site.	11
I will research Epic Systems as a possible private sector partner/donor for this work.	11
I will provide resources that exist so that people don’t continue to reinvent the wheel. I believe in modifying/ improving programs based on evaluation.	11

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