


Breathe Easy at Home: A Qualitative Evaluation of a Pediatric Asthma Intervention

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Abstract

The Breathe Easy at Home Program enables clinicians to refer asthmatic patients to Boston Inspectional Services Department (ISD) if they suspect housing conditions trigger symptoms. The authors conducted one-on-one interviews with clinicians ($n = 10$) who referred patients, and focus groups with inspectors from the ISD ($n = 9$) and a variety of stakeholders ($n = 13$), to gain insight into program function and implementation. Clinician interviews revealed inconsistencies in enrollment approaches, dissatisfaction with the web-based system, and patient follow-up difficulties. Inspectors identified barriers to working effectively with residents and landlords, and the stakeholder focus group highlighted successes of an unusual institutional collaboration. Interviews and focus groups identified strong and personal rapport between clinicians, inspectors, and patients as key to program retention, and that participating families required additional support throughout the process. Despite recommendations for improvement in program implementation, clinicians, inspectors, and stakeholders felt that the program overall improved both the home environment and asthma outcomes.

Keywords

asthma, pediatric, housing, community-based programs, health care, teamwork, intervention programs, marginalized populations, program evaluation, research, qualitative

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Background

Asthma is a chronic respiratory disease affecting 8.3% of children in the United States, particularly in low-income and minority populations (Centers for Disease Control and Prevention [CDC], 2015). Compared with non-Hispanic White children, asthma prevalence is 2.4 times higher among Puerto Ricans and 1.6 times higher among African Americans (Akinbami, Moorman, Garbe, & Sondik, 2009). Household environmental triggers, including cleaning products, chronic dampness, pest infestation, dust mites, cigarette smoke, and poor ventilation, are linked to increased asthma symptoms and severity (Arruda et al., 2001; Murray & Morrison, 1993; Rumchev, Spickett, Bulsara, Phillips, & Stick, 2004). Disparities in asthma prevalence among urban minority and low-income youth may, in part, be due to differential levels of allergen presence in homes in high-poverty areas, where substandard housing is more common (Kitch et al., 2000; Sarpong, Hamilton, Eggleston, & Adkinson, 1996). Consequently, the home environment is a focus for asthma interventions (Shani et al., 2015; Turcotte, Alker, Chaves, Gore, & Woskie, 2014).

Over the past decade, many health care providers have introduced programs that incorporate home visits to reduce asthma triggers. A review of 23 studies evaluating such interventions found overall improvements in symptom-free days, reductions in school days missed because of asthma, and reduction in acute care visits (Crocker et al., 2011). Because of the complex physiological, socioeconomic, and environmental factors that affect asthma severity and management, the most effective programs take a multifaceted approach by incorporating care coordination across multiple stakeholders (Clark, Lachance, Milanovich, Stoll, & Awad, 2009; Crocker et al., 2011; Fabian, Adamkiewicz, Stout, Sandel, & Levy, 2014; Kelly et al., 2015; Krieger, 2010; Weil et al., 1999).

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Specifically, community-based asthma programs with positive outcomes are frequently engaged with a community organization, are clinically integrated, provide asthma training to practitioners, collaborate with government agencies, are culturally competent, and include assessments of the home environment (Clark et al., 2009). Effectiveness is enhanced with the clinician making referrals similar to prescriptions for patients (Kizer, 2015). Effective asthma management strategies have been associated with improved general quality of life, fewer school absences, improved education outcomes, and decreased costs (Barnes, Jonsson, & Klim, 1996; Moonie, Sterling, Figgs, & Castro, 2008; Shortell, Bennett, & Byck, 1998).

Physicians, nurses, social workers, and community health workers (CHWs) most commonly perform home visits in asthma interventions. However, few interventions incorporate staff of municipal Inspectional Services Departments (ISDs) who can enforce sanitary codes (Crocker et al., 2011). The Breathe Easy at Home (BEAH) program in Boston, Massachusetts, is a partnership of the City of Boston ISD, the Boston Public Health Commission (BPHC; the Health Department for the City of Boston), and Boston Medical Center, which serves primarily vulnerable and low-income Boston residents (Reid et al., 2014).

Clinicians screen asthmatic patients for BEAH program eligibility during an appointment or home visit. They then submit a program referral through a secure Internet portal. The electronic referral system is meant to provide an easily accessible tool for clinicians. Once a referral is entered, an ISD inspector is assigned to conduct a home inspection in accordance with the Massachusetts Sanitary Code for housing, focusing attention on asthma triggers that are covered by the Code. According to BEAH protocol, inspectors should provide the landlord and tenant a form that details the terms of the violation and the timeline for mitigation. As per Massachusetts General Laws, and the policies of the City of Boston ISD, the landlord is given between 24 hours and 30 days, depending on the severity of the violation, to perform any mitigation (Massachusetts Department of Public Health, 2007). If the landlord does not correct the violation, he or she is summoned by a court (Reid et al., 2014). ISD then schedules a reinspection with the family to review mitigation progress and close the case. Patients referred to the program are potentially supported by other community programs to which they are referred by CHWs or primary care physicians, including the Medical-Legal Partnership (Murphy, Lawton, & Sandel, 2015).

Although there has been an increase in asthma-based home-inspection programs, there is a gap in published evaluations of program implementation and integration into clinical practice (Brown et al., 2011; Clark et al., 2009; Durlak & DuPre, 2008). Of the evaluations that have been published, most examine quantitative measures of success rather than report on the specific steps, barriers, and facilitators to program implementation. To replicate successful programs and

bring them to fruition, qualitative evaluation is needed to understand the complexities that affect the implementation process. For programs that involve clinical practice, program evaluation allows investigators and program stakeholders to assess whether the clinically integrated program into general practitioner (GP) care represents effective and efficient mechanisms for service delivery. Furthermore, program evaluation provides valuable information to improve aspects of implementation such as program quality, fidelity, and intervention strength (Durlak & DuPre, 2008). Programs that achieve effective implementation practices are more likely to report positive program outcomes compared with programs with unsuccessful implementation (Durlak & DuPre, 2008).

This article reports findings of a qualitative evaluation of the effectiveness, applicability, implementation, and clinical integration of BEAH. The following summarizes analyses of one-on-one and group interviews with primary BEAH stakeholders to identify barriers and successes of the program. Results of this study contribute to the growing body of literature on effective community-based asthma management programs that focus on the pediatric population, and can be used to inform planning and implementation of future programs and asthma management in clinical practice.

Method

We used qualitative research methods to gain a deeper understanding of BEAH operations, the nature of stakeholder collaboration, and perceptions of program protocol fidelity by BEAH stakeholders and clinicians. A forthcoming article details program implementation from the perspectives of the family participants.

Recruitment and Data Collection

Table 1 lists the characteristics of one-on-one interview and focus group participants identified using purposive sampling. We conducted 10 individual interviews with clinicians and two separate focus group interviews with ISD and BEAH stakeholders between January 2014 and January 2015.

Researchers identified the types of clinicians to interview for the purpose of this research, with an emphasis on diversity of clinician type (GPs, registered nurses, CHWs, and nurse practitioners), clinical settings (such as community health centers [CHCs] and hospitals), and referral frequency. The BEAH program coordinator, who maintains the BEAH database, recruited clinicians using contact information from the database. Because of conflicting schedules, we were unable to get clinicians in one room for a focus group. Therefore, the BEAH Program Coordinator emailed referring clinicians to schedule individual phone interviews. Of the 37 clinicians contacted, we interviewed 10 who made themselves available for phone interviews.

BEAH staff also identified BEAH steering committee members (pediatric nurse practitioners, CHWs, attorneys,

Table 1. Characteristics of Participants.

Position	<i>n</i>	Data Collection Method	Description
Clinicians	10	One-on-one telephone interview	Three medical doctors, three nurse practitioners, two registered nurses, and two community health workers from three separate Boston-based health institutions
Housing inspectors	9	Focus group	Inspectors who have worked with BEAH cases
Stakeholders	13	Focus group	Representatives of organizations directly invested in BEAH. This included pediatric nurse practitioners, community health workers, attorneys, the ISD housing director, healthy housing advocates, parents of children with asthma, and representatives of Boston Public Housing Commission

Note. BEAH = Breathe Easy at Home; ISD = Inspectional Services Department.

the ISD chief of staff, healthy housing advocates, parents of children with asthma, and managers in the Boston Public Housing Commission) and recruited them via phone and email for participation in a focus group.

Housing inspectors who had ever performed a BEAH inspection ($n = 30$) were asked by the ISD chief of staff via a broadcast email to participate in a focus group. Of the 30 eligible inspectors, nine participated, and did so without the knowledge of their Chief of Staff so that information shared in the focus group could not be attributed to an individual and staff would be protected from any possibility of retaliation.

Research team members (M.K.S. and A.R.) created semistructured interview guides for the inspector and stakeholder focus groups, and the clinician interviews, containing open- and closed-ended questions. A trained research assistant not otherwise affiliated with the BEAH program (M.Z.) conducted the clinician phone interviews. Probes and follow-up questions were used throughout the interview as needed. Interview questions were designed to elucidate information about communication with program staff, navigating the online portal, perceived acceptance of the program among the target population, effectiveness of clinical integration, perceived impact on health disparities, program successes, and suggested improvements. At the beginning of each interview, clinicians gave verbal consent to participate and to audiorecord the interview. Each interview lasted approximately 30 minutes.

The inspector focus group was designed to elicit information about the inspection process, patterns of communication and interaction between parties, and effectiveness at improving housing conditions. Participants of the stakeholder focus group were prompted to discuss the operational capacity in the BEAH partnership, interactions between collaborators, accessibility of the system, barriers to success, and areas for improvement. Participants were also asked to write on post-it notes what areas of the program could use improvement, and what improvements could be made. An experienced focus group facilitator (M.K.S.) facilitated the inspector and stakeholder focus groups, with a separate observer and notetaker (A.R.). Each focus group lasted 60 to 90 minutes.

All interview participants consented to participate in accordance with the Boston University Medical Campus

Institutional Review Board (BUMC IRB) which exists to “protect the rights and welfare of human subjects of research and to assure that human research is conducted according to applicable federal, state, and local laws and regulations,” and to provide ethical review of human subjects research (Boston Medical Center and Boston University Medical Campus Human Research Protection Program, 2016). All consent forms, consent practices, and ethical concerns were addressed in our application to the BUMC IRB. Interviews were audiorecorded.

Data Analysis

Interview and focus group recordings were transcribed, and identifying information was removed. Analysts (A.R. and M.K.S.) used standard social science methods for analysis (Patton, 2002). Briefly, the analysts iteratively developed preliminary codes from the transcripts until they established a final code book. All transcripts were subsequently coded, enabling the investigators to extract salient pieces of information and assign values of frequency, presence/absence, and relationship with other codes (Macqueen, Mclellan, Kay, & Milstein, 1998). Analysts used inductive reasoning to group the codes under logical categories, which allowed the investigators to arrive at analytic concepts that describe themes and subthemes in the data and relations and trends between variables. Findings generated from these concepts reflect theories generated from the data itself, absent a priori hypotheses (Snape & Spencer, 2003). The conceptual framework guides evaluation of successful program implementation by focusing on barriers and facilitators—an approach employed by previous public health intervention evaluation studies (Clark et al., 2009; Durlak & DuPre, 2008; Ellen et al., 2014; Varda, Shoup, & Miller, 2012).

Findings

Interviews and focus groups revealed three distinct concepts regarding successful BEAH program implementation and clinical integration: program participation, retention, and operation. We present barriers and facilitators to each with

Table 2. Facilitators and Barriers to BEAH Implementation.

	Facilitators	Barriers
Participation	<ul style="list-style-type: none"> • Clinicians work to alleviate caregiver fears about landlord retaliation • Educate patients on legal rights • Referral submission with the family present 	<ul style="list-style-type: none"> • Unwillingness of patients to participate because of fears of deportation and landlord retaliation • Familial priorities that supersede asthma intervention
Retention	<ul style="list-style-type: none"> • Follow-up with families to address new concerns and decrease turnaround time • Devoted health care team that includes primary care providers, nurses, community health workers, and asthma home educators • Additional community resources such as the Medical-Legal Partnership 	<ul style="list-style-type: none"> • Inability to reach the family to schedule an appointment or complete an inspection • Disagreeable relationships between the family and inspector and/or landlord • Uninformative and untimely web-based updates and inability to follow-up with the patient • Lack of written information
Program operation	<ul style="list-style-type: none"> • Consistencies and flexibility in program operation: Patient eligibility screening First inspection • Transparency and managing expectations by providing consistent information to family and landlord • BEAH staff availability • Positive working relationships between inspector, tenant, and landlord to promote trust • Program partner collaborative capacity and aligned objectives 	<ul style="list-style-type: none"> • Cumbersome electronic referral system • Uninformative web portal updates • Inconsistencies in program operation: Electronic updates Reinspection schedule • Ambiguity around responsible party for violations • Reluctance to accept responsibility for violations by landlord and tenants • Lack of financial resources

Note. BEAH = Breathe Easy at Home.

illustrative quotes to reflect the experiences and voices of stakeholders and clinicians. Table 2 lists the principal facilitators and barriers under these three concepts.

Program Participation

Barriers and facilitators to program participation primarily occurred during the screening and referral process. There was consensus among clinicians that some families chose not to participate in BEAH because of competing priorities, fear of eviction, deportation, or incriminating other individuals. Fear of landlord retaliation was the most prominent concern in interviews. While some clinicians assured families that there would be no landlord retaliation, others candidly discussed legal problems patient caregivers might anticipate. Regardless of approach, clinicians acknowledged their role in alleviating fears was important for program participation: “A lot of it is just educating families about what their rights are and then helping them to understand what resources are available to them, and then helping them to access those resources.”

After screening patients for program eligibility, most clinicians believed that making referrals with families present enabled the clinician to obtain up-to-date contact information and accurate information about the home environment. It was also an opportunity to clearly explain the program, provide education on asthma self-management and triggers in the home, and for the family to ask questions. Clinicians who submitted referrals after the patient visit without the family present cited “time constraints” as the primary reason

for not doing it with them in the room and engaging the caregiver in the process.

During the referral process, clinicians provided a variety of fact sheets and pamphlets containing information about asthma management and BEAH to the family. Three clinicians provided written information about asthma triggers that they created or received from other programs. Two clinicians gave pamphlets provided by BEAH detailing program expectations. However, four of those five who provided written information used it sparingly because it was cumbersome, people tended not to read it, and because of language barriers. Clinicians indicated that concise written information would attract otherwise tentative patients and would facilitate a smoother first inspection (described below). In addition, many clinicians and stakeholders thought that more frequent on-site workshops would encourage participation, as new clinicians only learned about BEAH through champions in the clinic who individually promoted the program.

Program Retention

Figure 1 outlines the BEAH inspection process and places where participants might drop out or be lost to follow-up (explained below).

Interviews revealed potential reasons for losing patients before the first inspection (Figure 1). Several clinicians and stakeholders mentioned that families say they never received a phone call or letter from BEAH to schedule a first inspection, but when clinicians contacted BEAH staff to follow-up, they were told that several contact attempts were made with no

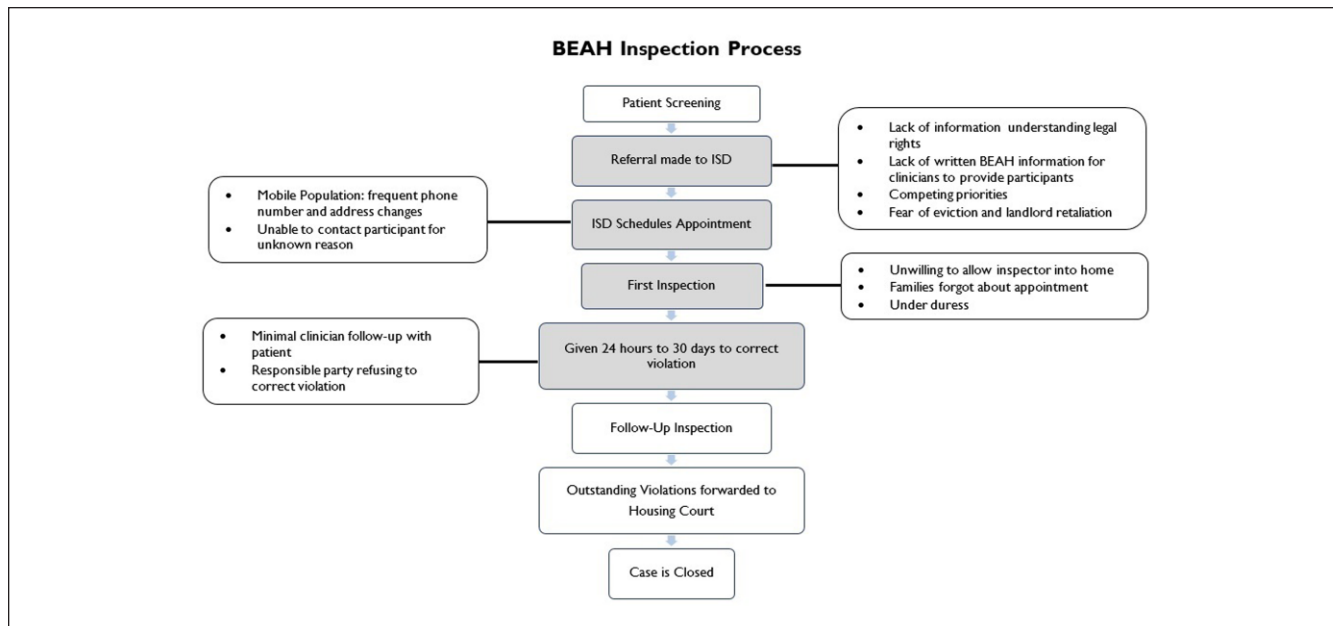


Figure 1. BEAH inspection process.

Note. Shading indicates places where participation failure is likely to occur and cited reasons. BEAH = Breathe Easy at Home; ISD = Inspectional Services Department.

response. Inspectors described that even after confirming an inspection, on arrival to the home, either the family was not present or they were refused entry because (a) families forgot about the appointment and were unprepared, or (b) they agreed to the program in the company of their physician because they were “under duress” but did not in fact want the inspection. There was also agreement among inspectors that families failed to schedule an appointment because of fears of landlord retaliation, or busy schedules. Finally, there was consensus among clinicians, inspectors, and stakeholders that the population served by BEAH is relatively mobile, resulting in frequent phone number and address changes. This would be relevant if the referral were made by a clinician after the patient visit without confirming up-to-date contact information.

Most interview participants agreed that between the first inspection and reinspection is a second point of loss-to-follow-up (Figure 1). There was a general consensus that retaining cases in the BEAH program is dependent on a team of “providers” who track the progress of each case. Across the board, key stakeholders felt that their ability to do this was limited by the present web-based system.

Clinicians indicated that more frequent and specific web portal updates would allow them to discuss their patient’s progress during appointments, send reminders to patients, and provide additional support as needed. As stated by a stakeholder focus group participant, “As a referrer, feedback via email often comes late. If I knew ahead of time someone had an inspection date, I could remind the family.”

As part of the care team, clinicians spoke highly of community resources that can provide additional support and

empower their patients. These include the Medical-Legal Partnership, which integrates legal assistance for health and housing needs into patient care, and other community health programs, such as Healthy Homes and the Community Asthma Initiative (Cohen et al., 2010; Murphy & Sandel, 2011; Woods et al., 2012). Several clinicians suggested that a continuum of care across these programs facilitated patient retention in the program. One clinician stated,

In the case of someone who is worried about deportation or something like that, we can refer them to Medical/Legal Partnership. So, we’re very fortunate that we have access to a great deal of wonderful resources that can be accessed, but they just need to know how to do that.

There was also agreement that longer turnaround time between the first inspection and violation correction increased likelihood of loss-to-follow-up but could be mitigated by clinician involvement and proactive inspectors (described below). Stakeholders suggested that cases sometimes got buried in legal proceedings with recalcitrant landlords or lost because of other issues related to tenant compliance and that these losses should be tracked more carefully.

Program Operation and Overall Impressions

One-on-one interviews and focus groups revealed that program fidelity and consistent communication were the two main themes under program operation that affected implementation. Below we present how those subthemes emerged in chronological order of BEAH program implementation.

Patient screening. Clinicians reported that they screened patients for BEAH eligibility using primarily a combination of observed asthma symptoms and severity, and, additionally, information about the home environment. Although some clinicians referred only patients with severe or persistent asthma, most referred any patient with asthma whom they knew or suspected also had home-based risk factors and/or for whom sensitivity to home-based allergens (e.g., mold) was identified by a skin test. The three primary care physicians who worked with a CHW who performed home visits prior to the referral expressed the opinion that this experience provided a more comprehensive understanding of the patient's risk factors.

Referrals. The majority of clinicians submitted referrals through the electronic system during a scheduled appointment or, for CHWs, during a home visit. Clinicians consistently cited the referral system as the principal barrier to complete and comprehensive referrals. Although two clinicians found the referral process straightforward and efficient, the other eight found it time-consuming, especially the level of housing detail required in each field (e.g., about the type of heat).

First inspection. BEAH protocol states that an ISD staff member calls families within 24 hours after receiving the referral. If the patient cannot be reached, a letter should be sent to the tenant with the inspection date and time. After three attempts to visit the home, protocol allows the case to be marked as "closed." Both inspectors and stakeholders described this process as consistent with protocol.

Descriptions of the first inspection process, once in the home, were consistent among inspectors. They described walking through the home with the caregiver and discussing code violations, with added attention to asthma triggers. Four of the nine inspectors attended trainings provided by the BPHC in the identification of home-based asthma triggers and the asthma symptoms. Informed by this training, inspectors described "counseling" tenants on specific behaviors to reduce asthma triggers such as dusting and vacuuming, not smoking cigarettes, ventilation, preventing pests, and general cleanliness. As consistent with BEAH and ISD protocol, upon inspection completion, the inspector submits a form to ISD staff that lists violations, which is logged in the ISD system and mailed to the tenant and the landlord. Inspectors noted that they also commonly give informal "write-ups" to tenants directly after the inspection that highlight sanitation and lifestyle factors related to asthma exacerbation.

Both inspectors and clinicians desired consistent messaging to manage family expectations of the BEAH program during the first inspection. For example, inspectors wanted clinicians to set expectations with families that asthma triggers or code violations might be the family's responsibility, and not just the landlord's. Similarly, several clinicians cited

the need for inspectors to clearly define remediation responsibility between the tenant and the landlord. To manage landlord-tenant relationships during the first inspection, stakeholders suggested that inspectors should also provide the landlord pamphlets explaining the BEAH program and that the inspection is initiated by a clinician.

Electronic updates. Within the stakeholder focus group, there was disagreement around who issues the update, determines its content, and where to access it. All clinicians and some stakeholders expressed the opinion that updates provided on the web portal were uninformative and a primary barrier to thorough patient follow-up. One clinician stated, "The communication through the computer system is horrible. I don't have words strong enough for it. It gives me no information . . . There is no information about what they found." Most clinicians wanted more detailed information including accurate reinspection dates, expected time to correct the violation, the party that was responsible to correct violations, and a copy of the complete violation sheet sent to the landlord. In addition, several clinicians wanted a direct connection between the referrals to the patient's medical records for more coordinated care across the health care team.

Clinicians also identified inconsistencies between their patient's reported experience and the electronic update. Some patient cases were marked as "closed" if the family could not be reached for a first inspection, erroneously suggesting that the case was resolved—another source of misunderstanding for the clinician and a lost opportunity to understand why a first inspection was unsuccessful.

Fortunately, clinicians have the option of calling BEAH staff to follow-up with a case. Most clinicians were very positive about BEAH staff accessibility, describing their interactions with BEAH as helpful. However, clinicians admitted to not following up directly with BEAH because of demands on time. If it was not at their fingertips, they were not going to search for the information.

Violation correction and reinspection. Among inspectors, the most commonly cited barrier to violation correction was confusion about who was responsible for violations, which often resulted in a delayed reinspection. Regardless of responsibility, clinicians and participants of both stakeholder and inspector focus groups agreed that lack of financial resources for tenants and landlords was another barrier to mitigation. Both landlords and tenants did not have financial resources to fix the violations (e.g., ventilation in the bathroom) and asthma triggers that are not violations (e.g., replace old and moldy rugs).

Both inspectors and clinicians cited trust and a good working relationship between inspectors, the family, and the landlord as the main facilitators in complying with the mandated mitigation timeline. To promote trust, all inspectors described their work as beyond noting violations and citing the responsible party. For example, inspectors described a

process of building trust with the tenant to truly understand the root of problems in the home. Inspectors also noted that the landlord almost always called the inspector after receiving a violation notice, which is when inspectors described becoming mediators between the landlord and the tenant. Some clinicians, however, reported that their patients expressed feeling slighted by the inspector or believed the inspector favored the landlord.

Clinical integration and partnerships. To improve integration into clinical practice, both clinicians and stakeholders suggested that the care team could play a more prominent role in augmenting the primary care provider practice by systematically integrating BEAH into clinical care. As described by one clinician,

. . . I look at the model of the CHW and I see that the CHW doesn't do what we already do. They augment our practice. So, that might be a way that Breathe Easy referrals might take off, if a nurse is asking a family member, "How are things at home? Did you get the leaky pipe fixed? Were you able to?" That sort of thing.

Some clinicians also emphasized that integration of inspection results and BEAH updates into electronic medical records would also streamline BEAH integration into clinical practice.

Clinicians, inspectors, and stakeholders all had positive attitudes about the BEAH partnerships and were generally pleased with the program outcomes and operation. Inspectors had anecdotal evidence of improved housing conditions and improved asthma symptoms and severity:

I think the program's a great success. I can't tell you how many times I've written up the landlord and I've talked to the tenant, I've written up the tenant. And then I go back or I get a phone call months down the line and say you know "my child hasn't been in the emergency room since you've been out here, thank you so much."

When asked about BEAH successes, stakeholders spoke enthusiastically about partners' unique abilities to collaborate, highlighting well-aligned objectives as the main driver in maintaining an effective collaboration. Both stakeholders and inspectors indicated that BEAH partners shared a genuine interest in improving asthma symptoms and health care delivery. Stakeholders also felt that the partners recognized and trusted the unique assets that each partner brings to the program.

Discussion

Qualitative analysis of interviews with BEAH stakeholders identified facilitators and barriers of program implementation and clinical integration, giving insight to the program, noting where perceptions of the program differ and how

clinician, inspector, and BEAH staff are linked throughout the process. We found that clinicians primarily focused on asthma self-management and on general triggers in the home, whereas inspectors primarily focused on case-specific structural and home-based asthma triggers and facilitated approaches to address them. The principal barriers and facilitators to successful program implementation were rooted in participant attraction to the program, keeping participants in the program and whether the program was communicated and implemented consistently and effectively by clinicians and inspectors.

BEAH successes reflect aspects that have been recognized as fundamental components of successful health interventions: integration into GP care, collaboration between community coalitions, and a patient support team comprised of both medical professionals and CHWs (Clark et al., 2013; Crocker et al., 2011; Durlak & DuPre, 2008; Loignon, Fortin, Bedos, & Haggerty, 2015). Shared decision making, nonhierarchical relationships, mutual trust, and open communication between collaborators have all been cited as facilitators to program implementation and sustained member commitment (Foster-Fishman, Berkowitz, Lounsbury, Jacobson, & Allen, 2001; Varda et al., 2012).

Efficacious clinical integration into preventive services has been attributed to a clear governance structure, information management tools (an electronic portal), patient follow-up, and coordinated services across operating units (Kizer, 2015; Klompas et al., 2012). A central element of clinical integration is putting the clinician at the nucleus of information coordination (Shortell et al., 1998). Electronic medical records have been shown to improve GP productivity and facilitate information transfer across health care settings (Klompas et al., 2012). In this study, clinicians articulated the need for integration of referrals and updates into electronic medical records to improve case management and individual care.

Barriers listed in Table 2 are consistent with the literature on community-based asthma interventions. The authors of a systematic review of home-based, multicomponent interventions with an environmental focus found the most common barriers to implementation were "reluctance of families to accept home visits, inability to maintain follow-up because of the transient population, difficulty scheduling appointments, and poor compliance with recommendations" (Crocker et al., 2011). Previous research has also found that mitigation often did not occur because of lack of financial resources, consistent with our findings (Crocker et al., 2011; Patel, Brown, & Clark, 2013). Our findings also revealed that the key places of patient dropout are easily addressed through improvement of the electronic system and better communication between parties.

Asthma disproportionately affects minority and low-income populations (Lara, Akinbami, Flores, & Morgenstern, 2006). Many of these populations are not only disproportionately lacking health care resources but are also burdened

with higher pollution levels, more neighborhood stressors, and poor housing quality (Adamkiewicz et al., 2011; Messer et al., 2006; Morello-Frosch & Lopez, 2006; Rauh, Landrigan, & Claudio, 2008). Each of these factors have been associated with asthma morbidity (Camacho-Rivera, Kawachi, Bennett, & Subramanian, 2014; Corburn, Osleeb, & Porter, 2006; Raun, Ensor, Campos, & Persse, 2015). Asthma interventions are therefore uniquely positioned to address asthma prevalence and management at the individual and community levels. Community-level, multicomponent asthma interventions must have the capacity to create and sustain collaborations with a diverse set of stakeholders for effective asthma management. For example, incorporating ISD in BEAH has the added benefit of holding a responsible party legally liable for violation correction. From an implementation standpoint, collaborating with an agency outside of the clinical space adds a layer of complexity.

Programs wishing to address the individual and community determinants of asthma morbidity can include BEAH as a component of a well-rounded patient asthma education system, supplemented by further collaboration with programs that support lifestyle improvement, dietary management, and additional social supports (Hunter, 2015). Studies on GP interaction with vulnerable populations have found that collaboration with other health care professionals and organizations is a fundamental strategy for successful chronic care management and encourages relational continuity with patients (Kelly et al., 2015; Loignon et al., 2015).

What is clear from interviews and focus groups in this study is that clinicians and a care team are integral in successful completion of BEAH. They facilitate program retention, a productive first inspection; maintain the family's expectations of program processes; and provide community resources that empower patients and provide holistic asthma management. These findings suggest that BEAH has incorporated many aspects of collaborative capacity associated with effective community coalitions in asthma interventions but falls short on formalized procedures, an effective internal communication system, and additional resources that GPs and inspectors can provide to families (Foster-Fishman et al., 2001).

Limitations

We did not interview landlords whose homes were inspected by BEAH. Their perspective may have provided insight about mitigation processes and timelines, relationships with tenants, and their interactions with BEAH. This study might be subject to self-selection bias. People who volunteered to participate might be biased toward the program; the interviews are not necessarily representative of all BEAH stakeholders.

Conclusion

BEAH has begun to implement changes that improve program functionality and retention. The program is in the

process of updating and simplifying written materials for patients and landlords to help them better understand the link between violations in the home and health (Reid et al., 2014). The program has developed videos to introduce and explain BEAH to potential patients, landlords, and referring clinicians, including one explaining the BEAH referral process and database specifically for clinicians. Modifications are being made to the BEAH portal for better navigation and increased standardization. The program has improved its initial contact process through more thorough family outreach and a letter sent after multiple contact attempts. BEAH is also piloting email and text options for scheduling inspections and for scheduling reminders.

Pediatric asthma among vulnerable populations is a persistent public health problem. Evidence-based evaluations demonstrate that clinically integrated home-visiting programs are instrumental to reducing asthma prevalence and severity (Crocker et al., 2011). Taken together, these findings provide guidance for implementing and maintaining a clinically integrated, home-inspection program that can be incorporated in primary practice and clinical care. They also demonstrate that a clinically integrated program to address asthma represents effective and efficient mechanisms for service delivery.

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References

- Adamkiewicz, G., Zota, A. R., Patricia Fabian, M., Chahine, T., Julien, R., Spengler, J. D., & Levy, J. I. (2011). Moving environmental justice indoors: Understanding structural influences on residential exposure patterns in low-income communities. *American Journal of Public Health, 101*, S238–S245.
- Akinbami, L. J., Moorman, J. E., Garbe, P. L., & Sondik, E. J. (2009). Status of childhood asthma in the United States, 1980–2007. *Pediatrics, 123*, S131–S145.
- Arruda, L. K., Vailes, L. D., Ferriani, V. P., Santos, A. B., Pomés, A., & Chapman, M. D. (2001). Cockroach allergens and

- asthma. *The Journal of Allergy and Clinical Immunology*, 107, 419–428. doi:10.1067/mai.2001.112854
- Barnes, P. J., Jonsson, B., & Klim, J. B. (1996). The costs of asthma. *The European Respiratory Journal*, 9, 636–642.
- Boston Medical Center and Boston University Medical Campus Human Research Protection Program. (2016). *Policies and procedures*. Retrieved from <http://www.bumc.bu.edu/irb/irb-guidance/>
- Brown, A. S., Disler, S., Burns, L., Carlson, A., Davis, A., Kurian, C., . . . Wilson, K. (2011). Family and home asthma services across the Controlling Asthma in American Cities Project. *Journal of Urban Health*, 88, S100–S112.
- Camacho-Rivera, M., Kawachi, I., Bennett, G. G., & Subramanian, S. V. (2014). Perceptions of neighborhood safety and asthma among children and adolescents in Los Angeles: A multilevel analysis. *PLoS ONE*, 9(1), Article e87524. doi:10.1371/journal.pone.0087524
- Centers for Disease Control and Prevention. (2015). *National Current Asthma Prevalence (2013)*. Retrieved from http://www.cdc.gov/asthma/most_recent_data.htm#modalIdString_CDCTable_0
- Clark, N. M., Lachance, L. L., Benedict, M. B., Doctor, L. J., Gilmore, L., Kelly, C. S., . . . Wilkin, M. (2013). Improvements in health care use associated with community coalitions: Long-term results of the allies against asthma initiative. *American Journal of Public Health*, 103, 1124–1127. doi:10.2105/AJPH.2012.300983
- Clark, N. M., Lachance, L., Milanovich, A. F., Stoll, S., & Awad, D. F. (2009). Characteristics of successful asthma programs. *Public Health Reports*, 124, 797–805.
- Cohen, E., Fullerton, D. F., Retkin, R., Weintraub, D., Tames, P., Brandfield, J., & Sandel, M. (2010). Medical-legal partnership: Collaborating with lawyers to identify and address health disparities. *Journal of General Internal Medicine*, 25, S136–S139. doi:10.1007/s11606-009-1239-7
- Corburn, J., Osleeb, J., & Porter, M. (2006). Urban asthma and the neighbourhood environment in New York City. *Health & Place*, 12, 167–179. doi:10.1016/j.healthplace.2004.11.002
- Crocker, D. D., Kinyota, S., Dumitru, G. G., Ligon, C. B., Herman, E. J., Ferdinands, J. M., . . . Sipe, T. A. (2011). Effectiveness of home-based, multi-trigger, multicomponent interventions with an environmental focus for reducing asthma morbidity: A community guide systematic review. *American Journal of Preventive Medicine*, 41(2, Suppl. 1), S5–S32.
- Durlak, J. A., & DuPre, E. P. (2008). Implementation matters: A review of research on the influence of implementation on program outcomes and the factors affecting implementation. *American Journal of Community Psychology*, 41, 327–350. doi:10.1007/s10464-008-9165-0
- Ellen, M. E., Léon, G., Bouchard, G., Ouimet, M., Grimshaw, J. M., & Lavis, J. N. (2014). Barriers, facilitators and views about next steps to implementing supports for evidence-informed decision-making in health systems: A qualitative study. *Implementation Science*, 9, 179. doi:10.1186/s13012-014-0179-8
- Fabian, M. P., Adamkiewicz, G., Stout, N. K., Sandel, M., & Levy, J. I. (2014). A simulation model of building intervention impacts on indoor environmental quality, pediatric asthma, and costs. *The Journal of Allergy and Clinical Immunology*, 133, 77–84. doi:10.1016/j.jaci.2013.06.003
- Foster-Fishman, P. G., Berkowitz, S. L., Lounsbury, D. W., Jacobson, S., & Allen, N. A. (2001). Building collaborative capacity in community coalitions: A review and integrative framework. *American Journal of Community Psychology*, 29, 241–261. doi:10.1023/A:1010378613583
- Hunter, C., Chew-Graham, C.A., Langer, S., Drinkwater, J., Stenhoff, A., Guthrie, E.A., & Salmon, P. (2014). ‘I wouldn’t push that futher because I don’t want to lose her’: a multiperspectie qualitative study of behaviour change for long-term conditions in primary care. *Health Expectations*, 18(6), 1995–2010. doi:10.1111/hex.12304
- Kelly, R. P., Stoll, S. C., Bryant-Stephens, T., Janevic, M. R., Lara, M., Ohadike, Y. U., . . . Malveaux, F. J. (2015). The influence of setting on care coordination for childhood asthma. *Health Promotion Practice*, 16, 867–877. doi:10.1177/1524839915598499
- Kitch, B. T., Chew, G., Burge, H. A., Muilenberg, M. L., Weiss, S. T., Platts-Mills, T. A., . . . Gold, D. R. (2000). Socioeconomic predictors of high allergen levels in homes in the greater Boston area. *Environmental Health Perspectives*, 108, 301–307.
- Kizer, K. W. (2015). Clinical integration: A cornerstone for population health management. *Journal of Healthcare Management*, 60, 164–168.
- Klompas, M., McVetta, J., Lazarus, R., Eggleston, E., Haney, G., Kruskal, B. A., . . . Platt, R. (2012). Integrating clinical practice and public health surveillance using electronic medical record systems. *American Journal of Preventive Medicine*, 42(6, Suppl. 2), S154–S162. doi:10.1016/j.amepre.2012.04.005
- Krieger, J. (2010). Home is where the triggers are: Increasing asthma control by improving the home environment. *Pediatric Allergy, Immunology, and Pulmonology*, 23, 139–145. doi:10.1089/ped.2010.0022
- Lara, M., Akinbami, L. J., Flores, G., & Morgenstern, H. (2006). Heterogeneity of childhood asthma among Hispanic children: Puerto Rican children bear a disproportionate burden. *Pediatrics*, 117, 43–53. doi:10.1542/peds.2004-1714
- Loignon, C., Fortin, M., Bedos, C., Barbeau, D., Boudreault-Fournier, A., Gottin, T., . . . Haggerty, J. L. (2015). Providing care to vulnerable populations: A qualitative study among GPs working in deprived areas in Montreal, Canada. *Family Practice*, 32, 232–236. doi:10.1093/fampra/cmu094
- Macqueen, K. M., McLellan, E., Kay, K., & Milstein, B. (1998). Codebook development for team-based qualitative analysis. *Cultural Anthropology Methods*, 10(2), 31–36.
- Massachusetts Department of Public Health. (2007). *105 CMR 410.000: Minimum standards of fitness for human habitation (State Sanitary Code, Chapter II)*. Boston. Retrieved from http://www.cityofboston.gov/Images_Documents/sanitary-code_tcm3-35385.pdf
- Messer, L. C., Laraia, B. A., Kaufman, J. S., Eyster, J., Holzman, C., Culhane, J., . . . O’Campo, P. (2006). The development of a standardized neighborhood deprivation index. *Journal of Urban Health*, 83, 1041–1062. doi:10.1007/s11524-006-9094-x
- Moonie, S., Sterling, D. A., Figgs, L. W., & Castro, M. (2008). The relationship between school absence, academic performance, and asthma status. *Journal of School Health*, 78, 140–148. doi:10.1111/j.1746-1561.2007.00276.x
- Morello-Frosch, R., & Lopez, R. (2006). The riskscape and the color line: Examining the role of segregation in environmental

- health disparities. *Environmental Research*, 102, 181–196. doi:10.1016/j.envres.2006.05.007
- Murphy, J. S., Lawton, E., & Sandel, M. (2015). Legal care as part of health care: The benefits of medical-legal partnership. *Pediatric Clinics of North America*, 62, 1263–1271.
- Murphy, J. S., & Sandel, M. T. (2011). Asthma and social justice: How to get remediation done. *American Journal of Preventive Medicine*, 41(2, Suppl. 1), S57–S58. doi:10.1016/j.amepre.2011.05.006
- Murray, A., & Morrison, B. (1993). The decrease in severity of asthma in children of parents who smoke since the parents have been exposing them to less cigarette smoke. *Journal of Allergy and Clinical Immunology*, 91, 102–110. doi:10.1016/0091-6749(93)90302-V
- Patel, M. R., Brown, R. W., & Clark, N. M. (2013). Perceived parent financial burden and asthma outcomes in low-income, urban children. *Journal of Urban Health: Bulletin of the New York Academy of Medicine*, 90, 329–342. doi:10.1007/s11524-012-9774-7
- Patton, M. Q. (2002). Two decades of developments in qualitative inquiry: A personal, experiential perspective. *Qualitative Social Work*, 1, 261–283. doi:10.1177/1473325002001003636
- Rauh, V. A., Landrigan, P. J., & Claudio, L. (2008). Housing and health: Intersection of poverty and environmental exposures. *Annals of the New York Academy of Sciences*, 1136, 276–288. doi:10.1196/annals.1425.032
- Raun, L. H., Ensor, K. B., Campos, L. A., & Persse, D. (2015). Factors affecting ambulance utilization for asthma attack treatment: Understanding where to target interventions. *Public Health*, 129, 501–508. doi:10.1016/j.puhe.2015.02.009
- Reid, M., Fiffer, M., Gunturi, N., Ali, A., Irish, D., & Sandel, M. (2014). Breathe Easy at Home: A web-based referral system linking clinical sites with housing code enforcement for patients with asthma. *Journal of Environmental Health*, 76(7), 36–39. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/24683937>
- Rumchev, K., Spickett, J., Bulsara, M., Phillips, M., & Stick, S. (2004). Association of domestic exposure to volatile organic compounds with asthma in young children. *Thorax*, 59, 746–751. doi:10.1136/thx.2003.013680
- Sarpong, S. B., Hamilton, R. G., Eggleston, P. A., & Adkinson, N. F. (1996). Socioeconomic status and race as risk factors for cockroach allergen exposure and sensitization in children with asthma. *The Journal of Allergy and Clinical Immunology*, 97, 1393–1401. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/8648037>
- Shani, Z., Scott, R. G., Schofield, L. S., Johnson, J. H., Williams, E. R., Hampton, J., & Ramprasad, V. (2015). Effect of a home intervention program on pediatric asthma in an environmental justice community. *Health Promotion Practice*, 16, 291–298.
- Shortell, S. M., Bennett, C. L., & Byck, G. R. (1998). Assessing the impact of continuous quality improvement on clinical practice: What it will take to accelerate progress. *The Milbank Quarterly*, 76, 593–624.
- Snape, D., & Spencer, L. (2003). The foundations of qualitative research. In J. Ritchie & J. Lewis (Eds.), *Qualitative research practice: A guide for social science researchers and students* (pp. 1–23). London: Sage.
- Turcotte, D. A., Alker, H., Chaves, E., Gore, R., & Woskie, S. (2014). Healthy homes: In-home environmental asthma intervention in a diverse urban community. *American Journal of Public Health*, 104, 665–671. doi:10.2105/AJPH.2013.301695
- Varda, D., Shoup, J. A., & Miller, S. (2012). A systematic review of collaboration and network research in the public affairs literature: Implications for public health practice and research. *American Journal of Public Health*, 102, 564–571. doi:10.2105/AJPH.2011.300286
- Weil, C. M., Wade, S. L., Bauman, L. J., Lynn, H., Mitchell, H., & Lavigne, J. (1999). The relationship between psychosocial factors and asthma morbidity in inner-city children with asthma. *Pediatrics*, 104, 1274–1280.
- Woods, E. R., Bhaumik, U., Sommer, S. J., Ziniel, S. I., Kessler, A. J., Chan, E., . . . Nethersole, S. (2012). Community asthma initiative: Evaluation of a quality improvement program for comprehensive asthma care. *Pediatrics*, 129, 465–472. doi:10.1542/peds.2010-3472

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