



**ENHANCING ASTHMA MANAGEMENT USING
IN-HOME ENVIRONMENTAL INTERVENTIONS:
A REVIEW OF PUBLIC HEALTH DEPARTMENT
PROGRAMS**

produced by

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INTRODUCTION

As part of its *Environmental Investments Initiative*, the **Asthma Regional Council of New England** (ARC) is encouraging public health departments in the region to take leadership in improving asthma outcomes by making available in-home services—education, environmental assessment, and interventions—to high-risk populations. To this end, ARC engaged the Environmental Health Initiative (EHI) at the University of Massachusetts Lowell to examine successful programs and synthesize information about them for use by health departments as they consider developing or strengthening in-home programs. EHI conducted interviews with health department officials and reviewed literature about ten such programs around the country. This paper presents and synthesizes the results. The analysis is supported, in part, by the US DHHS Region I (New England) Office of the Regional Health Administrator.

Section I of the paper compares and contrasts the ten health departments programs chosen for review, and highlights lessons learned. Section II provides a detailed description of each program. These descriptions are intended to provide sufficient information about each in-home asthma program to facilitate replication of key elements and to provide a basis for discussion of promising approaches.

Background

The disproportionate burden in rates of hospitalizations and emergency room visits among low income, populations with asthma has prompted health plans, hospitals, provider organizations, community coalitions and government agencies to investigate new approaches to improve the quality of life for people living with the disease. In recent years, numerous studies in the research literature have linked asthma exacerbations with indoor housing conditions and exposure to allergens and irritants such as such as dampness, carpets, pests, pets, unvented/unfiltered heating sources, environmental tobacco smoke and consumer products, including cleaners, fragrances and paints¹. Rigorous intervention studies such as the Inner City Asthma Study (ICAS) and the Seattle-King County Healthy Homes Project have bolstered the evidence on the effectiveness of in-home programs in improving asthma control in children. In addition, a 2004 review² suggests that in-home education and environmental interventions are cost effective approaches to improving the health status of patients, particularly those with more severe asthma. A 2005 examination of the cost effectiveness of the ICAS intervention³ strengthened this evidence and extended the finding to those with moderate forms of asthma as well.

On the basis of strong evidence associating environmental exposures with exacerbations of asthma, the National Heart Lung and Blood Institute's National Asthma Education and Prevention Program's Guidelines for Effective Management of Asthma recommend "control of environmental factors and triggers that contribute to symptoms and disease severity, e.g. tobacco smoke, dust mites, mold and cockroaches." Many clinicians are aware of these guidelines, and provide basic education about environmental triggers and self-management techniques during office visits. However, follow-up to ensure that patients and their families understand the information provided and are taking steps to reduce exposure to environmental triggers is rare. In the meantime, asthma rates continue to increase, and the burden of the disease continues to fall disproportionately on low income and minority populations.

The promise of in-home programs to reduce environmental exposures and improve health status have motivated health departments, not-for-profit organizations and some health plans to design programs that combine asthma education with home environmental assessments, materials and services. Health departments are particularly well suited to lead these initiatives, often bringing relevant experience with in-home programs to address other chronic

¹ For an extensive review of this literature: see Institute of Medicine (IOM). Committee on the Assessment of Asthma and Indoor Air, Division of Health Promotion and Disease Prevention, *Clearing the Air: Asthma and Indoor Air Exposures*. Washington DC, National Academy Press, 2000. Available at: <http://books.nap.edu/books/0309064961/html>. (Accessed January 15, 2005).

² Brugge D, Hyde J, Weinbach BH et al. Economic benefits of including environmental issues as a component of comprehensive asthma care: a managed care perspective, *Dis Manage Health Outcomes*. 2004; 12(4): 259-272.

³ Kattan M, Stearns Sc, Crain EF et al. Cost-effectiveness of a home-based environmental intervention for inner-city children with asthma, *J Allergy Clin Immunol*. 2005; 116(5):1058-1063.

diseases, expertise in surveillance, and broad orientation towards disease prevention and health promotion. Programs in which health departments play a lead role have begun to yield impressive results, reducing asthma symptoms as well as utilization of health care services. These programs may stand alone, or complement/enhance existing programs already provided by local housing authorities or health providers and payers.

SECTION I: COMPARATIVE REVIEW OF TEN IN-HOME ENVIRONMENTAL PROGRAMS SPONSORED BY PUBLIC HEALTH DEPARTMENTS

Figure 1 lists the programs reviewed in this paper. They are located in local, county and state health departments around the country. Half of the programs reviewed are nested within environmental health departments or divisions; others are based in departments of community health, epidemiology, planning/evaluation and asthma.

These are not the only successful environmental intervention programs sponsored by health departments, nor are they necessarily representative of such programs around the country. We selected them on the basis of word of mouth with three criteria in mind: 1) they are considered innovative and successful by those responsible for the program, people with asthma receiving program services, and/or by objective outcome measures; 2) as a group, they include local, county and state programs, and 3) they have made different choices about how to deliver and finance their programs, so reflect a range of options for design and implementation.

In the discussion that follows, we characterize these asthma programs: their origins or rationale; their design, target population and goals; partnerships they consider essential to their success; program content; staffing models; referrals; funding sources and results. We then highlight themes and lessons learned that provide further insight into the range of opportunities and barriers encountered in designing and implementing in-home environmental programs for asthma.

Figure 1: Health Department-Sponsored Programs Reviewed in this Paper

Program Name	Public Health Department
<i>LOCAL</i>	
1. Home System for an Asthma Free Environment (SAFE)	Boston Public Health Commission (Boston, MA)
2. Cambridge-Somerville Healthy Homes Program	Cambridge Public Health Department (Cambridge, MA)
3. Milwaukee Healthy Homes Demonstration Project	City of Milwaukee Health Department (Milwaukee, WI)
4. Breath of Fresh Air	Stamford Department of Health & Social Services (Stamford, CT)
5. Healthy Homes for Healthy Airways	San Francisco Public Health Department (San Francisco, CA)
<i>COUNTY</i>	
6. Project In-Home Asthma Literacy Education Program (INHALE)	Erie County Health Department (Erie County, NY)
7. Seattle-King County Healthy Homes I	Public Health Seattle & King County (Seattle & King County, WA)
8. Asthma Start	Alameda County Health Department (Alameda County, CA)
9. Multnomah County Healthy Homes Collaborative	Multnomah County Health Department (Multnomah County, OR)
<i>STATE</i>	
10. Putting on Asthma Indoor Risk Strategies (AIRS)	Connecticut

Prevalent Characteristics of Public Health Department Programs

1. Programs were Initiated to Address Gaps in Services, and Gaps in Research on Effective Interventions for Asthma.

The primary motivation for the majority of case study programs was filling gaps in services identified through previous program work. For example, research investigations and public health programs in Multnomah County, Oregon, and in Cambridge and Boston, Massachusetts had documented poor conditions in public housing, and a high degree of awareness and concern among residents with asthma. These conditions, and the availability of federal grant funds, motivated the health departments to initiate the Healthy Homes and Home Safe projects. Most programs also sought

information that would help them continue to refine their programs over time, and contribute to the knowledge base about effective interventions. Two of them—the Milwaukee Healthy Homes Demonstration Project and the Public Health Seattle King County Healthy Homes Project --used randomized-control designs and aimed to answer specific research questions. Others used quasi-experimental designs, such as pre-test/post test, to evaluate the impact of their programs. These designs offer more limited ability to draw conclusions about effective interventions.

2. Programs Target Populations at High Risk of Exposure to Environmental Triggers for Asthma

The primary target populations in case study programs are people with asthma living in older, poorly maintained housing units. Though most programs have a particular focus on children, they also offer services to older residents. One program (San Francisco Healthy Homes Healthy Airways project) exclusively targets adults. Broad program goals are to reduce exposure to environmental triggers and improve health status via delivery of education, materials and services in the home. Secondary goals include fostering collaborations among a range of organizations so as to strengthen the capacity of communities and organizations to reduce the burden of asthma over time. Several programs (Cambridge-Somerville Healthy Homes, Milwaukee Healthy Homes Demonstration Projection, Stamford's Breath of Fresh Air and Erie County's Project INHALE) also use the home visits to examine other health hazards such as lead and carbon monoxide.

3. Community & Organizational Partners are an Essential to Successful Program Planning & Implementation

All the case study programs depend on partnerships with hospitals and/or health care organizations, as well as other government agencies focusing on health, environment and/or housing, for the purposes of identifying patients who could benefit from the program, and providing appropriate services. Most programs also partner with asthma coalitions that include community-based organizations and local chapters of the American Lung Association. In addition to referrals, asthma coalitions provide advice and input in the design of the programs, and leadership on relevant policy initiatives.

4. All Programs Provide Education Tailored to the Individual with Some Follow-up; Provision of Materials, Supplies and Services Varies.

Three of the case study programs focus primarily on environmental education, providing only basic information about medical management of asthma. The remaining seven programs provide substantial information about both the clinical and environmental aspects of asthma. The intensity of the interventions vary widely; programs range from providing one home visit with one to two follow-up calls up to five or six home visits. Visits generally last one to two hours.

The home visits sponsored by all the programs include an environmental assessment of the home to identify sources of asthma triggers, using a standardized home inspection checklist. Education provided during the visit includes a review of this assessment, and information about how to manage those triggers found in the home. Additional educational content in all programs includes basic information on asthma and asthma management techniques, including the importance of compliance with an asthma management plan. All programs also include the administration of questionnaires to collect data regarding asthma knowledge, medications, and symptom frequency, and referrals to other social, legal or health services.

Though all programs provide information about asthma triggers and strategies for reducing them, they vary in the extent to which they provide materials, supplies and services to mitigate trigger sources.

- ◆ All ten programs provide families with pillow and mattress covers;
- ◆ Nine programs provide cleaning supplies;

- ◆ Five programs provide or loan participants a vacuum fitted with a HEPA filter;
- ◆ Others provide vacuum bags, dusting clothes, Swiffers, mops or non-toxic cleaning solutions;
- ◆ Six programs provide homes with supplies for integrated pest management (e.g. pest traps);
- ◆ Some programs offer additional supplies, including doormats, smoking jackets (often a plastic rain coat given to participants to encourage household members to smoke outside), shower curtains, air purifiers, and heating filters;
- ◆ Two programs support minor home repairs such as carpet removal and repair of leaks to mitigate moisture sources.

Programs that include a more intensive clinical education component also review medications, treatment plans, severity classification and additional asthma management techniques such as peak flow meters and spacers.

5. Similar Mechanisms for Program Referrals are Used; Retention Rates Vary

Most programs draw referrals primarily from community health clinics and hospitals. Additional referral sources include other public health programs (such as WIC), community agencies and self-referrals. Some programs proactively tap other sources. Stamford Health Department’s Breath of Fresh Air program, for example, works predominantly with school nurses to identify patients who could benefit from in-home interventions. Most programs had some difficulty garnering sufficient referrals; suggestions for overcoming this problem are discussed under “lessons learned” below.

Not all programs were able to provide information about retention rates among families referred to the programs. Among those that did have data, percentages of patients who received the full array of services available to them ranged from 24%-95%. Interviewees provided insights about conditions and characteristics of patients who tended not to complete the program; their strategies for addressing retention problems are described under “lessons learned” below.

6. Programs Use a Range of Staffing Models; Training Requirements Vary

The case study programs use either registered nurses, community health workers, health educators or social workers—or a combination—to conduct home visits. In some programs, these employees also conduct the environmental home assessments; in others, code inspectors or other certified inspectors carry out the assessments. Staff from all programs are health department employees, although aspects of some programs—particularly their written materials—are being used by employees of other organizations, such as visiting nurse associations (examples include materials developed by the Boston Public Health Commission’s Home SAFE program and the Milwaukee Health Department’s Asthma Care Coordination initiative). Roughly half of the programs use certified home inspectors and pediatric or public health nurses with some prior history of seeing patients with asthma, and do not require special training. Programs that use community health workers or asthma/health educators (as well as one program that includes a registered nurse and home inspector) require additional training using specified education modules. Some health departments create their own education modules; others use those developed by the American Lung Association’s Master Home Environmentalist Program. Some provide training directly; others require participation in sessions organized by outside groups.

7. Programs Depend Heavily on Grant Funds; Program Costs Vary

Most programs are funded by federal grants, either from the Environmental Protection Agency (EPA), the Department of Housing and Urban Development (HUD), or the Centers for Disease Control and Prevention (CDC). Grants vary widely, from a one year \$16,000 grant that requires the leveraging of additional funds to multi-year \$1,000,000 grants with \$1,000 available per family to cover costs of supplies and rehabilitation of housing. Some programs that do not provide more expensive supplies—such as vacuums and air purifiers—report supply costs of approximately \$100-\$150 per household.

Although core health department funding provides some staff support for in-home asthma management programs, most home visiting programs expressed difficulty sustaining services once a particular grant ends. For example, Milwaukee Health Department's asthma program has been supported entirely by grants, and all in-home visits for asthma provided by the Health Department ceased when grant funds ran out. Some programs have sought diverse sources of funds and explored innovative funding mechanisms. Alameda County's Asthma Start Program, for example, has secured consecutive years of funding from diverse sources including state-sponsored grants, a new tax measure, state tobacco settlement monies, Medicaid Targeted Case Management reimbursements as well as reimbursements as a contracted provider for a Medicaid-HMO. To sustain funding for as long as possible, some programs have attempted to contain costs. The Boston Public Health Commission and the Connecticut Department of Public Health have developed models with fewer home visits which appear to be meeting their goals despite lower expenditures.

8. Program Outcome Data Are Limited, But Suggest Positive Results, Including Reductions in Environmental Triggers and in Adverse Asthma Outcomes

Not all programs are able to describe research/evaluation results since some are in the early stages of implementation or are still analyzing data they have collected. Where evaluation data are available from in-home environmental intervention programs, they are consistent with results seen in the literature that document decreases in various health outcome measures—including symptom days and medical encounters—as well as declines in levels of in-home triggers.

Lessons Learned

In-home environmental intervention programs for asthma are a good fit for health departments, but sustainability is a challenge

Several interviewees made the case that it is a natural fit for health departments to provide in-home environmental services. Municipal health departments in particular are accustomed to working with individuals in their homes because of their responsibility for enforcing housing codes. However, the availability and sustainability of grants remains a barrier to all programs that aim to deliver in-home assessments and asthma education on an ongoing basis. Some health departments are seeking mechanisms for sustainable financing of their programs. Public Health-Seattle, King County and Cambridge Public Health Department, for example, are exploring interest by health payers and hospitals in delivering and/or financing in-home environmental interventions as elements of disease management or community benefits programs, particularly for patients who are high users of hospital services.

Case study interviewees perceive long-term benefits to participants and program staff

All interviewees highlighted the effectiveness of in-home visiting programs in improving patients' and care-givers' knowledge about both asthma and actions that can reduce exposure to in-home triggers. They posit that this improved knowledge strengthens parents' confidence in their abilities to help manage their children's asthma and subsequently improves communication with the patient's physician in ways that will last. One program is taking steps to sustain patients' and families' knowledge base by offering follow-up group classes that reinforce the in-home education.

These programs may have an important and lasting impact on public health department personnel as well, even after grants end and programs close. Interviewees report that participation in in-home intervention programs resulted in sustained awareness among staff about routine responsibilities regarding environmental conditions, and that staff carried that awareness into subsequent work. The San Francisco Department of Public Health, for example, stated that their environmental inspectors are now much more astute regarding conditions that affect asthmatics having participated in the Healthy Homes for Healthy Airways program.

Successful in-home programs can be staffed with people who have different professional backgrounds and skill-sets

Review of these programs suggests that a variety of staffing strategies can deliver effective environmental education and interventions for asthma, as long as there is appropriate professional support for the home provider. For example, in the Public Health-Seattle and King County program, Community Health Workers have been effective at delivering the intervention -- not only because of the cultural connections these workers have with the patient population -- but also because there are clear protocols for when outreach staff should seek the support of nurse supervisors and other personnel. Health department officials planning intervention programs should consider a number of factors as they decide how to staff their projects, including, for example, the infrastructure available to support a particular staffing model; referral and contractual mechanisms; quality control; cost; ability to gain reimbursement from a third party payer, etc.

Additional work is needed to enhance referrals and increase retention rates

As noted above, several programs have experienced difficulty obtaining patient referrals and many see retention after referral as a challenge. To ensure a steady flow of referrals, case study interviewees highlighted the need to aggressively market the program to physicians and partnering clinical and community organizations, and to keep the referral form simple to facilitate its use.

The dramatic range in retention rates among case study programs appears to be linked to the referral source. Interviewees reported that patients who self-referred or were introduced to the program after a recent hospitalization tended to maintain their participation in the program at higher rates than those referred by other sources. Health departments planning intervention programs should be aware of the range of additional factors that may contribute to poor participation and retention rates. These include the length of time someone has lived with asthma (resignation/acceptance of low quality of life and belief that they know how to manage their asthma); fear of landlord retaliation, residence in illegal housing, frequent moves; language barriers; lack of time and unpredictability of schedule. Case study interviewees identified a range of strategies for addressing these factors, including making multiple attempts at the first contact with the referred patient; emphasizing the availability of free materials and supplies during recruiting to provide an incentive for continuing with the program; covering as much content as possible in the first encounter in case subsequent visits fall through; and obtaining an emergency contact number to increase the chance of successfully completing follow-up visits.

Target populations face complex multi-faceted challenges; in-home programs provide opportunities to address multiple factors that contribute to poor health

All the programs demonstrate that visiting patients in their home permits better identification of physical factors in the home environment that may compromise the patient's health. Moreover, seeing the home environment and spending hours with patients over the course of the program illuminates the myriad of psychological, social, political and legal issues that may also be affecting the patient's health. Although most programs have attempted to deal with such issues by referring to other programs (e.g., to WIC, food stamps, housing inspectional services, job training services, etc.) some interviewees describe problems with lack of information about appropriate referrals, as well as insufficient tracking to determine whether and how such issues are resolved. Health departments should anticipate and plan for how in-home visitors will address issues beyond environmental aspects of asthma that they may come across, and consider coordinating or collaborating with programs with relevant expertise.

Integrating home visits into a patient's asthma management program is important and difficult

Programs reflect an understanding that in-home environmental education, materials and services are one component of a comprehensive approach to managing a patient's asthma, and that comprehensive asthma management requires effective communication among all caregivers: physicians, families, school nurses, etc. One interviewee noted that communicating with the patient's primary care provider not only ensures appropriate follow-up, but also educates physicians regarding the extent to which home environments can affect patients' asthma. Tracking and communication with providers is facilitated in the Cambridge program by a secure asthma registry--used by a

majority of physicians that refer patients to the program⁴-- which program staff can access, both to input and retrieve patient data. Most health department programs use written communications—primarily letters sent in the mail—to inform a patient’s physician that a home visit has occurred and to highlight specific issues that arose, but not all interviewees are confident that these methods are sufficient. Health departments planning in-home programs should consider the need and challenge of effective communication with providers early in the planning stages of the project

More resources are needed to adequately address structural problems in the homes

Assessing the environmental exposures in the home that are risk factors for the exacerbation of asthma is a key component of the ten asthma management programs. However, few programs have the resources to remediate structural or other aspects of the building and building materials that generate asthma triggers, such as removal of carpeting and repair to floors that are exposed as a result, or improvement to ventilation systems. Those that do provide such services tend to be research studies (such as the Multnomah Demonstration Project), rather than intervention programs (such as the Cambridge-Somerville Healthy Homes Project or the Boston Public Health Commission’s Home SAFE project). Healthy Homes programs work with landlords to address such problems, but they are rarely successful unless housing code violations are involved, and, as discussed below, residents are often wary of exposing landlords to legal action. As they plan in-home intervention projects, health departments should consider innovative mechanisms for undertaking structural remediation where it is necessary.

Programs need to address tenants’ concerns about landlord retaliation

Because the target populations of most programs rent their homes, interviewees repeatedly noted the importance of renter-landlord power dynamics. In particular, they described residents’ anxiety that pressure put on landlords or property managers to fix problems would result in eviction. All the case study programs attempt to work with landlords and property managers to encourage voluntary cooperation before turning to inspectional services that have the legal authority to issue citations. Housing laws in some areas pose particular risk to families. In Multnomah County, for example, landlords are not required to show cause for eviction. Multnomah County intends to respond by leveraging other laws in support of residents, such as the Americans with Disabilities Act, and to build broad-based community coalitions to help reform housing policy and standards that will foster healthier and safer homes.

Concluding Remarks

Our review of review of ten public health department programs along with analysis of relevant scientific literature⁵ suggests that in-home environmental intervention programs have great potential to reduce exposure to asthma triggers and improve asthma symptoms, particularly among people living in sub-standard housing. In-home programs are most effective when integrated into comprehensive asthma management strategies. Though public health departments are well-suited for conducting in-home visits, channels for communication with physicians are often not well-established. Establishing the infrastructure, incentives and a culture of frequent and effective communication among a range of individuals and organizations involved in a patient’s care should be a high priority for health departments and others committed to reducing the burden of asthma. Addressing policies and regulations to support these efforts should also be considered as part of the health department strategy to improve care and outcomes.

Asthma management is not a “one size fits all” approach, either at the level of the individual or at the level of an intervention program. A range of referral mechanisms, staffing strategies, number of visits and funding sources show promise. Nonetheless, there is much to be learned from the experiences of those that have planned and

⁴ It is important to note that Cambridge Public Health Department is part of the Cambridge Health Alliance. Physicians that refer to the Cambridge-Somerville Healthy Homes Program are also part of the Cambridge Health Alliance.

⁵ Hoppin P and Donahue S. Improving Asthma Management by Addressing Environmental Triggers: Challenges and Opportunities for Delivery and Financing. Asthma Regional Council of New England. Symposium Edition, December 6, 2004.

implemented in-home visit programs. This first section of the paper has highlighted characteristics of and lessons learned from ten public health department programs. In Section II, we provide detailed descriptions of each of the programs, as well as contact information for people who are now deeply knowledgeable about the challenges and opportunities of in-home interventions. We are encouraged by the accomplishments of these public health programs and hope their work inspires others at earlier stages of considering and planning enhancements to existing asthma management activities.

To obtain and download Section II, which contains the detailed descriptions of health department programs, please visit the Asthma Regional Council of New England's website at: www.asthmaregionalcouncil.org

Asthma Regional Council of New England (ARC)
www.asthmaregionalcouncil.org

SECTION II: DETAILED SUMMARIES OF HEALTH DEPARTMENT PROGRAMS

CASE STUDY 1

**Home System for an Asthma Free Environment (SAFE)
Boston Public Health Commission
Boston, Massachusetts**

Origin

In 2000, the Boston Public Health Commission applied for and received US Department of Housing and Urban Development Healthy Homes funding to support a demonstration project involving 250 Boston families in a program of environmental assessment and in-home education aimed at reducing exacerbations among children with asthma. Interventions were low to moderate cost. Eligible families lived in private and section 8 housing.

In 2001, the Boston Public Health Commission participated in a Healthy Public Housing Initiative jointly led by the schools of public health at Boston University, Harvard University and Tufts University. Both projects demonstrated that that pest infestations and environmental tobacco smoke were significant problems that threatened residents' health and quality of life. Further, both studies concluded that low-income Boston children with asthma were not receiving optimal medical management of the disease.

As a result of these findings, the Boston Public Health Commission sought to provide low cost in-home environmental interventions for asthma patients. In response to a request for a small grant, the U.S. EPA provided funding to the Commission beginning in 2002 to implement its Home SAFE (System for an Asthma Free Environment) program. The program's objectives are to improve pest management and environmental tobacco smoke reduction services received by participants in existing in-home asthma programs, to foster collaborations between organizations on these issues, and to increase communication between families and health care providers regarding symptom frequency, peak flow monitoring and asthma action plans.

Program Partners

A number of individuals and organizations partner with the Boston Public Health Commission to disseminate the Home SAFE kit. The Commission's partners include:

- Boston Asthma Initiative (BAI), a community-based asthma coalition. Health Net, a Medicaid-managed care plan, is funding BAI to conduct in-home asthma visits for patients using the Commission's Home SAFE kit. Data from these home visits were used in the Home SAFE program evaluation.
- Committee on Boston Public Housing: a multi-cultural organization of Boston public housing residents and supporters who work to ensure safe and healthy public housing communities, and has a long-standing asthma advocates program, involving public housing residents in peer education on asthma. The Committee provided consultation to Home Safe on working with public housing residents and the Boston Public Housing Authority.
- Community Health Centers provided patient referrals to the program.
- Megan Sandel MD, MPH provided clinical advice to the program. Dr. Sandel is a pediatrician at Boston Medical Center and currently using the Home SAFE kit for an intervention program for asthma in collaboration with HealthNet.

In-Home Visit Details

Individuals are referred to the Commission's Home SAFE program by clinicians, school nurses, residents and community advocates. Although the initial years of the program required that individuals be 17-years of age or younger to be eligible for services, the current Commission home visit program is open to anyone with asthma living in Boston.

A community health educator usually conducts all the visits. However, an environmental inspector (with multiple degrees and certifications) has, at times, accompanied the community health educator during the home visits. The Commission created a Home SAFE training to instruct health educators and community health workers how to implement the Home SAFE kit. The training is conducted through the Commission's Community Health Education Center. Typically, one home visit is conducted and followed up with a telephone call. The home visit uses a structured protocol to convey the program's messages. Although some data are collected during the visit, the focus is on education and interaction with the participant and family.

- **Home Visit:** During the home visit, usually lasting two hours, the community health educator administers the Home SAFE kit to families. The Home SAFE kit contains low-cost supplies and information to support environmental control of asthma including:
 - Asthma Control Checklist
 - Asthma action plan
 - Smoke Free Home Pledge
 - Mattress and pillow covers
 - Pest traps
 - Plastic containers for food storage
 - Cleaning supplies to support IPM
 - Covered trash container
 - Weather stripping
 - Smoke free home refrigerator magnets
 - Home SAFE video (provided in English, Spanish or Haitian/Creole) which reinforces asthma management messages related to smoking, IPM and communicating with the patient's physician

The community health worker has families complete a Smoke Free Home Pledge, which identifies approaches families are committed to using to reduce ETS. The health worker also administers the Asthma Control Checklist to assess frequency of asthmatic episodes (number of daytime/nighttime symptoms in the last two weeks, use of reliever medication in the past two weeks; number of emergency room visits and hospitalizations in the past 6 months), impact on quality of life (impact during exercise/play in the last 2 weeks; missed school days in the past two weeks;) and adherence to clinical guidelines (use of an asthma action plan and use of a peak flow monitor).

Health workers—sometimes accompanied by an inspector—conduct an environmental walkthrough of the participant's home. The walkthrough focuses primarily on identifying sources of pest concerns, environmental tobacco smoke, and other asthma triggers. Using the IPM fact sheet and Home Kit supplies, the community health educator teaches the family about IPM strategies to reduce pest problems. The kit is designed to be interactive. The health educator introduces information and supplies as s/he and the participant or caregiver walk through the home.

2-Month Follow-up Phone Call: During the 2-month follow-up phone call, the community health educator re-administers both the Asthma Control Checklist and the Smoke Free Home Pledge. The Home SAFE kit messages are reinforced and if necessary, referrals are made for additional social/health services.

Home SAFE is designed to provide tools and information to the participants that enhance communication with their health care provider. For example, the Smoke Free Home Pledge, and the Asthma Control Checklist are created in

triplicate and the health educator encourages the participant to discuss these forms with their clinicians. Participants are provided with asthma action plans and the benefits of the action plan are explained. The health educator encourages participants to discuss the action plan with their clinician as well.

Program Outcomes

The Home SAFE program was evaluated in 2005 based on 15-months of program implementation. Data considered in the evaluation included those from the Commission's home visiting program as well as from other organizations administering the Home SAFE Kit as part of their home visit programs for asthma. At that time, 66 homes with a total of 95 asthmatic children had received the Home SAFE Kit and associated education. Limited follow-up data permitted an evaluation based on 37 households and 37 children. According to the evaluation, the Home SAFE program resulted in a 5% reduction in both emergency room visits and hospitalizations due to asthma. Reductions in frequency of daytime asthma symptoms were observed in the subset of patients with more severe symptoms (reduction of 8% among patients reporting daily symptoms); however the frequency of nighttime symptoms was stable in the same group. Other notable findings include a reduction of roach (2%) and mouse (19%) problems as reported by participants. A future evaluation will assess any change in the number of asthma action plans among participants as a result of the program and will review more extensive data from collaborators, including the Boston Visiting Nurse Association and Boston's Children's Hospital, who are currently implementing the Home SAFE kit.

Financing for the Delivery of Services

Initial funding for the Home SAFE program was provided through a \$25,000 EPA grant. The EPA funding primarily supported the involvement of the community partners in the development of the kit (providing honoraria for people's time) and paid for Commission staff to attend meetings, conduct home visits and place follow up calls. Other funding supported translation and printing of written materials. Subsequently, the Home Safe project drew on funding provided by GlaxoSmithKline Inc. for broader programmatic efforts to address asthma in Boston. Current Home SAFE visits are funded by both GlaxoSmithKline and core funding through the City of Boston made possible by high-level Commission officials who are extremely supportive of the HomeSAFE program.

Incorporating Research Findings into Subsequent Development of In-home Asthma Programs

The Commission continues to provide Home SAFE visits for individuals referred to the program. In addition, the Home SAFE tool kit is used by multiple organizations in Boston implementing environmental interventions for asthma. The Commission recently received a grant from a private foundation to refine the Home SAFE kit and provide to expand the in-home IPM education program to additional asthmatics living in Boston Public Housing.

The Commission is currently collaborating with Boston's Inspectional Service Department in its Breathe Easy program. The Breathe Easy program allows health care providers to expedite referrals of families with asthma to the Inspectional Service Department in order to address environmental health issues in the home. Working with the Commission and other partners, Breathe Easy is now implementing an enhanced tracking system to ensure that follow-up actions are pursued and referrals to other necessary health and social service programs are made. The Commission also trains inspectors on asthma and issues in the home environment that affect the disease.

Opportunities and Constraints in Delivering In-Home Intervention Programs for Asthma: Lessons Learned from the Home SAFE project

The Commission's budget for implementing Home SAFE was small, with funding to support part of one staff member's time, and direct costs of the Home SAFE kit (~\$100 per participant). However, the Home SAFE program resulted in notable health, environmental and behavioral changes among participants. This program is heralded as one of the biggest successes of the many asthma initiatives underway at the Commission. By working closely with other asthma coalition partners, the Home SAFE kit is now being implemented by a broader network of organizations providing in-home environmental intervention services for asthma.

Future work will focus on the aspects of the program designed to facilitate communication between patients and physicians, and on providing information to clinicians regarding services the patient received as a participant in the program.

The Commission provided the following recommendations regarding the establishment of a successful referral process for in-home visiting programs:

- 1) Keep the referral process simple and transparent, and make the eligibility criteria generous. If the service is only available to a small percentage of high-risk patients, it will not be high on the radar of the clinicians. A complex, time-consuming referral system and time lags in providing services would further impede utilization of the services.
- 2) Develop a tracking system. Parties referring to the program want feedback that action has occurred, and tracking data make program evaluation possible.
- 3) Promote the program to the whole clinical team – not just physicians and not just in clinical settings. Nurses and social services staff are often the team members most attuned to the social and environmental context of health and most likely to be responsible for these types of referrals. School nurses can be advocates for the children and families with whom they work.
- 4) Find multiple avenues for reminding the clinical community about the availability of the service.
- 5) Have clinicians and community members on the planning team, so that the program design anticipates their needs.
- 6) Ensure that the program works for the client/patient. The patient will give feedback to the clinician!

Contact Information

Boston Public Health Commission

Home SAFE Program

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CASE STUDY 2

Cambridge-Somerville Healthy Homes Program Cambridge Public Health Department Cambridge, Massachusetts

Origin

Beginning in 1999, The Cambridge Public Health Department in Massachusetts launched its Cambridge-Somerville Healthy Homes Program as part of a statewide healthy homes initiative funded by the Massachusetts Department of Public Health. Although the state's preference was to conduct a general healthy homes visit that included lead poisoning prevention, child safety and asthma if needed, evidence from the Cambridge and Somerville's lead inspection programs demonstrated that many of the buildings in poor condition were homes to asthmatics who needed extensive clinical management and education services. Prompted by this evidence, the Environmental Health Unit within the Cambridge Health Department sought funding from the state to engage managed care in delivery and financing of in-home environmental assessment and assistance. The mission of the Healthy Homes Program is to lower the frequency of childhood asthma attacks and to help families make their homes safer.

Program Partners

The Somerville-Cambridge Healthy Homes Program collaborates with a range of organizations and institutions. Patients are referred to and from many collaborating programs, including the Early Intervention Partnership Program (a maternal child health program in communities with high rates of infant mortality & morbidity) and Lead-Safe Cambridge. The Program also works closely with Cambridge Health Alliance medical providers, the Boards of Health in Somerville and Everett, the Inspectional Services Department in the City of Cambridge as well as staff from local public housing agencies and advocacy organizations.

Target Population

The Healthy Homes Program targets children up to the age of 13 who have been diagnosed of asthma and who physicians think would benefit. Although some families hear about the program independently and self-refer, most are patients of physicians in the Cambridge Health Alliance (CHA), a unique integrated health care system that incorporates public health, clinical care, academics and research for patients in Cambridge, Somerville, Revere and Everett. CHA encompasses three hospitals, over 20 primary care practices, the Cambridge Public Health Department, the Alliance Foundation of Community Health and Network Health, a Medicaid managed care plan. Program personnel attribute solid referral rates over time to outreach events and more recently to flags within CHA's electronic medical record/chronic disease registry that prompt providers during the clinical encounter to refer patients to the program if appropriate.

Home Visit Details

The Program has two employees that provide the in-home visiting services: a registered nurse (Program Coordinator) and a community health worker, who is fluent in Portuguese and Spanish. Although the community health worker is not currently an asthma certified educator, she has completed numerous seminar trainings on topics such as asthma, home assessments, mold/moisture, pests, communication, and interviewing and has conducted home visits on behalf of the program for a number of years. In general, the Program Coordinator supervises the home visits and delivers the medical education component while the community health worker is responsible for conducting environmental assessment and delivering the environmental education.

During the home visit, the Program provides families with medical education, assesses the home for asthma triggers and home safety hazards and provides environmental interventions to reduce exposure to such triggers. Occasionally, extenuating circumstances require staff to conduct more than the 3 standard home visits.

- **Initial Visit:** The first visit routinely takes about 2-hours. The objective of the visit is to better understand the child's medical and living situation as well as the caregiver's knowledge of asthma. A standardized home assessment tool is used to examine the health and safety of the general living areas including the condition

of carpets and furnishings, exposed wires, leaks, other moisture concerns, rodent holes, presence of roaches and other pests, household smokers, use of fragrance sprays and candles, fire places, stuffed animals and clutter. The home assessment is also used to examine for other home hazards such as lead. Although the home assessment is not considered a code inspection, referrals to city inspectors are made when needed. However Program staff first approach the landlord or housing management service regarding structural or pest problems.

In addition to information on asthma knowledge and beliefs, background data collected also include frequency of daytime/nighttime asthma symptoms, asthma severity, current medication use, expired dates on medications, medication compliance, use of an asthma action plan, and knowledge of asthma triggers both in general and with regard to the child's individual profile. These data inform the development/refining of an asthma management plan and allow for tailoring of the asthma education.

- **Follow-up Visit #1:** Based on findings during the initial visit, tailored education is provided during the 1st follow-up. The focus of the clinical education is usually on issues such as the appropriate use of medications and the use of peak flow meters, spacers and dosers. Depending on findings from the home assessment, supplies may be provided to families during the first follow-up visit including:
 - High quality mattress and pillow covers for every bed and pillow where the child sleeps;
 - Vacuum bags and a vacuum cleaner with a HEPA filter (loaned to families);
 - Cleaning supplies which include a mop bucket, mop, sponge, an odor-free National Allergy Supply Brand Cleaning Solution and dust mask. Education is also provided about natural cleaning products such as white vinegar and baking soda;
 - Sticky traps and roach traps for pest control;
 - Accordion wall vent filters which provide extra filtration of airborne particulates (made available when donated by suppliers);
 - Referrals for affordable smoking cessation programs; and
 - Mold identification services that recommend remediation needs for homes with extensive mold problems.
- **Follow-up Visit #2:** During the second and final visit, another environmental home assessment is conducted to identify improvements and continued problems in the home environment.

Program Outcomes

Each year the program provides services to 40-60 children and their families. The program is currently undergoing an evaluation to determine whether or not it has been successful in spurring behavioral changes and improving health status. On an anecdotal basis, staff have heard from patients that the program's pillow and mattress covers have lessened asthma symptoms for many patients.

Financing for the Delivery of Services

Funding for the Program--provided by a grant from the Massachusetts Department of Public Health's Childhood Lead Poisoning Prevention Program and core CHA funds--supports the two full-time employees: a Registered Nurse and a Community Health Worker as well as supplies. The Program is currently in conversation with a Medicaid Managed Care organization serving the CHA patient population about the possibility of direct reimbursement for services provided to patients with high rates of health care utilization.

Opportunities and Constraints in Delivering In-Home Intervention Programs for Asthma: Lessons Learned from the Cambridge-Somerville Healthy Homes Project

According to the Program, mold is one of the biggest problems encountered in the homes visited. Although the presence of mold is often due to tenant behaviors that result in high heat and humidity in the home (such as cooking or showering without using a fan or not opening windows), construction materials used in public housing—primarily steel beams and brick contribute to dampness.

When asked about benefits of in-home environmental interventions for asthma, Program staff stated that, in contrast to clinical visits in a physician's office, home visit providers can spend hours with patients on multiple occasions. This extra time is necessary for patients and their families to understand how to manage asthma and to encourage behavior change. When patients are seen in their personal surroundings, public health providers are able to identify a myriad of psychosocial and physical factors in the home environment that may be contributing to patients' health problems. Families can subsequently be connected with assistance for these issues if necessary.

Although funding is currently available to support most aspects of the Healthy Homes Program, it is not sufficient to finance needed structural changes that may be identified during the environmental home assessment. Even though the Program refers families to the necessary services, financial barriers often impede the mitigation of the structural problem(s). More funding and assistance are needed to address many of the building problems identified through the program and to make available equipment such as HEPA vacuums. In addition, more work is needed to standardize the identification and treatment of mold and moisture in homes.

The Program encourages new in-home asthma intervention programs to consider program evaluation at the outset. Questionnaires should be designed to capture measurable health outcome data and accommodate a range (scale) of responses, rather than yes/no, in order to permit more sensitive analysis.

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CASE STUDY 3

Milwaukee Healthy Homes Demonstration Project City of Milwaukee Health Department Wisconsin

Origin

Asthma is the most frequent reason for emergency room visits and inpatient stays at Children's Hospital of Wisconsin. In 2003, 14% of caregivers with children in two Milwaukee public schools and one Women, Infants and Children program reported that their child had been diagnosed with asthma. In response to statistics like these, Fight Asthma Milwaukee (FAM) Allies was established to improve control of children with asthma living in Milwaukee. FAM Allies is a community coalition under the leadership of Children's Hospital of Wisconsin and Health System, which provides an integrated system of family, community and clinical education around asthma.

Based on experience with case coordination and case management, FAM Allies saw a need for a home-based asthma program to be delivered within a community network that would assess environmental risks, develop family-centered care plans and provide information, technical assistance and referrals to families. Working with a coalition member, the Home Environmental Health Division of the Milwaukee Health Department, FAM Allies received funding from the Department of Housing and Urban Development in 2003 to conduct a randomized control study, titled Milwaukee Healthy Homes Demonstration Project (MHHDP). MHHDP's purpose is to develop, demonstrate, evaluate, and promote cost effective interventions to reduce allergen and lead in the homes of children with asthma and 2) to demonstrate that these environmental interventions result in reductions in asthma symptoms, emergency room visits and hospitalizations.

Program Partners

Although FAM Allies itself is comprised of a number of partners organized into eight standing committees, the MHHDP has invited additional partners to facilitate specific elements of the project:

- Milwaukee Health Department: Responsible for coordinating MHHDP and providing the outreach staff (nurse manager and environmental inspector) for the home visits. The Milwaukee Health Department laboratory provided the allergen and lead dust analysis.
- Downtown Health Center: A pediatric health clinic affiliated with Children's Hospital. Wisconsin/Medical College of Wisconsin. The clinic services Milwaukee's low-income population with the highest asthma hospitalization rates and provided the participant recruitment-base for the study.
- Center for the Advancement of Urban Children: A research center at Medical College of Wisconsin and the institutional home of the MHHDP's Principal Investigator. The Center provided Institutional Review Board oversight, conducted the initial screening of study participants, and assisted with the home-visit nursing case-load. All support was provided in-kind.
- University of Cincinnati, Environmental Health Laboratory: Responsible for training protocol, quality control, quality assurance and oversight for Milwaukee Health Department's allergen analysis.
- American Hmong Association: A community-based organization responsible for providing the environmental remediation services that included dust reduction, minor home repair and integrated pest management for participating homes.
- Dan Medina and The Family Harris Investments: Contractors who conducted the environmental interventions that included minor home repair, dust reduction and lead abatement.

Target Population

Study participants were recruited from the Downtown Health Center pediatric center. Potential study participants were extracted from the DHC's patient database and recruited during office visits if they met the study criteria:

- Current age less than 17 years
- Residence in one of the 10 zip codes with the lowest median household incomes and highest hospitalization rates
- Diagnosis of asthma as reported during physician visit, emergency department visit or hospitalization

Eligible study participants were invited to participate by mail (followed-up by phone) and were asked to complete a screening questionnaire. The screening questionnaire inquired about participation in other asthma research studies, residential address confirmation, and frequency of daytime and nighttime symptoms (in last 2 weeks and 12 months) in order to classify patients into severity categories. Additional eligibility requirements included:

- Not enrolled in an asthma research project
- Persistent asthma symptoms (2 or more days or nights of symptoms in the past 2 week)
- Live in 1-3 unit dwellings
- Dwelling has no building inspection orders
- Dwelling has all property taxes paid
- If rental property, owner consents to participate in the environmental assessment and interventions

A total of 150 patients participated: 75 in the intervention group and 75 in the control group.

Home Visit Details

A nurse case manager or research nurse (both with training in asthma) and an environmental home inspector conducted all the home outreach visits. The intervention group received intensive medical case management and environmental interventions; the control group received neither. However, if a lead hazard was identified in the home of a control participant, all necessary environmental interventions were performed. Six visits over the course of a year were conducted as follows:

- **Baseline Visit:** Once study participants were screened and enrolled in the study, the nurse manager and the environmental inspector conducted the initial home visit to review the study requirements with participants and to obtain their informed consent. Study participants were then randomized into intervention and control group. Both groups received the following activities to collect baseline data:
 - Allies Against Asthma (AAA) Core Caregiver Survey. Collects data on frequency of daytime and nighttime symptoms, physician, emergency room and hospitalizations for asthma events, general health status measures and demographic data.
 - A 55-question Home Environmental Trigger Assessment. Collects data on housing-related asthma triggers and health hazards, including environmental tobacco smoke.
 - Environmental dust sampling for allergens and lead.
 - Environmental home inspections. Inspections were used to visually assess trigger sources such as moisture, pests and housing deterioration using a standardized checklist.

In addition, both groups received the following:

- Pillow and mattress encasings for the child's bed
- \$25 gift certificate
- Basic education and informational tools regarding asthma self management and environmental trigger control

During the baseline visit, the nurse manager enrolled participants/care-givers of the intervention group into case management and began providing and scheduling the services listed above.

Depending on the findings of the visual environmental inspection and environmental sampling, the following environmental interventions were provided as necessary over the course of the 12-month program for the intervention group:

- Dust decontamination
- Integrated pest management
- Moisture control treatments
- Lead hazard control (also received by control group if needed)
- Lead clearance sampling (also received by control group if needed)
- Minor home repair

- Provision of a HEPA vacuum

If housing hazards existed, the environmental inspector referred the property to the City of Milwaukee Department of Neighborhood Services.

- **3-Month Follow-up Visit:** At 3 months, both intervention and control groups (as well as property owners) were notified about the baseline environmental sampling results. In addition, both groups received:
 - Environmental dust sampling for allergens and lead; and
 - Gift certificate (\$25 for intervention group; \$10 for control group)

During the 3-month visit the nurse manager also provided medical case management for the intervention group in order to help educate, guide and monitor asthma self-management. An asthma case management tool kit developed by the Milwaukee Health Department was used to guide the case management services, which included:

- Understanding symptoms, signs and peak flows
- Using an action plan
- Understanding the purpose of various medications/treatments and using them appropriately (including spacers/inhalers)
- Using an asthma diary
- Controlling environmental triggers
- Using and maintaining pillow and mattress covers
- Smoking cessation
- Visiting the DHC pediatric clinic for follow-up care as needed
- Referrals to FAM Allies activities as needed
- Referrals to other community services as needed.

- **6-Month Follow-up Visit:** At six months, both groups received:
 - AAA Core Caregiver Survey;
 - Home Environmental Trigger Assessment
 - Environmental dust sampling for allergens and lead
 - Environmental home inspection
 - \$25 gift certificate

The intervention group continued to receive scheduled medical case management services and education reinforcement as described above.

- **9-Month Follow-up Visit:** At nine months, both groups (and property owners) were notified about the 3- and 6-months follow-up environmental sampling. The intervention group received additional medical case management services while the control group received education to reinforce the information on asthma, trigger control etc. provided during the baseline visit and a \$10 gift certificate.
- **12-Month Final Visit:** At twelve months, both groups received:
 - AAA Core Caregiver Survey;
 - Home Environmental Trigger Assessment;
 - Environmental dust sampling for allergens and lead (results mailed to participant and property owner);
 - Environmental home inspection; and
 - \$25 gift certificate.

In addition to the in-home interventions described, study participants (both control and intervention groups) continue to receive their normal health care services from the DHC pediatric clinic. Participants were also asked to have allergy testing (RAST test) completed during the course of the study period. Allergen results were used reinforce

lifestyle changes among parents and maintenance practices among property owners. If allergy tests were conducted, letters to a participant's physicians were sent that outlined the test results. In addition, participants' physicians were also provided written communication regarding whether specific allergen sources were identified in the participant's home and whether or not the source was mitigated.

Program Outcomes

MHHDP was successful in reaching 183 children and 151 property owners. The environmental interventions were associated with improvements in several quality of life indicators including reductions in missed school days, emergency room visits and caregiver anxiety (percent reductions were not made available at the time of this writing, but will be made available in a forthcoming publication). The Project also successfully trained low-income contractors in IPM practices, minor home repair and specialized cleaning to reduce exposure to environmental triggers and lead dust.

Financing for the Delivery of Services

MHHDP was funded \$700,000 for 2.5 years through a HUD grant along with in-kind support from FAM Allies (whose activities were funded through grants from the Robert Wood Johnson Foundation and CDC). In addition, to the MHHDP, another in-home program, the Asthma Care Coordination and Case Management Program, is able to support asthma management services through some Medicaid reimbursements as described below.

Incorporating Research Findings into Subsequent Development of In-home Asthma Programs

Environmental assessment tools developed for MHHDP will be incorporated into another program developed in collaboration with the Milwaukee Health Department and FAM Allies, titled the Asthma Care Coordination and Case Management Program. The Asthma Care Coordination and Case Management Program began in 2003 and works to provide a centralized system for standardized in-home care coordination and case management for Milwaukee children considered at risk for a severe exacerbation⁶ and their caregivers. Its goals are to increase in-home asthma care for children with a diagnosis/classification of persistent asthma, decrease the number of children who are hospitalized or present at the emergency room with an asthma exacerbation, and increase the number of children who take their prescribed medication according to their asthma severity classification. Although the primary focus of the case management services is education about use of medications and devices, one component of the tool kit used with participants includes an environmental trigger assessment checklist to address the major sources of triggers in the home. Lessons learned from the MHHDP will guide revisions in the environmental assessment tools and the expansion of the program (dependent on additional funding) to provide more extensive environmental remediation services for participants.

Opportunities and Constraints in Delivering In-Home Intervention Programs for Asthma: Lessons Learned

Implementing the MHHDP allowed the Milwaukee Health Department to understand the strengths and weaknesses of the study design to better inform the development of a program extending beyond the study period. For example, because of the research context of MHHDP, the environmental interventions provided to the intervention group were as similar as possible to ensure comparability. As a result, many homes received interventions that were not completely necessary. Therefore, the cost of the study was likely much higher than would be expected if a public health department implemented the program with more targeted interventions. In seeking funding to cover environmental interventions for its case coordination and case management program, the Milwaukee Health Department has modified the MHHDP environmental intervention protocol to include a system of low, medium and high intervention services based on need.

⁶ The target population is children under age 17. Criteria for at risk of severe exacerbation include: at least 2 visits to the emergency room in the past 12 months; a stay in the Intensive Care Unit or a hospital admission for asthma in the past 12 months; has persistent asthma with complex psychosocial issues or co-morbidities.

Local Health Department Case Studies: Milwaukee, WI

For future HUD healthy homes grantees, MMHDP program staff recommended that study investigators take into consideration likely delays in obtaining HUD approval for the recommended home repairs. These delays will significantly affect the timing of interventions, which may affect the study outcomes.

The MHHDP was successful in strengthening relationships with program partners and the community. The family-oriented nature of the asthma case management services created a trusting environment between the case management nurse, environmental inspector and family. MHHDP results are consistent with other research studies and program evaluations that have demonstrated that environments that foster improved knowledge on behalf of caregivers translate into personal empowerment about how to care for their child, resulting in less caregiver distress and a reduction in adverse asthma events.

Although there is significant awareness in the Milwaukee community regarding the burden of asthma facing low-income children and the Milwaukee Health Department is supportive of its programs on asthma, all health department asthma programs are entirely by grants. Lack of current funding prohibits continuing the in-home asthma programs. However, the Milwaukee Health Department remains confident that future funding will come through in part due to the success of its case-management program and the strength of its relationships with program partners and the community.

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CASE STUDY 4

Healthy Homes for Healthy Airways San Francisco Department of Public Health California

Origins

Beginning in 1998, the San Francisco Department of Public Health began providing in-home asthma education to high-risk pediatric patients receiving care at a community asthma clinic. No such service existed for high-risk adult patients. In 2001, the Department received an EPA grant to implement a Healthy Homes for Healthy Airways Study. The goals of this quasi-experimental research study were to: 1) determine whether interventions to reduce asthma triggers present in the home are feasible for asthmatic adults served by the San Francisco Department of Public Health (SFDPH), and 2) examine the physical, personal and socioeconomic barriers that make the implementation of interventions difficult for the patient.

Program Partners

Partners included the Department of Public Health, the University of California San Francisco, medical providers from the San Francisco Community Health Network clinics, and the San Francisco General Hospital.

Target Population

The research study targeted and served primarily poor, minority adults with asthma living in San Francisco. Patients were recruited from medical provider referrals at San Francisco Community Health Network clinics and San Francisco General Hospital, primarily from the Hospital's Adult Asthma Clinic. Only individuals with a stable housing situation for at least 3 months were eligible for the study.

Home Visit Details

Referrals from providers consisted of a form that included the following information: 1) patient contact information, 2) primary and referring provider contact information, 3) patient demographics, and 4) patient's current asthma condition and management tools (i.e. home action plan, current medications and suspected triggers). After receiving the referral form, staff telephoned eligible patients to enroll them in the study and schedule a home visit. Environmental Inspectors (some of which were fluent in Spanish and Chinese) conducted a total of two home visits with a focus on mitigating in-home asthma triggers through education and support. During the visits, the inspectors educated patients on asthma risk factors, provided tailored recommendations and supplies (i.e. cleaning equipment and bed/pillow encasements) for mitigating sources of environmental triggers in the home, and provided information and resources for other social services. Since a primary objective of the study was to evaluate barriers that limit a patient's ability to implement recommended changes as identified during the home assessment, the final visit also collected this important feedback from participants.

- **Initial Visit:** The purpose of the initial visit was to gather baseline data on demographics, asthma-specific characteristics of the patient, their social support and the home environment. Examples of measures for asthma-specific characteristics and social support included:
 - Asthma-specific characteristics of the patient: self-reported asthma severity; known/suspected asthma triggers; frequency of asthma symptoms; and asthma severity in parts of the home
 - Social support (collected using a the social support module from the Year 2000 British General Household Survey):
 - Informal help, e.g., the ability to ask for a ride when needed, to have help when sick at home, to borrow money when needed
 - Support in the event of a crisis, e.g., someone to turn to; proximity of residence to people who could provide support if needed
 - Frequency that residents worry about encountering hardship

- Frequency that residents worry whether they have enough money to pay for their needs

During the visit, inspectors also conducted a home assessment using a standardized inspection guide that reviewed and documented structural characteristics of the home and personal habits and behaviors of the resident. Structural and personal characteristics of the home recorded included, for example:

- Structural characteristics: the number of units in the building, legality of the housing unit, public or private housing, presence of ventilation systems, and presence of leaks.
- Personal characteristics: the type of sleeping area (bed, couch), use of pillow/mattress covers, and presence of pets.

Based on the assessment results, tailored recommendations were provided to each participant. Because most participants had not completed allergy testing, recommendations were made based on general trigger avoidance techniques rather than individualized trigger profile. During the visit inspectors provided participants with mattress and pillow covers, squeegees and vacuum bags. In addition, informational brochures were provided on issues such as the basics of asthma mold remediation. Because of high illiteracy rates, videos were also provided. Inspectors provided letters and reports to the subject and his/her doctors following the home visit.

- **2nd Visit:** Between 3-6 months after the initial visit, participants received a second and final visit. Data were collected on asthma-specific measures and social support as in the initial visit. The environmental inspector also reassessed the home environment and spoke with the participant to measure compliance with previous recommendations. The inspector collected information using a standardized “barrier tree” to understand impediments to compliance with each of recommendations made during the initial visit. Participants were asked to review each recommendation and select whether any of 10 barriers impeded compliance:
 - Cost;
 - High level of sustained or one-time patient effort;
 - High level of sustained or one-time effort by helpers;
 - Formation of new habit by patients or others in the household;
 - Large time commitment;
 - Landlord involvement;
 - Structural changes in the home;
 - Need to ask for assistance from others;
 - Transportation; and
 - Need for demonstration of recommended activity.

Program Outcomes

The study developed useful educational materials and teaching tools for low-literacy population in English, Spanish, and Chinese. In total, 190 patients were referred to the study. Of the 190, 94 received the first home visit (49% participation rate) and of those, 52 received the 2nd visit (27% participation rate). For those participants that received a 2nd visit, more than 60% of the recommendations made by the home inspector were completed. Most of those patients who rated their asthma as severe at the first home visit completed 60% or more of the recommendations, whereas patients who reported their asthma as moderate completed fewer than 60% of the recommendations. Patients who completed fewer than 60% of the recommendations also reported less social support than participants who completed more of the recommendations. Both groups cited more barriers to complying with the dust mitigation recommendations (use of pillow mattress covers, asking someone else to vacuum and wash bedding weekly) than other recommendations. Lack of money was the barrier to complying with recommendations most frequently cited by participants.

Financing for the Delivery of Services and Incorporating Research Findings into Subsequent Development of In-home Asthma Programs

Some of the costs of the Healthy Homes for Healthy Airways project were covered by an EPA grant. EPA paid for supplies and other in-home visit expenses, and partially supported a staff epidemiologist. Core funding through the

City of San Francisco covered the salaries of the environmental inspectors, as well as direct costs of the home visits prior to and after the EPA grant.

Other In-home Asthma Programs from SF Department of Public Health

Although the EPA project has ended, home-based adult asthma education continues. Upon receiving a doctor's referral, an investigator from the Public Services Complaints Program and/or field-based public health nursing staff is sent to evaluate the homes of asthma patients to help reduce triggers in the home environment.

In addition, the San Francisco Health Department has helped to institute a citywide home-visiting program for pediatric patients, including those seen at San Francisco General Hospital and the Mission Neighborhood Health Center. This project was launched as part of the statewide California Asthma Initiative and focuses on providing home visits to asthmatic children 5 years and younger. The San Francisco Health Department provides program oversight, health education and public health nursing staff. In addition, the health department has helped train community health workers to conduct in-home environmental intervention visits to provide both medical and environmental education. Twenty-six measures are collected during interviews at baseline (enrollment into the program) and after the intervention. Measures include:

- Frequency of day/night symptoms in the past 2 weeks;
- Missed days of work/school by caregiver and patient in the last 4 weeks;
- Frequency of emergency room visits and hospitalizations in the last 6 months;
- Use of an asthma management plan; and
- Caregiver quality of life.

The 209 children served by the program showed improvements in all categories, including:

- Frequency of day and night symptoms associated with the most severe asthma classification (i.e. symptoms everyday all the time, symptoms everyday, not all the time) were reduced;
- Missed days of work/school by the caregiver were reduced by 12%;
- Missed days of school/daycare by the patient were reduced by 32%;
- Emergency room visits and hospitalizations were reduced by 34% and 11%, respectively; and
- The number of patients with an asthma management plan increased by 44%.

Opportunities and Constraints in Delivering In-Home Intervention Programs for Asthma: Lessons Learned from the San Francisco Department of Public Health's Home Visiting Programs

Changes in understanding and attitudes resulting from the Healthy Homes for Healthy Airways study lay the groundwork for continued improvements in asthma management. As a result of the Department's marketing efforts for the study, the general public is more aware of the burden of asthma. Study participants learned about their right to safe and habitable home, increased their knowledge about asthma, and were empowered to take action to improve the quality of their home environment. Environmental inspectors learned that communication and education are powerful tools to improve the home environment and can be used instead of, or in conjunction with, code enforcement.

Two primary constraints faced by the Healthy Homes for Healthy Airways study were also noted: 1) physician referrals and 2) participation rates. Despite extensive city-wide outreach, recruitment of study participants through physician referrals was difficult, and only a few physicians provided the majority of the participants. The most frequent reason cited by providers for not referring their patients to the study was "lack of time." Some providers also stated that they were skeptical that an environmental home assessment would address their patient's underlying needs. Based on these referral difficulties, study staff suggest that other health department programs plan to devote significant resources to recruitment and make the referral form as simple as possible.

As noted earlier, participation rates in this study were low. The primary reasons cited by those who refused to participate in the study included "fear of or actual landlord disapproval of a home visit from a governmental agency" and "disapproval of other household member of a government agency inspection." The study also cited significant lag

time between the time the program received the physician referral and the time staff contacted the patient as one of the reasons for poor retention; patients often forgot that their physicians had referred them to the program or could no longer be reached at the number provided on the referral form.

According to staff interviewed, many environmental health professionals are not prepared to deal with the myriad of social issues they may encounter among participants, some triggered by the home assessment (such as difficult dynamics with landlords making housing less secure) and some inherent in living in poverty. To ensure that appropriate social and legal referrals sources are in place, home visiting programs need to identify in advance the likely needs of the population. In addition, tracking of referrals to other code enforcement agencies or service providers and their outcomes needs to be incorporated into home-visiting programs to ensure follow-through.

The program urges clinic-based practices and organization to incorporate home visits into their asthma management programs. As demonstrated by the several home visit programs sponsored by the San Francisco Department of Public Health, these in-home programs can supplement medical education traditionally provided in a clinic setting and provide in-depth assessment, education and supplies to reduce environmental triggers. Although some health care organizations in San Francisco have implemented in-home environmental intervention programs for their asthma patients, more education of health care organization/physicians is needed regarding the role of the home environment in asthma management and the effectiveness of home visit programs.

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CASE STUDY 5

Breath of Fresh Air

Stamford Department of Health and Social Services Connecticut

Origins

Like many urban cities, Stamford, Connecticut is burdened by a high prevalence of asthma that disproportionately affects African-American children. In 2001, rates of asthma among children in the city were 35% higher than rates in the rest of the county. Stamford children were hospitalized for asthma 2.4 times more frequently than were children in neighboring communities. Struck by these patterns, in 2002 the Stamford Department of Health and Social Services sought and received a Healthy Homes grant from HUD to develop implement a 3-year in-home asthma education and environmental inspection program in order to improve the lives of children with asthma. The goal of the Breath of Fresh Air program was to efficiently identify, assess and ameliorate housing hazards associated with environmentally-induced illness in children.

Program Partners

Breath of Fresh Air partnered with community-based and health care organizations to help implement the program including:

- Fairfield County Safe Kids, an organization focused on preventing unintentional injuries to children--gave the program free safety items to distribute during the home visits.
- American Lung Association--provided many of the educational materials and worked with program participants to secure nebulizers when needed.
- Pediatric Pulmonary Specialist--provided two visits to children who were referred by the program.
- Stamford Public Schools--provided the recruitment base for the project.
- Stamford Asthma Management Council, a collaborative comprised of the health department, board of education, Stamford Hospital, American Lung Association, two private corporations and local physicians-- provided advice to the project.
- Stamford Health System, the parent organization of Stamford Hospital--served in an advisory capacity to the project and provided a small portion of the recruitment base.

Target Population

Lists of school nurses generated lists of children in grades K-12 with asthma provided by school nurses and based on school health records provided the primary source of program participants. Letters were sent to parents of children with asthma informing them about Breath of Fresh Air and encouraging their voluntary participation. In the early years of the program, only those children living in asthma "hotspots" of the city were targeted for participation. These "hotspots" are characterized by high poverty, poor housing stock, large populations of ethnic and racial minority populations and non-English speaking immigrants, and a high prevalence of lead poisoning and housing code violations. In subsequent years, the program was offered to all asthmatics identified by the school nurse. Recruitment was also expanded to include the local hospital and clinics, pediatric physicians, health fairs, day cares and community centers.

Home Visit Details

Breath of Fresh Air provided four home visits over the course of a year: an initial visit and follow-up at 3-months, 6-months and 1-year. A nurse educator with expertise in pediatrics and asthma and a housing inspector with extensive experience in housing code enforcement and specialized training in mold participated in each visit. During each visit, the program staff:

- **Initial Visit**

- Administered the Standardized Assessment Instrument to the parent/child, which served as education prompts for the home visit nurse, and collected information on:
 - Demographics
 - Risk measures including the frequency of emergency room visits, hospitalizations and ICU admissions due to asthma, as well as use of rescue medications
 - Other medication usage
 - Frequency of asthma symptoms in the last two weeks and other quality of life measures
 - Severity index
 - Adequacy of asthma treatment and treatment compliance including use of an asthma management plan, spacer, peak flow and whether the child had allergy testing
 - Parents' knowledge of asthma
 - Confidence of caregivers in asthma management skills
 - Child knowledge of asthma
 - Trigger education checklist
- Gave literature to families including booklets from the American Lung Association on asthma triggers including smoking, mold and cockroaches, a booklet on asthma, "What Everyone Should Know" (available in both Spanish and English), a healthy homes coloring book, and a DVD, "Natalie Says," which features a child with asthma.
- Conducted an environmental inspection to identify asthma trigger sources areas such as moisture, clutter and dust, pests, structural problems, and other safety hazards such as lead. The inspection was guided by a standardized inspection report form. Findings and recommendations from the inspection were sent to both the tenant and landlord.
- **3-Month Follow-up**
 - Re-administered the Standardized Assessment Instrument.
 - If needed, the nurse educator referred participants to a pediatric pulmonary specialist for up to two visits.
 - Re-inspected the home to assess improvements and persistent problem areas.
 - Provided a canvas bag with hypoallergenic mattress, pillow encasements and sheets (instructions were provided to the participant's and caregiver regarding how to put on the mattress and pillow encasements), asthma action plan, peak flow monitor, spacer, Frisbee and used books. Although a few supplies/gifts were donated, most were purchased through the grant (this is true also for supplies provided during the 6-month and 1-year follow-up).
- **6-month Follow-up:**
 - Re-administered the Standardized Assessment Instrument.
 - Re-inspected the home to assess improvements and persistent problem areas.
 - Provided \$50 gift certificate for CVS (purchased with grant money), smoke and/or carbon monoxide detectors, wool duster, Frisbee and tee shirt.
- **1-Year follow-up:**
 - Re-administered the Standardized Assessment Instrument.
 - Re-inspected the home to assess improvements and persistent problem areas.
 - Provided either a clean-air machine and swifter (if participant's home had wood floors), or a HEPA vacuum (if participant's floor had carpet).

During all visits the nurse educator and the home inspector reinforced educational points made during previous visits and provided tailored education to each participant. Typically, services and materials were provided according to the program protocol as described above. In cases of extremely unhealthy conditions, staff expedited the provision of services and materials. The Program also worked with the American Lung Association to provide nebulizers for those children in need whose medical plans did not cover the cost of such equipment.

After each visit, the nurse educator conducted a spirometry test for each child in the school nurse's office. Results of the test were printed at the Health Department and read by the Department's Medical Director. If there were

problems with the spirometry reading, the child's primary care physician was contacted. The nurse educator also routinely encouraged the family to participate in the Environmental Protection Agency's (EPA) Open Airways Program, which was taught by the school nurse to 3rd-5th graders. As a result of these interactions with the school nurse and the home nurse educator, the continuity of care for the child's asthma was extended beyond the home visits.

General cleanliness of the home was identified early as the biggest risk factor facing most participants. Consequently, many of the materials and incentives provided to the participants focused on tenant-based solutions, rather than property-based interventions, such as structural remediation. Although the home inspector educated participants about environmental concerns in the home, it was the responsibility of the homeowner/landlord to mitigate issues such as mold and pest infestations. Housing code citations were issued when necessary. In these cases, landlords had 30-days to fix the problem or face criminal proceedings. Program staff always assured participants that their landlords had no legal right to evict them when citations were issued as a result of the resident's participation in the Program.

Program Outcomes

Breath of Fresh Air ended in 2005. Over the 3-year grant period, 1300 children were contacted for participation in the program and 315 children living in more than 250 units enrolled. Fear of landlord retaliation, residence in illegal housing and initial language barriers were cited as the primary reasons for refusal to participate in the program.

As a result of the Program, the prevalence of asthma triggers in the home dropped significantly from 565 triggers identified in all homes receiving the initial visit to 110 triggers in the final visit. Similarly, housing code violations dropped significantly (from 259 at the initial visit to 50 at the final visit), and asthma symptom days decreased. Anecdotal information suggests that unscheduled medical care visits and hospitalizations were reduced. (The Program was not able to get data from the local hospital to validate these findings, but hospital nurses noted a reduction in number of patients repeatedly showing up for emergency care). The Program received an award from the National Association of County and City Health Officials (NACCHO).

Financing for the Delivery of Services

An \$850,000 three-year grant from HUD supported the Breath of Fresh Air Program. Approximately 80% of the grant supported staff costs and 20% supported materials/supplies and housing abatement/rehabilitation costs.

Incorporating Research Findings into Subsequent Program Development

The Stamford Health Department recently received a \$30,000 from the Bridgeport Community Health Center Inc. as part of an EPA Healthy Communities Grant. The grant will support the development of a community-based Asthma Network for Environmental Community Education Program to educate children with asthma and their families about indoor asthma triggers. The Breath of Fresh Air in-home environmental intervention model will be provided to children referred by clinicians at two Bridgeport community health centers. The community health centers serve a population within Stamford that has a high rate of poverty, is largely an immigrant community and has an asthma prevalence rate that is twice the rate of Stamford as a whole. To date, 10 children have received in-home visits as a result of this program. The home visits are identical to those delivered under the HUD grant, although the program is condensed into 3 rather than 4 visits and some supplies are provided in the first visit.

When external funds expire, Breath of Fresh Air activities will be absorbed into existing health department activities performed by nursing and inspection staff such as the Department's Lead Poisoning and Prevention Program.

In the summer of 2005, Stamford Health Department also participated in the Connecticut Department of Health's Putting on Airs Program. With \$5,000 of funding, Stamford was able to service 15 children for one visit and one

follow-up call (the Connecticut Public Health Department, Putting on Airs case study includes more information on the content of these visits).

Opportunities and Constraints in Delivering In-Home Intervention Programs for Asthma: Lessons Learned from Stamford Health Department

Effective communication between school nurses and other program personnel was critically important to the success of the Stamford program. Communications and efficient and effective targeting and enrolling of children and families was made easier because school nurses are employees of the Stamford Health and Social Services Department. This relationship also enhanced participation in EPA's school-based Open Airways for Asthma program; the Stamford program's nurse educator encouraged study participants to become involved.

Among the many positive outcomes of the study, program staff highlighted increased knowledge and understanding by a range of people involved in the study as providing a basis for long-term reduction in the burden of asthma. An evaluation of Breath of Fresh Air concludes that the program enhanced tenants' level of knowledge about asthma and in-home environmental risk factors. Prior to the study, parents typically did not understand why their child was so sick, and the ways in which changes in the home environment could improve the control of asthma in the short term, and reduce risk of long-term lung damage. The evaluation reported similar results among landlords, as well as home inspectors. Prior this program, home inspectors lacked knowledge of the in-home environmental risks factors for asthma; now, they intend to continue to using this knowledge in their current work.

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CASE STUDY 6

Asthma Start Program

Alameda County Health Department California

Origin

In 1998, California voters passed Proposition 10, the California Children and Families Act, a state program aimed at promoting, supporting and improving the early development of children in the prenatal stage to five years of age. Proposition 10 required each county to form a commission to carry out the legislation. In Alameda County (located in the San Francisco Bay area) the resulting First Five Alameda County Commission developed a strategic plan in which one of the primary objectives was to improve the lives of children with asthma. The Asthma Start Program was established within the Alameda County Public Health Department's Community Health Services Division to carry out the goals of targeting asthma. The Asthma Start Program provides in-home case management services, asthma health education, environmental trigger assessment and reduction interventions, and advocacy in an effort to improve asthma services for children under five, reduce emergency room visits and hospitalizations due to asthma, reduce school absences, reduce environmental triggers, and strengthen care coordination.

Program Partners

The program works with a number of health provider organizations such as Children's Hospital of Northern California in Oakland, public health and community clinics, WIC, and individual physicians to refer children to the Asthma Start Program. As described below, the program also teams with the local American Lung Association to provide comprehensive delivery of in-home services to children living in Oakland. The program works closely with the two Medicaid managed care programs, Alameda Alliance for Health and Blue Cross State Sponsored Program, for referrals and financing of visits.

Target Population

The program began operation in 2001. In the first years of the program, Alameda County provided home visits to children and their families living in Oakland, a city where the rate of hospitalizations due to asthma is among the highest in California and double the goals of Healthy People 2000 (1998-2000 data). Children were referred to the program by Children's Hospital of Northern California, Oakland, the hospital in the area which provides the vast majority asthma-related emergency room visits and hospitalizations.

Since the local American Lung Association also provided in-home asthma management services to children in Oakland, the two programs partnered and shared referrals from Children's Hospital of Oakland following emergency room visits or hospitalizations. ALA provides in-home services to children ages 6-18, while Asthma Start expanded its population-base to provide in-home services to children 0-8 years of age. In 2004, the Asthma Start Program expanded once more and now provides in-home asthma services to children 0-18 years of age living in 14 cities in the county (with a total population of 1,443,741). In addition to Children's Hospital of Oakland, referrals came from community and county clinics, individual physicians and self-referrals. The marketing of the program to providers and the leadership and prominence of the First Five Alameda County Commission have contributed to a constant flow of referrals.

Home Visit Details

Home visiting services are provided by two medical social workers, one of whom is able to provide services in Spanish. Both workers received training on asthma at Children's Hospital of Northern California, Oakland and have been with the program since its inception. One worker is personally affected by asthma.

The in-home services focus on providing asthma education, environmental assessments and interventions, and linking families to additional services such as stable health care, health insurance, employment services, pre-schooling, etc. The program consists of three home-visits. Although the content of each visit is standardized,

elements are emphasized or deemphasized depending on the needs of the child and/or their caregiver. The purpose and content of each visit are outlined below:

- **Initial Visit:** The objective of the first visit is to get to know and understand the varied issues affecting the child's health. The visit focuses on collecting data on the child and his/her asthma history for the purpose of developing an asthma management plan. Information is collected on demographics, frequency of asthma symptoms in the last two weeks, emergency department visits and hospitalizations in the past six months, medication use, whether the child is in preschool, and whether the child has medical insurance and a stable physician. The initial visit takes approximately 2-hours. The foci of the asthma education during this visit include warning signs, triggers, and the purpose of different asthma medications.
- **2-Month Follow-up:** The second visit focuses on environmental health assessment of the home and teaching families how to reduce exposure to asthma triggers. The medical social worker surveys the home to assess leaks and moisture sources, cleaning habits, pets, presence of stuffed animals, use of fragrances (home & personal), talc, etc., and puts together a checklist for families indicating areas that need improvement. Materials and supplies provided to the families include: dust mite-proof mattress and pillow covers for each bed where the child sleeps; bleach free mold cleaner; a HEPA vacuum if the house has carpet; a mop for homes with hardwood floors; smoking jackets (rain coats) to encourage people to smoke outside and to not bring the smoke inside on their clothes; and roach traps ("motels"). The social worker advises families about the need for larger structural modifications to the home such as carpet removal, roof leaks, window replacements etc., but the program is not funded to provide such services. Education provided during this visit includes triggers and environmentally friendly cleaners (e.g. baking soda & vinegar).
- **3-Month Follow-up:** The third visit focuses on trigger source reduction and asthma control, and assessing the parents' knowledge of asthma. This visit also focuses on nutrition education to emphasize healthy eating and choosing foods that do not inflame airways. The program typically concludes its work with a family after this visit, but if the child's asthma is not in control, more visits are conducted.
- **3-Month Follow-up After Discharge:** Program staff⁷ telephone parents three months after the child is discharged from the program to collect data on perceptions about the effectiveness of the program's services, and the current health of the child.

The social workers also follow-up with families on an as-needed basis. Typically these additional contacts are made to help advocate for and link families with additional services related to employment, housing, domestic violence, etc. When necessary, the social workers refer families to legal advocates who can help pressure landlords to take steps needed to make the family's home safer and healthier.

The program communicates with the child's physician based on findings during the home visits. Physicians receive notes from the initial visit informing them that the child is enrolled in the program. In addition, a discharge summary is provided to the physician detailing what the child and family were able to accomplish in the program.

The Asthma Start Program is also involved with a number of community-specific activities such as childcare provider training, advocacy for smoke-free locations and healthcare provider training. The program also assists in the surveying of school environments for sources of asthma triggers. (Schools in Alameda County are astute about the issue of asthma, particularly the Oakland School District. Oakland schools have just started a program to collect data on school absenteeism due to asthma⁸.)

⁷These calls are made by staff other than the medical social workers.

⁸ The emergency card used by Oakland schools now asks whether the child has asthma, diabetes and allergies. Informed by this card, the school personnel are starting to collect and record absences due to asthma when parents call to report that their child is sick.

Program Outcomes

To date, approximately 800 individuals have received home visits. Less than 5% leave early or refuse services. The program has found that providing vacuums, encasings and cleaning products may help retain participants. The program currently has a caseload of 90 patients. An evaluation of data collected on children in Every Child Counts program (ages 0-5), shows that 96% of children enrolled in Asthma Start for a minimum of three months showed a decrease in asthma symptoms. At admission to the program, 42% of children had been hospitalized in the last 6 months and 55% had been to the emergency room. During case management 4% were hospitalized and 11% were seen in the ER. Data have been collected on all children ages 6-18, but have not yet been analyzed.

Financing for the Delivery of Services

In its first two years, the program was funded entirely through a grant from Every Child Counts (ECC), the County Program formed in response to Prop 10. In addition to ECC funding, the program's \$537,000 budget is also supported by a variety of state and county funds, including state, county and Medicaid-sponsored health care programs. Roughly 68% of funding is used to support staff and benefits. The majority of financial support for the program comes from the Tobacco Master Settlement, as well as Measure A, a tax passed in the Alameda County to fund county hospitals, 25% of which is ear-marked to support public health and community-based organizations. For children covered by Alameda Alliance for Health, a health maintenance organization that administers Medi-Cal (the CA Medicaid), Asthma Start is able to bill for case management at a rate of \$175 per encounter. Supplies such as mattress/pillow encasements, vacuums, cleaning products etc. are not considered "durable equipment" and are not a covered medical benefit and cannot be paid for by any of these mechanisms. These supplies are purchased instead with grant funds. The program can also bill Targeted Case Management (TCM)⁹, including linkages to services, case management and assessments provided during the in-home visits. However, asthma education per se is not a reimbursable TCM service.

Opportunities and Constraints in Delivering In-Home Intervention Programs for Asthma: Lessons Learned

The biggest constraint in delivering the in-home asthma services for the Asthma Smart Program is funding. Although the Tobacco Master Settlement and ECC program have consistently provided funding thus far, the program struggles to pay for supplies such as vacuums. Moreover, the case load is too large for two home workers, resulting in delays in following up on referrals. The ability to charge case management services to Medicaid is helpful, though overall, Medicaid funds covers only about 10% of the program's budget.

Program staff stated that having an opportunity to see patients and their families in their homes is the key to the success of the program. The program's social workers are able to identify opportunities to reduce exposure to asthma triggers in the home, and they have the time to improve the parents' knowledge about asthma. The resulting empowerment of parents has translated into the reduction of symptoms and emergency room visits.

The program discovered early on that social workers had difficulty delivering the dozens of educational booklets, fact-sheets and pamphlets in an organized fashion, and families had difficulty accessing and retrieving the information after the visit. As a result, the program organized all the educational materials into a binder with sections for each visit.

⁹ "Targeted Case Management is a covered Medi-Cal benefit which assists Medi-Cal eligible individuals within targeted specified groups to access needed medical, social, educational, and other services. Service components include needs assessment, setting needs objectives, individual services planning, service scheduling, crisis assistance planning and periodic evaluation or service effectiveness. Each State Plan Amendment (SPA) for TCM specifies the target population, the geographic area to be served, the provider qualification, the definition of covered services, the unit of service and the reimbursement methodology. TCM providers are limited to Local Governmental Agencies under contract with DHS to provide TCM services and are identified in the California SPA." Excerpts taken from Targeted Case Management Overview.

<http://www.dhs.ca.gov/mcs/mcpd/mbb/acss/TCMProviderManual/Section%201.pdf>. Accessed 1/24/05.

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The program would like to employ more group education, modeled after a group education program for diabetes patients which has had good results: the health department routinely has roughly 20 attendees to their monthly classes and patients have started their own support networks. Staff anticipate that a similar program for asthma could enhance the home-visit program by allowing outreach workers to elaborate on issues introduced during the home visits.

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CASE STUDY 7

In-Home Asthma Literacy Education (INHALE) Program Erie County Health Department New York

Origin

Erie County Health Department's (ECHD) In-Home Asthma Literacy Education (INHALE) Program grew out of two previous research and programmatic grant-funded initiatives. First, ECHD received a grant from the New York State Department of Health (NYSDOH) to examine whether the presence of in-home asthma triggers based on dust samples was correlated with asthma severity. Although the study demonstrated a correlation, it concluded that visual inspections showed the same correlation and were more cost-effective than dust sampling. A second initiative funded by EPA Region II sought to build and solidify linkages with other community and governmental organizations in order to provide more comprehensive referrals to and from the County's asthma program, which consisted of a modified version of the in-home visit designed in the NYSDOH-funded Project. Building on these previous initiatives, the County requested and received funds from EPA in 2003 for INHALE, a 2-year study to develop and deliver an in-home asthma education program for inner-city residents that focused on identifying and eliminating exposure to in-home asthma triggers and providing personalized asthma management. INHALE seeks to reduce rates of hospitalization, medication use, and visits to the emergency room, as well as reduce asthma severity and the burden of asthma on families' quality of life.

Partnerships

INHALE developed extensive partnerships to build its participant referral base. Partnering community organizations include Catholic Charities, Parents Anonymous, Community Action Center, Children's Hospital (intensive care unit), Stepping Stones Academy, Head Start, a number of independent pediatric centers, and the CDC-funded Inner City Asthma Study. Additional referrals come from other County programs, such as the NYSDOH-funded Healthy Neighborhoods Program, the HUD-funded Healthy Homes Initiative, and the Department of Social Services. The partnerships were essential to meeting the recruitment goals of INHALE.

Target Population

INHALE focuses on providing in-home asthma services to children ages 3-18 in high risk urban housing, and recruitment efforts focus in these areas. Enrollment in the program is open to people with asthma of any age residing in Erie County, excluding patients in assisted living facilities or those with COPD. In addition to referrals from partnering organizations, INHALE also receives self-referrals.

In-Home Visit Details

Early in the implementation of the program, INHALE's home visits were performed in two steps: an environmental assessment by an Environmental Education Specialist or a Public Health Sanitarian and an asthma education visit by a Respiratory Therapist. Subsequently, the two visits were merged and performed by a staff member who is both a Certified Asthma Educator and a Public Health Sanitarian. This visit typically lasts an average of 2 hours.

- **Intake:** After a referral to the program is received, a staff member performs a telephone intake with the participant and/or caregiver. During the call, staff administers a questionnaire that collects demographic data and quality of life indicators (e.g., frequency of asthma symptoms day/night, frequency of urgent health care services, etc.). A home visit is then scheduled.
- **Initial Visit:**
 - Environmental Assessment of the Asthmatic's home. Eight major asthma trigger sources are evaluated: smoking, rodents, cockroaches, mold/mildew, pets, general indoor air quality hazards, dust and dust mites and excessive moisture and humidity. Thirty-two contributing factors are also evaluated, including housekeeping, food storage, garbage, and standing water. Depending on need, the outreach staff person provides participants with the following:

- non-toxic cleaning products
 - laundry detergent and soap (Sun & Earth)
 - mattress and pillow covers for all rooms where the asthmatic spends a significant time sleeping
 - high efficiency furnace filters
 - dusting cloths (Pledge 'Grab-It' or Swiffer)
 - shower curtain
 - carbon-monoxide alarm
 - vacuum cleaner bags (supplies ran out after the 1st year of the program)
 - smoking cessation kit and educational materials.
- **Asthma Education** The Asthma Educator collects a variety of data both to help tailor the education to the participant and for program evaluation purposes. The data collected include medication usage, knowledge of asthma triggers, and quality of life indicators. The education provided includes self-monitoring using peak flow monitors and diaries, demonstration of peak flow, spacer and inhalers, asthma action plan, and asthma triggers. Results of the home assessment help to inform the discussion regarding asthma triggers. Referrals to additional social services and home remediation services are provided if needed including rodent pest control services, housing and building code inspections, heating assistance, child protection, job assistance and training, domestic violence assistance, food assistance, and community housing/living assistance programs.
 - **6-Month Follow-up Visit:** At six months, outreach staff conduct another home visit. The visit is used to reassess the home for environmental trigger sources and to look for improvements. The visit also collects quality of life indicators. Continued education is provided to reinforce content provided in the earlier visits.
 - **12-Month Follow-up:** A telephone call is made to follow-up with the participant/caregiver on the individual's status and to answer any questions/concerns. Data on quality of life measures are also collected.
 - **Exit Interview:** After the 12 month telephone follow-up, an exit interview with the participant/care giver is conducted to gather information regarding their satisfaction with the program

At the end of the study, a very brief explanation of services provided is faxed to the referring agency. Cases that were self-referred did not receive an explanation.

Project Outcomes

Of the 407 people who were referred to the program, 202 received an initial home environmental assessment visit and 184 received a visit from an asthma educator. One hundred sixty five completed the 6-month follow-up call and 136 completed the 12-month telephone survey.

The program was able to monitor specific outcome measures using pre- and post-intervention questionnaire data. The data demonstrate reductions in health care utilization and asthma symptoms following the home visit program, especially among severe asthmatics. At the outset of the program 26% of individuals classified with moderate to severe persistent asthma had breathing problems at least one time per week, but not every night. At final follow-up, only 8% had breathing problems one or more times per week. Hospitalizations were reduced from 17% in the initial visit to 6% at final follow-up. Similarly, emergency room visits decreased from 40% at the initial visit to 7% at final follow-up.

The concerns that were most pressing to households in the study were pest exposures and household conditions that contribute to mold (e.g., plumbing leaks); these exposures declined sharply over the course of the study. Improvements were also observed in general housekeeping, clutter levels, and the use of pillow/mattress encasements, although some dust exposure remained. The project found that household exposure to tobacco smoke (direct or indirect) and pets generally did not change.

Incorporating Research Findings into Subsequent Development of In-home Asthma Programs

Although in-home visits related to the EPA grant are completed, ECHD continues to offer similar in-home asthma visits as part of their Healthy Homes and Neighborhoods Program. This HUD- funded program focuses on community outreach to improve quality of life by reducing exposure to home-based health and safety risks. When

the program encounters households with an asthmatic family member, a home assessment/asthma education visit is provided. Although the HUD program lacks funds for supplies and materials for the in-home assessment/asthma education visit, an inventory of supplies left over from Project INHALE are used. Only one home visit is currently offered. However, the program is considering offering a 6-month and 12-month follow-up visit.

Financing for the Delivery of Services

To date, all funding for INHALE and similar in-home visiting services for asthma has been through federal grants. The two year EPA grant that supported INHALE totaled \$150,000; roughly 75% supported staff salary and fringe and 25% paid for supplies. Intervention supplies cost roughly \$150-\$175 per family. The ECHD is currently examining the potential for private foundations to support continued services and supplies.

Opportunities and Constraints in Delivering In-Home Intervention Programs for Asthma: Lessons Learned

Program staff stated that in-home environmental intervention programs for asthma are seen as a natural fit for health departments, since health departments are accustomed to working with individuals in their homes,. As a result of the asthma education, participants had an improved understanding of the disease and its treatment, which in turn resulted in more effective communication with their physician. Funding remains a barrier to INHALE sustaining its in-home environmental assessment and asthma education services.

INHALE greatly benefited from the two previous ECDH studies (described in the Origins section) which generated many of the program's resources such as the questionnaire and overall service delivery design. However, the program recommends additional refinements based on the INHALE experience, such as reducing the length of the intake questionnaire. In future programs, INHALE staff would build in an evaluative component to measure retention of knowledge regarding asthma gained from the education provided.

Based on previous experience, Erie County expected a 25% participation rate for the initial visit and, of those, a 50% retention rate for completion of the program. Though INHALE exceeded these rates, staff recommend additional steps to enhance referrals, participation and retention: 1) building an asthma coalition to market the program to partnering agencies and educate this referral base regarding how in-home visits will serve their clients; 2) describing up front to potential participants the free supplies and other incentives; and 3) persisting with telephone follow-up. INHALE was most successful in providing services to people who were self-referred, suggesting that individuals who believe they need the recommended services have the commitment to follow through with the program.

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CASE STUDY 8

Multnomah County Healthy Homes Collaborative Multnomah County Health Department Oregon

Origin

In 2003 and 2004, the Environmental Health Section of the Multnomah County Health Department (MCHD) undertook a community environmental health assessment based on CDC's Protocol for Assessing Community Excellence in Environmental Health (PACE EH), a tool allowing communities and local governments to identify environmental health issues, rank local environmental concerns and prioritize environmental health program activities. This assessment identified significant issues with mold, mildew, and lead in affordable housing units in several areas of the county. In addition, community residents voiced concerns that their complaints about housing conditions were routinely ignored by landlords and property managers. As a result of these findings, MCDH applied for HUD Healthy Homes funding in 2004. Although the initial proposal was rejected, the County applied again in 2005 and was recently awarded a 3-year grant to support the Multnomah County Healthy Homes Collaborative (MCHHC). The primary goal of this demonstration program is to decrease exposures to multiple household hazards that contribute to asthma exacerbations and other serious illnesses among children under the age of 6 in distressed communities. A second goal is to implement sustainable healthy homes concepts at the programmatic and policy levels. MCHHC is currently in the formative stages of the project.

Partnerships

MCCHC is a collaborative-based healthy homes initiative that mobilizes several departments within MCHD as well as community-based organizations, the private sector and local, state and federal government agencies. A key objective of the program is to establish a sustainable collaboration between health and housing organizations in order to foster healthy living environments. These organizations include: Multnomah County Health Department Primary Care Facilities, Coalition of Community Health Clinics, Housing Authority of Portland, City of Portland Bureau of Housing and Community Development, Portland Development Commission, American Lung Association of Oregon, City of Portland Office of Neighborhood Involvement, Community Energy Project, Community Alliance of Tenants, Fair Housing Council of Oregon, and Multnomah County Weatherization and Energy Assistance Program. Many of the partnering organizations currently have existing outreach services that will be leveraged by the initiative, such as the County's Weatherization and Energy Assistance Program and the services of the Portland Bureau of Housing and Community Development. Most organizations serve the project in an advisory capacity, helping to refine the content and delivery of resources to project participants.

Target Population

MCCHC will target children with asthma under the age of six who receive primary health care services from Multnomah County Primary Care Clinics which serve the most economically distressed communities. In order to qualify for home visiting services, households must be at or below 133% of the 2006 federal poverty level. It is estimated that at least 72% of participants will be of minority racial/ethnic populations.

Home Visit Details

The in-home visits to families of asthmatic children are intended to decrease home environmental exposures to asthma triggers, lead sources, and other indoor home hazards through individualized education, hazard remediation, linkages to community resources and community empowerment. Project staff responsible for delivering the in-home intervention includes a bilingual Community Health Nurse, an Environmental Health Specialist and a bilingual Community Health Educator. Prior to home visits, project staff will attend workshops on home health hazards provided by trainers from the Master Home Environmentalist Program of the American Lung Association of Oregon. In addition, a certified asthma educator and licensed respiratory therapist will conduct a one-day training to teach the staff about asthma triggers, home assessments, and interventions for reducing exposure. Project staff will also attend a lead training conducted by the Multnomah County Certified Lead Risk Assessor. Staff will make 4 visits to the homes and two follow-up telephone calls over a 6-month time period.

- **Initial Visit:** Although the first visit to the home will involve extensive data gathering, a primary focus of the visits will be for staff and families to develop trust and understanding of one another. Staff will conduct a health assessment of the child which will include demographics, asthma symptoms, and the use of asthma action plans and medications, and baseline peak flow readings. The assessment will also collect information about knowledge of asthma in order to help identify what support is needed from the program. An environmental home assessment (currently under development) will also be performed, which includes an inspection of the home for asthma triggers, the collection of information on home safety and home management practices, and the administration of a lead assessment questionnaire.
- **2-Month Visit:** The second visit will focus on education about asthma trigger and lead poisoning, action planning, the provision of materials and equipment to mitigate exposures in the homes, and the linking of the family with community resources. Based on findings of the home and health assessment, staff members will work with families to develop and implement an Action Plan. Data from the home assessment will be processed by a software program that will assist in the generation of the Action Plan. (This program is likely to be similar to that used by Public Health-Seattle and King County). One thousand dollars per participant will be available for home interventions. Program staff and families will work together to decide how to use of this money for needed services, materials, or repairs. Such interventions could include:
 - Repairing leaking faucets/sinks/toilets
 - Carpet cleaning
 - Installation/repair of bathroom/kitchen fan
 - HVAC maintenance
 - Allergen Mattress Covers
 - Integrated Pest Management
 - Green Cleaning Kit
 - HEPA Vacuum
 - Severe mold/mildew removal
 - Laminate floor repair
 - Carbon Monoxide monitor
 - Utility/energy assistance
 - Smoke alarms
 - Walk off mats
 - Vent cleaning tool kit
- **3-Month Telephone Follow-up:** The purpose of this telephone call is to provide continued support, education associated with the Action Plan, and follow-up for any identified concerns.
- **4-Month Visit:** The third home visit will continue education and support, follow-up on housing resource referrals, and help troubleshoot other issues that emerge.
- **5-Month Telephone Follow-up:** The final telephone follow-up call is used to provide ongoing support and to identify and provide additional resource needs.
- **5-Month Final Visit:** Final follow-up health and environmental home assessments will be completed. Staff will also collect final health data and conduct exit interviews.

Although not all project staff will visit the home at the same time, each visit is a team endeavor and all staff help trouble shoot issues and develop and refine the Action Plan. The specific primary responsibilities of each staff include:

- Community Health Nurse: responsible for the initial and final health assessment and asthma education
- Environmental Health Specialist: conducts the home assessment, provides education on home health issues, and helps to identify resources to improve the housing condition
- Community Health Educator: Helps families navigate resources and referrals

Project staff are aware that the home visits will likely identify other service needs for family members, such as food insecurity, lack of physical or mental health care, unemployment, etc. The program intends to use the in-home visits to link families with all necessary services.

Program Outcomes

As stated earlier, the MCCHC is in the design phase of the project. However, it is anticipated that 200 children will receive services from the program. A number of outcomes are anticipated, including increased knowledge of residents about maintaining healthy homes, reduction of home health hazards, and increased number of families who can successfully manage asthma symptoms.

Incorporating Research Findings into Subsequent Development of In-home Asthma Programs

The project is designed to sustain capacity to provide in-home services for asthma beyond the end of the grant period. An important objective of the program is to promote sustainability by integrating healthy homes concepts into the daily work of local housing and health workers through training and technical assistance. By mobilizing multiple sectors and enhancing staff capacity across public, private and community-based organizations to identify and address indoor environmental hazards, the project aims over time to serve additional populations in need.

Financing for the Delivery of Services

The current program is funded through a \$1,000,000 HUD grant over three years. Roughly 60% will be used for personnel and supplies for the homes. Staff have secured and will continue to pursue donations and in-kind services from a variety of program partners, such as building supply companies.

Opportunities and Constraints in Delivering In-Home Intervention Programs for Asthma: Lessons Learned

In anticipation of resistance by landlords and property managers to mitigate structural deficits in buildings that are identified by the program's environmental assessment, staff is developing protocols and sensitivity among its outreach staff to ensure there is minimal retaliation by landlords. This is especially critical because the County has a "no cause eviction law" whereby landlords/building managers can evict families for no reason. Given that a lack of housing protections is a disincentive for individuals to participate in the program, the project is linking with local tenants' rights organizations as well as legal services. The program intends to use the Americans with Disabilities Act if there is discrimination against families because the child has asthma.

MCDH is keenly aware of the need for policy reform in order to provide systemic changes in the County's ability to provide safe, healthy and affordable housing. Staff have been told by some families that they were healthier living on the streets than in public housing. In this context, MCDH sees an opportunity for this program and its partners to build a task force that advocates for stronger, healthier local building code standards and for better enforcement of such standards.

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CASE STUDY 9

Seattle King County Healthy Homes Project Seattle King County – Public Health Department Washington

Origins

In the mid 1990s, healthy homes models were emerging as a useful approach for reducing exposure to indoor asthma triggers. However, evidence was lacking from rigorous evaluations about the effectiveness of these models in reducing health outcomes, and no data were available regarding the effectiveness of these programs in populations suffering disparate impacts associated with asthma, such as those in urban, low income and ethnically diverse households. At the same time, community health workers (CHWs) were emerging as effective providers of community-based health interventions because of their ability to bridge the gap between community members and health institutions, likely due in part to shared cultural backgrounds with program participants,, although data regarding their effectiveness in improving asthma outcomes were limited.

Public Health-Seattle King County, a county health department serving 1.7 million residents in King County, Washington, applied for and received a grant from the National Institute for Environmental Health Science's (NIEHS) Community-Based Prevention/Intervention Research Program to implement an in-home intervention program for their asthma population and to answer needed research questions regarding the effectiveness of these program designs¹⁰. The 4-year study, designed as a randomized controlled community-based participatory research study, began in 1997. The study compared the relative effectiveness of a high-intensity in-home asthma intervention with that of a low-intensity intervention in changing asthma-related behaviors, reducing trigger exposure, and decreasing asthma morbidity among low income, ethnically diverse urban households. The study also examined the effectiveness of using community health workers to carryout the in-home intervention.

Program Partners

The study was sponsored by the Seattle Partners for Healthy Communities. Seattle Partners—a multidisciplinary partnership of individuals and organizations in the public, private, community-based and academic sectors supporting community-based participatory health research—supported the study's implementation, reviewed its progress, and provided guidance on implementing the principals of community-research collaboration. In addition, a steering committee for the study was developed whose members included the American Lung Association of Washington, The Apartment House Association of Washington, the Center for Multicultural Health, Engineering Plus, Group Health Cooperative of Puget Sound, the League of Women Voters of Seattle, the Washington Toxics Coalition, the University of Washington and Public Health-Seattle and King County. The study also partnered with a number of health care organizations which referred individuals to the study.

Target Population

The majority of asthma patients were referred to the program from health care organizations including local community and public health clinics as well as hospitals and emergency departments and community agencies. The program also received self-referred patients. Given the randomized controlled trial nature of the study, patients had to meet specific eligibility requirements to be enrolled in the program, which included:

- Child aged 4-12 with a diagnosis of persistent asthma
- Income below 200% of the 1995 federal poverty threshold or the child enrolled in Medicaid;
- Caregiver verbally proficient in English, Spanish or Vietnamese

¹⁰ Specific details of this research study were primarily abstracted from two publications for the purpose of writing this case study: 1) Krieger J. et al. The Seattle-King County Healthy Homes Project: Implementation of a Comprehensive Approach to Improving Indoor Environmental Quality for Low-Income Children with Asthma, *Env Health Perspect.* 110(Sup2): 311-322, 2002 and 2) Krieger JW et al. The Seattle-King County Healthy Homes Project: A Randomized, Controlled Trial of a Community Health Worker Intervention to Decrease Exposure to Indoor Asthma Triggers among Low-income Children. *American Journal of Public Health.* 2005;95:652–659.

- Child spent at least 50% of nights in the house; and
- House located in King County, Washington.

Children were excluded from the study if they had another chronic illness requiring daily medications, if the household participated in any other asthma case management program in the last two years, or had plans to leave King County during the following 6 months.

Home Visit Details

CHWs conducted the home visits for the study. All CHWs received a 40-hour training program designed specifically for the study, which used a training manual adapted from the American Lung Association's Master Home Environmentalist Program. Each CHW also accomplished 10-20 hours of continuing education per year. All CHWs lived in the targeted communities and the majority was personally affected by asthma.

Study participants (N=274) were randomized into each of two groups: 1) high intensity (N=138) or 2) low intensity (N=136). Prior to randomization, baseline data were collected using a Pediatric Asthma Caregiver Quality of Life Scale (which produces a score ranging from 1 to 7, with higher scores indicating better quality of life), frequency of daytime/nighttime asthma symptoms in the last two weeks, emergency room, hospitalizations and unscheduled physician visits for asthma in the last two months, etc. *High-intensity* study participants received a structured home environmental assessment at the first visit. The assessment generated an action plan linking assessment findings with action steps prioritized by both the CHW and the study participant. The action plan formed the basis of 4-8 additional visits which provided education, social support, delivery of resources (low emission vacuum, bedding covers, door mat, cleaning supplies) and services to reduce exposures and to advocate for improved housing conditions. High-intensity study participants were also encouraged to receive free skin-prick allergy testing at multiple clinic sites and asthma fairs. The *low-intensity* study participants received a single CHW visit consisting of the home environmental assessment, development of an action plan, limited education and pillow/mattress covers. After the study was completed and all exit data were collected, the low intensity group members also received the entire package of services and resources.

The home environmental assessment consisted of a joint visual inspection (CHW and study participant) of the home for exposure to indoor asthma triggers. Areas covered during the inspection included sources of exposure to: tobacco smoke; allergens (cockroaches, mites, pets, dust rodents); dust (cleanliness; bedding encasements); mold and moisture; poor structural conditions (carpeting, building age, leaks, holes in walls, etc); tap and washing machine water temperature; use of hazardous products; presence of other indoor air contaminants and exposure to take-home hazards from work; and other exposure factors such as food debris/storage; clutter, heating system filters etc. During the initial home assessment visit, a questionnaire was also completed to capture data on knowledge of asthma triggers, prior asthma education, asthma severity, medication usage, access to asthma medical care.

Follow-up visits to the high-intervention study participants were informed by a visit schedule protocol. Follow-up visits were conducted at 2-weeks, 1-month, 4.5-months, 7.5-months and 10.5-months. Portions of the home assessment inspection were repeated in order to assess progress or the development of new problems. Education on asthma basics and on 11-specific trigger topics such as household cleaning, moisture control, pets, roaches etc., were covered as outlined by the visit schedule. When educating study participants on specific asthma trigger topics, supplies and referrals were provided to study participants to help mitigate specific triggers. In addition to pillow and mattress covers, these resources included: low-emission vacuums, commercial-quality door mats, cleaning kits, referrals to smoking cessation counseling, roach bait and rodent traps.

Program Outcomes

The study was completed by 214 participants (78% participation rate: 80% of the high-intensity group and 76% of the low-intensity group). Several interesting findings emerged from the study. Those participants receiving the high-intensity intervention demonstrated statistically greater improvements based on the Pediatric Asthma Caregiver Quality-of-Life-Score and in asthma-related urgent health care visits compared to the low-intensity group. Asthma symptom days declined more (although the difference between groups was not significant) and participants' actions

to reduce triggers generally increased among the high-intensity group compared to the low intensity group. The study also calculated that the 4-year net savings related to health care utilization costs per participant in the high-intensity group relative to the low intensity group ranged from \$189 to \$721.

Incorporating Research Findings into Subsequent Program Development

Resources developed for this study, known as Healthy Homes I, helped to initiate and sustain three asthma management programs nested within Public Health-Seattle and King County.

1. In 2001, Healthy Homes II was launched. This 5-year randomized-controlled trial, funded through a NIEHS grant, examines three approaches for improving asthma control among low-income children living in King County. The three approaches are based on providing the following:
 - I. Clinic-based asthma education emphasizing self-management and case management provided by a nurse;
 - II. Clinic-based asthma education (as described in approach I above) and the addition of an in-home support for asthma self management, environmental home assessment and trigger reduction as well as social support delivered by CHWs based on the design of Healthy Homes; and
 - III. Clinic and home-based asthma management and support (approach I and II) and structural remediation of housing conditions that increase exposure to asthma triggers. This third approach was funded separately in a grant from HUD and remediation expenses for each home (which averaged \$3000 per unit) was supplemented by funds leveraged from weatherization and other local housing programs.

The study will seek to answer questions such as, “Does the addition of an in-home environmental assessment and associated support reduce asthma-related medical care utilization beyond that seen with asthma education and case management alone?” and “Does adding remediation of structural problems related to exposure to asthma triggers yield additional improvements in health status and reductions in asthma-related medical care beyond those seen with just the interventions described in approach I or II?” Standardized visit summary reports were developed and shared with the participant’s clinician. The study is currently in the data analysis phase.

2. The King County Asthma Forum received funding from the Robert Wood Johnson Foundation for a 4-year project beginning in 2002 to strengthen the community coalition’s ability to address asthma across multiple sectors (e.g. community, health service delivery and schools) and to implement an intervention program to reduce asthma rates in areas of King County with high asthma morbidity. The project, Allies Against Asthma Initiative, used the Healthy Homes II intervention resources for asthma delivered by CHWs to provide in-home support regarding asthma self management, home environmental assessment and trigger reduction, but included a new component of a Community Asthma Nurse that coordinates care that patients receive across sectors, including the schools.
3. King County Steps to Health (STEPS) is a current program funded through CDC to reduce the impact of chronic diseases through a comprehensive approach of prevention and control, with a particular emphasis on reducing health disparities in areas of high rates of disease and where poverty is most concentrated in King County. To address community-based needs surrounding asthma and diabetes, CHWs are being used to make home visits to improve self-management. CHWs provide all education, but receive are supervised and receive clinical back-up support by the project nurse. The project nurse also liaisons with clinics and medical providers. For asthma patients, resources developed in Healthy Homes I and II are being used and visits have expanded to provide services to adults as well as children.

Financing for the Delivery of Services

With the exception of city funding that supported the salary of one CHW, all of Public Health-Seattle and King County’s research and intervention programs that have provided in-home intervention services for asthma have been funded through either foundation or federal grants. The cost per client to implement the Healthy Homes I program was \$1124 for the high intervention and \$215 for the low intervention. A policy goal for both King County Asthma Forum and the STEPs project is to advocate with state and local governments and the state Medicaid agency for funds to support in-home asthma programs. King County-Public Health is also working with a Medicaid managed

care plan, which is interested in having their telephone-based asthma nurse case managers partner with the County's CHWs. Should this partnership progress, patients would be referred to the County's home visiting asthma program by the health plan's case manager. After the home visit, CHWs would communicate the result of the visit back to the patient's asthma nurse case manager at the health plan.

Opportunities and Constraints in Delivering In-Home Intervention Programs for Asthma: Lessons Learned from Public Health-Seattle and King County

According to Public Health-Seattle King County staff, in-home intervention programs for asthma offer opportunities to patients, their families, providers and insurers. For patients, CHWs are viewed as peers and able to develop bonds with participating families. These connections have improved communications with families about how to improve their child's asthma management. In addition, both patients and their families receive important social support from CHWs such that caregivers no longer feel isolated in dealing with the child's asthma. This social support has proven to be a powerful motivator to produce changes in behavior that result in a variety of psychosocial benefits, including better organization of the home. CHWs also help clients navigate the health and social services systems, thereby increasing access and improving communication between clients and professionals.

As a result of these in-home visits, important information is communicated to providers about the impact of the home environment on their patient's health, such as the presence of triggers, lack of adherence to medication use or psychosocial issues. By connecting public health service and clinical care, improvements in patients' health are being realized.

Health plans are also beginning to see home visit programs as complements to their current disease management programs. By referring patients that are considered high health care utilizers for home visits, future health care costs can be reduced.

Some of the biggest barriers seen with Public Health-Seattle and King County's programs are the limitations of resources to effectively mitigate structural problems in homes. Both the local public housing authority and local landlords often lack the funds necessary to remediate costly structural deficits in old homes or to deal with extensive mold/water damage issues. Although the local housing authority is more aware of the impact of housing condition on health due to the County's programs, the issue is complex and more advocacy is needed to promote wide-spread changes in the quality of housing stock.

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CASE STUDY 10

Putting on AIRS (Asthma Indoor Risk Strategies)

Connecticut Department of Public Health

Connecticut

Origins

The Asthma Shoreline Action Partnership, a project of the New London Department of Health and Social Services and the LedgeLight Health District received funding through the Connecticut Department of Public Health (CTDPH) to implement a pilot in-home asthma program focusing on health education and identification and mitigation of environmental exposures that exacerbate asthma in order to reduce asthma-related adverse events. The pilot was successful, demonstrating a 62-85% reduction in asthma-related emergency department visits, physician office visits and the number of missed school days due to asthma among study participants. Encouraged by the results of the New London model, CTDPH sought to formalize and expand the pilot model in order to disseminate and implement the program in other regions of Connecticut. Through funding from a CDC asthma-planning grant, CTDPH, together with the Asthma Shoreline Action Partnership, developed a comprehensive implementation guide that outlines protocols and procedures for providing in-home asthma education, identification of environmental triggers, dissemination of educational materials, patient monitoring and linkage to other resources and referrals informed on the pilot study. In keeping with the CTDPH's Statewide Asthma Plan, the in-home asthma program adopted a regional approach to implement the program. Currently four regions in Connecticut have a Putting on AIRS program including: New Haven/Milford, New London/Groton/Norwich, Middletown, Waterbury. The objective of this statewide program is to reduce acute asthma episodes and improve asthma control through recognition and elimination/reduction of environmental and other asthma triggers in five regions.

Partnerships

CTDPH worked closely with the Asthma Shoreline Action Partnership to develop the Putting on AIRS implementation guide.

Target Population

Putting on AIRS currently services asthmatics living in the 4 regions described above. Although the program is open to anyone, children 0-18 are the primary target. Referrals are received from clinicians, hospitals, school nurses and self-referrals. Currently the main referral sources are school nurses and hospitals.

Home Visit Details

There are two main parts to the Putting on AIRS home visit: asthma education and environmental assessment. An asthma project with experience in asthma management and an environmental specialist, such as a sanitarian, staff the visit. Given the regional approach to program implementation, often the asthma project nurse and the environmental specialist are from different towns. All staff members receive formal Putting on AIRS training conducted by CTDPH. A train the trainer approach is used for subsequent personnel needing training in a specific region.

The program consists of an initial visit and two follow-up encounters. Additional visits may also be provided, depending on the status of the program participant at the last encounter.

- **Initial Visit:** After the asthma project nurse administers an intake questionnaire with the participant/caregiver via telephone, a home visit is scheduled. The asthma project nurse and environmental specialist both participate in the initial home visit. The nurse administers a home assessment questionnaire that captures baseline data on knowledge of asthma triggers. The nurse collects additional baseline data regarding missed school days, emergency department visits due to asthma, asthma-related physician visits in the past 3 months, medication usage, and current asthma action plan and begins a dialogue with the participant about issues and questions. Both the nurse and the environmental specialist conduct a walk-through of the home, assessing and recording sources of environmental triggers for asthma and other home

hazards. Results from the home assessment inform an environmental summary care plan which outlines low or no-cost options to reduce or eliminate the trigger sources. The environmental summary care plan is discussed with the participant. At the end of the visit, the participant/caregiver retakes the home assessment questionnaire regarding knowledge of asthma triggers for the purpose of post assessment evaluation. Staff leave a folder of educational information is left with the participant containing various brochures/fact sheets including: "Helping Your Child Manage Asthma: A Parent Handbook," "What Everyone Should Know About Asthma," and "Controlling Asthma and Allergies in Your Home," as well as an asthma action plan and fact sheets on medications specific to the participant. Depending on funding or donations, the program may also provide pillow/mattress covers, spacers and peak flow meters. Subsequent to the visit, an in-home evaluation summary with action recommendations is completed and sent to the participant (or caregiver) and the participant's medical providers (i.e. primary care physician, school nurse, asthma specialist, school health services, school-based health center)

- **2-Week Follow-up:** At two weeks, the asthma project nurse follows up with the participant either in-person or by telephone. The nature of the follow-up is to evaluate the participant's progress regarding the environmental summary care plan and other suggested recommendations. The in-home assessment questionnaire on knowledge of asthma triggers is administered again and the results are discussed.
- **3-Month Follow-up:** At three months, the asthma project nurse contacts the participant to review the progress in implementing the care plan. The nurse offers recommendations and answers questions and concerns. If progress is not occurring, another visit is encouraged. Otherwise, the nurse collects final data regarding number of missed days of school, emergency room visits, and asthma-related physician visits since the Putting on AIRS initial visit. In addition, knowledge of asthma triggers is again evaluated and discussed. A program evaluation form is left with the patient with a self-addressed stamped envelope to gather feedback about the program.
- **6-Months Follow-up:** At six months, the asthma project nurse is encouraged to make a final follow-up call to determine if any additional follow up or answers to questions are needed.

Elements of the home visits described above are detailed in the Putting on AIRS implementation protocol. The protocol is part of the CTDPH's Putting on AIRS program implementation guide, which is made available to all participating health departments on CD ROM. The guide contains background information on the program:

- how to get started (i.e. assembling the in-home staff, supply and training needs, etc.)
- templates for all forms, questionnaire, summaries etc.
- asthma education topics to be covered and tips on how to effectively deliver the education
- program promotion and marketing materials
- a template MS Access database for data collection and analysis.

Program Outcomes

The statewide program is in its first year of implementing the home visits. Data will be collected annually from the 4 regional programs, including number of home visits, pre/post data on knowledge of asthma triggers, number of missed days of school, emergency room visits, and asthma-related physician visits. To date, 18 individuals have participated in the program.

Incorporating Research Findings into Subsequent Development of In-home Asthma Programs

CTDPH is seeking funding through CDC to expand the program to all 10 regions in Connecticut.

Financing for the Delivery of Services

CTDPH used CDC Asthma Planning Grant funding to support staff in the development of the Putting on AIRS program implementation guide. Currently, some core state funds and CDC funds continue to support state staff time for their time overseeing program. CTDPH received CDC funding to provide approximately \$16,000 in grants to each of the five regions participating in the Putting on AIRS program. Although each region decides how to use these funds, most cover costs of local health department staff salaries (asthma program nurse or environmental specialist) or to pay for supplies such as mattress/pillow covers. Implementation of the program on a regional versus a city-by-

city basis is intended to facilitate the leveraging of support and resources for the program across multiple health departments.

Opportunities and Constraints in Delivering In-Home Intervention Programs for Asthma: Lessons Learned from Connecticut Department of Public Health

Staff see great opportunity in one-on-one education in the home environment. This program design allows outreach staff to more fully understand what participants do and do not know about asthma and in-home environmental triggers, and to make recommendations and action plans for families that will reduce adverse asthma events.

Although Putting on AIRS has been well received by the participating regions, CTDPH has encountered some constraints in the program's first year of implementation. First, a regional approach to public health implementation is new for many municipalities, and working out the organizational and administrative logistics of collaboration among health departments has taken more time than anticipated. Second, some regions have had a difficult time developing a referral base to obtain program participants. In response, the CTDPH has developed marketing and promotional templates for the regions to use. According to the 4 regional programs, referrals to the program now are steady, suggesting that the marketing and referral procedures have been effective. Lastly, some regions have voiced concerns about how to deal with other psychosocial issues affecting the participating families. Although the Putting on AIRS Program does not intend for the in-home outreach staff to become case managers for families, it does encourage health departments to develop a system to link between families and needed social services.

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