

Final Report to HUD:

The Healthy Public Housing Initiative

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EXECUTIVE SUMMARY

Project Elements

The Healthy Public Housing Initiative (HPHI) is a multi-year program to improve the health of Boston public housing residents, especially children with asthma. The project goals were to understand current home environmental conditions in the Boston Housing Authority (BHA) developments, to implement interventions that improve environmental conditions related to health, especially asthma; to measure the health and quality of life impacts of those interventions on children and caregivers; and to empower residents through training and employment as Community Health Advocates. In addition, HPHI has used evidence gathered from project activities to help affect change in practices at the BHA and other housing authorities as well as to influence health and housing policy to promote healthier housing for public housing residents.

The Healthy Public Housing Initiative has operated as a collaborative organization. Partners are the Boston Housing Authority and the Boston Public Health Commission (BPHC); the Committee for Boston Public Housing (CBPH), the West Broadway Tenant Task Force and the Franklin Hill Tenant Task Force; Boston's three schools of public health at Boston University, Harvard University, and Tufts University; and Peregrine Energy and Urban Habitat Initiatives. HPHI was funded by HUD's Healthy Homes Initiative, as well as grants from the W.K. Kellogg Foundation, the Boston Foundation, the Jessie B. Cox Charitable Trust and the Ford Foundation. In addition, HPHI received allergy-free mattresses from the Simmons Company and air filtration equipment from the Sharper Image Corporation.

The project had several key components. The first element was *an environmental assessment survey*. Our trained resident Community Health Advocates (CHAs) surveyed 238 households in West Broadway and Franklin Hill, typical Boston public housing developments. This cross-sectional survey information served several purposes, including comparison of conditions pre- and post-energy upgrades at West Broadway, and a comparison of conditions between West Broadway and Franklin Hill.

The second project element was *health and housing interventions* targeting 60 asthmatic children. The project was designed to understand whether apartment-level interventions can result in demonstrated improvements in asthma conditions for participants. Interventions included air cleaning, new mattresses, commercial cleaning, low-toxicity pest control applications (gels, baits and traps), and family pest control education and support for improved food storage and waste management.

The third project element was *pre-and post-intervention health assessments* for the asthmatic children in the participating households, thereby focusing on the efficacy of interventions in addition to understanding the baseline prevalence of housing and health conditions. Assessment tools include quality of life questionnaires, monthly calendars, and peak flow and spirometry measurements over a 9-12 month period to determine health status and health care usage before and after the package of housing interventions. Environmental assessment complements the health information with instrument measures of chemical and biological contaminants, pesticide exposure and comfort parameters.

A fourth element of our project sought to *develop resident empowerment* through training, employment and engagement in analysis. Over the course of the project, 20 public housing residents were trained to conduct surveys and unit inspections, and to be environmental and health data collectors in their roles as Community Health Advocates (CHAs) and IPM assistants in the HPHI project. The CHAs contributed their experience living in public housing and their acquired experience through training and employment to the development of policies, training material and research. They participated in formal classes through a local health outreach worker job training program as well as project-specific training covering asthma symptoms, asthma medication, environmental and health sampling, peak flow lung function testing, integrated pest management (IPM), and ethics training in the use of human research participants.

Key Findings

After nearly four years of funding by HUD's Healthy Homes Initiative in the Office of Healthy Homes and Lead Hazard Control and the additional support of several foundations, our Health Public Housing Initiative has gained experience and evidence on a variety of factors that affect the healthfulness of housing and the health of residents, in particular public housing. The consortium of partners represent resident interests, city agencies responsible for public health and housing, three universities whose interest is public health research and policy, and energy and housing experts. We conducted training, surveys, focus groups, and environmental and health surveillance around interventions aimed at relieving the symptoms and burden of childhood asthma. Our HPHI has been truly enriched by the personal involvement of directors and staff alike in virtually all aspects of the endeavor. Over four years we met frequently as a whole or in the various subgroups responsible for specific aspects of the endeavor. Our influence and the influence on us reached beyond our primary activities for we interacted often and directly with residents, property managers, service contractors, and the management and tenants of other housing agencies, both in Massachusetts and elsewhere. These key findings reflect not just the research findings but include our reflections after numerous hours and days of interactions, debates, analysis and reporting.

1. *Current approaches to pest control are often ineffective, especially for cockroaches, with resulting high levels of infestation, exposure to allergens, and resident use of dangerous pesticides.* Nearly 50% of the homes tested showed cockroach allergen levels in excess of asthma sensitivity exposures while nearly 60% of the tested children showed allergic sensitivity to the most prevalent cockroach antigen (Peters et al. 2005; Levy et al. 2004) Eighty percent of the children tested positive to at least one common allergen (Levy et al. 2004). Pesticide use is ubiquitous, with every home tested showing evidence of at least one compound that has been either banned as a product or is restricted to non-residential use (Julien et al. 2005).
2. *A package of interventions designed to reduce allergen burden and re-infestation is effective and improves both environmental and health indicators.* Intense cleaning and integrated pest management (IPM) reduced allergen loads in all homes. An integrated pest management program that included reducing pathways through targeted repairs, careful applications of less-toxic pest control products, and resident education on pests and pest management combined to limit

reoccurrence of infestations. Months after project cleaning, homes remained low in cockroach allergen levels while a few were beginning to show an increase (Peters et al. 2005).

3. *New dust mite-resistant mattresses contributed to reduced allergen loads in bedrooms*, for example, *Der f 1* dust mite allergen levels went from 78% above detection to less than 3% for bed vacuum dust samples (Kosheleva et al. 2005).
4. *The interventions result in improved Quality of Life for children and their caregivers*. Quality of Life assessment scores improved during the initial lead-in period prior to the interventions and improved at an even greater rate in the four months following the interventions before tapering off somewhat. Total improvement exceeded clinically observable/significant levels. Improvements during the pre-intervention phase suggest that education regarding asthma medication management and monthly visits by our Community Health Advocate and nurse had an effect. Our experiences reconfirmed the need to have “health education” as a component of asthma interventions. Furthermore, a peer-to-peer asthma health education program can be an effective model. Continued and increasing improvement post intervention suggests additional benefits from the documented allergen reduction. (Levy et al. 2005; Clougherty et al. 2005)
5. *The interventions result in improved health response*. Reported respiratory symptoms improved significantly from the start to the end of the study. While 76% of children had reported wheeze or tightness in the chest or cough in the two weeks prior to enrollment in the study, only 40% of children reported these symptoms in the two weeks prior to the end of the study. Similar reductions were seen for slowing down or stopping play due to asthma (from 64% to 26%) and for waking up at night due to asthma (from 64% to 30%). (Levy et al. 2005)
6. *Reducing pesticide exposure is more challenging and will require a multi-pronged approach*. Our survey of pesticides found evidence of banned organophosphate pesticides, an array of pyrethroids and several restricted or illegal pesticides. Every apartment sampled had one and often several compounds present in the kitchen and living room wipe samples and/or the living room dust samples. Despite the cleaning and resident education, pesticide residue levels were not significantly reduced in post-intervention testing. It is possible that our cleaning methods did not remove the residues or that households continued to use the products. Other health and housing studies are showing that fetal and early childhood exposures to these substances are causing adverse birth and development outcomes, indicating that this is a critical area for further investigation and interventions. (Julien et al. 2005)
7. *Gas appliances used with little or no ventilation result in unhealthy levels of nitrogen dioxide exposure*. Gas-cooking appliances in the apartment increased the indoor NO₂ concentration to levels well over the ambient levels in the neighborhood outdoors. Indoor NO₂ levels were higher in the winter months when air exchange was reduced. Residents reporting the use of gas stove to heat the apartment and/or dry clothes had higher NO₂ levels in winter. NO₂ has been shown to exacerbate asthma and, in more recent studies, it has been demonstrated that co-exposure of allergens and NO₂ increases respiratory symptoms in asthmatics. There is a concern that if winter apartment temperatures are reduced

- through energy conservation measures without corresponding ventilation improvements that NO₂ exposures will increase. (Zota et al. 2005)
8. *Survey comparisons support the associations between building conditions and health.* After assessing building condition and health responses, comparing survey responses to health questions from a renovated and un-renovated development, evaluating work order requests before and after energy and water conservation upgrades and considering utility consumption in relation to building conditions and health concerns, we found indications that improved building conditions contribute to improved health (Brugge et al. 2003a).
 9. *Active work in building equitable relationships within the partnership strengthened the collaboration's effectiveness.* Community and academic partners alike praised the personal commitment of all members. Team members recognized that each individual's willingness to be honest with each other "created the glue for the collaboration". The relationships that were formed in the day-to-day smaller group work of the project emerged as one of the most appreciated products of HPHI. Having heard each other in meaningful ways, having grown to know and trust each other more, HPHI members will continue in collaboration to improve community health.
 10. *Many obstacles hinder efforts to make health and comfort a priority for public housing residents.* Public housing is critical to the lives of many families and senior citizens in Boston. While many senior administrators, property managers, staff, and residents understand the important contribution housing can have on health and comfort, there are numerous economic, educational, regulatory and institutional factors that prevent the implementation of new approaches directed at reducing or eliminating health hazards, let alone conditions that primarily effect resident comfort. Our efforts show that institutional support and funding for health-focused interventions can make a difference in residents' health. The challenge remains to convince regulators and funders of the need to provide the adequate resources to support change.

Major Project Accomplishments

1. *Building and maintaining a University/City/Community partnership.* HPHI has been a collaborative effort of faculty from Boston's three schools of public health, two city agencies, public housing resident organizations and housing and energy experts. Maintaining that partnership has required significant efforts from all partners and a willingness to work toward common goals despite individual and organizational differences.
2. *Developing the project workforce using public housing residents.* The fieldwork for the project required skills such as proper surveying techniques, use of environmental sampling equipment, interpersonal skills, time management and activity documentation, as well as knowledge of asthma and pest control. Residents were recruited from the developments where the project was conducted and completed many training modules in order to fill roles as Community Health Advocates and IPM Educators. Because the residents were known and trusted in their communities the project had access to homes and acceptance in the developments that would have been difficult to obtain with hired

- outside workers. In turn, these residents gained knowledge, experience and confidence for future employment.
3. *Developing a training and employment program for Integrated Pest Management.* HPHI, in collaboration with MissionWorks, a local job training organization, has developed a model syllabus, curriculum, and job description for an IPM Educator. Department of Labor funding is funding this job training program for 8-10 under- and un-employed residents of BHA and the city at large.
 4. *Validating and refining the Environmental Assessment Survey for broader use.* The survey analysis included validation through comparison of responses to observed conditions, evaluation of question effectiveness and other methods to streamline the survey and improve its suitability for use by others (see Appendix A). The survey has been posted on the HPHI website together with a Survey Kit that includes a surveyor training curriculum, sample consent forms and instructions for use. It will also be posted on the HUD website with a link to its instructions for use.
 5. *Developing and maintaining a project website.* To increase awareness of the project's on-going efforts and findings we created and maintain a project website: <http://www.hsph.harvard.edu/hphi/>

Next Steps

The HPHI collaborative is now moving forward with plans to expand from our current work to larger efforts. To date HPHI has determined that, to be effective, pest management (e.g., Integrated Pest Management or IPM) must address the underlying problem of pest infestations, and educate property managers, pest control applicators and residents. The program must restore conditions and offer assistance to residents to help maintain pest-free environments without reliance on potentially harmful chemicals. Approaching IPM as a systems problem, currently HPHI is implementing a pilot test of IPM in a 1000-unit development and will be seeking funding to expand a demonstration program to 8-10 developments in the next 3 years. Recognizing that resident education and multi-language instruction are important IPM components, a video/DVD on maintaining pest-free apartments (by film students in a local college) and a safe pest-control message are being developed for promotion in BHA and the city of Boston, with additional funds provided by the Boston Foundation. Finally, some graduates of the MissionWorks IPM Educator job training program will be employed as part of the model IPM program that has grown out of this project.

To expand and support the efforts to improve health through scheduled energy and water conservation upgrades HPHI intends to continue to support BHA's conservation planning and implementation over the next several years. Recently, the BHA awarded a \$30 million energy upgrade contract for 15 of their properties. To our knowledge, for the first time among all public housing authorities, this resource recovery contract explicitly requires the inclusion of elements that address health improvements along with energy and water savings. HPHI continues to work with the BHA to develop an inspection protocol to identify health, comfort and energy-related conditions as part of a pre-upgrade assessment (see Appendix B). HPHI will assist the BHA in developing a performance-based evaluation of residents' perceptions of health, odor, thermal comfort, security, acoustics and other conditions. If adopted, this performance audit will provide the basis for developing resident education programs and direct where further improvement is

required. If implemented, our HUD-sponsored HPHI will have created the first effort of its kind where the energy contractor, housing authority and residents are committed to continuously improve the quality of living conditions through an evolving set of programs identified by a systematic evaluation process. The goal of the performance-based evaluation system is straightforward: to ensure that public housing is and remains healthy.

References:

Brugge D, Melly S, Finkelman A, Russell M, Bradeen L, Perez R, Henson L, Heeren T, Snell J, Helmes D, Hynes HP. A community-based participatory survey of public housing conditions and associations between renovations and possible building-related symptoms. *Applied Environmental & Public Health* 1:89-101, 2003a.

Clougherty JE, Levy JI, Hynes HP, Coull B, Spengler JD. A longitudinal analysis of the efficacy of environmental interventions on asthma-related quality of life and symptoms among children in urban public housing. (Manuscript in preparation), 2005.

Julien R, Adamkiewicz G, Bennett D, Hauser R, Levy J, Coull B, Kosheleva A, Nishioka M, John Spengler. House dust as a source of pesticide exposure in public housing (Manuscript in preparation), 2005.

Kosheleva A, Adamkiewicz G, Vallarino J, Peters J, Brugge D, Spengler J. Analysis to evaluate efficacy of the Simmons "BackCareKids" mattress. Final Report to the Simmons Bedding Co., 2005 (http://www.hsph.harvard.edu/hphi/HPHI_SimmonsReport_Final.pdf).

Levy JI, Welker-Hood LK, Clougherty JE, Dodson RE, Steinbach S, Hynes HP. Lung function, asthma symptoms, and quality of life for children in public housing in Boston: a case-series analysis. *Environ Health: A Global Access Science Source* 3:13, 2004. Available (**BioMed Central**): <http://www.ehjournal.net/content/3/1/13>.

Levy JI, Brugge D, Peters JL, Clougherty JL, Saddler SS. A community-based participatory research study of the efficacy of multifaceted in-home environmental interventions for pediatric asthmatics in public housing. Submitted to *Social Science and Medicine*, Sept. 2005.

Peters JL, Levy JI, Rogers CA, Burge HA, Spengler JD. Determinants of allergen concentration in apartments of asthmatic children living in public housing. (Draft manuscript, preparing for submission), 2005.

Zota A, Adamkiewicz G, Levy JI, Spengler JD. Ventilation in Public Housing: Implications for Indoor Nitrogen Dioxide Concentrations. Accepted, *Indoor Air*, April 2005.