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W.K. Kellogg Foundation Final Report
Healthy Public Housing Initiative, Boston Massachusetts
WKKF Grant # P0042336; Reporting Period: April 1, 2004 – September 30, 2005
Report Date: February 6, 2006

Project Summary

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 Housing 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

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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.

A final element of the project is to *affect changes in policies and practices* at the BHA and other housing authorities as well as in state and federal housing and health programs. Fully developing and disseminating the results of these endeavors was the focus for the final project year.

Progress toward Goals

As proposed in our workplan for the final year of our project, WK Kellogg Foundation funding enabled all HPHI partners to continue with the project as work moved from the field to analysis, evaluation, documentation and dissemination. We continued our practice of working in smaller committees on specific tasks while meeting as a full team on a regular basis. One of our intentions was to develop recommendations for policy or program change based on evidence from the project. In order to maintain momentum, utilizing the experiential knowledge of the project team, our plan was to complete analysis and evaluation on a parallel track with policy development. This proved to be somewhat of a challenge when analysis was more complex or took more time than we had hoped and experience had to wait for evidence to catch up. Nevertheless, our approach enabled all partners to participate to a large degree in the evaluation of the project analysis with the university partners taking the lead on this work. Everyone had an opportunity to grapple with the preliminary conclusions, to attempt to reconcile them with experience and personal observations, and provide input into the recommendations that grew from the analysis.

In the sections that follow we will highlight the key findings, major project accomplishments, the initial policy recommendations that have grown out of the project and some additional project evaluation elements of particular interest to the Kellogg Foundation.

Key Findings

Over a period of four years, with funding from the Kellogg Foundation, HUD's Healthy Homes Initiative in the Office of Healthy Homes and Lead Hazard Control and the additional support of several other 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,

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city agencies responsible for public health and housing, three universities whose interest is public health research and policy, and energy and housing experts. HPHI has been truly enriched by the personal involvement of directors and staff alike in virtually all 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 thresholds while nearly 60% of the tested children showed allergic sensitivity to the most prevalent cockroach antigen. Eighty percent of the children tested positive to at least one common allergen. 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.
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. As shown in Figure 1, interventions reduced the number of households exposed to asthma exacerbation levels of cockroach allergens in kitchens from 72% to 31%.

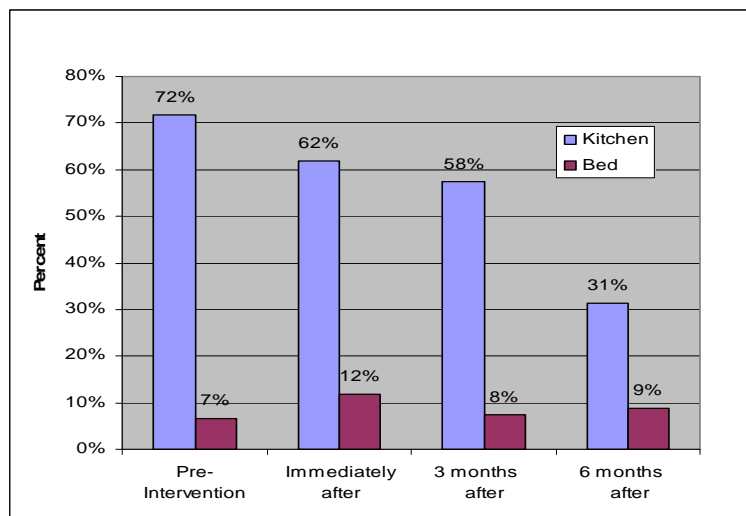


Figure 1: Kitchen/bed cockroach allergen levels above exacerbation thresholds (%).

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3. *New dust mite-resistant mattresses contributed to reduced allergen loads in bedrooms*, for example, *Der f 1* dust mite allergen levels were reduced from 78% above detection to less than 3% for bed vacuum dust samples.
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. Interventions resulted in measurable improvements in Quality of Life as measured by the Juniper scale (see Figure 2).

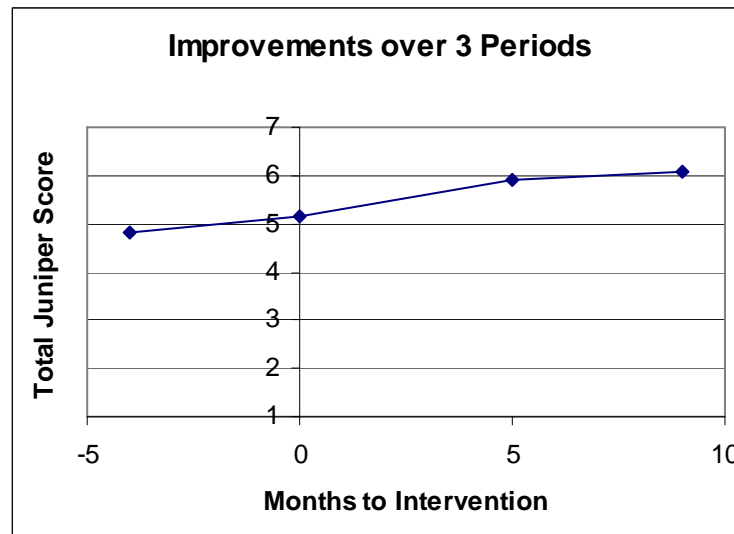


Figure 2: Improvements in Quality of Life over the course of study.

5. *The interventions result in improved health response*. When initial and close-out responses to questions regarding coughing/wheezing, activity limitations, and sleep quality are compared the rates of reported problems were reduced by 50% or more. As shown in Figure 3, the interventions resulted in improvements in reported respiratory symptoms in children.

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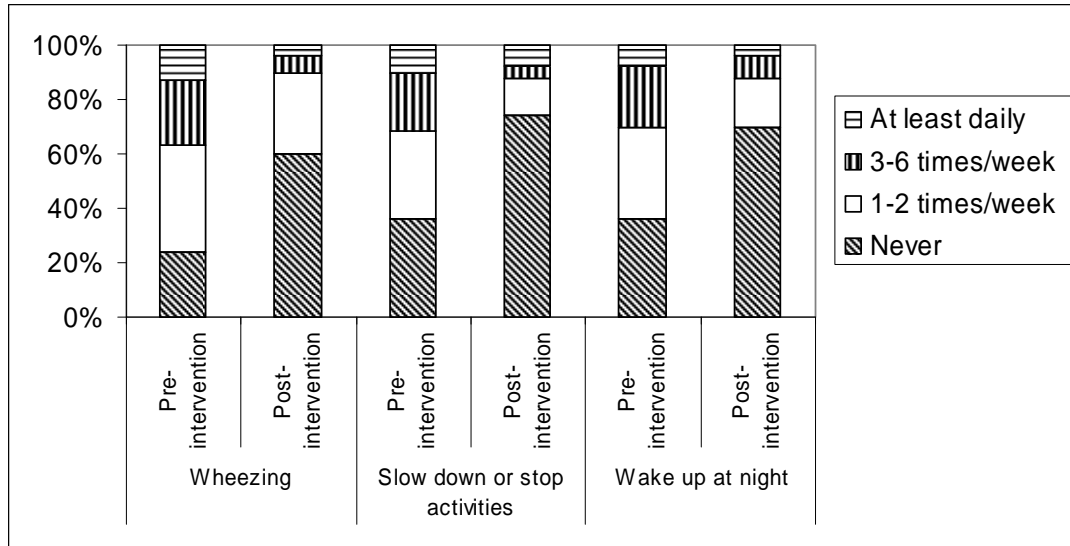


Figure 3: Reported respiratory symptoms in the two weeks prior to enrollment in the study versus the two weeks prior to the end of the study.

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. Pesticide analysis shows extensive personal use of pesticides, many of which are restricted or illegal (see Figure 4).
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.

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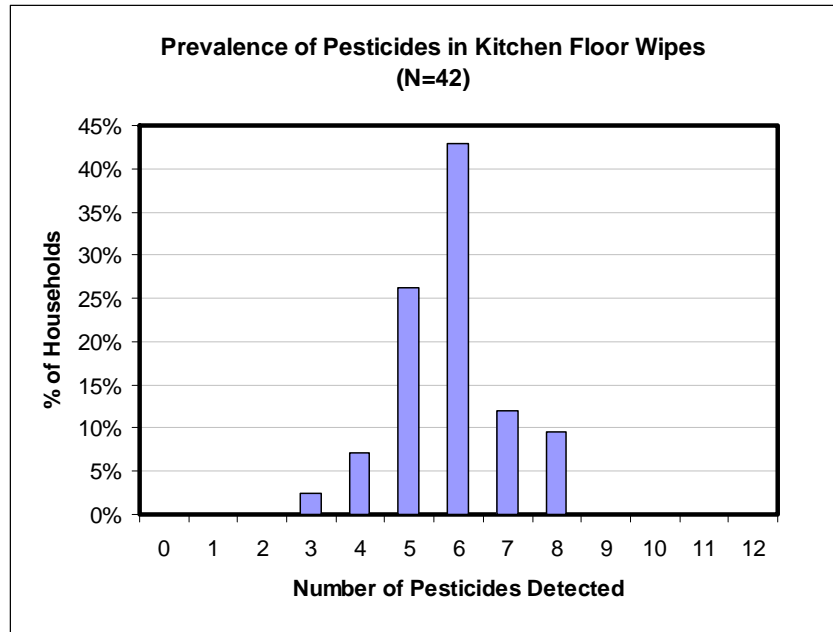


Figure 4. Distribution of pesticides in households (kitchen floor wipes).

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.
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 project's day-to-day smaller-group work 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.

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These key findings have been and continue to be reported on in detail in peer-reviewed articles and other publications. A full listing of articles, reports and presentations to date is included as an attachment to this report.

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. Building upon these relationships and the knowledge gained through the HPHI experience, a new proposal, entitled the Healthy Pest-Free Housing Initiative, has been submitted to the W.K.Kellogg Foundation. If awarded, a systems approach to implementing integrated pest management in public housing will be applied.
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. The Department of Labor is funding this job training program for 4 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. 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/>

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Policy Objectives

We divided our work on informing policy and programmatic change into four areas: Resident Empowerment, Operations & Maintenance, Capital Planning, and Health and Housing.

Resident Empowerment

This group focused on fully developing and implementing an Integrated Pest Management Assistant program. The elements of the program include:

1. A job description with an employment plan that is adaptable to hiring of Assistants by housing authorities, other housing management companies or pest control contractors. Developed from HPHI experience and in consultation with pest control contractors.
2. A comprehensive 120-hour job-training curriculum that combines classroom knowledge with field experience and includes both personal and professional development. One of the objectives of the curriculum is to prepare students to take and pass the Massachusetts State Pest Control Applicator Licensing Exam.
3. Identification of funding for the training program through U.S. Department of Labor grants for workforce development administered by Mission Works, a program of Mission Main Housing.
4. Completion of the first training program, with 4 participants, all of whom completed the program

Hiring commitments from BHA for two participants and expressions of interest from other property management companies have enabled the first group of trainees to move directly into employment or positions of greater responsibility with their current employers.

Members of this group have continued to adapt the training program curriculum to meet other training needs and have developed shorter modules of 1/2 day, 1 day and 2 days in length that are targeted to housing authority staff and residents. The strengths of this training program, in contrast to other pest management programs, are its emphasis on residents as peer educators and health advocates and its emphasis on creating partnerships between housing authority management, residents and pest contractors to reduce infestations.

The reach of the training program continues to expand through new program and funding partnerships. Locally, funding has been received from the Environmental Protection Agency and the Toxics Use Reduction Institute at University of Massachusetts Lowell to provide 2-day training programs for housing authorities in Massachusetts. A developing partnership with the National Center for Healthy Homes may provide an opportunity to extend the reach of the training program nationally.

Maintenance and Operations

This group's efforts revolved around developing strategies to implement integrated pest management as the primary pest control strategy for the BHA. Strategies were developed and evaluated within a four-part framework:

- System Level—BHA policies, procedures and interaction with other institutions
- Building Level—Pathways between units, waste management
- Unit Level—Cleaning, repairs, vacancy turnover, pesticide application
- Family/Resident Level—Education, cleaning and storage, responsibilities

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Several HPHI activities provided a foundation for these strategies. For example, HPHI reviewed and revised the standard pest control contract that BHA used to emphasize performance-based measures of pest reduction rather than continuous callbacks to reapply pesticides. This important System Level change is being adopted across the BHA. HPHI also provided several training programs for BHA staff. The experience of the CHAs in providing support and assistance to families to improve the success of pest control has also informed plans to integrate an IPM Assistant role into BHA's pest management strategy.

HPHI experiences also provided insights into elements of the framework. For example, our work focused on individual units because we were tracking health impacts on children with asthma but we learned from this unit-by-unit work that pest control will be more effective if a whole building can be addressed at once. Thus the framework adds a Building Level component that was not part of HPHI activities. Another insight gained from team experience is that BHA can improve building and unit level conditions for pest control by reconsidering certain work order requests as pest related, such as requests to repair leaks or holes in walls, and perhaps assigning them a higher priority than in the past. In another example, our experience with CHAs in resident homes strongly suggested the need for a special focus by BHA on high-priority units with high levels of infestation, together with recognition that the problems may be related to physical conditions or to needs of vulnerable families that should be addressed by outside support services.

BHA has begun to take action within this framework by continuing to expand the number of developments where the revised pest control contract is being used and by implementing an IPM approach using an IPM Assistant in a pilot program at the Charlestown Housing Development. One of the priorities for the funding request to the Kellogg Foundation for continuation of the project is to fully implement the IPM strategy across all four levels.

Capital Planning

As reported in earlier communications BHA has been involved in a multi-year, multi-property effort to improve energy and water performance through energy performance contracts. Through this HUD program the Housing Authority is able to retain savings from energy efficiency and use them to pay Energy Services Companies (ESCOs) to implement conservation strategies. HUD's program focuses solely on energy conservation. Past experience of the BHA and other HPHI team members has resulted in awareness that this narrow approach can sometimes have unintended negative health impacts. At the same time there is recognition that awareness of health concerns by ESCOs, simple additions to the scope of work, or housing authority capital improvements in combination with energy improvements could have a positive effect on the building conditions and on resident health. Thus the goal of the capital planning policy group was to have health-focused performance-based standards implemented at three levels of energy performance contracts:

1. Health indicators as part of the preliminary assessment process
2. Health parameters to guide implementation planning (for example providing adequate ventilation to compensate for tightening up buildings)

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3. Health or health proxy physical condition benchmarks to calibrate performance over time

We had the opportunity to work closely with BHA as it began another round of energy improvements. For the first time that we know of in an energy performance Request for Proposals, BHA included language referencing health concerns as one of the elements the proposals would be asked to address. Although the language was limited and open-ended it provided an opening for consideration and future negotiations of the final scope of work that would address health. As a result of this RFP language most of the potential bidders for the contract met with or spoke with HPHI team members to discuss ways to incorporate health elements in their proposals. That in itself provided a learning opportunity for key ESCO staff members to increase their awareness of health as it relates to energy conservation activities.

Once an ESCO was selected for the preliminary assessment and conservation opportunities analysis the Capital Planning group was able to work with them to incorporate Health-focused Visual Inspection protocols into their standard energy-focused inspections. Team members also provided training support for these inspection elements.

We found that working directly with the BHA and the ESCO in developing protocols and standards was the most effective way to devise approaches that could be implemented. As a result, we completed the work on the investigative phase and hoped to continue work on implementation and long-term monitoring as the contracts move to those steps. We applied to HUD for new funding to support this effort but did not get funded in 2005. After debriefing we will consider whether to re-apply in 2006. In the meantime, incorporating health considerations into energy conservation improvements is continuing through the BHA and its ESCO contractor.

Health and Housing

This group's efforts proved to be most dependent on analysis of health outcome measures from the project, which were some of the most difficult and most time-intensive elements of analysis. The Health Policy Working Group of the Healthy Public Housing Initiative had two primary objectives for its policy action agenda. The first involved communicating our findings regarding inadequacy of health care to stakeholders that include health care providers, public housing residents, and policy makers. The second includes similar stakeholders but focuses on the efficacy of our interventions in improving the health of asthmatic children and the potential mechanisms to institutionalize effective interventions.

Our activities to date have focused on our first objective, as the analyses related to the efficacy of interventions were only recently completed and have not yet undergone peer review. Baseline information about adequacy of health care as well as other social, environmental, and medical risk factors has been presented in key forums. This included Pediatric Grand Rounds at a major teaching hospital (Tufts-New England Medical Center), in which background about urban asthma and public housing as well as key baseline data were presented to pediatric residents and attending physicians. Related information was also presented to other important stakeholder groups, including to academic researchers and community groups (at the Science for Environmental Justice Working Conference and other academic conferences), to the Boston Urban Asthma Coalition (which includes multiple health care providers, community members,

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and policy makers), and to health reporters affiliated with The Kaiser Media Internships in Health Reporting. Health findings were also presented at multiple community forums held near the West Broadway development. The PowerPoint presentation from Pediatric Grand Rounds is posted on the HPHI website, <http://www.hsph.harvard.edu/hphi/hphigrandrounds.pdf>; other presentation materials are available upon request. In addition, we drafted a two-page executive summary of our key findings intended for a health care provider audience, also posted online, <http://www.hsph.harvard.edu/hphi/hphisummaryforhealthcareproviders.pdf>.

Once the statistical analyses regarding the effectiveness of interventions have been reviewed and deemed acceptable for publication, in spite of the end of our funding cycle, we plan similar outreach that will more directly inform specific policy mechanisms. We will prepare an executive summary and press releases focused on the health benefits of our interventions and the resulting changes in public policy that might be warranted to institutionalize our interventions, and will also discuss the subsets of individuals for whom interventions appeared more or less effective.

Other Program Evaluation

CHA Participation: Impact on Personal and Professional Growth & Development

A key HPHI goal that the Kellogg Foundation supported was to employ public housing residents as staff for the project. This commitment presented challenges: many of the prospective resident employees came to the project with limited English literacy and limited employment history. Some of them needed training and practice in basic job skills such as showing up on time, meeting work expectations and being accountable to supervisors and the families for which they were responsible. All were expected to participate in extensive training on asthma, housing conditions and health, survey taking, using the health monitoring tools, integrated pest management and then to remember what they learned and apply much of it independently as they completed their visits with families and coordinated visits by contractors and researchers. Initially the long lead time for training and the need for basic skills development caused concern among the professional and academic partners but the payoff came in the rich contributions that these team members made to the project. First, the residents brought community-based knowledge to team planning, adding community connection for project activities. Second, the residents were known in their communities and were able to establish trust with the intervention participant families that enabled them to have access to these families' homes, lives, and personal information and to help them stick with a long and invasive health tracking process. If we had not had residents in the role of CHAs it is doubtful that we would have had the participation and cooperation of families in the project.

The project also provided a number of benefits to the residents. In an evaluation completed in September 2003 CHAs reported that they had learned about asthma and asthma triggers, how to patch and repair to reduce pest pathways, and that it is possible to take action against pests, mold and other indoor environmental problems, both as an individual and through the BHA systems. CHAs noted that new skills they had acquired included how to work with the families and to "put them at ease" as well as how to use tools and equipment such as HEPA vacuums, medical equipment and environmental sampling materials. CHAs were also asked to evaluate the progress they had made on a scale of 1 to 10 in a specific area of skill, knowledge or ability. The

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self-selected areas included reading, self-confidence—especially in speaking in public and at resident meetings, knowledge that pests are problems that can and should be addressed, and speaking and reading in English. On average the CHAs reported an increase of 6.18 points in the skill or ability they had identified.

Collaboration and Participation in Community/City/University Partnerships

This project took place in a larger context of growing academic interest in “community-based participatory research.” HPHI team members came together with a desire to work collaboratively but with numerous differences in perspective and knowledge. BHA and resident groups brought a long history of adversarial relations and were initially wary of collaboration. The academic principal investigators brought their personal commitments to the project but having three Boston-based academic institutions in the same project added a layer of complication to participation and defining leadership roles. Funding uncertainties, institutional review board requirements, and differences in partners’ perspectives during the project’s early stages had an impact on project direction and early decision-making. Despite these challenges the team held to its commitment of collaborative decision-making and revisited core issues of team dynamics many times in a conscious effort to honor the “community-based” and “participatory” nature of the project.

Understanding the core mission of the project in the context of the mission for different partners was the main topic of several self-reflective discussions by the team and was a special focus of project evaluation funded primarily through the Ford Foundation. This project evaluation noted the challenge for community partners when the project “scaled up” from small (\$20,000 - \$100,000) to large (multimillion dollar) programs. University and city partners have some capacity to invest resources and attend meetings prior to project funding while community partners have much less capacity for this. As a result community partners are less present as plans develop. This affects their ability to fully grasp the scope of work, their expected responsibilities and to make sure that the budgets and plans support their participation. One lesson learned is that starting small, building trust and then expanding the scale of a project must be done with care to promote equitable relationships among partners along the way. Another observation from our project experience is that academics and community partners approach problems differently. While both groups seek to remedy the causes, academics tend toward a hypothesis testing approach and the community partners are interested in research that verifies their first-hand experiences. One proposed approach to bridging this gap is to engage partners as “allies for positive change.”

A parallel to the participation and impact on communities of community participatory projects is the impact of community/university partnerships on university partners. One of the challenges of evaluating institutional impact is that commitments to projects are usually made by individual academics and not by the institution per se. Participation can have a profound and enduring impact on the individual researchers and the students they bring to the project but any impact on the larger enterprise can be harder to identify. This project had high visibility and a long enough time-frame that it has been able to have some institutional impact. Comments from each of the academic partners regarding impact on their respective institutions follow.

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How HPHI Influenced Tufts University

HPHI occurred in an opportune timeframe for Tufts. The university was in the process of establishing civic engagement as one of the core themes of its strategic plan. This probably makes Tufts the only research extensive university in the country to make such a strong commitment to civic involvement. *Dr. Doug Brugge*, as co-director of HPHI, became one expression of that emerging commitment and had an influence on the development of civic research efforts at Tufts. Specifically, he was appointed as a University Fellow by the University College of Citizenship and Public Service. From his position as a faculty fellow, he was able to present HPHI to a wide audience of faculty and administrators and use it as an example of how Community-Based Participatory Research (CBPR) could be a bridge between the traditional research agenda of the university and its newer emphasis on civic involvement.

The primary focus of *Dr. Brugge's* fellowship was to conceive of and foster the creation of a new Tufts Community Research Center. The center now has start-up funding from the university and has launched two pilot projects. One pilot is with Boston Chinatown groups and will provide technical assistance around community planning and gentrification. The other pilot is with the Latin American Health Institute and addresses health communication with HIV positive Latinos. While the process of institutionalizing the center will continue over the next couple of years, it has already begun to promote and popularize deep involvement with communities around research.

HPHI also raised *Dr. Brugge's* profile at the university, for example, he was promoted to associate professor during the project period. . The fact that the medical dean commended *Dr. Brugge* for community work suggests a genuine understanding of and appreciation for CBPR and community collaboration on the part of Tufts faculty.

In addition, HPHI had numerous other direct, but smaller scale, influences on Tufts. About a dozen students, both undergraduate and graduate worked on the project at various times. And *Dr. Brugge* gave numerous presentations on the project to Tufts audiences, including students in his classes, and faculty in his department and other departments.

Change in the Boston University School of Public Health as Consequence of HPHI

The Boston University School of Public Health (BUSPH) HPHI group was led by *Prof. Pat Hynes*. *Prof. Hynes* reflects that BUSPH has engaged more extensively with the Boston Housing Authority and the Boston Public Health Commission as a result of their involvement with the Healthy Public Housing Initiative. They have partnered with both agencies for a CDC-funded Prevention Research Center. Called Partners in Health and Housing, the Prevention Research Center has focused on multiple health needs and issues of public housing residents, such as domestic violence, physical activity and nutrition for girls, and smoking cessation. Funded in 2001 and re-funded for five years in 2004, the Center adapted the model of the Community Health Advocate from the Healthy Public Housing Initiative and has trained more than 40 public housing residents in general health issues, domestic violence, and smoking cessation advocacy. The school's intensive work in public housing, with two major public health research, intervention and capacity-building projects, has contributed to raising the awareness of numerous faculty that the school must engage more deeply and institutionally with the goal of eliminating health disparities. Thus, recently they created the BUSPH Program to Eliminate Racial and

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Ethnic Health Disparities and are seeking resources from the Community-Campus Partnerships for Health to support building the infrastructure of this program.

Reflections from Harvard School of Public Health Faculty and Students on How HPHI Changed Them and their Institution

The HPHI project has accessed a large network of local organizations while strengthening the core with mutual support. The new proposal, the Healthy Pest-Free Housing Initiative, to the Kellogg Foundation exemplifies the maturing of HPHI and a recognition that for science to inform society we need to scale up our demonstration projects and guide the development of sustainable practice. With the experience and findings gained through HPHI, Prof. Spengler's group at Harvard has been successful with two grant proposals related to low-income populations and public housing. They have joined forces with colleagues in the Department of Society, Human Development and Health in a study of cancer prevention strategies for public housing residents. Work has begun with participation of Cambridge, Chelsea and Somerville housing authorities. In a HUD-funded research project, Spengler and his colleagues will examine residential exposures to cancer and endocrine disrupting chemicals in a set of inner city and rural low income housing. This second project is a collaboration with faculty from Florida A&M University.

On an individual basis, many of the Harvard researchers involved in HPHI found that it influenced their subsequent teaching and research efforts, with a strong multiplier effect.

Prof. Jack Spengler reflects that the project had a profound influence on how he now perceives the complexity of public health issues. A naive view that information derived from science would be persuasive to change organizational behavior was replaced with an appreciation for the difficulty of being an agent of change in the context of public housing, racism, poverty and federal abandonment. He encountered incredibly dedicated individuals within city agencies and community organizations who were committed to making a positive difference in the lives of public housing residents. The barriers to change were certainly not the lack of appreciation for environmental conditions. Rather, the insidious nature of the "system" continuously presents restraints that stifle creativity, cooperation, responsiveness and financing. Research-derived findings on the nature of environmental risk and asthma were certainly important in conveying a coherent message about health and housing. But what Prof. Spengler appreciates now is the need to create an atmosphere of change by embracing the perspectives and energized participation of multiple stakeholders.

Prof. Jon Levy took many of the collaborative experiences to heart in the design of a subsequent community-based participatory research study focused on asthma etiology in urban Boston, and also gained an appreciation for the complex interplay between social and environmental factors in low-income urban dwellings. Aside from the research dimension of the project, he is currently working with a community partner to draft an article about university-community partnerships. In addition, experiences with HPHI strongly influenced his curriculum for a freshman seminar at Harvard College, which began as a more academic investigation of environmental equity and has evolved to include other dimensions of health disparities and "field trips" in which the students visit community settings to learn about first-hand experiences with these issues in Boston. In general, the students in this class as well as the graduate students involved in HPHI report being

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strongly influenced by their on-the-ground experiences, affecting their career choices and subsequent research efforts.

Ongoing effects are seen at multiple institutional levels as well. For example, Dr. Levy has developed an area of research focused on incorporating equity and urban environmental issues into risk assessment, and is currently working with the new Executive Director of the Harvard Center for Risk Analysis to encourage a paradigm shift in the Center's focus. Harvard School of Public Health developed a "professor of the practice" track for faculty involved in the practice of public health in the community, which continues to have institutional support. Harvard University's Center for the Environment is providing support for a conference in early 2006 focused on linking academic researchers with community organizations to address air quality issues in urban Boston. While many of these efforts were influenced by a number of factors, the ongoing success of HPHI and its influence on individual researchers played an important role.

Profs. Spengler and Levy are particularly pleased that HPHI was the learning place for four doctoral students. The experiences gained by these students through involvement in community-based research projects will enrich their careers.

For *Ami Zota*, working on HPHI was an invaluable experience as it simultaneously gave her the opportunity to exercise leadership and use her technical skills to improve the environmental conditions of underprivileged communities. Prior to HPHI, she had acquired scientific skills in the lab and classroom; and separately developed an interest in environmental justice, but had not been able to successfully connect the two. As a graduate student, she instantly became interested in the HPHI project. During her participation in field work she gained insight on the multiple environmental insults that residents of public housing must face. Additionally, Ami received experience in laboratory and statistical analysis of data. As a result of these experiences, she published her first peer-reviewed journal article. Recently Ami was selected to be a fellow of the Environmental Leadership Program, a national program dedicated to fostering the potential of diverse, visionary, action-oriented emerging leaders in the environmental field. As part of her doctoral studies, Ami Zota is now participating in a community-based research project in Tar Creek, OK. Tar Creek, located in NE Oklahoma, is an abandoned lead and zinc mining site. Ami is undertaking a multimedia study of exposure pathways of several toxic metals for infants participating in an HSPH neurodevelopment children's health study

The Healthy Public Housing Initiative gave *Junenette Peters* critical experience in conducting community-based research. This experience was an important factor in her being selected for the Yerby Postdoctoral Fellowship working on the EXPORT project, a community-based project on lead, stress and hypertension in African Americans in rural Gadsden county, FL and the urban Roxbury, MA. Junenette's experience with HPHI has prepared her to be a good liaison between the research core and the community core of the EXPORT project, and to give valuable input on avoiding pitfalls and utilizing lessons learned. A tangible example is the use of the training of the community advocates in HPHI as a spring board for the training on survey administration that she coordinated for the community advocates in the EXPORT project. Dr. Junenette Peters received her doctorate in June 2005 and is completing three HPHI manuscripts for publication. Her work provides important information on the effectiveness of interventions to reduce allergens in public housing and the physical and behavior aspects that modify success.

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Rhona Julien's involvement with the HPH project has been a very rewarding experience both professionally and personally. As a doctoral student, it has provided her with the opportunity to apply classroom training on exposure assessment and data analysis within the context of research design and implementation. As a part-time employee with US EPA Office in Region I, Boston, it has earned Rhona the distinction of Bronze Medal recipient for her participation in the peer education program in the HPHI project which focused on educating families on the identification and mitigation of asthma triggers employing the techniques of Integrated Pest Management (IPM). From a personal standpoint, the interactions with the families, the research team, officials from the housing development authority and community-based groups affiliated with the Authority allowed Rhona to experience first-hand, the true essence of community-based participatory research. She witnessed the dynamic interactions among community activist organizations city agencies and academic researchers, but most importantly, she witnessed the dedication and commitment of all the partners. At the end of the day, despite their many differences, they rallied together to achieve the desired objective, i.e., improving the quality of life of pediatric asthmatics and their families living in public housing. Rhona continues her work at the U.S. EPA, leading intervention efforts in other minority communities through New England, while completing her doctoral studies at HSPH. Her papers and conference presentations are redefining the nature of pesticide exposures to low-income residential populations. Evidence for banned pesticides still exists in environmental samples collected in public housing apartments years later. Restricted pesticides are widely used among some ethnic groups, primarily because contracted pest control methods are not working in public housing. Rhona's research has led directly to devising new approaches to managing both pest and the risk of pesticides in public housing. Her research is clearly reflected in the newly submitted Healthy Pest-Free Housing Initiative proposal to the Kellogg Foundation.

For doctoral student *Jane Clougherty*, the benefit of working in a community-based participatory framework clearly lies in the breadth of experience obtained. Most doctoral candidates spend five or more years in one lab, learning very specific techniques with an astounding degree of specificity. The HPHI project has brought her in direct contact with academics of multiple perspectives, government agencies, public housing residents, and community organizers. There is little doubt that she has become better poised to contact real-world environmental research in a complex urban setting, and will be better prepared to influence environmental policy, government, and corporate practices because of this breadth of experience. In the past year, Jane's work on the longitudinal design for collection and analysis of health outcomes data for the HPHI has been honored with both the American Lung Association (ALA) Lung Health Dissertation Grant and the International Society for Environmental Epidemiology (ISEE) New Investigator Award for Best Presentation at ISEE's annual conference, held in Johannesburg, South Africa. The work that earned each award is highly multi-disciplinary, and explores the interaction among the medical, social, and physical environment that impacts the well-being of lower-income urban children with asthma. She believes that the recognition of the HPHI project by major national and international organizations indicates a paradigm shift in our field of Environmental Health towards broadening our definition of 'environment', increasingly developing an awareness of, and techniques for incorporating, the roles of multiple exposure types in creating environmental health disparities. Jane Clougherty is scheduled to graduate

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from HSPH in June 2006. She is pursuing several postdoctoral and faculty positions with distinguished researchers in the U.S. and abroad.

Dr. Gary Adamkiewicz, a postdoctoral Research Associate on the project, has also benefited from working on the project. His involvement with HPHI has provided invaluable experience in conducting scientific research that can improve the health of low-income communities. This experience has led directly to his participation in two community-based research studies that attempt to understand and address disparities in environmental exposures and related health risks. Dr. Adamkiewicz and Prof. Spengler are collaborating with investigators at the Dana Farber Cancer Institute to study cancer risk among residents of low-income housing in the Boston-area communities of Cambridge, Somerville and Chelsea. This study, funded by the National Cancer Institute, will provide valuable insight into the design of strategies to reduce cancer risk in these communities. In addition to environmental exposures, this study will examine a wide range of diet and lifestyle factors that contribute to disparities in cancer rates that run along racial and economic lines.

The knowledge gained through HPHI has led directly to a study of pesticide and other chemical exposures in urban and rural minority communities. This HUD-sponsored study is examining the factors that contribute to these chemical exposures in two predominantly African-American communities (Roxbury, MA and Gadsden County Florida). As we learned through Rhona Julien's thesis work, the majority of BHA residents are exposed to potentially harmful pesticides in their homes, including several banned and illegal products. This 3-year study, building on the EXPORT project, will continue this important work in Roxbury and will also examine the pesticide exposures in a rural minority community.

Dr. Adamkiewicz and Kim Vermeer also developed a short course entitled "Intro to Healthy Homes" for Neighborworks America, a national nonprofit organization created by Congress to assist community-based revitalization efforts. The experience derived from the HPHI project has served to shape much of the content of the course. HPHI's focus on residents living in public housing is especially relevant for the organizations that are served by Neighborworks.

Future Plans

Integrated Pest Management

Plans are now moving forward to expand the IPM concept to a large-scale pilot program at the Boston Housing Authority. A preliminary funding proposal has been submitted to the Kellogg Foundation to support this work, which will be led by the Boston Housing Authority and the Boston Public Health Commission.

Energy and Health

The BHA is currently reviewing the proposals from Ameresco, the conservation feasibility consultant, to determine the preferred mix of energy and water conservation measures for the first group of properties in the current energy conservation program. Water conservation efforts are expected to be first, followed by energy conservation measures in the summer of 2006.

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Unfortunately, due to the lack of funding, HPHI has not had a direct role in reviewing or guiding the proposals currently under negotiation.

As plans are implemented in this first group of properties planning will start for the remaining properties in this program. It is our hope that funding from energy, housing or health sources will be found to support HPHI efforts to thoroughly interlace a health framework into the planning and implementation of this work.

Dissemination

Direct project dissemination efforts continue through preparation and publication of analytical papers, presentations at conferences. Highlights of presentations this past year include:

- Two presentations of HPHI project results at statewide Massachusetts housing conferences in May and June 2005. The first presentation was at the annual conference of the Massachusetts chapter of the National Association of Housing and Rehabilitation Officials, the primary trade association of public housing authorities. The second was at the annual Public Housing Stakeholders conference, an annual meeting of public housing staff, residents, regulators, consultants, and advocates.
- In September 2005, student presentations of HPHI projects were given at the *Indoor Air 2005* conference in Beijing, China and the *Conference of the International Society for Environmental Epidemiology* in Johannesburg, South Africa (Recipient of the ISEE New Investigator Award for Best Oral Presentation).

An HPHI website, <http://www.hsph.harvard.edu/hphi/>, is maintained by HSPH and updated as new information on the project becomes available, e.g., newly published papers. This site contains a wealth of information on the Healthy Public Housing Initiative, including an overview of the project, protocols, and the results of the interventions as presented in reports, presentations, and publications.

The project team continues to generate papers describing analysis and results, with several papers currently under review and more in progress. Below are several recent HPHI publications (for a more comprehensive list see <http://www.hsph.harvard.edu/hphi/>):

- Snell J, Brugge D, Helmes D, Julio B. Central Steam Heating Challenges and Solutions. *Home Energy*. March/April:38-44, 2004.
- Brugge D, Hyde J, Weinbach BH, Levy JI, Steinbach S. The economic benefit of including environmental issues as a component of comprehensive asthma care: a managed care perspective. *Disease Management and Health Outcomes*. 12(4):259-272, 2004.
- 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>.
- Hynes HP, Brugge D, Osgood N-D, Snell J, Vallarino J, Spengler J. Where does the damp come from? Investigations into the indoor environment and respiratory health in Boston public housing. *Review on Environmental Health*, Special Issue: Housing, Health and Well-Being, Volume 19 (Nos.3-4):271-289, 2004.

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- Zota A, Adamkiewicz G, Levy JI, Spengler JD. Ventilation in Public Housing: Implications for Indoor Nitrogen Dioxide Concentrations. *Indoor Air*, 15:393-401, 2005.

Although HPHI and the team as previously constituted have come to an end, the relationships built and the knowledge gained have resulted in a number of new efforts by various partners. Indirect project spin-offs include:

- The West Broadway Task Force and Urban Habitat Initiatives have joined with the Mass. Union of Public Housing Tenants and the Fall River Joint Tenant Council to develop a resident peer-to-peer training program to encourage safer use of pesticides, paints and home cleaning products, funded through the Massachusetts Environmental Trust.
- Harvard School of Public Health has partnered with the Dana Farber Cancer Institute on a major NIH-funded study of cancer in public housing
- Boston University is the lead representative from HPHI in a partnership with the National Center for Healthy Homes to develop standardized assessment tools using the models developed by HPHI and other recent healthy housing projects.
- Tufts University has created a new Tufts Community Research Center and is partnering with community groups in Boston's Chinatown neighborhood.
- Kim Vermeer (Urban Habitat Initiatives) and Gary Adamkiewicz (Harvard School of Public Health) have developed a course, "Introduction to Healthy Homes" for the NeighborWorks® Training Institute, and teach the course to staff of community development corporations from around the country.