

## **OLHCHH Lead & Healthy Homes Technical Studies Grants (FY06 – FY20)**

The following are research abstracts with brief descriptions of cooperative agreements funded through the Healthy Homes (HHTS) and Lead Technical Studies (LTS) programs during the period covering Fiscal Years 2006 – 2020. The principal investigator, their contacts, award amount, grant number and citations (if there has been any publication from the study) are also provided (note: the listing of publications may not be current).

### **Fiscal Year 2020 (7 HHTS and 6 LTS awards)**

#### **HHTS Awards**

**Project Title:** Better Recognition of Exposure to Asthma Triggers in the Home Environment using Smartphones (BREATHE-Smart)

**The Ohio State University** - The goal of this project is to develop and validate a rapid, point-of-care, smartphone-based test of house dust for semiquantitative detection of inhalant allergens which commonly cause asthma symptoms. The applicant hypothesizes that their system will be consistent with allergen measurement by the HUD standard protocol and better than questionnaire responses used as standard-of-care in homecare programs. The researchers propose to develop and validate a rapid, smartphone-based system to: 1) detect allergens in dust and 2) provide residents with education and intervention strategies. The researchers will also demonstrate usability of the app for improved real-time hazard assessment in homes of asthmatic children. They will work with their community partner, the Asthma Express program, at Nationwide Children's Hospital Homecare. This program has direct access to the community and provides follow-up education and instruction to families of pediatric patients who suffer from severe asthma attacks through in-home nurse visits. The applicant will work with them to integrate direct allergen measurement into their workflow using the developed device, which will enhance their ability to target interventions for each family and may help reduce emergency room usage.

**Contact:** Karen Dannemiller, PhD (614) 292 4031 [dannemiller.70@osu.edu](mailto:dannemiller.70@osu.edu)  
Award: \$ 999,884 Grant #: OHHHU0057-20

**Project Title:** Engaging residents to maximize the impacts of housing rehabilitation programs.

**Silent Spring Institute, Inc.** - The primary goal of the study is to evaluate the effectiveness of integrating resident engagement in homes participating in lead and healthy homes rehab programs to sustainably improve housing conditions and to evaluate the combined influence of housing rehabilitation and resident engagement on exposures to SVOCs, lead, and allergens. The objectives of the study are 1) to assess the influence of a HUD-funded lead hazard control program on SVOC levels and 2) evaluate the effectiveness of adding a healthy housing assessment program to the LHC grant program on exposure-related behaviors and levels of lead, allergens, pesticides, and other SVOCs. The applicant will enroll 100 owner-occupants participating in the City of Rochester's HUD-funded LHC Program. Using a randomized controlled trial (RCT) design, half of the residents will take part in the LHC program (control) while the other half of the residents will take part in LHC and an enhanced version of New York's Healthy Neighborhood Program (HNP+), a low intensity healthy homes education and referral program. Researcher will evaluate the impact of the LHC program on levels of SVOCs, which are often found in house dust, and compare the impact on residential behaviors and measured lead, allergen, and SVOC dust levels in homes also taking part in HNP+.

**Contact:** Robin Dodson, Sc.D. (617) 332 4288 [dodson@silentspring.org](mailto:dodson@silentspring.org)  
Award: \$ 927,069 Grant #: MAHHU0060-20

**Project Title:** Preventing Injuries to Children Through Home Safety Modifications.

**Johns Hopkins University** - This study combines the child injury prevention expertise of the Johns Hopkins Center for Injury Research and Policy faculty with the home modification and community outreach expertise of GHHI to demonstrate and address the gap between what is known to work for preventing child home injuries and the uptake of those prevention approaches by high-risk families. The study team will use the CHASE Tool, developed by Johns Hopkins University, to assess child injury risks in low-income foster family homes before and after implementation of evidence-based modifications, to document the time and cost burden to conduct the assessments on a large scale and the residents' willingness to accept the modifications. The study aims to: 1) implement injury prevention measures based on safety hazards identified using the CHASE Tool within 300 low-income households (at or below 80% AMI) in Baltimore City or County; 2) determine the costs of the injury prevention measures completed by residents and/or professional providers; and 3) conduct a formative evaluation using mixed methods to determine feasibility of incorporating injury prevention into residential programs from the perspective of installers and residents, including identifying barriers and facilitators, and to understand the consistency of implementing and maintaining the injury prevention measures across referral sources, by residents and staff. The study will enroll families with children < 7 years of age who are referred from two of GHHI's active programs, DSS Foster Care Homes Program (FCHP, n=200 homes) and Amerigroup Maryland Asthma Program (AMAP, n=100 homes), which are households with Medicaid eligible children referred from Amerigroup-Maryland into GHHI's asthma home-visiting program.

**Contact:** Wendy Shields, PhD (443) 803 9183 [wshield1@jhu.edu](mailto:wshield1@jhu.edu)  
Award: \$ 999,871 Grant #: MDHHU0059-20

**Project Title:** Control of House Mouse Infestations, Ectoparasites, and Allergens.

**Rutgers, The State University of New Jersey** - The objectives of the proposed study are to: 1) evaluate the cost-effectiveness of integrated house mouse management programs by comparing the cost and effectiveness of three different mouse treatment programs in multifamily apartment buildings with varying degrees of interventions from low to high; 2) evaluate the effect of integrated house mouse control programs on mouse allergen reduction in homes; and 3) profile house mouse ectoparasites and their potential role as disease vectors by investigating the species and infestation rates of ectoparasites on house mice found in multifamily buildings. They will select nine low-income high-rise apartment buildings and a community with at least 30 low-rise apartment buildings, all of which have histories of chronic mouse infestations and divided the buildings into three treatment groups. The researchers will collaborate with four public housing authorities and Johns Hopkins University in conducting field experiments, collecting live mice for examination of ectoparasites, and mouse allergen analysis.

**Contact:** Changlu Wang, PhD (848) 932 9552 [changluw@rutgers.edu](mailto:changluw@rutgers.edu)  
Award: \$ 641,756 Grant #: NJHHU0055-20

**Project Title:** The Association Between Indoor Air Pollution and Cardiopulmonary Health

**The Administrators of the Tulane Educational Fund** - The overall objective of the study is to examine exposure to air pollution (black carbon, PM<sub>2.5</sub> and NO<sub>2</sub>) in the homes of 100 adults ≥ 60 years of age of low-income status (eligible participants include residents of HUD subsidized housing) in the Greater New Orleans. Black carbon, a primary constituent of PM<sub>2.5</sub>, will be measured at baseline and at 6 months using both personal monitoring and stationary samplers in study homes, with other analytes sampled using stationary samplers. The primary goal of the study is to assess the impact of indoor exposure to black carbon and cardiopulmonary health, with a focus on the potential effects on blood pressure and

heart rate. Air pollutants chosen are those known to be combustion byproducts and thought to be predictors of adverse cardiovascular and respiratory outcomes.

**Contact:** Felicia Rabito, PhD (504) 988 3479 [rabito@tulane.edu](mailto:rabito@tulane.edu)  
Award: \$ 999,019 Grant #: LAHHU0058-20

**Project Title:** Evaluating the Long-Term Effectiveness of Healthy Homes Interventions.

**Sonora Environmental Research Institute, Inc.** - The study has two major interrelated objectives: (1) Determining the effectiveness and longevity of healthy homes interventions and education for reducing unintentional injuries and fires resulting from housing-related hazards; and (2) Determining the barriers and incentives affecting future use of these cost-effective strategies. It builds on a previously awarded Healthy Homes Production grant, which targeted a population of 2,985 low-income households and provided home assessment utilizing the SERI Healthy Homes Rating System app, installation of smoke alarms and an educational packet discussing methods to make residents' homes healthier, with some receiving physical interventions for unintentional injuries and fires. The applicant plans to recruit 600 households for this study.

**Contact:** Ann Marie Wolf (520) 529 0080 [annmarie@seriaz.org](mailto:annmarie@seriaz.org)  
Award: \$ 624,250 Grant #: AZHHU0056-20

**Project Title:** Cockroach Eradication through Community Engagement: Empowering Residents to Improve their Health.

**University of Kentucky Research Foundation** - Although the association between cockroach allergens and asthma has been known for decades, effective and sustainable cockroach management plans have not been consistently implemented in affordable multiunit housing. Additionally, residents are rarely involved in pest management, thus denying them the opportunity to improve the IEQ of their homes. The main objective of this study (accounting for the reduction in funding) is to: 1) Evaluate resident perception of cockroach management in affordable housing, and 2) Develop and evaluate an accessible, resident centered cockroach management protocol. Researchers will develop a protocol to reduce cockroach populations in affordable housing communities by reshaping how cockroach management is implemented and sustained as well as centering control efforts on residents, by placing them in a position to be champions for their own health. (note: this abstract reflects the expected focus of the research at the partial level of funding)

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Award: \$ 400,000 Grant #: KYHHU0061-20

## LTS Awards

**Project Title:** Evaluating the Long-Term Efficacy of Residential Lead Remediation and Its Impact on Children's Cognitive Levels in the City of Lancaster, PA

**Franklin & Marshall College** will partner with the Partnership for Public Health and the City of Lancaster to study the long-term effectiveness of lead hazard control activities and investigate the duration of residence in a lead remediated home on cognitive outcomes. The study will use the 425 homes remediated in Lancaster over the past 18 years. They will perform lead hazard risk assessments to determine the differences in the risk assessment findings in relation to the type of lead hazard control work and the time since remediation. Using the Raven's Colored Progressive Matrices (RCPM) test, a

non-verbal intelligence test for children, they will investigate the hypothesis that children who lived for longer durations in a “lead-safe” home will have higher scores on cognitive tests.

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Award: \$ 699,139 Grant #: PALTS0018-20

**Project Title:** University of Nevada, Las Vegas Tile Investigation and Lead Evaluation Study (UNLV TILES)

**Board of Regents, NSHE, obo University of Nevada, Las Vegas (UNLV)** will study a knowledge gap surrounding the extent of potential hazards associated with the lead content of commercially available ceramic tile. The applicant will purchase a variety of ceramic tiles and determine the lead content using X-ray fluorescence analysis. This will be followed by measuring the dust lead levels on the tile and the lead content of dust generated during demolition of the tiles. Characterization of the potential lead hazards of ceramic tiles could inform policies and practice concerning the extent of lead dust hazards originating from tile, lead utilized in the manufacture of tile and glazes, and guidance regarding the handling, installation, and demolition of tile during home renovations. Guidance regarding testing tile could be incorporated into combined Lead Inspection/Risk Assessment procedures and educational information provided to residents and homeowners.

**Contact:** Shawn Gerstenberger, PhD. (702) 8951565 [shawn.gerstenberger@unlv.edu](mailto:shawn.gerstenberger@unlv.edu)  
Award: \$ 530,891 Grant #: NVLTS0016-20

**Project Title:** Targeting Homes with High Lead Exposure Risks by Leveraging Big Data and Advanced Machine-Learning Algorithms

**Trustees of Indiana University** will partner with three HUD LHC grantees: City of Greensboro, NC; City of Fort Wayne, IN; the Indiana Housing and Community Development Authority, and with RTI International to use existing databases to define a “lead exposome” – combining all of the potential contributors to lead exposure in one place. Compiling data linking a child’s total lead exposome to previously collected blood lead data could lead to a precision approach to healthy housing and lead hazard control. The study goals are to decrease reliance on children as a sentinel for identifying at-risk homes, increase the likelihood of preventing cognitive damage from lead exposure, and focus spending on lead hazard control interventions where it will have the greatest effect. They will link data including blood lead surveillance data for 59,483 children, house age, tax value, proximity to selected lead sources, water source, predicted soil lead levels, neighborhood-scale demographics, lead hazard control activities and household-level demographic and occupational information. Then they will use machine learning algorithms to predict: (1) expected children’s blood lead at each household; (2) the probability that blood lead will exceed 5, 2 or 1  $\mu\text{g}/\text{dL}$ ; (3) the relative contributions of different lead exposure sources, and (4) the potential effectiveness of alternative interventions.

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Award: \$ 449,995 Grant #: INLTS0020-20

**Project Title:** A New Paradigm for Environmental Lead Reduction: Community Lead Screening

**The University of Notre Dame** will partner with Indiana University and Purdue University Indianapolis to further validate and scale-up a household lead screening kit to detect environmental lead hazards in two of Indiana’s largest counties. The study’s goal is to prove that their screening kit will make household lead risk assessments more cost-effective. The kit would do this by allowing health departments to target

the expensive and time-consuming household lead risk assessments to homes that are most likely to contain the worst environmental lead hazards. The purpose of the study is three-fold: (1) to validate the lead screening kit in 320 households; (2) to test the scalability of the lead screening kit by distributing the kit to 1000 households across St. Joseph and Marion Counties, and (3) to understand whether and how the kit helps households to identify lead hazards. The lead screening kit is predicted to increase the capacity of local health departments to serve households with children who have had an elevated BLL and who's homes have not received a lead risk assessment.

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Award: \$ 700,000 Grant #: INLTS0017-20

**Project Title:** Detroit Lead Technical Study

**Wayne State University** will partner with the Michigan Department of Health and Human Services, CLEARCorps Detroit, and the Detroit Health Department to study the cost-effectiveness of protecting children from lead exposure through improved temporary emergency relocations, and new permanent voluntary relocations. Where full lead remediation is delayed, it is critical to support families with a child with an Elevated Blood Lead Level (EBLL) and assure that the family and the child end up in a safe setting. The objective of this study is first to establish whether the policies are effective in reducing blood lead levels in children, and then to compare the costs of relocation to the costs of current approaches. This Detroit-based Lead Technical Study will develop: (1) a temporary relocation model for households where a child is hospitalized with an EBLL greater than 35 µg/dL of lead in their blood, and (2) a permanent voluntary relocation model for households where children have an EBLL below 35 µg/dL.

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Award: \$ 699,171 Grant #: MILTS0015-20

**Project Title:** Impact Lead – Kansas City

**Curators, University of Missouri on behalf of UMKC** will partner with The Kansas City Health Department Childhood Lead Poisoning Prevention Program and Children's Mercy Kansas City Environmental Health Program to study how different interventions have made housing lead safe and if this leads to fewer lead poisoned children among those who move into a home after remediation activity. An existing lead testing data base will be used to evaluate the efficacy and long-term outcomes of lead hazard control interventions on children that are both those in residence at the time of the Lead Safe intervention as well as those who began to reside at the address any time post lead-hazard clearance. UMKC will also develop a Housing Based Lead Risk Index to cost effectively target homes with higher interior lead dust levels. The Index will be tested to see if and how it facilitates an efficient target testing approach, using easily obtained information such as age of housing and condition of exterior housing components. The agenda is to develop a primary prevention approach based on exterior housing observations as well as neighborhood level social determinants of health.

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Award: \$ 699,997 Grant #: MOLTS0019-20

**Fiscal Year 2019 (7 HHTS and 3 LTS awards)**

**HHTS Awards**

**Project Title:** Drinking water lead remediation strategies for Illinois homes with domestic wells.

**Board of Trustees of the University of Illinois at Chicago** - The objectives of this study are: 1) to identify predictors of water lead levels in tap water of homes with private wells, and 2) to characterize the cost and efficacy of interventions to reduce tap water lead in homes with private wells. Few states have any regulations to test well water for lead content. UIC will generate information to inform prioritization of homes with private wells for water lead testing. A pilot study suggests that age of home, water corrosivity, plumbing composition, and well composition and condition may be predictors of lead in the tap water of homes with private water wells. Researchers will also generate information on the costs and efficacy of three different approaches to removing lead from tap water of homes with private wells. Partner organizations include the Illinois Association of Groundwater Professionals, Illinois Department of Public Health, Champaign-Urbana Public Health District, Jackson County Health Department, Kane County Health Department, Peoria City/County Health Department and the Whiteside County Health Department.

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Award: \$ 999,999 Grant #: ILHHU0052-19

**Project Title:** Air filtration to improve indoor air quality (IAQ) and chronic obstructive pulmonary disease (COPD) outcomes in a high-risk urban population of U.S. military veterans.

**Illinois Institute of Technology** – The primary goal of this study is to investigate the effectiveness of stand-alone air filtration for improving indoor air quality (IAQ) and chronic obstructive pulmonary disease (COPD) outcomes in a high-risk urban cohort of 80 U.S. military veterans with COPD. Additional secondary goals of the study are to: (1) investigate housing-related factors that may contribute to COPD exacerbation; (2) investigate the utility of using low-cost sensors for indoor air pollution epidemiology studies and for providing actionable or useful information on the quality of their indoor air to patients and their physicians, and (3) evaluate the costs and benefits of using stand-alone air filtration to improve IAQ and COPD outcomes. Participants will be recruited from the Jesse Brown Veterans Affairs Medical Center (JBVAMC) through the West Side Institute for Science and Education (WISE) using a community-based participatory process in which stakeholders, including patients, physicians, and local nonprofits, will assist in the development of research objectives, recruitment, retention, and dissemination of results. The study objectives will be met by combining measurements of environmental conditions and indoor and outdoor air quality (using both research-grade and low-cost sensors) with housing condition assessments, respiratory questionnaires, and records of clinical outcomes.

**Contact:** Brent Stephens, PhD (312) 567 3629 [brent@iit.edu](mailto:brent@iit.edu)  
Award: \$ 1,000,000 Grant #: ILHHU0049-19

**Project Title:** EXTRACT Study (EXTRACTing Indoor Pollutants with Proper Ventilation)

**National Center for Healthy Housing Inc.** - This study will evaluate the effectiveness of the installation of kitchen range hoods to reduce moisture and gas stove-generated NO<sub>2</sub> and other contaminants compared with the effectiveness of bathroom fans, the latter being the more common approach to achieving compliance with ASHRAE ventilation standard 62.2, in 120 single family homes undergoing weatherization. The main objective of the study is to offer evidence-based guidance to homeowners, energy and housing programs, and policy makers on how to improve indoor air quality in homes with gas stoves in a cost-effective manner. Although the intervention of interest will be the installation of ventilation systems, the provision of air sealing/insulation services will also influence pre-/post-work changes. The researchers will use the information about building tightness to control for the effects of energy efficiency measures, which could affect infiltration rates and contaminant levels. The study will also track the costs of the bathroom ventilation systems as compared to the kitchen exhaust hoods.

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Award: \$ 799,999 Grant #: MDHHU0051-19

**Project Title:** Transformative Interventions for Cockroach, Endotoxin and Allergen reduction to Sustain a healthy home Environment.

**North Carolina State University** - Working with public housing agencies and the Lumbee Tribe, this study will test a new pest control protocol for eradicating cockroach infestations and reducing cockroach allergen levels in homes in both urban and rural communities in North Carolina. Community members and pest management professionals will be included to help ensure the success of the study and the future application of study findings. The study consists of three aims: Aim 1 will develop and validate a new pest eradication protocol by assessing the efficacy and cost of several practices (gel bait application, IGR sprays), then whole-home treatments, and finally resident participation. Aim 2 will extend and generalize the most efficacious inner-city cockroach elimination protocol to rural homes in eastern North Carolina and tribal homes (Lumbee Tribe). IEQ measures will include reductions in cockroaches, allergens and endotoxin. Resident participation will be a component of these interventions. Aim 3 will demonstrate a proof-of-concept transformative community participatory intervention model with early intensive PMP inputs and sustainability through community participation. It will incorporate the best aspects of Aims 1 and 2. IEQ measures will include reductions in cockroaches, allergens and endotoxin.

**Contact:** Coby Schal, PhD (919) 515 1821 [coby@ncsu.edu](mailto:coby@ncsu.edu)  
Award: \$ 999,295 Grant #: NCHHU0053-19

**Project Title:** The Impact of Housing Assistance on Residential Environmental Exposures.

**The George Washington University** - Prior research suggests housing assistance programs are important social and health policy tools since housing assistance is associated with improved physical and mental health for children and adults. However, it is unclear which attributes of housing assistance are contributing to improved health. This study investigates the impact of HUD housing assistance on exposure to indoor environmental contaminants such as lead, secondhand tobacco smoke, and pesticides. This will be accomplished through extensive analysis of a unique dataset that links HUD administrative data (1999-2016) with those from the National Health and Nutrition Examination Survey (1999-2016). There are 8,500 NHANES respondents who are linked to the HUD record, including 4,111 children ages 2-19 and 4,389 adults. The research also includes the development of a housing environmental quality index using American Housing Survey data.

**Contact:** Ami Zota, ScD (202) 994 9289 [azota@gwu.edu](mailto:azota@gwu.edu)  
Award: \$ 850,000 Grant #: DCHHU0054-19

**Project Title:** Improving Health and Indoor Air Quality for Older Adults with Asthma

**University of Massachusetts, Lowell** - This study tests the effectiveness of portable high efficiency air filtration units in improving indoor air quality and reducing asthma symptoms and healthcare utilization among 100 older adults (age 55+) with asthma living in smoke-free public or other federally assisted housing. The research will be conducted in units with gas stoves, which are known to emit contaminants that can trigger asthma. The study uses a stepped-wedge design to evaluate the impact of this intervention separately and in combination with the well documented improvements seen with typical multifaceted educational and environmental interventions. The study will fill a major knowledge gap by measuring both PM and NO<sub>2</sub> concentrations in homes that cook with gas stoves and document the reductions in both pollutants when using HEPA/activated charcoal air purifiers. The study will provide environmental data

on the effectiveness of air purifiers, as well as document changes in respiratory health measures following the air purifier intervention as well as the benefit of adding subsequent standard multifaceted environmental and educational interventions.

**Contact:** David Turcotte, ScD (978) 934 4682 [David\\_Turcotte@uml.edu](mailto:David_Turcotte@uml.edu)  
Award: \$ 999,999 Grant #: MAHHU0048-19

**Project Title:** Implementation and cost determination of an Assessment-Based Pest Management (APM) protocol for German cockroaches; and evaluations of bed bug heat treatment in US HUD Housing Authorities

**Virginia Polytechnic Institute and State University** - This study assesses the efficacy and cost of Assessment-based Pest Management (APM) protocols for controlling cockroaches and bed bugs in public and other HUD-assisted housing. The researchers will study how the determination of pesticide resistance among cockroach populations can be incorporated into pest management protocols and will test the efficacy of different heat systems for bed bug control. The researchers intend to determine the costs of an APM baiting protocol for German cockroach control, the cockroach population resistance profiles for resistance management recommendations, the efficacy of different whole heat-systems for bed bug eradication, and provide pest management training and contract writing seminars to managers, facilities staff and public housing residents.

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Award: \$ 756,570 Grant #: VAHHU0050-19

## LTS Awards

**Project Title:** Development of a Test Kit for Lead Clearance Testing

**QuanTech, Inc.** - This study builds on previously awarded HUD-sponsored work, Enhancing the Performance of Spot Test Kits for Lead Based Paint Using Solid-Phase Dilution. The main objective of this study will be to develop a fast, on-site procedure to determine clearance after lead hazard control work. QuanTech will develop the test kit based on previous research developing a test kit to determine the presence or absence of lead-based paint. It will decrease the amount of time necessary to obtain clearance and reduce costs for relocation. The test kit will be based on the previous work using the rhodizonate color change to pink in the presence of lead.

**Contact:** Gary Dewalt, PhD. (240) 397 2993 [gdewalt@quantech.com](mailto:gdewalt@quantech.com)  
Award: \$ 611,534 Grant #: MDLTS0012-19

**Project Title:** Help Eliminate Lead Program (HELP)

**The University of Illinois at Chicago (UIC)** - This study will evaluate the existing HELP program in Galesburg, IL. The HELP Program provides services to communities with documented lead problems and is being offered to the City of Galesburg in rural Illinois as a pilot program. Services provided to eligible households prioritize pre-1978 housing units where an EBL child resides. Homes are selected according to age and condition of the structure, number of children 1-6, and relative degree of poverty. Eligible households will receive a risk assessment and be eligible for lead service line replacement and lead hazard remediation. Comparisons will include lead service line replacement, dust lead and health outcomes, and calculations of costs and benefits. The study will help determine the incremental benefits of lead service



line replacement as well as dust lead and health outcomes using an existing analytical predictive lead risk model.

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Award: \$ 700,000 Grant #: ILLTS0014-19

**Project Title:** Reducing Metal Exposures in the Home: A Pilot Intervention

**Trustees of Boston University** - This study will focus on the effects of take-home contamination on children's blood lead levels. The pilot study will characterize 60 homes of low-wage construction workers living with a child and evaluate interventions to reduce take-home contamination, and the effectiveness in reducing metals in household dust and residents' blood. Intervention groups will be assigned to different combinations of customized home assessment, take-home prevention training and professional cleaning. Collaborators will include the Massachusetts Coalition for Occupational Safety and Health, Brazilian American Center, Vietnamese Health Collaborative, New England Carpenters Training Fund, and New England Region Laborers' Health & Safety Fund of North America.

**Contact:** Diane Ceballos, PhD (617) 358 1911 [ceballos@bu.edu](mailto:ceballos@bu.edu)  
Award: \$ 670,799 Grant #: MALTS0013-19

**Fiscal Year 2018 (6 HHTS and 3 LTS awards)**

#### **HHTS Awards**

**Project Title:** The Houston "Breathe Easy" Healthy Homes-Based Model for Multifamily Rental Communities.

**Baylor College of Medicine** - This project proposes to use data on environmental exposures and health from two previous studies, supplemented with innovative biomarker analyses, to strengthen our understanding of home environmental exposures and their relationships to health. That knowledge (with input from the affected community and key stakeholders) will then be used to refine, implement, and evaluate a "Healthy Homes"-based intervention for low-income, multifamily housing residents. The study team will conduct a randomized pragmatic clinical trial (PCT) to assess the efficacy of residential asthma interventions in the homes of 100 individuals with asthma aged 12 years and older who reside in one of two public housing communities owned and operated by the Houston Housing Authority. Participants will be randomized into one of two treatment groups: (1) phone calls only, or (2) home visits to implement and reinforce a clinically driven multicomponent trigger reduction and asthma control plan. The study will include an on-site clinic for enrollment at each complex. In addition, a community health worker will be hired and trained from each property and will be as an integral part of the research team. The phone-call group will receive four calls over the 6-month intervention period; the home-visit group will receive four home visits. Visits will reinforce the asthma action plan and provide up to \$350 in supplies to help reduce asthma triggers. The study leverages findings from two previous studies and includes novel components such as assessment of exposure to volatile organic compounds using a silicone wristband and the presence of chronic rhinitis and mycosis (fungal infections) in participants.

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Award: \$ 1,000,000 Grant #: TXHHU0043-18

**Project Title:** Reducing Older Adult Asthma Disparities Extension study (ROAAD-X)

**Massachusetts Department of Public Health** - The ROAAD-X study will provide evidence as to whether a scaled down version (fewer home visits) of an innovative Community Health Worker-led multi-trigger, multi-component asthma home-visiting intervention with strong clinical-community linkages, has the potential to improve asthma control and healthcare utilization for older adults with asthma. The ROAAD-X study will enroll eligible participants at the Lowell Community Health Center (LCHC), the ROAAD pilot clinical site, and include the addition of a dynamic wait list design and an analysis of cost effectiveness and return on investment (ROI). It will also seek to validate a tool created by MDPH to quantify indoor environmental asthma triggers. A study sample of 90-110 older adults, aged 55 and older, with provider-diagnosed asthma of at least mild persistent severity that is not well controlled according to the National Asthma Education and Prevention Program (NAEPP) guidelines. The study will utilize a dynamic wait list design in which participants will be enrolled in the study but will receive standard care for the first six months (“Control Period”) with asthma control assessed at baseline, 3-months and 6-months and health care utilization assessed at baseline (beginning of control period) and 6 months (end of control period). At six months, each participant will begin the “Intervention Period” and receive the ROAAD-X intervention, consisting of four home visits conducted by a CHW with visiting nurse accompanying CHW on Visit 1 and Visit 2 and a follow up phone call completed at 18 months (Visit 5). CHWs will provide asthma self-management education, assess the home environment to identify triggers, engage and teach patients to eliminate triggers from the home environment and make referrals for social services.

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Award: \$ 1,000,000 Grant #: MAHHU0045-18

**Project Title:** Optimizing the Impact of Smoke-Free Residential Policies using an Evidence-Informed Implementation Approach

**President and Fellows of Harvard College** - No evidence-based approaches are available to support implementation of smoke-free (SF) housing policies by public housing authorities (PHAs) to ensure that HUD’s rule yields optimal benefits for residents. This study uses six key implementation strategies identified in earlier research on the experiences of PHAs that adopted SF policies before the rule was effective. The primary objective is to develop evidence-based smoke-free policy implementation strategies, using approaches informed by the experiences of early-adopter PHAs. It uses an established implementation science framework—Proctor’s Conceptual Model of Implementation Research—to guide the approach using a mixed methods approach embedded within a longitudinal design to collect and analyze outcome and implementation process data. From a portfolio of 55 HUD-subsidized affordable housing properties in the Appalachian region (managed by Beacon Properties), 12 sites will be selected based on: larger size (to optimize the size of our participant sample); geographic accessibility; and willingness to participate. Eligible participants will be adult residents aged 18 and above, who consent to participate by completing structured surveys on their attitudes and behaviors regarding the smoke-free rule at three time points. The study will recruit non-smokers (n=360) and smokers (n=180). The overall study aims are to: a) Assess the effectiveness of a set of implementation strategies tailored to the characteristics of each property by varying their order and intensity, compared with standard support; b) Assess the incremental benefit of using structured implementation techniques and feedback from earlier adopters; and c) Develop an evidence-based implementation toolkit to meet the needs and preferences of public and affordable housing communities.

**Contact:** Vaughan Rees, PhD. (617) 432 6345 [vrees@hsph.harvard.edu](mailto:vrees@hsph.harvard.edu)  
Award: \$ 999,912 Grant #: MAHHU0041-18

**Project Title:** Urban Fungal Exposure, Sensitization and Asthma Among a Low-income Population

**The Trustees of Columbia University in the City of New York** - Despite the established link between sensitization to the fungus *Alternaria alternata* (*A. alternata*) and asthma, the importance of domestic *A. alternata* exposure to allergic disease in lower-income urban communities remains poorly understood relative to cockroach, dust mite and mouse exposures. This proposal directly builds on a prior HUD funded work and has the objectives to address critical knowledge gaps in the understanding of the determinants of fungal exposure in low-income, urban homes and the relevance of early-life domestic exposure to fungi from the family Pleosporaceae, including *A. alternata*, to asthma development. The study design leverages biospecimens and databases readily available from two New York City (NYC) cohorts including a comprehensive prospective birth cohort of African-American and Hispanic children who have grown up in the northern Manhattan and the South Bronx, two communities with high burdens of poverty, asthma and reported domestic mold. The study will use next generation sequencing (NGS) to test the hypothesis that in NYC, *A. alternata* and other domestic fungal taxa are influenced by features of the built environment, housing type, water damage, homeowner behavior and bacterial communities, and that these will thereby impact asthma risk. Additionally, the study will test the hypothesis that, among children living in lower-income NYC neighborhoods, domestic exposure to Pleosporaceae fungi early in life is associated with development of allergic sensitization and asthma later in childhood. The possible synergistic effects of co-exposures to combustion byproducts will also be explored.

**Contact:** Matthew Perzanowski, PhD. (212) 305 3465 [mp2217@cumc.columbia.edu](mailto:mp2217@cumc.columbia.edu)  
Award: \$ 991,572 Grant #: NYHHU0042-18

**Project Title:** Linking Microbial, SVOC and Pro-Inflammatory Exposures in Homes to Childhood Asthma Severity: A Community Filter Forensics Approach.

**The University of Texas at Austin** - This study proposes to investigate and compare the Filter Forensics and Community Filter Forensics approaches for assessing home exposures and asthma outcomes in a low-income urban community in Austin and demonstrate the feasibility of scaling up Community Filter Forensics to a statewide home and asthma assessment campaign. The study will be divided into two phases. In Study Phase I, the team will evaluate and compare the Filter Forensics and Community Filter Forensics methodologies for assessing home bio-contaminants and SVOCs associated with asthma severity and asthma control in a sample of 50 low-income homes in East Austin. This study phase will allow them to determine how the Filter Forensics approach applied to an urban setting compares to their previous Filter Forensics findings in a rural setting. In addition, it will allow them to directly compare and verify how community-supplied data compares to data collected by researchers in the same homes. In Study Phase II, they will roll out a statewide Community Filter Forensics campaign in Texas targeting 150 households in cities across three climate zones to assess the feasibility of engaging with a variety of communities to rapidly (and remotely) collect home exposure and health data. If successful, the Community Filter Forensics methodology could provide a potentially more efficient and effective way for exploring healthy homes.

**Contact:** Kerry A. Kinney, PhD. (512) 232 1740 [kakinney@mail.utexas.edu](mailto:kakinney@mail.utexas.edu)  
Award: \$798,498 Grant #: TXHHU0046-18

**Project Title:** Sustainable Air Quality Control in Affordable Housing Near Highways

**Tufts University** - The goal of this study is to develop a performance-based evaluation framework specific to multi-family housing near highways that considers air quality benefits, indoor comfort, and sustainability of various HVAC and air-filtration systems. The study has two main objectives: (i) to quantitatively assess the indoor air quality benefits derived from use of high efficiency filters and optimization of ventilation system design parameters in near-highway housing; and (ii) to develop a guidance document based on a stakeholder workshop that can be used to inform the design of HVAC systems and their operation for multi-family housing near busy roadways. To achieve the first objective, three important design factors: efficiency of filtration to remove particulate air pollution, air recirculation rate, and fresh air supply rate will be tested. It uses a factorial experimental approach to determine which of these factors or combinations of factors are the most influential determinants of improved indoor air quality and comfort. Eight different affordable housing unit types – that differ in terms of filtration, recirculation rates, and fresh air supply rates – will be selected from three or four multi-family buildings near highways in Somerville, MA. To better understand unit-to-unit variation, three units of each type will be studied, i.e., a total of 24 units. Respirable particles, carbon dioxide, nitrogen dioxide, volatile organic compounds, temperature and relative humidity will be continuously monitored. For the second objective, a Stakeholder Workshop inviting study participants, multi-family housing developers, tenant associations, city planners, public housing advocates, HVAC systems designers and technicians, inspection services, and academic researchers will be conducted.

**Contact:** John L. Durant, PhD. (617) 627 5489 [john.durant@tufts.edu](mailto:john.durant@tufts.edu)  
Award: \$ 779,935 Grant #: MAHHU0044-18

## LTS Awards

**Project Title:** Analysis of Benefits of Abatement Techniques and Effectiveness in the HOME Study (the ABATE HOME Study)

**National Center for Healthy Housing, Inc.** - This study builds on a previously HUD-sponsored work, the Evaluation of the HUD Lead Hazard Control Grant Program, the HOME Study. The three main objectives of this study are; (1) To determine the efficacy of the type and intensity of lead hazard control interventions used in the HOME Study (2003-2006) on blood lead levels and neurobehavioral factors; (2) to identify which housing interventions are capable of routinely achieving compliance with low dust lead levels in the most cost-effective manner; and (3) to determine if residential dust lead loadings are related to neurobehavioral outcomes in children.

The HOME Study was a randomized controlled trial carried out with funding from NIEHS, HUD, and EPA. This ABATE HOME study is a retrospective analysis of the HOME Study data. NCHH hypothesizes that the HOME Study data will show that intervention practices currently used by HUD lead hazard control grantees can reduce dust lead levels to below 5  $\mu\text{g}/\text{ft}^2$  on floors and 50  $\mu\text{g}/\text{ft}^2$  on windowsills. The study will also provide information about the intensity of interventions needed to achieve clearance at these levels.

**Contact:** David E. Jacobs, PhD. (202) 607 0938 [djacobs@nchh.org](mailto:djacobs@nchh.org)  
Award: \$ 650,000 Grant #: MDLTS0008-18

**Project Title:** The MI CHILD Study (MIchigan CHildren's Lead Determination Study)

**National Center for Healthy Housing, Inc.** - The absence of recent data characterizing lead exposures in paint, dust, soil, and water while controlling for other key variables has made it difficult to understand the relative importance of different sources. This evaluation will help to fill this evidence gap by

analyzing data collected by Michigan Dept. of Health and Human Services' (MDHHS) lead poisoning prevention program to characterize and assess recent lead levels in dust, soil, paint, and drinking water, while controlling for relevant confounding variables. These data will be modeled to predict exposures using Structural Equation Modeling (SEM). The study will also use other models to estimate the relative importance of exposure sources and pathways, identifying factors that have a direct or indirect influence on blood lead levels. There are two main objectives for this evaluation: (1) Analyze exposures and pathways from paint, dust, soil, and water; and (2) characterize recent lead levels in children's blood, paint, dust, soil, and drinking water in 350 Michigan homes, including estimating the influence of other characteristics. The database in Michigan is unique and has been developed pursuant to the state's HUD lead hazard control grant, Michigan state general fund dollars, and a Medicaid/CHIP (Children's Health Insurance Program) state plan amendment.

**Contact:** David E. Jacobs, PhD. (202) 607 0938 [djacobs@nchh.org](mailto:djacobs@nchh.org)  
Award: \$ 596,830 Grant #: MDLTS0009-18

**Project Title:** Lowering Children's Blood Lead Levels by Mitigating Household Lead Paint in Central El Paso, TX.

**The University of Texas at El Paso** - This study will use a holistic approach strategy, integrating community neighborhood-level education on child lead exposure solutions, with household-level lead hazard detection and mitigation. Three sets of objectives guide the collection of data needed to test the hypotheses: 1) measure child BLLs in previously identified high-risk neighborhoods, geographically map child BLLs, identify and recruit homes with lead exposed children; provide mitigation education and quantify parents' knowledge, perceptions and attitudes towards mitigation pre- and post-education; 2) through home visits, measure lead content with an XRF and determine the bioaccessibility of possible interior and exterior lead paint contamination sources; determine most likely source(s) of child exposure; inform parents of findings and review mitigation options and practical issues; assist parents in mitigation; and 3) re-test child BLLs and environmental lead sources to determine efficacy of mitigation, and changes in attitudes and perceptions regarding perceived barriers to mitigation.

**Contact:** Christina Sobin, PhD. (915) 747 7274 [casobin@utep.edu](mailto:casobin@utep.edu)  
Award: \$ 699,911 Grant #: TXLTS0010-18

**Fiscal Year 2017 (5 HHTS and 3 LTS awards)**

#### **HHTS Awards**

**Project Title:** Evaluation of Radon Measurement Protocols for HUD Multifamily Structures

**Health Research, Inc./New York State Dept. of Health** - There is significant variation in multifamily housing financing program recommendations for the number of individual units in a multifamily building that should be tested for radon. Current recommendations to test 10% (Fannie Mae and Freddie Mac) or 25% (HUD-FHA) of ground-floor units have a low probability of identifying a single unit with radon  $\geq 4$  pCi/L. Previous studies suggest that at least half of the units need to be tested in structures with 20 total units, while in the highest-risk areas (e.g., Zone 1) at least 5 units need to be tested in buildings with 10 or fewer units to achieve high (e.g., 90%) probability of identifying a unit with radon above 4 pCi/L. This indicates that current percentage-based testing is likely inadequate to identify units with elevated radon levels. The primary objectives of the proposed research are to: 1) obtain >7,000 results of completed

radon measurements from 100% of ground-floor units in over 500 multifamily buildings from radon professionals located in several states; 2) develop and apply statistical analyses to actual radon measurement data to ascertain the minimum number of measurements needed to adequately assess the radon risk at a particular (e.g., 90%) confidence limit; 3) calculate and compare the increased health (lung cancer) risks to occupants associated with partial (e.g., 10%; 25%) and complete (100%) testing of multifamily units, and 4) timely dissemination of the study results through professional presentations and peer-reviewed manuscripts.

**Contact:** Michael Kitto, PhD. (518) 486 1476 [Michael.kitto@health.ny.gov](mailto:Michael.kitto@health.ny.gov) Award:  
\$435,000 Grant #: NYHHU0038-17

**Project Title:** Survey of Pest Infestation in Low-income Communities and Evaluation of Cost-Effective Bed Bug Management Techniques

**Rutgers, The State University of New Jersey** - Pest infestation, frequent indoor pesticide applications, and allergens produced from pests continue to be a significant health concern to residents in low-income communities. Resurgence of bed bugs brings new challenges to residents and housing authorities. The objectives of this study are to: 1) Investigate patterns of pest infestation and pesticide use in low-income communities in 4 housing communities (Jersey City, Linden, Paterson, and Trenton in New Jersey that collectively manage 3,928 apartments); 2) Evaluate silica gel dust for bed bug control in apartments; 3) Evaluate plastic and fabric encasements for early detection and control of bed bugs; and 4) Evaluate two minimum risk bed bug treatment protocols (chemical and non-chemical) for control of bed bug infestations. It is expected that the study findings will be useful to property managers and residents by providing guidance on effective bed bug control tools and methods.

**Contact:** Changlu Wang, PhD. (848) 932 9552 [cwang@aesop.rutgers.edu](mailto:cwang@aesop.rutgers.edu)  
Award: \$360,000 Grant #: NJHHU0039-17

**Project Title:** Role of measured and observed mold in the development of children's asthma

**University of Cincinnati** - Allergic disorders including asthma are major concerns in childhood health. The association between observed dampness and mold (D/M) and asthma is well-established. However, most epidemiologic studies have focused on dichotomous metrics of observed mold that cannot assess dose-response relationships. The goal of the proposed study is to define more precisely the dose-response relationships between mold exposure in homes and adverse health outcomes, which can be used to support the development of health-protective guidelines for indoor mold. The proposed work involves the analysis of data and dust samples from a prospective cohort study of asthma development, the Cincinnati Childhood Allergy and Air Pollution Study (CCAAPS). a well-defined birth cohort of high-risk children living in the Cincinnati (Ohio) and Northern Kentucky metropolitan area. The study proposes to combine reanalyzed data on observed mold and quantitatively assessed mold (quantitative PCR) with new microbiome data derived from archived dust samples to conduct a uniquely comprehensive analysis on the role of observed versus measured mold in the development of children's asthma.

**Contact:** Tiina Reponen, PhD. (513) 558 0571 [tiina.reponen@uc.edu](mailto:tiina.reponen@uc.edu)  
Award: \$670,000 Grant #: OHHHU0037-17

**Project Title:** Identification of Factors Impacting Efficacy and Adoption of Low-Cost Point of Use Filters

**Virginia Polytechnic Institute and State University** - The proposed research aims to determine the short- and long-term performance of common point-of-use filters (POUs) under water conditions typical of high-risk water systems to develop knowledge needed to protect consumers. The applicant will also develop evidence-based exposure reduction guidelines, outreach strategies to address weaknesses in public education, with a focus on vulnerable, low-income and limited English proficiency communities. The study objectives are to: (1) examine POU lead removal efficiencies when exposed to varying concentrations of soluble and particulate lead and iron; (2) evaluate POU efficacy for periods up to and beyond rated capacity; (3) identify challenges and barriers to POU use; (4) evaluate pre-and post-intervention awareness and risk perceptions of lead; and (5) conduct community focus groups to develop culturally appropriate strategies for outreach and intervention. This study uses mixed-methods which entails: (1) bench-scale research to identify top-rated POU models and water quality conditions associated with POU performance; and (2) descriptive community-based participatory research (focus groups, semi-structured interviews, surveys) to characterize barriers to POU adoption, knowledge gaps, risk perceptions and information-seeking strategies. It's a collaboration between Virginia Tech Department of Civil and Environmental Engineering, Louisiana State University School of Public Health, Macon County Health Department (Macon County, NC; private well community), Louisiana Environmental Action Network (St. Joseph, LA), and Southern United Neighborhoods (New Orleans, LA).

**Contact:** Marc Edwards, PhD. (540) 231 7236 [edwardsm@vt.edu](mailto:edwardsm@vt.edu)  
Award: \$600,000 Grant #: VAHHU0036-17

**Project Title:** Removing Home Hazards for Older Adults Living in Affordable Housing.

**Washington University** - This study examines the feasibility of translating fall prevention research on removing home hazards into an effective home hazard removal program delivered in affordable senior housing units. This hybrid design study will look at both the effect of the intervention in a real-world setting and the implementation strategy. A hybrid effectiveness/implementation trial will simultaneously establish the effectiveness of home hazard removal in affordable housing and conduct a process evaluation of how the intervention works in the context of senior apartments. To examine the implementation outcomes, a concurrent process evaluation will be conducted. The study has two objectives; 1) Determine the acceptability and feasibility of delivering the home hazard removal program in low-income senior apartments and, 2) Determine whether the home hazard removal program is effective and cost-effective in reducing the rate and post-intervention risk of falls.

**Contact:** Susan Stark, PhD. (314) 932 1033 [starks@wusm.wustl.edu](mailto:starks@wusm.wustl.edu)  
Award: \$665,000 Grant #: MOHHU0040-17

## LTS Awards

**Project Title:** A Novel Phytoremediation Method to Cleanup Lead-Based Paint Contaminated Soils: Phase III – Demonstration Study

**Michigan Technological University** - The primary objective of the proposed investigation is to demonstrate the efficacy of phytoremediation via longer-term, in situ studies in six residential properties in two geographically distant areas in the United States, NJ and TX, characterized by very different climate pattern and soil types. The secondary objective is to develop a guidance manual for

implementation of catalyzed vetiver phytoremediation (CPT) technology, which will be made available for free to affected home owners. The study achieves these objectives through six aims: 1) Test the CPT model in situ in six properties for a period of 2.5 years. 2) Validate the biochemical mechanisms behind vetiver's lead tolerance from the Phase-I and II studies using onsite data. 3) Test the ability of vetiver grass in reducing soil erosion, and hence, decreasing the amount of lead-laden dust generated. 4) Evaluate reuse possibilities of the vetiver biomass, such as recycling as compost material, or feedstock for bioethanol production, or anaerobic digestion to produce biogas. 5) Engage the community through various outreach and educational activities to spread awareness of lead hazard control technologies, and 6) Develop a Guidance Manual for wide scale public use of CPT technology.

**Contact:** Rupali Datta, PhD. (906) 487 1783 [rupdatta@mtu.edu](mailto:rupdatta@mtu.edu)  
Award: \$492,633 Grant #: MILTS0007-17

**Project Title:** Primary Prevention of Lead Poisoning through Targeted Deployment of Community Health Workers

**Sinai Health System, Inc.** - This proposed proof-of-concept study will work towards the long-term goal of reducing lead poisoning among children living in some of West and Southwest Chicago's most economically challenged communities. It will do so by generating evidence concerning the feasibility, effectiveness and cost-effectiveness of utilizing Community Health Workers (CHWs) to conduct proactive visual inspections in homes for LBP hazards before a child is exposed. To facilitate the identification of homes for this intervention, an innovative predictive model will be used to identify homes at highest-risk for having such hazards as well as enrollment data from City of Chicago's Dept. of Public Health (CDPH) Women Infant and Children (WIC) and Family Case Management (FCM) programs. During the study's 18-month intervention, Sinai Urban Health Institute will reach out to families of approximately 600 infants to attempt to enroll them into the study and complete the CHW-led visual inspection for lead-based paint hazards. When warranted, a full lead inspection and risk assessment by CDPH's licensed lead inspector will take place for testing and mitigation, if needed.

**Contact:** Helen Margellos-Anast, MPH. (773) 257 5259 [helen.margellos@sinai.org](mailto:helen.margellos@sinai.org)  
Award: \$499,987 ILLTS0005-17

**Project Title:** National Evaluation of the Housing and Neighborhood Impact of the HUD Lead-Based Paint Hazard Control (LHC) Program, 1993-2016

**The Regents of the University of Colorado** - The primary aim of this technical study is to use existing secondary data to conduct a large-scale national evaluation of the localized benefits of lead-based paint hazard interventions. Specifically, the study team will measure the impact of funding from HUD's LHC programs between 1993 and 2016 on property values and neighborhood health and economic outcomes. They will also provide a detailed analysis of the determinants of effective LHC grantee programs as measured by improvements in housing and neighborhood quality. The results directly contribute to the priority goals and objectives of HUD's Lead Technical Studies program and will provide a useful framework to use existing secondary data to help monitor and evaluate the effectiveness of other LHC interventions.

**Contact:** Stephen Billings, PhD. (704) 995 9627 [Stephen.billings@colorado.edu](mailto:Stephen.billings@colorado.edu) Award: \$ 500,000 Grant #: COLTS0006-17



## **Fiscal Year 2016 (5 HHTS awards)**

**Project Title:** Cost-effective approaches to upgrading residential mechanical ventilation systems to control indoor pollutants of both indoor and outdoor origin and improve asthma-related health outcomes

**Illinois Institute of Technology** - This study, a randomized crossover design, will investigate the effectiveness of three approaches to residential mechanical ventilation systems in existing homes to reduce indoor air pollutants, maintain environmental conditions and ventilation rates, and improve asthma health outcomes. They will also evaluate the impacts on building energy use and the costs of installation and operation for the costs and benefits of using the different systems. The three types of ventilation systems included: (1) continuous exhaust-only ventilation systems; (2) central-fan-integrated-supply (CFIS) ventilation systems with ERV/HRV units and automatic fan-cycler timers integrated into the existing HVAC; and (3) continuous “fully ducted” balanced supply and exhaust ventilation systems with ERV/HRV and dedicated, stand-alone ductwork. Forty-five (45) low-income households in Chicago, IL with at least one asthmatic resident will be recruited for participation in the study. There will be four weeklong periods of IAQ and data collection for approximately one year before installation, followed by four weeklong periods approximately one year after the installation. The team will administer standardized (ATC) asthma outcome questionnaires to residents every 2 months throughout the duration of the study, for a total of 12 months of asthma outcome data collected over the course of two years.

**Contact:** Brent Stephens, Ph.D. (312) 567 3356 [brent@iit.edu](mailto:brent@iit.edu)  
Award: \$ 699,611 Grant #: ILHHU0031-16

**Project Title:** Assessing the Sustainability of Home-Based Health and Environmental Interventions for Children and Older Adults with Asthma

**University of Massachusetts Lowell** - The objective of this proposal is to assess the sustainability of health outcomes and home environment improvements following initial healthy homes educational/behavioral and environmental interventions among children and elders with asthma. The study uses existing HH cohorts in public or subsidized housing to conduct another follow-up round of health and environmental trigger assessments with 100 children and 50 elders with asthma, 2-6 years after the original intervention. The study will evaluate whether an additional “booster shot” intervention by community health workers creates added benefit, improving the sustainability of asthma health indicators and environmental trigger behaviors. The study randomly assigns the 100 asthmatic children that are included in the initial baseline revisit (to assess sustainability over 2-6 years) to either a second/follow-up ‘intervention arm’ or a ‘control arm’ of the study. Those in the study ‘control arm’ will only receive the environmental trigger interventions determined necessary based on the baseline assessments (options include IPM supplies, HEPA vacuum, green cleaning products, bed covers etc.). The ‘intervention arm’ will also receive 2-3 visits by the CHWs for additional asthma health education and social support. Both study arms will undergo a final assessment one year after the re-visit baseline assessments. This approach will enable them to ascertain whether the benefits of the initial multifaceted healthy homes intervention, as measured in the baseline revisit assessment, are improved by either providing another round of environmental interventions and/or by the addition of CHW educational and social support visits.

**Contact:** David Turcotte, ScD. (978) 934 4682 [David\\_Turcotte@uml.edu](mailto:David_Turcotte@uml.edu)  
Award: \$ 700,000 MAHHU0021-16

**Project Title:** Defining Building Microbial Ecology for Post Remediation Verification of Water Damaged Homes

**The University of Tulsa** - The goal of the proposed research is to provide a technically-defensible and economically practical tool for defining the dampness-associated fungal contribution to a building's fungal ecology. Specific objectives include the following: (1) Conduct an extensive, nation-wide field campaign to sample fungi in water damaged and non-water damaged homes; and (2) Leverage this nationwide fungal ecology data to produce indices that quantitatively define the contributions of dampness-associated fungi in U.S. homes. The results will be used to develop indices based on fungal DNA analyses that can be used to identify homes with abnormal patterns (i.e., indicative of mold problems) and to confirm the effectiveness of remediation to mitigate mold and moisture problems. Two field campaigns will be initiated to provide the necessary samples to build and test our indices for assessing moisture-associated fungi in buildings. The first campaign will be a nation-wide effort to sample visible mold on building materials and settled dust in water damaged and non-water damaged homes in a diversity of climatic regions that include 90% of the U.S. population. The second campaign will be conducted to sample water-damaged homes prior to, one month after, and one year after remediation; this campaign be used for testing the fungal index's ability to define clearance following remediation.

**Contact:** Richard J. Shaughnessy, Ph.D. (918) 230 3908 [richard-shaughnessy@utulsa.edu](mailto:richard-shaughnessy@utulsa.edu)  
Award: \$ 699,958 Grant #: OKHHU0033-16

**Project Title:** Assessing the Impact of Smoke-free public Housing on Smoking Behavior, Environmental Tobacco Smoke, other Tobacco use, and Smoking-related Disparities

**Eastern Virginia Medical School** - The study will assess the implementation of a smoke-free housing (SFH) policy implemented in multiunit public housing administered by the Norfolk (VA) Redevelopment and Housing Authority. Data will be collected through longitudinal surveying of residents, focus groups, and environmental sampling and will address the following issues: whether SFH reduces aggregate in-home smoking, resulting in decreased levels of environmental tobacco smoke as well as thirdhand smoke (i.e., tobacco smoke deposited on surfaces; the extent to which SFH disrupts individual smoking behavior, resulting in fewer cigarettes smoked per day and increased willingness to quit; whether SFH promotes increased likelihood of alternative tobacco product use (e.g., e-cigarettes); and whether SFH addresses smoking-related disparities specific to public housing residents. The research will also assess resident satisfaction with the extent to which they were included in discussions about SFH policy change and whether ongoing community engagement during the course of the study could ameliorate any concerns. The study will employ community health workers who are recruited from the resident population.

**Contact:** Andrew Plunk, PhD. (757) 668 6488 [plunkad@evms.edu](mailto:plunkad@evms.edu)  
Award: \$ 504,592 Grant #: VAHHU0035-16

**Project Title:** Smoke-Free Living in Public Housing: Evaluating Compliance and Refining Enforcement of Smoke-free Housing Policy in New York City Public Housing

**The Trustees of Columbia University in the City of New York** - The proposed study addresses four key research gaps including: 1) tobacco health disparities and the importance of effective policy interventions; 2) extending the current Smoke-Free Housing Policy (SFHP) literature to include compliance and enforcement; 3) the need to develop replicable, evidence-based SFHP models; and 4)

applying methodological innovations for a comprehensive study of secondhand smoke (SHS) exposures. The study aims to demonstrate the level of compliance with SFHP in established smoke-free buildings and introduce more robust measures to maximize compliance and refine enforcement measures. It proposes a Harm Reduction, Building Ambassadors and Resident Engagement (HRBR) model of SFHP compliance and enforcement. The collaborative development and evaluation of the HRBR model of SFHP compliance and enforcement will be carried out by employing mixed-methods and translational approaches. The research team will track environmental exposures and health outcomes among residents and compare them at two time points. Results are expected to improve the evidence base for the efficacy of HRBR/SFHP compliance with an aim to disseminate tools and resources to maximize successful HRBR/SFHP implementation in affordable housing settings.

**Contact:** Diana Hernández, PhD. (212) 305 0245 [dh2494@cumc.columbia.edu](mailto:dh2494@cumc.columbia.edu)  
Award: \$ 700,000 Grant #: NYHHU0034-16

### **Fiscal Year 2015 (3 HHTS awards)**

**Project Title:** Fungal Exposure in New York City Low-Income Housing Pre and Post Intervention

**The Trustees of Columbia University in the City of New York** - This study (with partners, the Little Sisters of Assumption Family Health Service and The New York Academy of Medicine) will conduct an intervention study to evaluate low-cost methods for preventing and controlling mold and excess moisture in the homes of New York City children with asthma. The study will focus on the East Harlem neighborhood, a low-income, primarily Latino neighborhood with high asthma prevalence. Methods will be employed to identify and quantify mold in homes before and after remediation, providing the evidence for intervention effectiveness in the short (1 year) and long term (2-5 years). Researchers will also examine the associations between presence of mold and health status, health care use and quality of life among the children with asthma.

**Contact:** Matthew Perzanowski, PhD. (212) 305 3465 [mp2217@cumc.columbia.edu](mailto:mp2217@cumc.columbia.edu)  
Award: \$ 672,158 Grant #: NYHHU0030-15

**Project Title:** Helping Chicago's Westside Adults Breathe and Thrive: Long Term Effectiveness of a Healthy Homes Approach to Improving Respiratory Health (HCWABT II)

**Sinai Health System** - The primary objective of this project is to evaluate the sustained effect of a community health worker-led healthy homes asthma intervention for adults over a 24-month post-enrollment period. Sinai will randomize 135 participants into either a low-intensity intervention or a no-additional-intervention control group at the completion of the 12-month intervention phase. The participants will be followed prospectively for 12 months. In addition, Sinai will assess the costs and benefits of implementing a low-intensity maintenance phase following the initial intervention. This study will evaluate progress towards the objectives of: 1) improving asthma control; 2) decreasing urgent health resource utilization; and, 3) improving asthma-related Quality of Life.

**Contact:** Helen Margellos-Anast, MPH. (773) 257 5259 [helen.margellos@sinai.org](mailto:helen.margellos@sinai.org)  
Award: \$ 677,658 Grant #: ILHHU0029-15

**Project Title:** Thirdhand Smoke Pollution and Remediation in Low-Income Housing

**San Diego State University Foundation** - In this study, San Diego State University plans to work with the Environmental Health Coalition and the City of San Diego Lead Safety and Healthy Homes Program to study the distribution of third-hand (THS) smoke residue in 200 low income homes. THS residue refers to nicotine and other toxic chemicals such as lead and tobacco-specific carcinogens, which settle on surfaces within a home. The study will also examine factors that affect THS levels in the tested homes (e.g., the presence or absence of a smoke-free housing policy) and will also assess the efficacy of three different approaches to cleaning the THS residue. THS residue samples will be collected immediately after and again in three months to assess the persistence of residue removal.

**Contact:** Georg E. Matt, Ph.D. (619) 594 2892 [gmatt@mail.sdsu.edu](mailto:gmatt@mail.sdsu.edu)  
Award: \$ 699,866 Grant #: CAHHU0028-15

### **Fiscal Year 2014 (6 awards - 4 HHTS & 2 LTS)**

#### **HHTS**

**Project Title:** Design and validation of sustainable insecticide resistance management strategies for German cockroaches

**Purdue University** - The objective of this research is to define effective resistance management strategies for minimizing cockroach populations in affordable urban housing. The proposed research has three specific objectives: (1) Refine assays for diagnosing insecticide resistance and use them to assess resistance levels to multiple insecticides in cockroach populations from two public housing test sites. (2) Implement integrated resistance management programs at housing sites and compare population changes in response to various treatments. (3) In surviving populations, assess longer-term impacts on population ecology and resistance levels. To accomplish these objectives, the study will utilize low-rise public housing available in Indianapolis IN and Danville IL, with identical replication of the entire study at both locations.

**Contact:** Michael Scharf, PhD. (765) 496 6710 [mscharf@purdue.edu](mailto:mscharf@purdue.edu)  
Award: \$ 659,050 Grant #: INHHU0026-14

#### **Publication:**

Fardisi M, Gondhalekar AD, Scharf ME. (2017). Development of Diagnostic Insecticide Concentrations and Assessment of Insecticide Susceptibility in German Cockroach (Dictyoptera: Blattellidae) Field Strains Collected from Public Housing. *J. Econ. Entomol*, 110(3): 1210–1217. doi: 10.1093/jee/tox076

**Project Title:** Prospective Evaluation of a Comprehensive Smoke-Free Policy in Public Housing in Six US States

**President and Fellows of Harvard College** - The primary objective of this project is to evaluate the effectiveness of an enhanced intervention vs. standard intervention to implement a comprehensive smoke-free policy, in a multi-site, privately managed affordable housing context in six states (MA, CT, RI, VA, ML & PA). The proposed study will undertake three aims: Aim 1: Demonstrate effects of an enhanced intervention on cessation outcomes, among residents who smoke, compared with standard intervention. These outcomes include report of 30-day abstinence from smoking, an increase in quit attempts, and motivations to quit smoking; Aim 2: Show effect of enhanced intervention on individual exposure to

second-hand smoke, compared with standard intervention; Aim 3: Develop the first empirically-based best-practice approach for implementation of smoke-free policies presented as a toolbox to inform future policy initiatives of large private O/As, based on findings of Aims 1 and 2, and qualitative interviews with housing property managers, Residential Service Coordinators, and smoking/non-smoking residents.

**Contact:** Vaughan W. Rees, PhD.(617) 432 6345 [vrees@hsph.harvard.edu](mailto:vrees@hsph.harvard.edu)  
Award: \$724,726 Grant #: MAHHU0025-14

**Publication:**

Anthony J, Goldman R., Rees VW, Frounfelker RL, Davine J, Keske RR, Geller AC. (2019). Qualitative Assessment of Smoke-Free Policy Implementation in Low-Income Housing: Enhancing Resident Compliance. *American Journal of Health Promotion*, 33(1), 107–117.

<https://doi.org/10.1177/0890117118776090>

Geller AC, Rees VW, Brooks DR. (2016). The Proposal for Smoke-Free Public Housing; Benefits, Challenges and Opportunities for 2 Million Residents. *JAMA*. 315(11):1105-1106.

<https://doi:10.1001/jama.2016.1380>

**Project Title:** Removing Home Hazards for Older Adults

**Washington University** - This study proposes to improve older adults' ability to maintain their independence and safety in the community by translating fall prevention research into effective community programs. They established the effectiveness in a pilot program that reduced falls among community-dwelling older adults at high risk for a fall. The intervention needs will be determined by occupational therapists partnering with the St. Louis Area Agency on Aging. The researchers will use a community-engaged research approach to study the intervention in a real-world setting. They will provide cost estimates, fidelity metrics, and intervention manuals to aid in dissemination through the US Aging Services Network.

**Contact:** Susan Stark, PhD. (314) 932 1033 [starks@wusm.wustl.edu](mailto:starks@wusm.wustl.edu)  
Award: \$724,996 MOHHU0024-14

**Publication:**

Stark S, Somerville E, Keglovits M, Conte J, Li M, Hu Y, Yan Y. (2017). Protocol for the home hazards removal program (HARP) study: a pragmatic, randomized clinical trial and implementation study. *BMC Geriatrics*. 17:90 DOI 10.1186/s12877-017-0478-4

**Project Title:** Efficiency of HEPA filtration in reducing traffic-related particle exposures

**University of Cincinnati** - The overall goal of the proposed study is to assess the efficiency of HEPA air filtration for reducing exposure to traffic particles and to explore the effect of this intervention in reducing the severity of children's asthma. The researchers propose a double-blind, placebo-controlled, randomized intervention study with a cross-over design. It will enroll asthmatic children (age 12-14) with high traffic exposure from the CCAAPS cohort. Subjects will be randomized to either HEPA or dummy air purifier (air cleaner without the filter) groups for one month, followed by one-month wash-out period, then will cross-over to the other treatment arm for an additional month.

**Contact:** Tiina Reponen, PhD. (513) 558 0571 [tiina.reponen@uc.edu](mailto:tiina.reponen@uc.edu)  
Award: \$ 688,261 Grant #: OHHHU0027-14

**Publications:**

Peck RL, Grinshpun SA, Yermakov M, Rao MB, Reponen T. (2016). Efficiency of Portable HEPA Air Purifiers against Traffic Related Ultrafine Particles. *Building and Environment* 98: 21-29.

Cox J, Indugula R, Vesper S, Zhu Z, Jandarov R, Reponen T. (2017). Comparison of Indoor Air Sampling and Dust Collection Methods for Fungal Exposure Assessment Using Quantitative PCR. *Environ Sci Process Impacts* 19(10):1312-1319. PMID:28858343

**LTS**

**Project Title:** Enhancing the Performance of Spot Test Kits for Lead Based Paint (LBP) Using Solid-Phase Dilution.

**QuanTech Inc.** - The proposed study aims to complete the development of a test kit that can reliably determine both the presence and the absence of LBP. Successful completion of this study will not only strengthen the RRP rule but will greatly increase the accuracy of LBP determinations. The proposed study is aimed at building upon prior work to: (1) develop a rhodizonate-based kit using the solid-phase dilution method; (2) incorporate a much larger set of tests by multiple operators so that the calculated confidence intervals for the fitted response curves will be small enough to definitively establish the false positive and false negative rates; (3) narrow the uncertainty of the true lead levels in the test panels, and (4) conduct validation testing against a test set of samples approved for evaluation of testing technologies for the determination of LBP.

**Contact:** Gary Dewalt, PhD.  
Award: \$ 498,517

(610) 255 5525 [fgdewalt@quantech.com](mailto:fgdewalt@quantech.com)  
Grant #: MDLTS0003-14

**Project Title:** Exploring the Geographic, Economic & Social Impacts of Childhood Lead Poisoning in Rhode Island

**The Providence Plan** - Building on the successes of a prior study that revealed that the RI 2005 Lead Hazard Regulations have had a measurable effect on reducing the lead burden for children who live in properties with compliance certificates, this proposal plans to use secondary data to assess the effectiveness of lead hazard control activities and regulations. The researchers hypothesize that the development of more detailed findings that identify micro-geographies where enforcement resources are most needed will engage legislators who will want to do right by their constituents. Furthermore, by conducting analysis that provides data about some of the economic consequences associated with childhood lead poisoning, residents and community groups will be more informed and empowered to understand the link between healthy housing and better public health outcomes. This proposal will address two primary research questions; (1) Among children (under 72 months) tested for lead between 2010 and 2014, what types of geospatial associations and other covariates exist relative to blood-lead level (BLL) variation among children and the presence of lead compliance certificates? and (2) Among children (under 72 months) tested for lead between 1997 and 2014, what direct and indirect costs are associated with BLL variation with regard to Medicaid and Early Intervention expenditures, school readiness, academic achievement, student discipline, and juvenile justice involvement? These research questions emphasize studying the relationships between children's residential history and lead exposure as well as examining lead exposure rates within the context of longitudinal education, human services, and juvenile justice data.

**Contact:** Alyssa Sylvaria, MPH. (401) 455 8880 [asylvaria@provplan.org](mailto:asylvaria@provplan.org)

Award: \$ 315,500

Grant #: RILTS0004-14

### **Fiscal Year 2013 (15 HHTS awards)**

In FY 13, OLHCHH awarded 15 healthy homes technical studies cooperative agreements for a total of \$10.5 million. (note: this was an atypical year, more typically the Office makes a total of \$2 - \$3 million in awards for this program in a given fiscal year).

**Project Title:** Improving the Respiratory Health of Alaska Native People through Home-Based Interventions

**Alaska Native Tribal Health Consortium** - Native Alaskans living in southwestern Alaska disproportionately suffer from a high burden of respiratory disease. Compared to the general US infant population, the hospitalization rate for pneumonia in Native Alaskan infants is five times higher, and the pneumonia hospitalization rate for southwestern Native Alaskans is seven times higher. Local health care providers identify respiratory conditions as the primary health problem facing children. The Alaska Native Tribal Health Consortium will expand a pilot project to improve indoor air quality through the implementation of low-cost household remediation in four southwestern Alaska Native villages. The Consortium's Division of Environmental Health and Engineering, in collaboration with regional health care providers, will select four more villages reporting a high incidence of childhood respiratory disease for the continued testing of low-cost home-based interventions to decrease air pollutant levels in thirty new residences over a two-year period. Measures of air quality include fine particulates, volatile organic compounds, carbon monoxide, carbon dioxide and relative humidity. In addition to air quality measures, the project will develop educational materials and provide home-based education to teach and reinforce practices known to reduce indoor air pollutants.

**Contact:** Troy Ritter, MPH.  
Award: \$743,044

(907) 729 5683 [tritter@anthc.org](mailto:tritter@anthc.org)  
Grant #: AKHHU0009-13

### **Publication:**

Singleton R, Salkoski AJ, Bulkow L, Fish C, Dobson J, Albertson L, Skarada J, Kovesi T, McDonald C, Hennessy TW, Ritter T. (2016). Housing characteristics and indoor air quality in households of Alaska Native children with chronic lung conditions. *Indoor Air* xx: 1–9. DOI: 10.1111/ina.12315.

Singleton R, Salkoski AJ, Bulkow L, Fish C, Dobson J, Albertson L, Skarada J, Ritter T, Kovesi T, Hennessy TW. (2017). Impact of home remediation and household education on indoor air quality, respiratory visits and symptoms in Alaska Native children. *International Journal of Circumpolar Health*, 77:1.

**Project Title:** Indoor Air Quality Interventions for Individuals with COPD: Measuring the Impact on Objective Lung Function, Quality of Life, Symptoms, and Health Care Utilization

**The American Lung Association of the Upper Midwest** - In an effort to address the lack of studies that investigate the link between IAQ exposures and quality of life and objective measures of lung function, the American Lung Association of the Upper Midwest is examining the impact of targeted interventions to remediate home indoor air quality (IAQ) threats to residents with chronic obstructive pulmonary disease (COPD) in four tribal communities (Pine Ridge, Cheyenne River, Standing Rock, and Mille Lacs Reservations). The objectives of the study are: (1) to measure the impact that IAQ interventions in tribal

homes have on COPD symptoms; (2) to measure the correlation between IAQ hazards and symptom severity; (3) to improve understanding of the impact of IAQ hazards on people with COPD; (4) to determine the impact of mold remediation on secondary fungal infections; (5) to determine the feasibility of bringing IAQ intervention services to limited income, geographically isolated tribal populations; (6) to measure the impact of IAQ interventions on the health care utilization of individuals with COPD; and (7) to measure the additional impact of the IAQ interventions on children and other household members with respiratory illness.

**Contact:** Jill H. Nesvold, MPH. (651) 223 9578 [jill.heins@LungMN.org](mailto:jill.heins@LungMN.org)  
Award: \$690,558 Grant #: ILHHU0010-13

**Project Title:** Clark County Landlord-Tenant Hotline Study (CCLTHS)

**University of Nevada, Las Vegas** - Clark County, Nevada currently has an existing landlord-tenant hotline managed by the Southern Nevada Health District (SNHD) that was established in May 2011. This pilot hotline has yet to be assessed for cost-benefit and effectiveness at improving housing conditions of Renter Occupied Units (ROUs). The University of Nevada, Las Vegas will evaluate the efficacy and costs associated with mitigating housing hazards through the use of this landlord-tenant hotline. To address significant health and housing disparities, the CCLTHS has outlined specific, measurable program objectives to be accomplished over the 36-month grant production period, which include: 1) Analyze existing (and new) landlord-tenant hotline data (n = 3000) to improve knowledge about the specific types of housing hazards present in ROUs; 2) Evaluate the effectiveness of the landlord-tenant hotline as a means to improve housing-related hazards in ROUs; and 3) Conduct a cost benefit analysis that compares the costs of operating the hotline to the costs and benefits of property remediation in ROUs.

**Contact:** Shawn Gerstenberger, PhD. (702) 895 1565 [shawn.gerstenberger@unlv.edu](mailto:shawn.gerstenberger@unlv.edu)  
Award: \$650,000 Grant #: NVHHU0020-13

**Project Title:** Building Assessment of Radon/Moisture Reduction w/ Energy Retrofits (The BARRIER Study)

**The University of Illinois** - Energy efficiency programs across the country have a primary focus on energy efficiency while also striving to improve occupant health and safety. One common energy improvement is air sealing, which includes interventions such as applying plastic sheeting over bare earth and sealing cracks in concrete foundations. The foundation measures are typically performed to reduce moisture in the home, but there may be additional benefits related to intrusion of soil gases such as radon. Moreover, the actual benefits regarding moisture have not as yet been quantified, and there are potential enhancements that can be made to prevent soil gas migration into the home. The University of Illinois (with its partner, the National Center for Healthy Housing) will assess the potential benefits of a low-cost “enhanced sealing” intervention when conducted in conjunction with home weatherization to improve energy efficiency in low income housing. This study will determine if the enhanced weatherization protocol will reduce radon levels in different housing types in two climate zones in areas with high radon levels, as well as quantifying any benefit in improved moisture control. A total of 160 houses will be randomly assigned to intervention and control groups in each of the two geographic regions. Eligible homes will be those with baseline radon levels of at least 1.5 pCi/L.

**Contact:** Paul Francisco, MS. (217) 244 0667 [pwf@illinois.edu](mailto:pwf@illinois.edu)  
Award: \$747,566 Grant #: ILHHU0012-13



**Project Title:** Residential Air Quality and Chronic Obstructive Pulmonary Disease (COPD)

**Case Western Reserve University** - There is little known about the impact of indoor air pollution on morbidity and mortality from cardiopulmonary diseases. Since the vulnerable populations, infants, young children and the elderly, spend as much as 90 percent of their time indoors, it is key to better understand and address indoor air pollution sources in the home. There has been a great deal of attention to the home environments of asthmatic patients and addressing the triggers in the home is built into the NHLBI medical guidelines for care. However, the home environment of COPD patients has not received similar attention or inclusion in medical care guidelines. Smoking by the patients and exposure to ETS have received much attention in the care of COPD patients, but other elements of the home such as particulates, allergens, and other products of combustion have not. Case Western Reserve plans to conduct an in-depth pilot study of elderly COPD patients cared for at the Louis Stokes Cleveland Department of Veterans' Affairs Medical Center. There will be continuous air quality measurements and at least daily respiratory health measurements in their homes over a two-year period. Following recruitment of these non-smoking COPD patients who have no significant co-morbidities, their homes will have an initial evaluation employing both HUD's Healthy Home Rating System and the moisture- and mold-focused Visual Assessment Tool to specifically assess potential sources of air quality concerns in their homes.

**Contact:** Dorr Dearborn, MD, PhD. (216) 368 5961 [dx9@case.edu](mailto:dx9@case.edu)  
Award: \$749,952 Grant #: OHHHU0022-13

**Project Title:** Kansas City Home Environmental Assessment Research Taskforce (KCHEART)

**The Children's Mercy Hospital** - There have been many studies and extensive reviews that show links between housing hazards and health issues, but the vast majority of this work has focused on interior environmental risks, which are labor intensive to identify. If it were possible to develop an exposure probability model by which a set of available housing data could be used to predict the likelihood of certain health outcomes, this would significantly advance scientific knowledge on risk factors associated with housing and be of particular value in rapidly determining and prioritizing community and neighborhood housing interventions resulting in immediate health benefits - a housing-based primary prevention program. Children's Mercy Hospital plans to develop an exposure probability model through a series of data collection and analysis tasks to evaluate the relationship between housing hazards and health. KC-HEART seeks to validate this model through a combination of health data analysis and community-based home environmental health assessments. They will perform 100 home assessments in the homes of children with no reported chronic health problems to serve as controls for the approximately 300 homes in the Kansas City Metro region that received extensive interventions through two completed Healthy Homes programs. Through this effort, KC-HEART will attempt to provide significant advancement in knowledge about the relationship between basic housing conditions and the health of occupants as well as new knowledge about the relationship between outdoor and indoor environmental characteristics of homes and the methods and data collected to assess these hazards.

**Contact:** Kevin Kennedy, MPH. (816) 960 8918 [kkennedy@cmh.edu](mailto:kkennedy@cmh.edu)  
Award: \$748,727 Grant #: MOHHU0016-13

**Publication:**

Kennedy K, Allenbrand R, Bowles E. (2019) The Role of Home Environments in Allergic Disease. *Clinical Reviews in Allergy & Immunology*. January. <https://doi.org/10.1007/s12016-018-8724-x>

**Project Title:** CARE MORE: Interventions for Cockroach Allergen Reduction and Elimination of Micro-Organisms from the Home Environment

**North Carolina State University** - The public is largely uninformed and confused about the direct and indirect impacts of pests such as cockroaches and bed bugs on humans. In recent years substantial progress has been made to highlight the etiological roles of cockroaches and house dust mites in respiratory disease. However, the roles of cockroaches and emerging pests such as bed bugs in supporting and disseminating microbial pathogens have been largely dismissed as ‘mechanical’ in nature and hence relatively unimportant. NC State will attempt to quantify the association of microorganisms (bacteria and fungi) with cockroach and bed bug droppings and highlight the clinical significance of these household pests. The study hypothesizes that microbes proliferate in association with organic substrates generated by cockroaches and bed bugs, thus contributing significantly to a substantial pool of endotoxins, mold and other triggers of allergies and asthma. This project seeks to quantify the association of microorganisms (bacteria and fungi) with cockroach and bed bug ‘Fras’ and highlight the clinical significance of these household pests. The primary objective of this study is to eliminate obstacles to the implementation of Integrated Pest Management (IPM) and evaluate the impact of two IPM-based interventions in reducing; 1) the numbers of cockroaches and bed bugs; 2) allergen levels (i.e., cockroach, dust mite, mold); and, 3) microorganisms and microbial metabolites in the home. If successful, the interventions would be expected to reduce asthma morbidity in inner-city and other at-risk populations.

**Contact:** Coby Schal, PhD. (919) 515 1821 [Coby\\_schal@ncsu.edu](mailto:Coby_schal@ncsu.edu)  
Award: \$735,264 Grant #: NCHHU0017-13

**Publications:**

Booth W, Balvin O, Vargo EL, Vilímová J, Schal C. (2015). Host association drives genetic divergence in the bed bug, *Cimex lectularius*. *Molecular Ecology* 24: 980–992. <https://doi:10.1111/mec.13086>

DeVries ZC, Mick R, Schal C. (2016). Feel the heat: Activation, orientation, and feeding responses of bed bugs to different host temperatures. *Journal of Experimental Biology* 219: 3773–3780. <https://doi:10.1242/jeb.143487>

Jensen K, Ko AE, Schal C, Silverman J. (2016). Insecticide resistance and nutrition interactively shape life-history parameters in German cockroaches. *Scientific Reports* 6, 28731. <https://doi:10.1038/srep28731>

Ko AE, Bieman DN, Schal C, Silverman J. (2016). Insecticide resistance and diminished secondary kill performance of bait formulations against German cockroaches (Dictyoptera: Blattellidae). *Pest Management Science* 72: 1778–1784. <https://doi:10.1002/ps.4211>

Ko AE, Schal C, Silverman J. (2016). Diet quality affects bait performance in German cockroaches (Dictyoptera: Blattellidae). *Pest Management Science* 72: 1826–1836 <https://doi:10.1002/ps.4295>

Martynova EU, Schal C, Mukha DV. (2016). Effects of recombination on Dengue virus phylogeny. *Archives of Virology* 161: 63–75. <https://doi:10.1007/s00705-015-2642-5>

Matos YK, Schal C. (2016). Laboratory and field evaluation of Zyrox Fly Granular Bait against Asian and German cockroaches (Dictyoptera: Blattellidae). *Journal of Economic Entomology* 109: 1807–1812. <https://doi:10.1093/jee/tow092>

Ko AE, Jensen K, Schal C, Silverman J. (2017). Effects of foraging distance on macronutrient balancing and performance in the German cockroach, *Blattella germanica*. *Journal of Experimental Biology* 220: 304–311 <https://doi:10.1242/jeb.146829>

Matos YK, Osborn JA, Schal C. (2017). Effects of cyclic feeding and starvation, mating, and sperm condition on egg production and fertility in the common bed bug (Hemiptera: Cimicidae). *Journal of Medical Entomology* 18-21. <https://doi:10.1093/jme/tjx132>

Matos YK, Sierras A, Schal C. (2017). Evaluation of the potential for secondary kill for ingested insecticides in the common bed bug (Hemiptera: Cimicidae). *Journal of Economic Entomology* 110: 1218–1225. <https://doi:10.1093/jee/tox082>

Sierras A, Schal C. (2017). Comparison of ingestion and topical application of insecticides against the common bed bug, *Cimex lectularius* (Hemiptera: Cimicidae). *Pest Management Science* 73: 521–527 (cover photo). <https://doi:10.1002/ps.4464>

DeVries ZC, Santangelo RG, Barbarin AM, Schal C. (2018). Histamine as an emergent indoor contaminant: Accumulation and persistence in bed bug infested homes. *PLoS ONE* 13(2): e0192462. <https://doi.org/10.1371/journal.pone.0192462>

**Project Title:** Implementation and Evaluation of a Model Bed Bug Management Program in Low-Income Housing

**Rutgers, The State University of New Jersey** - During the past 12 years, bed bugs have become a major pest in urban communities in the US. Nationwide, low-income housing communities experienced disproportionately higher bed bug infestation rates than the rest of the society. A survey of 16 housing authorities in November 2012 revealed up to 40 percent of the units were infested with bed bugs. Bed bugs are a significant public health pest that is not tolerated by most people. Unlike other common household pests, bed bug bites can cause itchiness, infections, pain, anxiety, loss of sleep, social ostracism and stress. The median control cost per bed bug infested apartment is \$450, which is a large burden to housing authorities. Even at such high cost, only 50% of the surveyed housing authorities saw reduction in bed bug problems. Moreover, repeated applications of pesticides in apartments with an emphasis on treatment of sleeping and resting areas result in greater human exposure to pesticides compared to treatment of other pest problems. Rutgers will design and implement a model bed bug integrated pest management (IPM) program for low income communities that focuses on quality of the pest control contractor's service and participation of the housing staff in monitoring and evaluation. A comparative analysis of the results from this IPM program with those of existing IPM strategies will be performed in an effort to create practical, widely applicable and accepted protocols that will reduce bed bug management costs and improve the health and well-being of residents through effective eradication of bed bugs.

**Contact:** Changlu Wang, PhD. (848) 932 9552 [cwang@aesop.rutgers.edu](mailto:cwang@aesop.rutgers.edu)  
Award: \$342,905 Grant #: NJHHU0018-13

**Publication:**

Wang C, Singh N, Zha C, Cooper R. (2016). Bed Bugs: Prevalence in Low-Income Communities, Resident's Reactions, and Implementation of a Low-Cost Inspection Protocol, *Journal of Medical Entomology*, May; 53(3):639-646. Epub 2016 Apr 5.

**Project Title:** Cost-Effective Detection of Multi-Family Housing-Related Health and Safety Hazards

**Rutgers, The State University of New Jersey** - In the U. S., millions of home occupants are exposed to moderate or severe health and safety hazards such as roofing other structural problems, heating and plumbing deficiencies, leaks, and pest problems which are associated with a wide range of health issues from injuries to respiratory illnesses. Several types of housing deficiencies can pose both overt and subtle health hazards, particularly in urban communities, where the lowest-income residents have few options for quality housing and building owners may have limited resources. While the health effects of some indoor pollutants are known, so far there is an inadequate scientific understanding of the interrelationships among indoor chemical reactions, indoor pollutant exposures, health symptoms, building features and maintenance practices, and occupant behavior. Besides building design and technology, building management and policy are also important determinants of occupant health, as organizational issues and psychological variables have often contributed to IAQ problems. Rutgers will test and refine cost-effective methods for detecting health and safety hazards in affordable housing by using laser and infrared imaging equipment capable of detecting structural deficiencies, moisture, mold, breaches in insulation, insect harborages and vermin tracks at very detailed levels and, by leveraging building information models created from laser scan data, to gain systems level understanding of patterns of health and safety hazards. This work will be conducted in at least two multi-family housing sites. The goal of this research is to improve knowledge about the occurrence and patterns of health-related building deficiencies and enhance quality of life for occupants of HUD-assisted and other low-income housing.

**Contact:** Clinton Andrews, PhD. (848) 932 2808 [clintonjandrews@gmail.com](mailto:clintonjandrews@gmail.com)  
Award: \$687,000 Grant #: NJHHU0019-13

**Project Title:** Helping Chicago's Westside Adults Breathe and Thrive: A Healthy Homes Approach to Improving Respiratory Health

**Sinai Health System** - One in twelve people nationally is living with asthma. Of these 25 million people, nearly 73% are adults. Studies consistently show asthma prevalence and associated morbidity to be highest among non-Hispanic Blacks (NHBs) and those living below the federal poverty level. A recent American Lung Association report showed the age-adjusted mortality rate due to asthma among NHBs was three times greater than for non-Hispanic Whites (NHWs). Chicago is one of the cities hardest hit by the surging asthma epidemic. Mount Sinai Hospital (MSH) located in the heart of Chicago's poverty-stricken, primarily NHB, Westside sees disproportionately high numbers of adults with asthma. Sinai Health System will address asthma disparities employing a multi-pronged approach to improve asthma by educating adults to better manage asthma medically and reduce the presence of asthma triggers in the home. The approach will address asthma at three levels: (1) individual; (2) environmental; and, (3) community. The project will document the process and evaluate the success of the initiative in meeting its goals and will use a community-based approach engaging stakeholders and community members to inform study methods and to help ensure a lasting change in the lives of the families and communities. The intervention is an intense environmental assessment, modeled after previous asthma interventions and a current HUD-funded program. Community health workers will make 5-6 home visits over a 12-month period, during which time they will educate participants on asthma and its proper management, assist adults with poorly-controlled asthma to improve asthma management and reduce the presence and effects of home asthma triggers. Expected outcomes for adults are improvement in asthma control, reduction of daytime and nighttime symptom frequency and a reduction in asthma-related health resource utilization. The study will include a cost-benefit and cost-effectiveness analysis.

**Contact:** Helen Margellos-Anast, MPH. (773) 257 5259 [helen.margellos@sinai.org](mailto:helen.margellos@sinai.org)  
Award: \$749,931 Grant #: ILHHU0011-13

**Publication:**

Ramsay J, Schwindt T, Nguyen T, Margellos-Anast H. (2018). Translating a Proven Pediatric Healthy Homes Asthma Intervention to Adults. *Health Promotion Practice*, 19(2), 222–232.  
<https://doi.org/10.1177/1524839916675118>

**Project Title:** Fungal Exposure, Allergic Sensitization and Asthma among Middle-Income Children in New York City (NYC)

**The Trustees of Columbia University in the City of New York** - Mold contamination is common in urban homes and disproportionately affects lower-income families who have less control over conditions conducive to mold growth. A 2004 Institute of Medicine report and several meta-analyses have concluded that mold and other factors related to home dampness are associated with asthma symptoms. However, a majority of this evidence is based on report of dampness or visible mold and not on the measurement of fungal exposure, limiting these studies from demonstrating that fungal exposure was the causative agent, which species of fungi were associated with the health outcomes and whether specific allergic sensitization is an etiological pathway to the asthma-related morbidity. Columbia University will attempt to identify the major fungi across selected homes in NYC and develop a unique panel to quantify NYC-specific fungal burden and test for associations with allergic-sensitization and asthma. The researchers will determine whether or not the individual species and concentrations of domestic dust borne fungi vary across NYC middle-income housing by neighborhood and housing type. They will also determine whether, among 7-8 year olds, higher levels of domestic fungi are associated with allergic sensitization at age 7-8 and with asthma persistence at ages 10-11.

**Contact:** Matthew Perzanowski, PhD. (212) 305 3464 [nj2128@columbia.edu](mailto:njk2128@columbia.edu)  
Award: \$722,378 Grant #: NYHHU0021-13

**Publication:**

Soffer N, Green BJ, Acosta LM, et al. (2018). *Alternaria* is associated with asthma symptoms and exhaled NO among NYC children. *J Allergy Clin Immunol* in press.

**Project Title:** Integrated Pest Management for the Control of Multiple Cockroach Species

**Tulane University** - Exposure to indoor allergens is driving asthma morbidity among inner-city children in the U.S. Cockroach allergen has been linked to hospitalizations for children with asthma, and poor asthma outcomes in studies performed in urban centers throughout the U.S. Within New Orleans, at least 41% of asthmatic children have allergic sensitization to cockroach proteins. Previous research by the study team found that exposure to cockroach allergen in the home was strongly associated with asthma severity as measured by hospitalizations due to asthma. This is consistent with the patterns of childhood asthma seen in other areas of the country, where allergic sensitization to cockroach proteins combined with high concentrations of cockroach proteins in house dust are the strongest correlates of asthma severity in young children. American cockroaches are a major source of asthma-inducing allergens found in homes throughout humid regions world-wide, but there is a large gap in the current understanding of this species because research in the U.S. has focused on geographic areas where American cockroaches do not thrive. Tulane will develop a new integrated pest management (IPM) approach that incorporates strategies targeting American cockroaches along with the German cockroaches that current IPM strategies primarily target. Using classic field ecology techniques of life history tables and mark-release-recapture

studies, combined with the innovative statistical techniques of pathway analysis, the most promising strategies in the IPM arsenal will be identified. This project will culminate in a controlled field trial employing promising techniques to assess the impact on reducing cockroach allergen levels in homes. The objective of this project is to target cockroach control interventions to reduce cockroach allergen in homes across the U.S., including regions in the south where multiple cockroach species thrive

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Award: \$748,610 Grant #: LAHHU0013-13

**Publication:**

Carlson JC, Rabito FA., Werthmann D, Fox M. (2017). The Distribution and Movement of American Cockroaches in Urban Niches of New Orleans. *Clinical Pediatrics*, 56(11), 1008–1012.

<https://doi.org/10.1177/0009922817701169>

**Project Title:** A Cost Benefit Study of Green & Healthy Homes Interventions in Baltimore, Maryland

**University of Maryland, Baltimore County (with their partner the Coalition to End Childhood Lead Poisoning)** - The Baltimore City Health Department estimated an 18 % lifetime prevalence of asthma for Baltimore children in 2006, which was above the state of Maryland (13.1%) and national (12%) prevalence rates. As of 2009 the statewide lifetime prevalence of asthma was just above 17 percent, a 61% increase from 2001. The fact that African America residents of Baltimore have significantly higher rates (6.5 times higher compared to whites) of asthma emergency department (ED) visits identifies asthma as a health disparity issue for African-American children and families. The University of Maryland, Baltimore County will conduct a cost benefit study of the reduction in asthma and associated Medicaid costs resulting from the implementation of the Green & Healthy Homes Initiative (GHHI) in low income homes in Baltimore. Using detailed intervention analysis and full medical and utility cost records, the research team will also study and document improvements in energy efficiency, school attendance and overall systems improvements effected by the GHHI. They will address three primary research objectives: (1) Determine the extent to which green and healthy housing (GHHI) interventions reduce asthma morbidity and costs measured directly as health care utilization and other costs among low- income Baltimore residents; (2) Assess the extent to which GHHI interventions reduce non-medical costs related to school absences, utility usage, and work-loss days for parents or caregivers of children with asthma; and (3) Evaluate how varying intensity levels of GHHI interventions impact post-intervention resident health and overall cost savings.

**Contact:** David Salkever, PhD. (410) 455 8459 [salkever@umbc.edu](mailto:salkever@umbc.edu)  
Award: \$749,856 Grant #: MDHHU0015-13

**Project Title:** Healthy Homes for Elders: Multi-Trigger, Multi-Component Environmental Interventions for Asthma

**University of Massachusetts, Lowell** - Studies show that asthma and other respiratory diseases disproportionately affect minority and low-income residents, particularly among vulnerable populations such as children and elders. The U. of Massachusetts, Lowell will evaluate the hypothesis that multi-trigger, multicomponent healthy homes interventions improve the respiratory health and reduce home asthma triggers for the elderly. The partnership for this project is experienced in working with diverse communities in the target city of Lowell, MA, and brings together the city's only university, the Lowell Housing Authority, the Lowell Community Health Center and the Massachusetts Department of Public

Health's Asthma Prevention and Control Program. The researchers will enroll 90 elders with asthma or chronic obstructive pulmonary disease (COPD) with a reactive airways component who reside in low-income, multi-ethnic public housing. Data will be collected on respiratory health outcomes before and after healthy homes intervention and exhaled nitric oxide (a measure of lung inflammation) will be measured. Home environmental assessments will also be conducted, including evaluation of asthma trigger-inducing activities and exposures before and after healthy homes intervention.

**Contact:** David Turcotte, ScD. (978) 934 4682 [David\\_Turcotte@uml.edu](mailto:David_Turcotte@uml.edu)  
Award: \$749,999 Grant #: MAHHU0014-13

**Project Title:** Filter Forensics: A Novel Method for Exploring Asthma Triggers for Children in Low-income Rural Homes

**The University of Texas at Austin** - The prevalence and severity of childhood asthma is increasing in the United States. Recent data indicates that children in rural areas have similar asthma rates and asthma morbidity may be an even greater concern for these children. Identification of environmental factors in the home that contribute to the development or exacerbation of asthma in children is an active area of research. In some studies, the level of a particular allergen or microbial agent in the home is associated with asthma development or asthma severity while, in other studies, the relationship is unclear. The majority of indoor studies conducted to date have relied on the collection and analysis of settled dust samples or short-term air samples to assess exposure to indoor asthma triggers. While useful, these “grab” samples may not provide the most accurate measure of indoor contaminant levels over time and thus may contribute to the seemingly contradictory results reported in the literature. The U. of Texas at Austin will conduct research utilizing an alternative contaminant sampling method. The proposed research will examine the merits of using HVAC filters as passive, integrated samplers of indoor airborne contaminants in homes to evaluate the relationship between environmental contaminant concentrations (asthma triggers) in HVAC filter dust and asthma severity and quality of life factors for asthmatic children. The study will focus on investigating the home environment of a particularly vulnerable population – rural and primarily low income, school age children diagnosed with asthma in central Texas. To provide a basis for comparison, contaminant levels in homes of children without asthma from the same study population will also be evaluated.

**Contact:** Kerry Kinney, PhD. (512) 232 1740 [kakinney@mail.utexas.edu](mailto:kakinney@mail.utexas.edu)  
Award: \$683,805 Grant #: TXHHU0023-13

**Publication:**

Maestre JP, Jennings W, Wylie D, Horner SD, Siegel J, Kinney KA. (2018). Filter Forensics: microbiota recovery from residential HVAC filters. *Microbiome* 6:22, <https://doi.org/10.1186/s40168-018-0407-6>

Givehchi R, Maestre JP, Bi C, Wylie D, Xu Y, Kinney KA, Siegel JA. (2019). Quantitative filter forensics with residential HVAC filters to assess indoor concentrations. *Indoor Air* 1-13  
<https://DOI:10.1111/ina.12536>

Bi C, Maestre JP, Li H, Zhang G, Givehchi R, Mahdavi A, Kinney KA, Siegel J, Horner SD, Xu Y. (2018). Phthalates and organophosphates in settled dust and HVAC filter dust of U.S. low-income homes: Association with season, building characteristics, and childhood asthma. *Environment International* 121:916–30 <https://doi.org/10.1016/j.envint.2018.09.013>

## Fiscal Year 2012 (5 HHTS awards)

**Project Title:** Measuring the Asthma-related Costs and Benefits of a Large-scale, State-funded Healthy Homes Program to Inform Medicaid Policy for Residents with Asthma

**Health Research, Inc. /New York State Dept. of Health** - This study provides a unique opportunity to assess the effectiveness of a healthy home approach in providing home-based environmental interventions to residents with asthma. It will generate evidence about the effectiveness of home-based environmental interventions when implemented on a large-scale and in real-world urban and rural settings. The scale and structure allow for stratification in the analysis, providing critical information about the impact of targeting the intervention to residents with poorly controlled asthma, sub-populations (e.g., adults) and the type of dwelling and professional staff providing the intervention. It has the potential to directly inform policy development in several states seeking to make healthy housing costs reimbursable by Medicaid which can increase access to and sustainability of healthy housing services. . While the primary focus is to articulate the benefit-cost ratio for asthma-related outcomes, the study will also capture the range of benefits associated with the costs of delivering services in the context of a comprehensive healthy homes' intervention helping to promote this more holistic approach. As a result of earlier, rigorous cost-benefit analysis, certain lead hazard identification costs became Medicaid reimbursable; this study proposes to do the same for asthma.

**Contact:** Marta Gomez, MS. (518) 402 7603 [marta.gomez@health.ny.gov](mailto:marta.gomez@health.ny.gov) Award: \$500,000 Grant #: NYHHU0004-12

### Publications:

Reddy AL, Gomez M, Dixon SL. (2017). The New York State Healthy Neighborhoods Program: Findings from an evaluation of a large-scale, multisite, state-funded healthy homes program. *Journal of Public Health Management and Practice* 23(2), 210-218. March/April.

Reddy AL, Gomez M, Dixon SL. (2017). An evaluation of a state-funded healthy homes intervention on asthma outcomes in adults and children. *Journal of Public Health Management and Practice* 23(2), 219-228. March/April.

Gomez M, Reddy AL, Dixon SL, Wilson J, Jacobs DE. (2017). A cost-benefit analysis of a state-funded healthy homes program for residents with asthma: Findings from the New York State Healthy Neighborhoods Program. *Journal of Public Health Management and Practice* 23(2), 229-238. March/April.

**Project Title:** Impact of Green Renovations on Asthma and IEQ in Public Housing: The role of phthalates, glycol ethers, flame retardants, perfluorinated compounds and PCBs.

**Silent Spring Institute** - The study collaborates with the Green Housing Study (GHS) to analyze additional chemicals of emerging concern, including phthalates, glycol ethers, flame retardants, perfluorinated compounds, and PCBs. The indoor environment is known to be an important source of exposure to these compounds where they are either present in building materials or products used by the occupants. It evaluates the associations between household levels of phthalates and glycol ethers and asthma symptoms in children. It also analyzes how green renovations affect exposure to phthalates, glycol ethers and EDCs (flame retardants, perfluorinated compounds, and PCBs). The CDC/HUD GHS is evaluating the effect of green renovation in urban public housing on asthma symptoms and measures of IEQ, including mold, particulate matter, and VOCs. The main objectives are to evaluate the influence of the targeted chemicals on asthma in children in public housing and the impact of green renovations on



relevant measures of IEQ and personal exposure; evaluate the association between measured phthalate and glycol ether exposures and asthma symptoms in children already diagnosed with asthma in public housing; and evaluate the impact of green renovations on IEQ in HUD-sponsored projects. To accomplish these objectives, the study team will conduct additional chemical analyses on air, dust, and urine samples being collected in the Boston and Cincinnati GHS, collect additional air samples for semi-volatile compounds and collaborate with the GHS to extend the analysis to include the chemicals of emerging concern. Exposure and outcome measurements will be taken 12 months after planned renovations. Regression analyses will be used to test for an association between asthma symptoms (pulmonary function, inflammatory marker, and self-reported symptoms) and exposures, while controlling for known asthma risk factors. It will also use the same data to evaluate differences in IEQ and exposures based on renovation status in all GHS units. The analyses will identify significant differences between green renovated and control units and will use air exchange measures being collected in the GHS. An exploratory analysis will be conducted in a subset of homes in the HUD-funded BRIGHT Study to evaluate the impact of the occupant on indoor environmental quality by sampling prior to and during occupancy.

**Contact:** Ruthann Rudel, MS. (617) 332 4288 [rudel@silentspring.org](mailto:rudel@silentspring.org)  
Award: \$699,793 Grant #: MAHHU0005-12

#### **Publications:**

Dodson RE, Udesky JO, Colton MD, McCauley M, Camann DE, Yau AY, Adamkiewicz G, Rudel RA. (2017). Chemical exposures in recently renovated low-income housing: Influence of building materials and occupant activities. *Environment International*. 109: 114-127.

Dodson, RE, Bessonneau V, Udesky JO, Nishioka M, McCauley M, Rudel RA. (2019). Passive indoor air sampling for consumer product chemicals: a field evaluation study. *Journal of Exposure Science and Environmental Epidemiology*. 29: 95-108.

**Project Title:** WSU Center for Urban Studies HHRT Three-city Survey

**Wayne State University** - HUD has adapted and is distributing for use, an English/Welsh rating tool, the Housing Health and Safety Rating System (HHSRS). The U.S. version is called the Healthy Homes Rating Tool (HHRT). It is intended to assess home health hazards and to guide home improvements for the HUD Healthy Homes Production Grants. This tool has substantial potential to produce systematic measurement of 29 different hazards occurring in American housing units. This has broad significance to identifying and remedying health hazards in American housing. The study examines the adaptation of the HHSRS (as the HHRT) for the U.S., investigating the ratings produced and the reliability of the ratings. The main objectives of the study is to assess the extent to which housing hazards measured by the Healthy Homes Rating Tool (HHRT) vary across cities in the U.S. when compared to England; assess the reliability of assessments completed using the HHRT; to test the effect on assessors of providing likelihood's and outcomes based upon U.S. (or even local) data; and assess the effect of training on assessment quality and reliability. The Center will subcontract with local community organizations in Detroit, MI, Oakland, CA and Atlanta, GA to implement and evaluate to determine the reliability of the HHRT assessment protocol in approximately 1,500 housing units.

**Contact:** Thomas L. Thompson, PhD. (313) 577 5209 [ad5122@wayne.edu](mailto:ad5122@wayne.edu)  
Award: \$692,221 Grant #: MIHHU0006-12

**Project Title:** Indoor Air Quality and Energy Efficiency: Establishing baselines before and after home weatherization measures

**Appalachian State University** - The objective of this study is to further our knowledge of the relationship between residential weatherization measures and IEQ conditions in homes. It will do this by establishing baselines before and after weatherization which will identify potential hazards that can be used to assess mitigation strategies. Specifically, the study will establish baselines for priority indoor contaminant concentrations (particulate matter, total volatile organic compounds, radon, formaldehyde, carbon monoxide and nitrogen dioxide), carbon dioxide, temperature and relative humidity, before and after weatherization. It will then compare measurements for individual homes before and after weatherization for definitive results on how weatherization affects indoor air contaminant concentrations. Then correlate activities in participants' daily log, building characteristics and ventilation status, and weatherization measures implemented with environmental data collected. Finally, it will test the effects of different ventilation strategies—including exhaust fans and ERVs—on post-weatherization contaminant levels and perform one-year follow-up monitoring on a minimum of 60 percent of the first season homes.

The study is conducted in our two NC community action agency areas (mountain and coastal climate zones), IEQ monitoring will be conducted in site-built and manufactured homes in approximate proportion to their prevalence in each agency area. Participants will be recruited from the agencies' low-income clientele receiving weatherization services. The ASU research team will collect IEQ data before and after weatherization in a total of 72 test homes, with 12 additional homes acting as controls. During 189 home visits, real-time monitoring equipment will be set up in each home for a 5-6 day indoor and outdoor data collection period.

**Contact:** Susan Doll, ScD. (828) 262 3119 [dollsc@appstate.edu](mailto:dollsc@appstate.edu)  
Award: \$696,810 Grant #: NCHHU0007-12

**Project Title:** Modeling the Impact of Building-wide Energy Retrofits on Environmental Exposures and Occupant Health

**Boston University** - The study intends to develop a simulation model that can be used to obtain key insights on how deep energy retrofits and other interventions can drive changes in indoor pollutants, which in turn impacts pediatric asthma and health care outcomes in multi-family housing. It will be applicable both to measures that are specifically designed to improve occupant's health and to the common situation in which buildings are being designed or retrofitted to minimize energy consumption or otherwise be "green", in which the health dimension is often not directly considered. In addition, cost-benefit analysis will be conducted and will include a prioritized list of interventions based on energy savings, health impacts and intervention costs. The approach can be applied to any type of building or population.

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Award: \$466,070 Grant #: MAHHU0008-12

**Fiscal Year 2011 (3 HHTS awards)**

**Project Title:** Eliminating Barriers to IPM Adoption in Low-income Homes: Comparative Efficacy, Costs, Insecticide Resistance, Environmental Residues and Allergen Mitigation

**North Carolina State University** - The study plans to improve the cost/benefit relationship of the choice of pest control tactics in residential settings; reduce potential human health risks from cockroaches and the pesticides used by consumers to control infestations; and minimize adverse environmental effects of pesticide foggers within the home. This study will provide science-based support and step-by-step approaches that can readily be implemented in low-income housing. They will test the efficacy of foggers in the context of promoting reduced-risk and IPM practices in low-income households, conduct a cost-benefit analysis of the use of foggers in comparison to reduced-risk and IPM-compatible approaches, measure and document the environment and human health impacts of using foggers, and develop approaches for cockroach elimination to implement in low-income housing.

**Contact:** Coby Schal, PhD. (919) 515 1821 [coby\\_schal@ncsu.edu](mailto:coby_schal@ncsu.edu)  
Award: \$541,179 Grant #: NCHHU0001-11

**Publications:**

DeVries ZC, Santangelo RG, Crissman J, Mick R, Schal C. (2019). Exposure risks and ineffectiveness of total release foggers (TRFs) used for cockroach control in residential settings *BMC Public Health* 19:96 <https://doi.org/10.1186/s12889-018-6371-z>

Wada-Katsumata A, Silverman J, Schal C. (2013). Changes in Taste Neurons Support the Emergence of an Adaptive Behavior in Cockroaches. *Science Vol 340*. May

**Project Title:** Venting For Health

**National Center for Healthy Housing** - The study will measure the health outcomes of a healthy housing intervention that combines energy conservation with improved ventilation and air shaft sealing in three multifamily buildings in the Surfside Gardens development owned by NYCHA in Coney Island, Brooklyn, New York. It will characterize the health of occupants in approximately 120 dwelling units in a multi-family building undergoing energy and ventilation improvements. Half of the building's ventilation shafts will receive standard weatherization upgrades, and the other half will receive enhanced ventilation upgrades, including the achievement of best practice ASHRAE 62.1 ventilation requirements, sealing ventilation shafts to reduce duct leakage and balancing ventilation exhaust flows, and air sealing between units to achieve the maximum compartmentalization between units. As used for this study, "health status" is defined as self-reports of respiratory health and measures of cardiovascular, mental and overall health using a CDC-standardized data collection instrument. Also, air samples will be collected and analyzed for CO, CO<sub>2</sub>, VOCs, and formaldehyde over a 24-hour period in a sub-sample of 24 non-smoking units before and one year after the ventilation improvements.

**Contact:** Jonathan Wilson, MPP. (410) 539 4162 [jwilson@nchh.org](mailto:jwilson@nchh.org)  
Award: \$649,533 Grant #: MDHHU002-11

**Project Title:** Neighborhood Associated Domestic Risk Factors Accounting for Asthma Persistence

**The Trustees of Columbia University in the City of New York** - Approximately 330 children in high and low asthma prevalence neighborhoods in New York City will be followed for 3 years from ages 7-8 to ages 10-11. The research will assess changes in lung function and an airway inflammation biomarker (exhaled Nitrous Oxide) and will test the following hypotheses; children living in high asthma prevalence neighborhoods will have more asthma symptoms and less lung function growth; household black carbon (a surrogate for combustion by-products) and household allergen exposure will be associated with less lung function growth and greater airway inflammation; and density of truck routes and buildings burning residual oil will be associated with less lung function growth.

**Contact:** Matthew Perzanowski, PhD. (212) 305 3465 [mp2217@columbia.edu](mailto:mp2217@columbia.edu) Award: \$650,000 Grant #: NYHHU0003-11

**Publications:**

Mainardi TR, Mellins RB, Miller RL, et al. (2013). Exercise-induced wheeze, urgent medical visits, and neighborhood asthma prevalence. *Pediatrics* 131:e127-35.

Rosa MJ, Yan B, Chillrud SN, et al. (2014). Domestic airborne black carbon levels and 8-isoprostane in exhaled breath condensate among children in New York City. *Environ Res* 135:105-10

Quinn A, Tamerius JD, Perzanowski M, et al. (2014). Predicting indoor heat exposure risk during extreme heat events. *Science of the Total Environment* 490:686-93.

Chen Q, Zhong X, Acosta L, et al. (2016). Allergic sensitization patterns identified through latent class analysis among children with and without asthma. *Ann Allergy Asthma Immunol* 116:212-8

Perzanowski MS, Ono JG, Acosta LM, et al. (2018). Distinct Serum Sphingolipid Profiles among School-age Children with Exercise-induced Wheeze and Asthma Persistence. *AJRCCM* in press.

**FY2010 Awards (5 HHTS awards)**

**Project Title:** Synergistic Effect of Home Exposure to Aeroallergens and Traffic-Related Air Pollution in the Development of Children's Asthma

**University of Cincinnati** - The main objective of this study is to assess the possible synergistic effect of exposure to aeroallergens and traffic-related air pollution on the development of asthma and allergic disease in children. The hypothesis is that the association between aeroallergen exposure and the development of asthma in children at age seven is modified by exposure to traffic-related air pollution (TRAP). The study will: a) Determine child-specific average and cumulative exposure to TRAP from birth through age seven utilizing geographic information system-based models and address history; b) Determine child-specific average and cumulative aeroallergen exposure levels from birth through age seven, combining currently available and newly obtained exposure levels to incorporate change of residence into the exposure estimates; and c) Perform multiple logistic and linear regression analyses to assess the synergistic effects of aeroallergen exposures and traffic-related air pollution on asthma, allergic asthma, and allergen sensitization. The study has strong foundation on an existing birth-cohort study, Cincinnati Childhood Allergy and Air Pollution Study (CCAAPS), which includes 762 children in the Greater Cincinnati metropolitan area. This study will generate unique new insights that will help understand the health effects related to environmental exposures in homes and lead to improved early prediction, cost-effective testing and diagnosis of disease, which will ultimately reduce morbidity and mortality.

**Contact:** Tiina Reponen, PhD. (513) 558 0571 [tiina.reponen@uc.edu](mailto:tiina.reponen@uc.edu)  
Award: \$268,709 Grant #: OHLHH0226-10

**Publications:**

Reponen T, Lockey J, Bernstein DI, Vesper S, Levin L, Khurana-Hershey GK, Zheng S, Ryan P, Grinshpun SA, Villareal M, LeMasters G. (2012) Infant origins of childhood asthma associated with specific molds. *J. Allergy Clin. Immunol.* 130:639-644. PMID: 22789397

Reponen T, Levin L, Zheng S, Vesper S, Ryan P, Grinshpun SA, Lemasters G. (2013) Family and home characteristics correlate with mold in homes. *Environ Res.* 124:67-70. PMID: 23683889.

**Project Title:** Reducing Ethnic/Racial Asthma Disparities in Youth 2 (READY 2) Study: A Cost Analysis Study

**Massachusetts Department of Public Health** - The READY2 study will evaluate the effect of low-cost home interventions on improving outcomes for children with uncontrolled asthma and determine the direct and indirect costs associated with this intervention, with a particular emphasis on Medicaid enrolled children. This study will evaluate: the ability of a home-based environmental and asthma education intervention to increase self-protective behaviors by families, such as vacuuming or storing food and reducing clutter in order to reduce pests, resulting in reduced in-home asthma triggers; and the cost effectiveness and cost benefit of this intervention in order to inform insurance coverage discussions in MA and nationally. READY2 will enroll 160 families over three years, to be combined with the data from 100 families in the READY1 pilot, for a total of 260. The target population for this intervention is low income, minority children ages 2 – 13 with poorly controlled asthma and who live in the urban communities of Boston and Springfield. The study will examine a number of key measures, including environmental triggers in the home (such as cockroaches and dust), parental behaviors to improve home environment (such as use of mattress covers and vacuuming), urgent care use, number of symptom days, use of rescue medication, number of exacerbations requiring oral steroids, and pediatric asthma parent/caregiver quality of life.

**Contact:** Jean Zotter, JD. (617) 994 9807 [jean.zotter@state.ma.us](mailto:jean.zotter@state.ma.us)  
Award: \$949,071 Grant #: MALHH0227-10

**Project Title:** Improving Asthma Outcomes through Cockroach Control - The NOROACH Project (New Orleans Roach and Asthma in Children Project)

**Tulane University** - The primary objective for this study is to evaluate the North Carolina Cockroach Reduction Program (NCRP), a modified and cost-efficient IPM program, in New Orleans inner-city atopic, asthmatic children; determine the degree to which the NCRP program reduces cockroach counts; and determine the degree to which the NCRP reduces levels of cockroach antigen in the home. Fifty children in both the intervention and control groups will receive total and allergen-specific IgE testing, home assessments of allergen exposures, educational materials on allergen exposures and asthma, and information on study results. At 2-month intervals, the parents/guardians of all study participants will be contacted to ascertain asthma symptoms, health care utilization, and other secondary outcomes. At the conclusion of the study, the intervention will be provided to control group homes. The researchers expect to find a reduction in the maximum number of symptom days as well as a reduction in cockroach count and allergen levels in the intervention homes.

**Contact:** Felicia Rabito, PhD. (504) 988 3479 [rabito@tulane.edu](mailto:rabito@tulane.edu)  
Award: \$942,465 Grant #: LALHH0228-10

**Publication:**

Rabito FA, Carlson JC, He H, Werthmann D, Schal C. (2017). A single intervention for cockroach control reduces cockroach exposure and asthma morbidity in children. *Journal of Allergy and Clinical Immunology* 140: 565–570. <https://doi:10.1016/j.jaci.2016.10.019>

**Project Title:** Benchmarking the Benefits of Green Public Housing: Health, Comfort and Environmental Performance

**Harvard University** - This 3-year study will focus on understanding the benefits of green public housing, as measured by changes in reported health problems, comfort and environmental exposures. The project's major elements include: Development of performance-based evaluation framework; Longitudinal study of 25 residents in 'green' housing (new construction); Longitudinal study of 25 residents in 'green' renovation projects; and Development of a resident education program. The study will take place in several new construction and rehab projects of the Boston Housing Authority, which incorporate 'green' elements. The project will advance the current state of knowledge by developing survey and inspection tools that identify and prevent potential health problems in public housing and measuring the effect of 'green' projects on resident health, comfort and satisfaction.

**Contact:** Gary Adamkiewicz, PhD. (617) 384 8852 [gadamkie@hsph.harvard.edu](mailto:gadamkie@hsph.harvard.edu)  
Award: \$942,788 Grant #: MALHH0229-10

**Project Title:** Health and Environmental Aspects Linked to Housing Ventilation (HEALTH-V Study)

**University of Illinois-Chicago** - This study employs a randomized controlled trial to evaluate two widely used ASHRAE ventilation standards that are often included in weatherization and other housing improvements. This study will determine the impacts on health and the indoor environment associated with the choice between two different residential ventilation protocols—ASHRAE 62-1989 and ASHRAE 62.2—in the course of weatherization work performed in low-income housing. These standards are widely used, but health outcomes associated with each have not been previously studied. The two hypotheses are: 1) Using a ventilation protocol leads to improved health and indoor environment conditions relative to conditions in homes before improvements; and 2) Adopting ASHRAE 62.2 results in significant health and indoor environment improvements compared with ASHRAE 62-1989. Participants will be recruited through three low-income home weatherization programs in Ohio, Indiana and Illinois. Each participating state weatherization agency will recruit 35 participating homes (n=105). The study will leverage \$37,255 in weatherization funding to implement ventilation improvements in low-income housing.

**Contact:** David E. Jacobs, PhD. (312) 413 4030 [dejacobs@uic.edu](mailto:dejacobs@uic.edu)  
Award: \$896,967 Grant #: ILLHH0230-10

**Fiscal Year 2009 (7 HHTS awards)**

**Project Title:** Integrated Pest Management (IPM) Intensity Impact Study

**Boston Public Health Commission** - The implementation of pest control activities in Boston Housing Authority housing developments occurs at differing levels of IPM intensity. The study will examine these variations in intensity of IPM and their impact on health outcomes. The hypothesis of the proposed IPM Intensity Impact Study is that, in public housing, households which receive more intensive IPM activities will experience more substantial health benefits and more sustained improvements in indoor environment quality. The study also hypothesizes that a dose-response relationship exists between intensity of IPM activities and the health and environmental quality benefits.

**Contact:** Margaret Reid. (617) 534 2673 [MReid@bphc.org](mailto:MReid@bphc.org)  
Award: \$799,503 Grant #: MALHH0193-09

**Publication:**

Shah SN, Fossa A, Steiner AS, Kane J, Levy JI, Adamkiewicz G, Bennett-Fripp WM, Reid M. (2018). Housing Quality and Mental Health: The Association between Pest Infestation and Depressive Symptoms among Public Housing Residents. *J Urban Health* 95: 691. <https://doi.org/10.1007/s11524-018-0298-7>

**Project Title:** Bacteria and Bacterial Immuno-modulators in Moisture Damaged Versus Reference Homes

**University of Cincinnati** - Bacteria and bacterial contaminants in moisture-damaged homes have not received as much attention from researchers and federal agencies, as have allergens and molds. Moisture-damaged building materials, however, serve as perfect niches for bacterial growth. Previous studies demonstrated significantly higher concentration and larger diversity of bacteria in moisture-damaged building materials as compared to non-damaged ones. Several studies have investigated airborne bacteria and endotoxin in office buildings and non-water damaged homes in the United States. However, no scientific information has been published that would help understand the prevalence of bacteria and bacterial immunomodulators in moisture-damaged homes. This study includes the assessment of bacteria and bacterial immunomodulators in high-ERMI (Environmental Relative Moldiness Index) and low-ERMI homes. The homes will be selected from those participating in the ongoing HUD-funded project “Mold Exposure in Homes and the Development of Children’s Atopy and Asthma” and the NIEHS-funded project “Cincinnati Childhood Allergy and Air Pollution Study (CCAAPS)”. This study focuses on key housing-related bacterial biocontaminants previously implicated in human health: gram-positive and gram-negative bacteria, *Streptomyces*, and bacterial immunomodulators including endotoxin, peptidoglycan, and total bacterial DNA.

**Contact:** Atin Atikhari, PhD. (513) 558 0500 [atin.adhikari@uc.edu](mailto:atin.adhikari@uc.edu)  
Award: \$554,845 Grant #: OHLHH0199-09

**Project Title:** Efficacy of Removing Hazards in Homes of Elderly at Risk for Fall

**Washington University** - Older adults who visit the emergency room for treatment after a fall have a significant risk of falling again in the subsequent 12 months (52%). Development of an effective intervention for fall reduction could have an immediate impact for this population and high public health significance. Intensive home hazard removal has been established as an effective environmental intervention for the prevention of falls; however, none of the published studies have been conducted in the US, and no study has adequately controlled for biases. This study is a double-blinded, randomized sham-controlled clinical trial to determine the efficacy of an intensive tailored home hazard removal intervention to reduce the cumulative incidence of falls among 110 community-dwelling older adults who visit the emergency room because of a fall. This three-year study will be the first to utilize a sham control group and a double-blind, randomized study design. The primary hypothesis will be tested by comparing the 12-month cumulative incidence of falls in an intensive tailored home intervention group with falls in a sham control group. The secondary hypothesis will be tested by comparing total number of falls, number of injurious falls, fear of falling and performance in daily activities between the intervention and sham control group.

**Contact:** Susan Stark, PhD. (314) 932 1033 [starks@wusm.wustl.edu](mailto:starks@wusm.wustl.edu)  
Award: \$599,937 Grant #: MOLHH0196-09

**Publications:**

DeLaney LM, Hu Y, Keglovits M, Somerville EK, Baum CM, Stark SL. (2016) Predictors of Engagement in Home Activities Among Community-Dwelling Older Adults. *Physical & Occupational Therapy In Geriatrics*. 34:4, 205-220. <http://dx.doi.org/10.1080/02703181.2016.1268237>

Stark S, Somerville E, Conte J, Keglovits M, Hu Y, Carpenter C, Hollingsworth H, Yan Y. (2018). Feasibility trial of tailored home modifications: Process outcomes. *American Journal of Occupational Therapy*, 72, 7201205020. <https://doi.org/10.5014/ajot.2018.021774>

**Project Title:** Fungicidal Activities of Green Products for Mold Remediation

**Saint Louis University** - In recent years there has been an increased emphasis in public, private and consumer sectors on the desirability of “green products” to protect people and the environment. This has motivated a search of green products for cleaning and disinfection of mold. Several new green commercial products are already in the market for mold remediation. Most of these are derived from natural sources or they include active ingredients considered harmless to people, but their effectiveness for mold treatment remains unknown. The study will test green products as an ancillary component of the current OHHLHC-funded project. This involves testing immediate and residual fungicidal efficacies of commercial mold remediation agents. The premise of the ongoing project is that the products currently favored by the mold remediation industry destroy or prevent mold growth for a short-term at best, and their residual or long-term activities remain largely unknown. The experiments will consist of inoculation of select structural building materials with fungal species frequently found growing on building substrates in high humidity environments or after moisture incursion, followed by their treatment with select commercially available “green” formulations to assess both short term and long-term fungicidal activities. The effects of “green” products on fungal allergens and toxic fungal metabolites will also be examined.

Contact: Anupma Dixit, PhD. (314) 977-3221 [dixita@slu.edu](mailto:dixita@slu.edu)  
Award: \$326,245 Grant #: MOLHH0195-09

**Project Title:** Evaluation of Cardiovascular Health Benefits of In-Home Air Filtration

**City of Somerville/Tufts University** - The study partners are the City of Somerville Housing Division, Schools of Medicine and Engineering at Tufts University, Somerville Housing Authority and the Somerville Transportation Equity Partnership (STEP). The study will measure the potential health benefits of air cleaning technology in homes adjacent to highways in Somerville, MA, just north of Boston. This study builds on an NIEHS-funded investigation of health effects in people exposed to highway pollution (“CAFEH” - Community Assessment of Freeway Exposures and Health). CAFEH is a study measuring cardiovascular health biomarkers in relation to exposure to ultrafine particles (UFP) and other air pollutants in the near-highway environment. This study will test the hypothesis that use of air filtration technology in near-highway residences will lead to measurable reductions in the levels of airborne UFP and biomarkers of cardiovascular health risk.

Contact: John Durant, PhD. (617) 627 5489 [John.durant@tufts.edu](mailto:John.durant@tufts.edu)  
Award: \$749,893 Grant #: MALHH0194-09

**Publications:**

Padró-Martínez LT, Owusu E, Reisner E, Zamore W, Simon MC, Brown CA, Chung M,



Mwamburi M, Brugge D, Durant JL. (2015) A randomized cross-over air filtration intervention trial for reducing cardiovascular health risks in residents of public housing near a highway. *International Journal of Environmental Research and Public Health*, 12: 7814-7838. PMC4515693

Brugge D, Reisner E, Padró-Martínez LT, Zamore W, Owusu E, Durant JL. In-home air filtration for improving cardiovascular health: Lessons from a CBPR study in public housing. *Progress in Community Health Partnerships: Research, Education, and Action*. 2013; 7:49-56. PMC3663298.

**Project Title:** Healthy Seniors Healthy Homes

**The Trustees of Columbia University in the City of New York** - Household-related injury and illness is a substantial public health problem particularly as it relates to the nation's growing population of elderly residents. While household hazards and their effects are fairly well characterized in households with children, similar information on the elderly is very limited. Assessment studies are needed to improve our understanding of the epidemiology of households' hazards in the elderly, as well as intervention studies to reduce risk in this population. This project is a household hazards assessment and hazards reduction intervention study, using a pre/post-test design. This is developing a reliable and low-cost method to identify and mitigate hazards in households of disadvantaged elderly residents, using a community-based participatory research (CBPR) study.

**Contact:** Robyn Gershon, DrPH. (212) 305 1186 [rg405@columbia.edu](mailto:rg405@columbia.edu)  
Award: \$799,947 Grant #: NYLHH0198-09

**Project Title:** Developing an Affordable Bed Bug Monitoring Tool and Community-based Bed Bug Management Programs in Low-Income Housing

**Rutgers University** - Bed bug infestations have increased during the past decade and have become a serious concern, particularly for low-income housing residents. Bed bugs cause pain, sleep deprivation, anxiety, social ostracism, as well as significant economic loss. Current costs associated with bed bug eradication are high and often beyond the financial capability of residents or public housing authorities. New infestations often go unnoticed until they have developed into more serious and deeply rooted infestations. Bed bug monitoring devices employing new technologies have recently been introduced into the market, but their high cost makes them out of reach for most people. The study proposes to: 1) develop and optimize a low-cost bed bug monitoring tool, and 2) develop and evaluate the effectiveness of a community-based bed bug IPM program. The proposed research is based on existing knowledge of bed bug behavior and the use of non-chemical and chemical bed bug management tools.

**Contact:** Changlu Wang, PhD. (732) 932 9552 [cwang@aesop.rutgers.edu](mailto:cwang@aesop.rutgers.edu)  
Award: \$251,453 Grant #: NJLHH0197-09

**Publications:**

Singh, N., C. Wang, R. Cooper, and C. Liu. 2012. Interactions among carbon dioxide, heat and chemical lures in attracting the bed bug, *Cimex lectularius* L. (Hemiptera: Cimicidae). *Psyche*. doi:10.1155/2012/273613.

Wang, C., and R. Cooper. 2012. The future of bed bug monitoring. *Pestworld* 2012 (January/February): 1-6.

Wang, C., W. Tsai, R. Cooper, and J. White. 2011. Effectiveness of bed bug monitors for detecting and trapping bed bugs in apartments. *Journal of Economic Entomology* 104: 274-278.

Wang, C., and R. Cooper. 2011. Detection tools and technologies. *Pest Control Technology* 39(8): 72, 74, 76, 78-79, 112.

### **Fiscal Year 2008 (7 HHTS awards)**

**Project Title:** Evaluation of Re-Suspended Particles from Carpeted versus Uncarpeted Flooring for Dust Control and Improved Indoor Air Quality

**Clarkson University** - Installing hard flooring instead of carpeting is often recommended to improve indoor air quality in residences and to reduce asthma prevalence. However, evidence to support this recommendation is lacking. Carpeting is less expensive than hard wood flooring, which makes it an obvious economic choice for affordable housing. An unbiased, definitive study is needed to estimate the level of exposure reduction based on flooring choice and other important environmental factors. The proposed research will provide the needed scientific knowledge to make informed decisions on flooring choices for low-income housing that will minimize human exposure to pollutants and related impacts on human health. The research will quantify resuspension of dust particles from human activities, model human exposures associated with resuspended particles, and communicate the results and associate recommendations in a clear, effective manner.

**Contact:** Andrea Ferro, PhD

**Award:** \$ 500,000

**Grant #:** NYLHH0168-08

**Project Title:** Intervention Trial to Reduce Indoor Nitrogen Dioxide and Carbon Monoxide Concentrations in Baltimore City Homes

**Johns Hopkins University** - Gas-powered ranges and stoves and other improperly adjusted appliances can add dangerous gaseous pollutants nitrogen dioxide (NO<sub>2</sub>) and carbon monoxide (CO) to the indoor environment. A previously studied showed that almost 14 percent of the homes in Baltimore City used gas stoves for heat, almost exclusively seen in the context of poverty, highlighting the complex interaction of poverty with environmental exposures in an inner-city minority population. Since the presence of a gas stove or gas heater and the use of a space heater or gas or oven for heat may be associated with higher NO<sub>2</sub> and CO concentrations, changes made to the home heating and cooking devices may be a feasible means to reduce these exposures in the home and subsequently decrease the burden of asthma and other respiratory diseases. The study involves 100 homes randomly assigned to one of three intervention treatment groups. The three interventions are replacement of gas stove by electric stove, installation of a range hood with ventilation to the outdoors, and placement of an air purifier in the home. All participants will receive educational materials on health effects of NO<sub>2</sub>, CO and other indoor pollutants, general methods to reduce NO<sub>2</sub> and CO concentrations in the home and energy efficiency tips. Indoor NO<sub>2</sub>, CO and airborne nicotine will be measured during the run-in period/prior to randomization and post intervention occurring at one week, three, six, nine and twelve months after intervention.

**Contact:** Nadia Hansel, MD

**Award:** \$750,000

**Grant #:** MDLHH0166-08

**Publication:**

Paulin LM, Diette GB, Scott M, McCormack MC, Matsui EC, Curtin-Brosnan J, Williams DL, Kidd-Taylor A, Shea M, Breysse PN, Hansel NN. (2013). Home interventions are effective at decreasing indoor nitrogen dioxide concentrations. *Indoor Air*. Dec 14. <https://doi:10.1111/ina.12085> [Epub ahead of print] PMID: 24329966

**Project Title:** Long-Term Fungicidal Efficacies of Most Favored Antimicrobial Products in Mold Remediation

**Saint Louis University** - In a recent (2007) survey of current mold remediation practices conducted by the principal investigator under the auspices of HUD grant MOLHH0137-05, greater than 80% of the survey participants acknowledged using antimicrobial products in mold projects. This contrasts with EPA guidance which discourages the use of biocides for mold remediation. Peer-reviewed scientific data supporting the effectiveness of chemical agents for mold control and prevention on building materials are very limited. The applicant proposes to validate the fungicidal activities and long-term efficacies of antimicrobial products and coatings currently favored by the mold industry professionals

**PI:** Anupma Dixit, PhD Award: \$500,000

**Grant #:** MOLHH0167-08

**Project Title:** Greensboro, NC, Private Multifamily Housing IPM Study

**National Center for Healthy Housing** - The grantee is assessing the effectiveness and cost of IPM compared to traditional pesticide applications in private, low income, multifamily rental housing. The owners and residents in 300 units in Greensboro, NC are receiving education, assistance, and incentives to adopt IPM. Effectiveness will be measured through cockroach trap counts and resident questionnaire in all dwelling units and allergen and pesticide levels in dust samples from a 20 percent sample of units.

**PI:** Jane Malone.

**Award:** \$350,000

**Grant #:** DCLHH0169-08

**The following FY 2008 cooperative agreements were funded through funds made available through the American Recovery and Reinvestment Act of 2009:**

**Project Title:** Moving Into Green Healthy Housing – The Yield in Health Benefits (MIGHHTY)

**University of Illinois at Chicago** - The grantee will partner with the National Center for Healthy Housing, the Center for Neighborhood Technology and Brinshore Development. The study will evaluate the health and monetary benefits for 300 low-income households that move from stressed unhealthy public housing into green affordable healthy housing, by analyzing Medicaid expenditures before and after residents of Chicago public housing move into new housing that met high-performance green healthy housing specifications. While the project design was suitable, in order to obtain quantitative results with broader applicability and a greater degree of statistical confidence than proposed, the OHHLHC is requiring a somewhat larger sample size than proposed; in order to accommodate this change, the award was increased above the proposed project budget. The Illinois Department of Healthcare and Family Services will provide access to and help interpret the Medicaid data.

**PI:** David E. Jacobs, PhD, CIH Award: \$978,982

**Grant #:** ILLHH0191-08

**Project Title:** Watts and Well-Being: Do Residential Energy Conservation Upgrades Improve Health?

**National Center for Healthy Housing** - The grantee will study how residential energy conservation measures in over 500 housing units affect the health of the occupants. The work will be performed in single family housing units in Boston and multifamily housing units in Chicago. The researcher measures respiratory, cardiovascular, mental health and overall health status before the measures are undertaken, and again one year after the measures are completed. At the same time, in a subsample of the housing units, the researcher will measure carbon dioxide, carbon monoxide, oxides of nitrogen and particulate matter levels.

**PI:** David E. Jacobs, PhD.

**Award:** \$792,570

**Grant #:** MDLHH0190-08

**Project Title:** Project TEACH (Targeting Environmental Aspects of Children's Health)

**University of Texas Health Science Center at San Antonio** - The applicant will identify and educate 140 children and families on environmental hazards in the home that can potentially expose them to lead and to known asthma triggers in an effort to improve the overall quality of life. The families will receive an environmental assessment with recommendations, as well as training on lead exposure and asthma triggers. The applicant will partner with the San Antonio Metropolitan Health District, Housing Neighborhood Services of the city of San Antonio, and the South-Central Area Health Education Centers.

**PI:** Victor German, MD

**Award:** \$326,962

**Grant #:** TXLHH0192-08

**Fiscal Year 2007 (3 HHTS awards)**

**Project Title:** Urban Moisture and Mold Program- Continuation Project

**Case Western Reserve University** - The Urban Moisture and Mold Program- Continuation Project (UMMP-2) plans to extend the previous studies performed with the HUD grant entitled Cuyahoga County Urban Moisture and Mold Program (original UMMP). The goal is to obtain longitudinal data on both the participants and on the homes that were remediated as part of the original UMMP in order to ascertain the sustainability of both the health and housing improvements. In addition, Dr. Dearborn's laboratory has recently found that mycotoxins produced by *Stachybotrys chartarum* form covalent adducts on proteins providing an analytical biomarker for exposure to this mold. The grantee will analyze archived serum and house dust samples for this biomarker and the related mycotoxins, respectively; whereupon these data can be analyzed in the context of the clinical symptom profiles previously gathered. The original UMMP explored the relationship between mold, moisture, asthma triggers and the respiratory health of children living in inner city neighborhoods throughout Greater Cleveland.

**PI:** Dorr Dearborn, MD, PhD

**Award:** \$359,197

**Grant #:** OHLHH0161-07

**Project Title:** How Much is Too Much to Wheeze?: Asthma Clinical Assessment and Standardized Allergen Sampling

**The Boston Medical Corporation** - The grantee will conduct robust standardized clinical assessments of 200 children with asthma, together with side-by-side allergen sampling in their homes, using three methods of settled dust collection and two metrics (loading and concentration). Eureka Mighty Mite,

HSV- 4 vacuum, and an AIHA vacuum protocol will be used to measure three allergens (Der p1, Bla g1, MUP) with individual, single-surface, non-composited samples collected from three rooms (child's bedroom, living room and kitchen.). All three methods have been used in previous field studies, and all are being evaluated in the laboratory study by the U. of Minnesota that HUD has previously funded. Statistical analyses will be performed to determine whether there are significant differences in the predictive power of the different methods by unit of measure and room sampled.

**PI:** Megan Sandel, MD

Award: \$855,655

Grant #: MALHH0163-07

**Publication:**

Sandel M, Murphy JS, Dixon SL, Adgate JL, Chew GL, Dorevitch S, Jacobs DE. (2014). A side-by-side comparison of three allergen sampling methods in settled house dust. *J Expo Sci Environ Epidemiol*. 2014 Nov; 24(6):650-6. PMID: [24802556](#); DOI: [10.1038/jes.2014.30](#);

**Project Title:** Mold Exposure in Homes and the Development of Children's Atopy and Asthma

**University of Cincinnati** - The main objective of this study is to identify an optimum method that is most predictive of the adverse health effects caused by mold exposure, especially the development of asthma and allergic rhinitis. The study will test two newly developed concepts for the evaluation of moldy buildings: 1) the Relative Moldiness Index (RMI) based on data analyzed by the Mold Specific Quantitative Polymerase Chain Reaction (MQPCR) assay and 2) the fungal fragment sampling (in combination of two newly-developed assay methods). These methods will be tested in a population-based study using the existing birth cohort of the Cincinnati Childhood Allergy and Air Pollution Study (CCAAPS)

**PI:** Tiina Reponen, PhD

Award: \$785,148

Grant #: OHLHH0162-07

**Publication:**

Reponen, T., Levin, L., Johansson, E., Ryan, P., Burkle, J., Grinshpun, S. A., Zheng, S., Khurana, H. G. K. (2011). High environmental relative moldiness index during infancy as a predictor of asthma at 7 years of age. *Annals of Allergy, Asthma and Immunology*, 107(2): 120-6.

**Fiscal Year 2006 (4 HHTS awards)**

**Project Title:** A Field Study of the Growth and Removal of Microorganisms and Allergens on Carpet

**Saint Louis University** - The applicant will conduct field studies at two locations to test the efficacy of two different methods for reducing levels of dust mites, fungi, and their allergens in carpet. The methods to be tested in approximately 120 homes include dry vacuuming and biocide compared to dry vacuuming and dry steam injection/extraction, with both compared to a control (dry vacuum) group. Study sites include both a Midwestern temperate climate (St. Louis, MO area) and a more consistently humid coastal location in New Zealand. This project follows a completed, HUD-funded laboratory study by the applicant that examined the growth of dust mite allergens and fungi in carpets.

**PI:** Roger Lewis, PhD

Award: \$ 495,732

Grant #: MOLHT0109-06

**Project Title:** Comparison of Samplers for Measuring Common Allergens in Inner City Homes

**University of Minnesota** - The main objectives of this laboratory-based study are to: (1) estimate the variability in the bulk dust and allergen collection efficiency for four vacuum samplers commonly used in allergen health effects studies; (2) quantify the effect of key environmental and sampler characteristics on allergen collection efficiency; (3) develop an empirical model that adjusts for varying collection efficiency, with the goal of making between-and within-study comparisons feasible, and supporting the development of health-based guidelines for allergens. The applicant will develop a reference dust (for use in calibrating sampling and analytical techniques) using bulk dust obtained from a recently completed HUD-funded allergen intervention study.

**PI:** John Adgate, PhD.

**Award:** \$490,000

**Grant #:** MNLHH0153-06

**Publication:**

Adgate JL, Banerjee S, Wang M, McKenzie ML, Hwang J, Cho JS, and Ramachandran G. (2013). Performance of dust allergen carpet samplers in controlled laboratory studies. *J Expo Sci Environ Epidemiol* 2013 Jul 2;23(4):385-91. Epub 2013 Jan 2.

**Project Title:** The Relationship Between Housing and Health: A 30-Year Retrospective Analysis to Forecast Change

**National Center for Healthy Housing** - The applicant proposes an analysis of existing housing and health databases, including the American Housing Survey, the National Health and Nutrition Examination Survey, U.S. Census data, and the Residential Energy Consumption Survey. The applicant proposes to merge the databases and to conduct data analyses to identify associations between housing conditions (and their change over time) and health endpoints (including their change over time) over a period of several decades. The applicant proposes to develop a model using housing variables to predict health status, and to “validate” the model using the National Health Interview Survey data. The applicant would then develop forecasting models to estimate future health status of the U.S. population based on housing trends and apply the results towards improving housing assessment tools and to improve housing interventions.

**PI:** Dave Jacobs, PhD

**Award:** \$150,120

**Grant #:** MDLHH0154-06

**Publication:**

Jacobs D, Wilson J, Dixon S, Smith J, Evens A. (2009) The relationship of housing and population health: A 30-year retrospective analysis. *Environmental Health Perspectives*, 117(4):597-604.

**Project Title:** Sampling of Biological Contaminants from Surfaces in Flooded Homes of New Orleans: Development, Evaluation and Implementation of a new Cost-Effective Protocol

**University of Cincinnati** - The proposed project utilizes a novel testing method, recently developed with HUD funding, for determining the aerosolization potential of mold and other biological contaminants growing on building surfaces (floor and mattress surface of each home). The project would explore the application of this tester prototype for aggressive sampling from floor and mattress surfaces of 50 homes in New Orleans that had been subjected to hurricane-related flooding. The researchers would then model the data to assess the potential inhalation exposure to biological contaminants associated with excess

moisture. Samples would be analyzed for, mold (using Beta-glucan, a surrogate for total fungal biomass), endotoxin, and dust mite allergens.

**PI:** Sergey Grinshpun, PhD

Award: \$400,000

Grant #: OHLHH0155-06

**Publications:**

Adhikari A, Lewis J, Grinshpun S, et al. Exposure matrices of endotoxin, (1→3)-β-d-glucan, fungi, and dust mite allergens in flood-affected homes of New Orleans. *Science of the Total Environment* [serial online]. October 15, 2010;408(22):5489-5498. Accessed April 9, 2012.

Sung-Chul, S, Reponen, T, Levin, L, Borchelt, T, & Grinshpun, S. (2008) Aerosolization of Particulate (1→3)-β-D-Glucan from Moldy Materials, *Applied & Environmental Microbiology*, 74, 3, pp. 585-593.

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