

Smart City Research Cluster

Final Research Report, Part 1

FedEx Institute of Technology

Project title: **Integrated Healthy Homes Assessment and Intervention for Children in Memphis**

Project PI: Pratik Banerjee, Assistant Professor, School of Public Health

RESEARCH EXECUTIVE SUMMARY

Two deleterious health-outcomes traditionally associated with poor housing and income levels – asthma and lead-based paint poisoning are significant problems among minority children in Memphis and Shelby County. Memphis was named as the nation’s top 3 “Asthma Capital” for five consecutive years (2011 to 2015). Moreover, Memphis has one of the highest percentages of substandard housing in the nation. Home environmental factors such as mold, allergens, dust mites, etc. are known to have a causal relationship with asthma and other respiratory illnesses. Indoor mold exposure has been studied extensively, and the results of scientific studies indicate that exposure can lead to increased severity of respiratory symptoms including asthma. Mold exposure does not necessarily have to be from the visible mold; exposure can also come from the invisible mold such as microscopic mold spores. The results of previous studies indicated that high-risk homes with exposure to high levels of molds would have a significant impact in developing respiratory illnesses.

Population-based environmental and clinical studies have shown asthma and lead poisoning often occur together, especially in urban, low-income minority children because of their increased vulnerability to both illnesses through environmental exposures. But most intervention studies target either one. Thus, no concrete information is available on the efficacy of integrated environmental assessment and interventions on lead and asthma health outcomes. This calls for attention to the unmet need of comprehensive environmental remediation investments addressing these two urban health problems. The proposed study addresses this research gap by implementing a comprehensive environmental assessment and intervention program combining both lead poisoning and allergic asthma under one umbrella. To develop and test this integrated healthy homes assessment and intervention (IHAI) regimen, we added supplementary activities (focusing on asthma trigger exposures in form of comprehensive mold assessment) to the ongoing lead intervention demonstration programs (LIPs) in Memphis and Shelby County, Tennessee.

In this project, we evaluated the burden of visible and invisible molds (known as allergic asthma triggers) in residences in Memphis. Dust samples from participating homes (with or without visible mold issues) were collected using a specialized vacuum filter collector. To estimate the concentration and diversity of the molds, we extracted DNA from dust samples and performed

metagenomic analysis by high-throughput sequencing of mold-specific internal transcribed spacer (ITS) genes, real-time PCR, followed by robust bioinformatics analysis.

Our metagenomic analysis has detected more than fifty different genera of molds which were predominant in house dust samples from both types of residences (with or without visible mold). We also analyzed samples for prominent mold species known to cause respiratory health effects. Pathogenic molds such as *Stachybotrys spp.* (black mold), *Alternaria alternate*, *Aspergillus niger*, *Chaetomium globosum*, *Cladosporium sphaerospermum* were detected in both types of homes. Our study underscores the need for continuous mold monitoring using sensitive and accurate methods (such as sequencing or PCR) that can detect potential mold contamination in homes regardless of the visual inspections.

Describe any next steps in your research agenda that have emerged from this project. (E.g., Revisions to methodology, new research questions, etc.) (250 words)

Based on the findings of this pilot study we have planned the following next steps:

We plan to recruit at least 30 new homes. Following recruitment, we will conduct the following activities to implement IHAI.

- (1) Administer home walkthrough questionnaire. We will use an abridged home-environment survey based on standardized HUD and MHE[®] checklists to examine house conditions, housing-related asthma triggers, and health hazards.
- (2) Expand environmental monitoring. Asthma trigger parameters and the UM-SPH developed novel integrated monitoring methods.
- (3) Administer asthma symptom survey. We will use the 4-Week Children's Health Survey for Asthma developed by American Academy of Pediatrics.
- (4) In-home environmental education. We will use the results from in-home environmental assessment to educate and equip asthma patients with the tools based on MHE[®] program guidelines. That will help reduce environmental hazards through behavioral changes, use of green cleaning products (supplied by us), and/or through referrals to outside resources or agencies.

Upon completion of these activities, we will be able to comprehensively assess the efficacy of the IHAI regimen.

List external funding that has been/could be leveraged by this project. Include grants/contracts awarded as well as pending funding opportunities.

Potential external sources of funding that could be leveraged:

1. HUD (Technical Assessment Program)
2. NIEHS (R21, R01)

3. NIH/NIAID (R21, R01)

List any publications / conference presentations that have stemmed from this project.

None to report as of now.

Summarize any student involvement in the project (e.g., classes that participated in the project, graduate assistants, PhD students, etc.) and list the number of students involved. Note whether the project has been connected to any doctoral dissertations.

The study was conducted by University of Memphis MPH student Bhavin Chauhan under the supervision of UofM School of Public Health faculty members, Drs. Pratik Banerjee and Chunrong Jia.

Total number of students involved: 1 (MPH)