

Improving Air Quality in Vulnerable, Near-source Households

Reducing the burden of air pollution on residents of near- source homes by designing, testing, and implementing low-cost intervention strategies with community partners

Urban Air Quality – Boston

Motivation

Air pollution is the second leading cause of premature death in the world, and the WHO estimates within 20 years deaths associated with air pollution will surpass those from all communicable diseases combined. Globally, the materially poor most acutely experience the burden of air pollution, with ultrafine particles (UFP; < 100 nm in diameter) associated with the most damage to human health. In urban America, UFP concentrations are frequently 10-100x higher near roadways and airports, where poverty rates are high, subsidized housing is disproportionately common, and incidence of asthma and cardiovascular disease are substantially higher than in the general population. There is a great need for technically sound, inexpensive, and culturally acceptable interventions that improve lives and reduce deaths through cleaner air inside households near sources of hazardous air pollutants. There are a number of possible strategies for reducing UFP concentrations in these homes, but they vary substantially in cost and accessibility. The Air Quality team exists to co-design effective strategies for reducing air pollutant exposure and product-service systems for expanding access to these strategies for at-risk populations in Boston.

Stakeholders

Our stakeholders are members of near-roadway and near-airport communities of East Boston and Winthrop – an estimated 15% of who experience asthma-like symptoms. Our stakeholders are representative of the 10% of Americans (35 million people) who live within 100 m of a highway or near a major airport.

Status

This is the fourth semester of the Air Quality track in ADE. Adviser Scott Hersey works extensively in the field of air quality and leads Olin's Air Quality Impact (AIR) Group. Previous semesters' teams worked to test the efficacy of a number of in-home interventions aimed at reducing indoor exposure to air pollutants (including UFPs). For the next 2 semesters (FA18-SP19), the ADE Air Quality will deep-dive into technical and venture design for a pilot venture that aims to facilitate the installation of air quality improvement strategies into near-source homes in East Boston and Winthrop. The pilot program is scheduled to launch during the summer of 2019.

Proposed activity

The ADE-AQ team will consist of two subteams who will work closely with one another: 1. Technical Design and Validation and 2. Venture Design. The Technical Design subteam will use mechanical design tools and air quality monitoring instrumentation to a) design and prototype low-cost, in-home air quality improvement products, and b) validate the effectiveness of air quality improvement strategies in real-world homes occupied by community partners. The Venture Design subteam will conduct in-depth prior art research, generate a business model, and identify and apply for funding to support a pilot program.

Talents needed

In general, team members will need to have a desire to learn from and engage with stakeholders in a diverse urban context.

Skills needed:

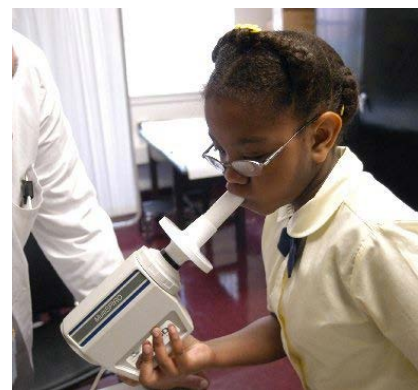
- Entrepreneurship for social benefit
- Cross-cultural competency and confidence to engage stakeholders in their context
- Mechanical design and prototyping to build and test an in-window filter fan
- Experimental design and data analysis to assess intervention effectiveness

Desired skills:

- Bilingual in Spanish
- Some EE/CE experience to modify instrument control software/firmware via serial port communications

Collaborators

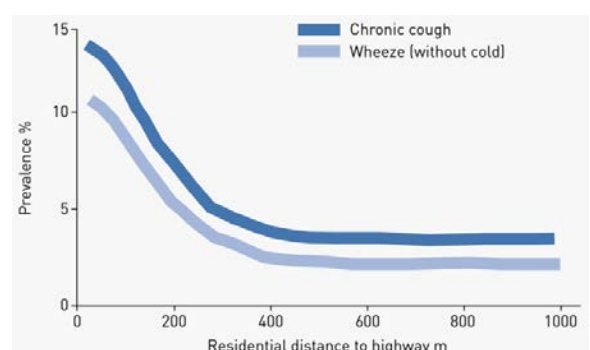
Airport Impact Relief, Incorporated (AIRInc; an East Boston air advocacy group), East Boston Social Center (EBSC), East Boston Community Health Center (EBCHC), Winthrop Airport Hazards Committee.



A young resident being tested for asthma.



Aircraft landing over homes in East Boston.



Incidence of pulmonary disorders in residents as a function of distance from UFP source.