

Exposure to Traffic-Related Air Pollution, Home Dust, and the Respiratory Mycobiome

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Background

- Exposure to traffic-related air pollutants (TRAP) has been associated with exacerbation of existing asthma and incident asthma among young and adolescent children
- Aggregates of elemental carbon nanoparticles are retained by the lung tissue, can induce pulmonary oxidative stress, and stimulate the inflammatory response by the release of cytokines from airway cells
- TRAP can increase adherence of microorganisms to the epithelial cells of the respiratory tract by damaging cells in epithelial layers of respiratory tract
- Bacterial diversity in sputum was found to be greater in asthmatic vs. non-asthmatic adult subjects
- Similar to how the gut microflora affect the development of the immune system, the airway microbiome may interact with the immune system in the respiratory tract
- Home health care workers are exposed to TRAP during travel between patients' homes. Indoor environment and work activities in patients' homes can contribute to elevated microbial exposures.

Aims

- Specific Aim 1:** Characterize the fungal community profiles of the lower respiratory tract mycobiome.
- Specific Aim 2:** Determine the association between exposure to TRAP and the mycobiome of the lower respiratory tract.
- Specific Aim 3:** Characterize the fungal community profiles of home dust samples and compare the taxa and diversity indices to those of the lower respiratory mycobiomes of the two exposure groups.

Methods

- 40 participants ages 13-15 were recruited from the Cincinnati Childhood Allergy and Air Pollution study (CCAAPS) cohort from two a priori TRAP exposure categories:
 - A. high exposure through age one and high exposure at early adolescence
 - B. low exposure through age one and low exposure at early adolescence

Methods, continued

- Collected induced **sputum**, saliva, and **home dust samples**
- Characterize fungal microbiome (**mycobiome**) of sputum and home dust samples using Illumina MiSeq with the amplification of the internal transcribed spacer (ITS) region of fungal ribosomal DNA
- Measure total fungal DNA using quantitative PCR with universal fungal primers
- Assess the associations between total fungal DNA, fungal operational taxonomic units (OTUs), and diversity indices of sputum and TRAP exposure
- Compare the sputum mycobiome to the home dust mycobiome using principle component analysis of taxa and diversity indices

Expected Results

- We hypothesize:
 - that high exposure to TRAP alters the lower respiratory tract microbiome
 - that there are taxa that overlap between that fungal community and the home dust mycobiome
- See Figure 1 for study rationale and expected results

Future Directions

- The knowledge gained from the proposed study provides preliminary data to conduct a larger investigation that focuses specifically on home health care workers and their occupational environments
- Further research into respiratory health outcomes from these combined exposures

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Questions or Comments?

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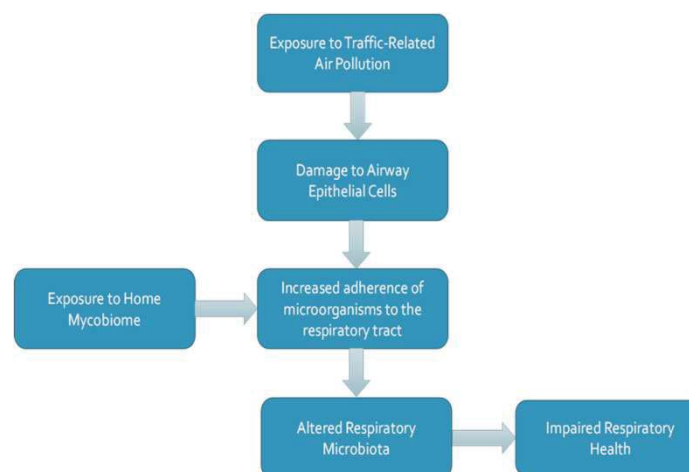


Figure 1. A flow chart describing the study rationale and expected results



University of Cincinnati 19th Annual Pilot Research Project Symposium October 11-12, 2018



Pilot Research Training Program (PRP) Overview

Welcome to the University of Cincinnati Education and Research Center's (ERC) 19th Annual Pilot Research Project (PRP) Symposium on October 11-12, 2018, held in the Kowalewski Hall Auditorium. The purpose of the PRP is to increase the research capacity of research trainees and young investigators in occupational health and safety and to encourage those in related disciplines to pursue occupational health and safety research.

Under the administrative direction of Dr. Amit Bhattacharya and Dr. Gordon Gillespie, research proposals are solicited and peer-reviewed annually by qualifying faculty and graduate students from the University of Cincinnati and the following PRP partnering institutions – Air Force Institute of Technology, Bowling Green State University, University of Toledo – Health Science Campus, Central State University, Purdue University, University of Kentucky, Western Kentucky University, Eastern Kentucky University, Murray State University, Ohio University and Kentucky State University.

At this symposium, the 2017-18 awardees will be presenting the results of their research and the 2018-19 awardees will make poster presentations of their proposed work. The keynote speaker on Thursday, October 11, 2018 is Captain Lauralynn McKernan from the CDC/NIOSH Division of Surveillance, Hazard Evaluation and Field Studies, presenting on "Listen to the Music: How Rock 'n' Roll Provides Touchstones for the Evolution of Occupational Health."

The University of Cincinnati's Education and Research Center is one of 18 national centers funded by the National Institute for Occupational Safety and Health (NIOSH). Dr. Tiina Reponen serves as the director of the ERC, which is based in the University's Department of Environmental Health within the College of Medicine. The purpose of the ERC is to train professionals in the didactic and research skills necessary to lead in occupational safety and health disciplines. Results of research are translated into action through an outreach program and shared with professionals and practitioners in the region via continuing education.

Since 1999, the PRP program has allocated over \$1.4 million to support 239 pilot research projects. These projects have served as a catalyst in bringing over \$41 million in additional research support to the region from sources independent of the PRP program, such as, the National Institute for Occupational Safety and Health (NIOSH), National Institutes of Health (NIH), United States Department of Agriculture (USDA), National Science Foundation (NSF), and the Centers for Disease Control and Prevention (CDC). Additionally, the PRP has brought 55 new investigators from other fields of expertise to the area of occupational safety and health research.

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