Pilot study of mold populations inside and outside of Puerto Rican residences

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Bolaños-Rosero, B., **D. Betancourt**, T. Dean and S. Vesper. 2013. Pilot study of mold populations inside and outside of Puerto Rican residences. Aerobiologia. 29 (4) 537-543.

- Disclaimer: The US Environmental Protection Agency (EPA) through its Office of Research and Development, collaborated in the research described here. Although this work was reviewed by EPA and approved for publication, it may not necessarily reflect official EPA policy. Mention of trade names, commercial products does not constitute endorsement or recommendation by the EPA for use. Since MSQPCR technology is patented by the US EPA, the Agency has a financial interest in its commercial use

Overview

- Objectives
- Introduction
- Methods
- Results
- Discussion
- Future Directions

Objectives

- Study mold exposures in PR homes using the Environmental Relative Moldiness Index (ERMI) metrics
- Determine the feasibility of using ERMI metrics to study the high incidence of asthma in PR

Introduction – Asthma Facts

Asthma continues to be a serious public health problem. According to the Centers for Disease Control and Prevention:

- An estimated 25.9 million people, including almost 7.1 million children, have asthma.
- Asthma prevalence is higher among persons with family income below the poverty level.
- Almost 14 million people reported having an asthma attack in a recent government survey.
- Asthma accounts for more than 15 million physician office and hospital outpatient department visits, 4, 5 and nearly 2 million emergency department visits each year.

Asthma Facts

The Cost of Asthma

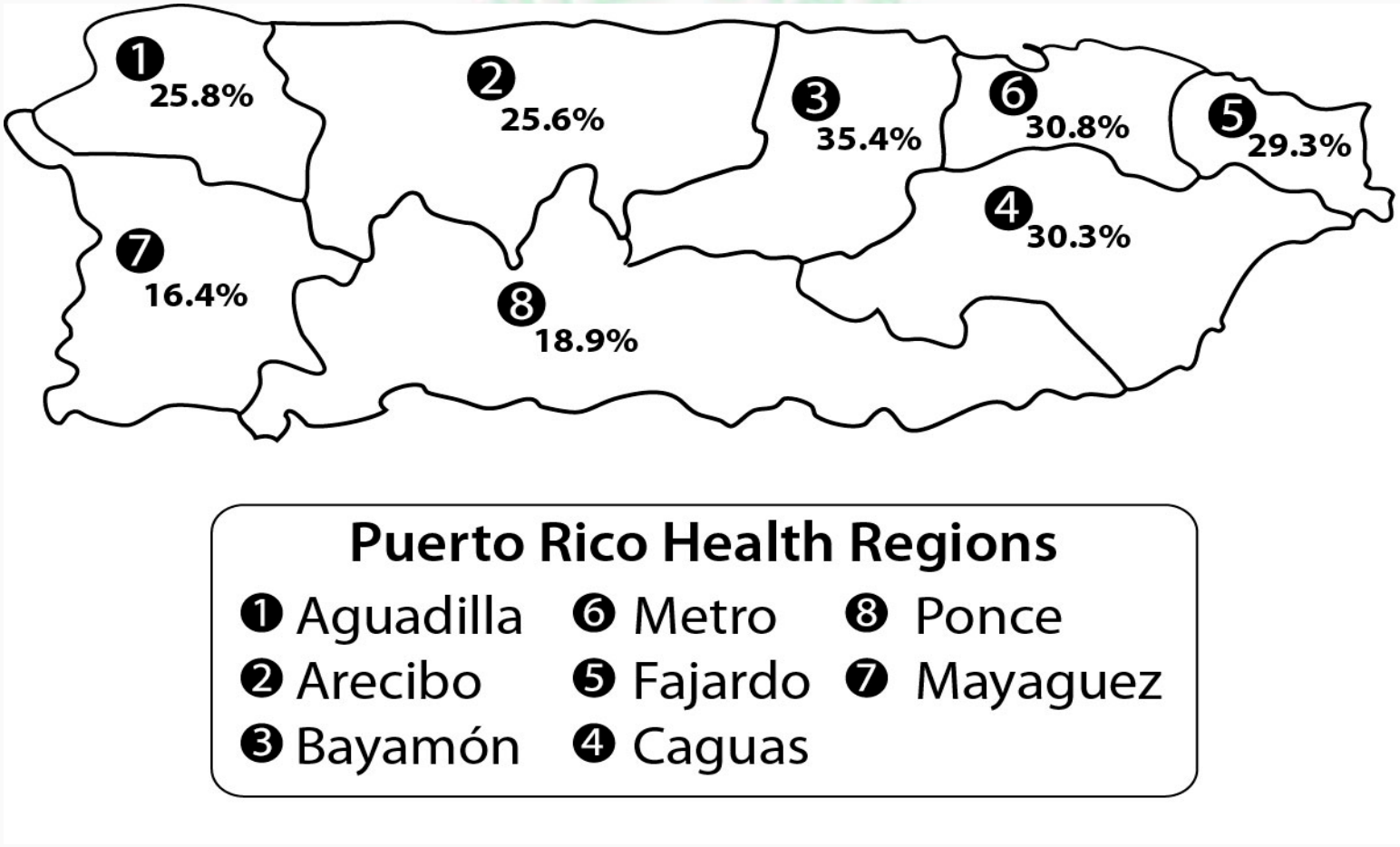
- The annual economic cost of asthma, including direct medical costs from hospital stays and indirect costs such as lost school and work days, amount to more than $56 billion annually.

Asthma Facts

Approximately 3 million Hispanics in the U.S. have asthma and Puerto Ricans are disproportionately impacted:

- The rate of asthma among Puerto Ricans is 113% higher than non-Hispanic white people and 50% higher than non-Hispanic black people.
- The prevalence of asthma attacks is highest among Puerto Ricans.
- Puerto Rican children are 3.2 times more likely to have asthma, as compared to non-Hispanic Whites.

Lifetime childhood asthma by health regions. Puerto Rico 2007



Asthma Facts

Asthma Can be Controlled

- With a plan that includes medical treatment and control of environmental triggers, people with asthma can lead healthy, active lives.

Asthma and the Environment

- Research by EPA and others has shown that:
- Dust mites, molds, cockroaches, pet dander, and secondhand smoke trigger asthma attacks.
- Exposure to secondhand smoke can cause asthma in pre-school aged children.
- Exposure to dust mites can cause asthma.
- Ozone and particle pollution can cause asthma attacks.
  - When ozone levels are high, more people with asthma have attacks that require a doctor's attention.
  - Ozone makes people more sensitive to asthma triggers such as pet dander, pollen, dust mites, and mold.

- **Learn more at http://www.epa.gov/asthma**

Methods

- 10 PR residences located in the north eastern region
- Collection of settled dust (outdoor and indoor) using Swiffer ™ duster cloth
- Collection of air samples (outdoor and indoor) using a MicroBio Air sampler MB2
- DNA extracted from dust
- mold populations determined by mold-specific quantitative PCR (MSQPCR)
- Determination of the ERMI value for each residence

Environmental Relative Moldiness Index (ERMI)- metric or scale to quantify mold contamination

- **METHOD: DNA-based analysis of 36 molds**
- **RESULT: The result is a single digit- the ERMI value for that home that describes mold contamination. The bigger the number the more mold present.**

Results

Comparison of the means and standard deviations (SD) of the Sum of the Logs of the Group 1 molds, Sum of the Logs of the Group 2 molds and the ERMI values for Swiffer ™ dust samples inside and outside in PR

	Swiffer inside (mean)	**SD**	**Swiffer outside (mean)**	**SD**	**Student's *t* test**
Sum Group 1	34.14	12.15	27.20	6.54	0.17
Sum Group 2	13.77	4.75	14.65	15.33	0.68
ERMI values	20.37	8.60	12.55	12.94	0.03

Results

- Average ERMI value inside homes 20.37 versus 12.55 outside from the same vicinity (from a previous study the average ERMI in homes in Miami, Florida was 5.3)

- Out of the 36 ERMI molds, 35 were identified in PR homes

Results

- **Group 1 mold populations in significantly greater concentrations inside than outside: *Aspergillus penicillioides, A. sydowii, Chaetomium globosum, Penicillium crustosum* and *Eurotium* group**

Discussion

- ***Aspergillus penicillioides, A. sydowii, Chaetomium globosum, Penicillium crustosum*** **and** ***Eurotium*** **group**

- **Have a potential to grow in high humidity conditions on bedding, food, textiles, leather and materials coated with resins and lacquer (e.g. furniture)**

Discussion

- This study is the first one to use MSQPCR to identify and quantify mold populations in PR residences.
- First to utilize the ERMI metric to describe mold contamination in PR homes
- A larger number of residences including more geographical areas within PR need to be analyzed to determine if the high ERMI values in some homes in PR contributes to the higher prevalence of asthma

Future Directions

1- Remodeling homes with mold-resistant furnishings

- Conduct ERMI metrics

2- Comparison of fungal microbiomes of homes with asthmatic children vs homes of non-asthmatics

- Analysis of fungal DNA using High-Throughput Sequencing technology (HTS)