INTERVENTIONAL ASSESSMENT OF AIR QUALITY ON LOW-INCOME HOMES IN SALT LAKE COUNTY
Monica-Rae Owens, Camden Alexander, Scott Collingwood, Marco Lorenzo Allain
Department of Pediatrics

Abstract

Salt Lake Valley is notorious\(^1\) for its air pollution, which occurs when harmful matter enters the atmosphere. Our air pollution consists of particulate matter\(^2\) (PM\(_{2.5}\)), ozone\(^3\), and arsenic\(^4\), which come from vehicles, homes, and industrial emissions. Poor air quality has been linked to adverse health outcomes\(^5\), such as higher rates of cancer, heart disease, stroke, and respiratory diseases. The study’s objective is to assess whether in-home interventions reduce air pollution and improve participant health. Methods include collecting air quality data within participant homes and implementing home improvements and renovations, including but not limited to installing HVAC systems, replacing swamp coolers with central AC, installing HEPA filters, and reinforcing shelter features. The study is in its elementary stages. Therefore, results have not been finalized.

Introduction

Utahns have consistently cited air quality as a top concern\(^6\) and have reason to be considering Utah’s historic\(^7\) air quality problems. Throughout the year, Utah’s consistent pollutants come from vehicle exhaust, industrial processes, and home and business emissions, although the seasons offer different pollutants. In summer, wildfire smoke\(^8\) and ozone levels are common pollutants that lower Utah’s air quality to some of the worst\(^9\) in the world. And in winter, PM\(_{2.5}\) levels and the inversion\(^10\) from the mountains adds to the poor air quality.

This study hopes to reconcile Utah’s poor air quality with implementable solutions tailored to Utah citizens, specifically Salt Lake County occupants. The Green and Healthy Homes Initiative\(^11\) is a national organization aimed at providing home improvements and housing strategies to create safe, healthy, and energy-efficient housing for low-income families. The Salt Lake County study serves as a pilot interventional research project with the home acting as the research entity. Salt Lake County funds\(^12\) the initiative, providing the resources and compensation needed to carry out necessary home interventions. The study intends to increase awareness of methods to reduce air pollution and improve public health, which could serve as advocacy for policy change at the state level.

Methods

Ten low-income homes were recruited through the Green and Healthy Homes Initiative and enrolled in the Salt Lake County research study. After recruitment, calibrated air quality sensors are deployed into participants’ homes, and a pre-intervention assessment of air quality is conducted to serve as a baseline reading. Air quality sensors will then provide a summary of exposures to the participants that can be used to determine areas for home improvements and/or
interventions. Possible interventions include installing proper drainage, pollutant detectors, and energy-efficient appliances, reducing clutter, improving ventilation systems, eliminating pests and pest openings, repairing and cleaning homes, and reducing the usage of dangerous cleaning products. Salt Lake County will provide the resources and compensation needed to complete the home improvements and interventions. Upon completion of the study, a post-intervention assessment will be conducted, and the air quality sensor data will be analyzed to determine if interventions were successful in improving air quality and environmental health outcomes.

AIR SENSOR CALIBRATION – The air quality sensors that are installed in participants’ homes are low-cost sensors calibrated to a high-quality DustTrak monitor. A mixture of ammonium nitrate and deionized water is aerosolized by an atomizer and dried in a chamber of silica beads. Once the ammonium nitrate is airborne, it simulates the fine particulate matter mass such as PM$_{2.5}$. The particulate matter is then pulled through a spiral chamber via the gas flow allowing the particulate matter to hit the low-cost sensors stationed at the bottom of the chamber. The low-cost sensors measure PM$_{2.5}$ at varying concentrations that the DustTrak monitor has set. Once the calibration session is concluded, the values that are recorded by the DustTrak monitor and the low-cost sensors are linearly modeled, and a best-fit line is applied to represent the calibration curve. Calibrating the low-cost sensors is an affirmative step that allows for precise and accurate measurements of air quality in participants’ homes.

Limitations

The Salt Lake Valley experiences adverse air pollution with inversion most prominent in winter, contributing to high PM$_{2.5}$ levels. Limitations of this study are the possibility of pre-intervention assessments conducted during winter months’ inversion, which can affect data comparison of post-intervention assessments, which would take place in the absence of the inversion. Results of this study may raise concern for its validity if there is a significant discrepancy in air quality measurements.

Discussion

This pilot study will allow researchers to conduct future large-scale studies that implement housing strategies and interventions to contribute to safe, healthy, and energy-efficient homes. Providing participants with a summary of exposures will aid them in making necessary lifestyle changes and necessary home interventions to improve their air quality and energy efficiency. The goal of this study is to provide supporting evidence of how effective home interventions are in improving air quality and health to implement policy change. Policy changes that adopt home-interventions as necessary solutions for improving air quality and health could lead to fewer sick days, fewer health-related complications, less spending on utilities, and fewer dollars spent on ER visits, health insurance, and other health-related costs. This study offers further exploration in hopes of advocating for policy change and better air quality practices to reduce dollars spent on health care.

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