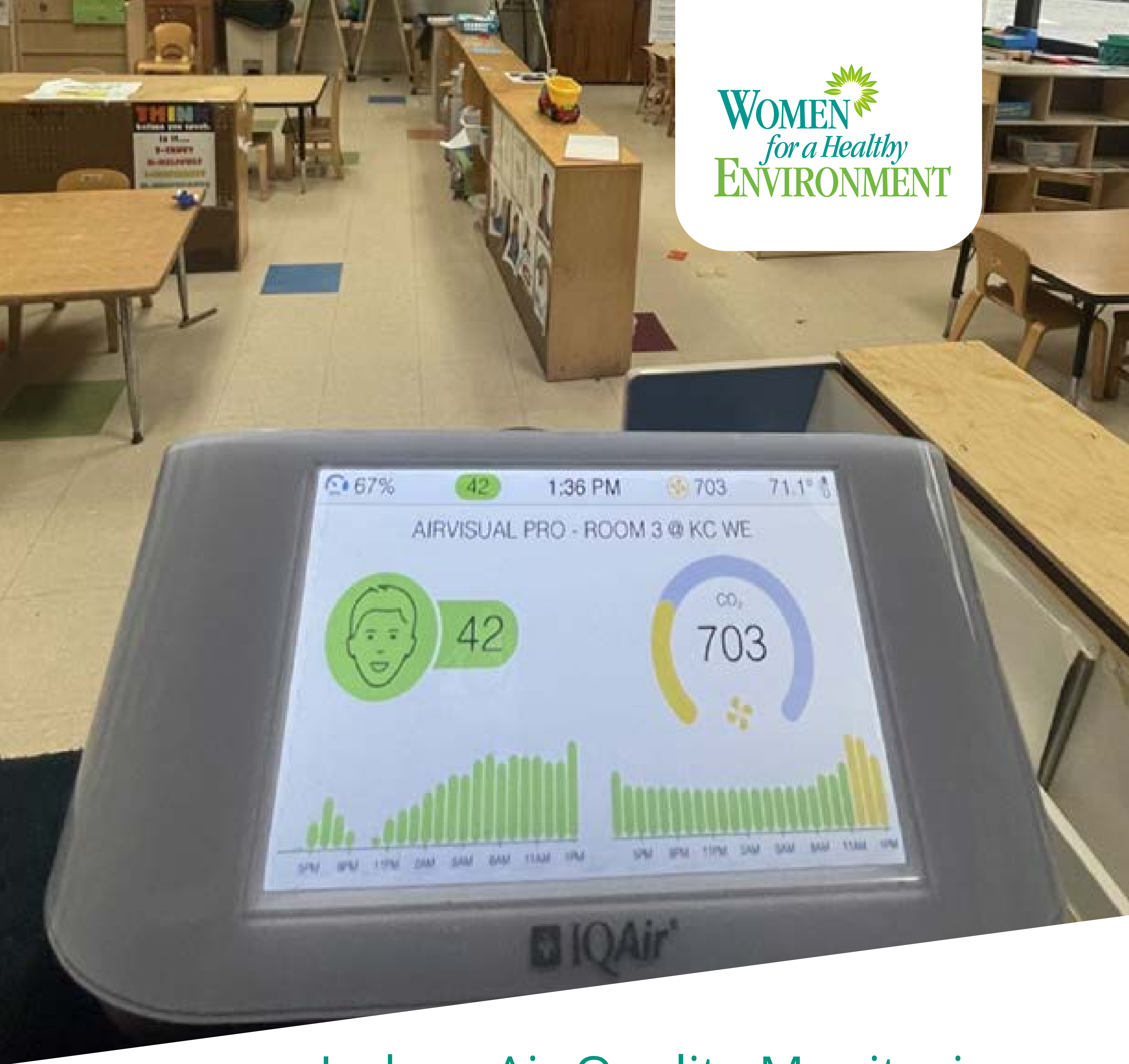


WOMEN for a Healthy ENVIRONMENT

Indoor Air Quality Monitoring of PM 2.5 in Philadelphia Child Care Facilities

May 2024

This project was funded by the US EPA through a Cooperative Agreement titled: Children's Healthy Learning Environments in Low Income and Minority Communities Across Philadelphia -GRANT NUMBER (FAIN): 96392901
EPA QA Document Control #: DCN 220236

Table of Contents

Abstract 4

Introduction 5

Objectives 7

Methodology 8

Results 12

Discussion 21

Bias And Limitation 24

Conclusion 25

Recommendations for Childcare 25

Acknowledgements 26

References 27

Appendix 28

Dedication

On behalf of Women for a Healthy Environment, we would like to dedicate this pilot project and report to Andani Dasana. Mr. Dasana was the former director of KenCrest North, an early childcare facility in North Philadelphia. He dedicated much of his work not only to educating the children but also to keeping their health through environmental impacts and exposure at the forefront. Mr. Dasana questioned how environmental hazards may impact the health of the children, and we hope this project, and many more, begin answering his questions. May he rest in peace.

Abstract

The pilot project investigates the efficacy of Medifyair Air Filters in reducing PM2.5 concentrations in eight childcare centers in four Environmental Justice areas in Philadelphia. Analyzing data collected over a two-week period, the study reveals a decrease in PM 2.5 levels, averaging from 6.04 $\mu g/m^3$ to 1.02 $\mu g/m^3$, demonstrating the effectiveness of the air filters. Concurrently, Indoor Air Quality (IAQ) improved, with an average IAQ drop from 23.79 to 4.13 $\mu g/m^3$. Variability among participants highlights the need for tailored interventions regarding family and center-based facilities. By childcare staff understanding the flow and quality of air inside their centers from indoor air monitoring data, they can potentially adjust their behavior and schedules to reduce poor air quality impacts. The findings not only provide insights into improving indoor air quality for childcare centers but also have broader implications to mitigate health disparities in diverse populations.

Introduction

Young children are especially vulnerable to indoor air pollution. The same concentrations of pollutants can result in higher exposures to children because they breathe more air in proportion to their body weight than adults. Also, since children are growing and developing, the potential for damage to their respiratory and neurological systems is greater. Indoor sources of pollutants include mold, pet dander, cleaning products, and smoking. Outdoor sources that can move inside homes and buildings include car exhaust, fires, and factor emissions. When childcare staff understands the flow and quality of air inside their centers through data generated from indoor air monitoring, they can potentially adjust their behavior and schedules to optimize the childcare environment to reduce exposures for the children and their staff.

This data collection focuses on the measurement and concentration of PM2.5, as particles in the PM2.5 size range are able to travel deeply into the respiratory tract, reaching the lungs. PM2.5 are those particles that are less than 2.5 micrometers in diameter. They are referred to as “fine” particles. Fine particles result from fuel combustion from motor vehicles, power generation, and industrial facilities, as well as from residential fireplaces, cooking and woodstoves. A significant amount of fine particulate matter is also formed in the atmosphere by the transformation of gaseous emissions such as SO2, NOx, VOCs, and ammonia.[1] [2] Sensitive groups at the greatest risk for harm to their lungs from PM2.5 are children, seniors, and individuals with cardiovascular disease or respiratory ailments such as asthma. Exposure to fine particles can cause short-term health effects such as eye, nose, throat, and lung irritation, coughing, sneezing, runny nose, and shortness of breath. Fine particles can also affect lung function and worsen medical conditions such as asthma and heart disease. Scientific studies have linked increases in daily PM2.5 exposure with increased respiratory and cardiovascular hospital admissions, emergency department visits, and deaths.[3] [4] Over the long term, fine particle exposure can also lead to chronic health conditions such as cancer. Health effects studies have not identified any threshold of exposure for fine particle exposure that is safe. Rather, risk of adverse health effects steadily increases as concentrations rise above background levels.

Indoor PM levels are dependent on several factors including outdoor levels, infiltration, types of ventilation and filtration systems used, indoor sources, and personal activities of occupants. PM indoors is generated by sources such as cooking, cleaning products and activities, burning candles, mold, and danger from animals and pests.[2] In homes and buildings without smoking or other strong particle sources, the indoor PM would be expected to be the same as, or lower than, outdoor levels. Outdoor air brings the

[1] Xing et al., 2016

[2] EPA, 2023

[3] Airnow, n.d.

[4] City of Philadelphia Department of Public Health Air Management Services, 2020

fine particles in homes through windows, doors, and small openings. Outdoor sources include car exhaust, smoke, road dust, and factory emissions.[2]

Philadelphia is a diverse city. Approximately 49% of its residents identify as people of color, 42% of the population speak Spanish, and 45% of the population has an average household income of less than $50,000 (24% below $25,000). There is a direct correlation between negative health outcomes and race, income level, and other social determinants of health correlated with these areas. According to a 2018 report on infants and toddlers in Philadelphia from Child Trends, nearly two-thirds (65%) of infants and toddlers live in neighborhoods of concentrated poverty, and less than 3% of infants and toddlers who are eligible for childcare subsidies are receiving high-quality services. Black and Hispanic children have asthma hospitalization rates which are 5 times higher than non-black and Hispanic children in north, west, and lower northeast Philadelphia. In December 2022, the Philadelphia Health Department began offering Medifyair MA-50 and MA-112 HEPA air filters free of charge to childcare providers in Philadelphia who requested them to help mitigate respiratory illnesses that are spread through the air like COVID-19, RSV, and the flu. According to the Philadelphia Health Department, using a high-grade HEPA (high-efficiency particulate air) filter can remove particles from the air, trapping respiratory viruses as well as allergens that contribute to chronic diseases and asthma[5].

[5] City of Philadelphia Department of Public Health, 2023

Objectives

Women for a Healthy Environment monitored PM 2.5 concentrations in childcare centers that received the free air filters with the following goals:

1. To provide a way for childcare centers to understand the quantity of PM 2.5 in their centers and how it influences the quality of the indoor air in their centers.
2. Determining the effectiveness of the Medifyair Air Filters in reducing PM 2.5 in childcare centers.
3. Based on the data collected after two weeks, provide feedback to childcare center staff on behavior changes or equipment maintenance that could reduce the concentration of PM 2.5.
4. Suggest more detailed research, based on the findings from this assessment.

Methodology

Study Design

The monitoring project investigated the efficiency of Medifair Air Filters in reducing PM 2.5 in 8 childcare centers in Philadelphia. The childcare centers in this study are located in four distinct environmental justice neighborhoods- three centers are in Hunting Park, one center is in Cobbs Creek, two centers are in Strawberry Mansion, and two centers are in Point Breeze. The study ran from September 5th, 2023, to October 20th, 2023. Each center participated for two weeks. The project team purchased indoor air quality sensors from IQAir and carried out training and installation at each site and downloading the Air Quality Index App. WHE staff worked with childcare providers to find an ideal location to install the monitors where they would be in close range to the air filters (i.e., in the same room). Every site had an air monitor and air filter inside of a classroom. Before installing the monitors in the facilities, all sensors were collocated to ensure proper working condition. The training included education on air quality, specifically indoor air quality, and the various indoor sources. The study consisted of site visits, phone calls, and daily form submissions. Participants submitted daily electronic forms recording working hours, student size, AQI readings, and potential impacts throughout the duration of the study. WHE staff regularly reviewed and updated each provider's research sheet. During Week 1 of the study, providers selected speeds 1 or 2 considered as the "as-found" conditions on the air filters; this first week was meant to record the lower speed. All of the participating childcare facilities already were sent air filters prior to the start of our study. Due to ethical practices, we did not record the "as-found" conditions with filters turned off due to possible negative impacts on health. The lower speed setting on the air filter served as the "baseline or as found". During Week 2 of the study, providers turned the filter to to the highest speed level 4. This comparison would determine the speed for the greatest reduction in PM 2.5.

Participant Selection

Recruited participants were identified from childcare facilities already enrolled in WHE's Healthy Childcare Champion program in the targeted environmental justice neighborhoods. Another key criterion for participant selection was the presence of the Medifyair Air Filter from the Philadelphia Health Department in their facilities. All participation in the project was voluntary.

Instruments for Data Collection

1. AirVisual Pro (Appendix B)

   At each participating center, an (1) AirVisual Pro, an indoor and outdoor air quality monitor from the company IQAir, was installed in a classroom for continuous data collection.

   The AirVisual Pro (Air Visual Pro, La Mirada, California) measures PM2.5, PM10, CO2 , relative humidity (RH), and temperature. The PM2.5 is measured using an proprietary sensor called AVPM25b, and a SenseAir S8 Sensor (a mini Non-Dispersive Infrared sensor) is used for measuring CO2 concentrations. It is an 82 × 184 × 100 mm unit that has a screen that displays PM2.5 , CO2 , RH, and temperature data in real-time, and the PM10 data can be manually accessed using a computer. The PM2.5 AQI and mass concentration can be displayed on the screen. The unit can store up to 5 years of data (~3 GB) internally. It does not require Wi-Fi to log data (it can be logged internally), but Wi-Fi is required to access the data remotely from a cell phone or computer, which could be done in a lab after sampling. The manufacturer reported accuracy range is ± 8% of the reading. It uses a small fan to draw air inside the laser cavity, where it utilizes light scattering to calculate the concentration. It has a life expectancy of > 3 years. The instrument has a minimum detect limit of 0 $\mu g/m^3$ and upper of 1799 $\mu g/m^3$ [6] [7].

To ensure that the data was of good quality, air quality monitors were collocated for a period of 24 hours prior to deployment and verified for consistent device operation. During the collocation testing, the acceptance criteria set is greater or equal 20% + 20 $\mu g/m^3$ difference between any two devices. Any reading outside of the criteria will be considered an outlier. Collocation was done by testing three monitors in a shared space to ensure similar readings between all monitors. The purpose of the colocation testing was to ensure that the AirVisual Pro (AVP) monitors were operating correctly and delivering good quality data. This was done by comparing the data received from multiple AVPs that were collocated, and sampling the 'same' air quality conditions against each other. Ideally, all collocated AVPs would report the same values. If the collocated AVPs did not track one another within tolerances, then the AVP needed repair. Collocation testing before and after each deployment ensured that 1) the AVP was working prior to deployment, and 2) the AVP was working after deployment. If the tests were positive, then it was reasonable to assume that the AVP was also working properly during the deployment. If the AVP failed the first test, then that AVP simply was not used for the deployment, and another AVP was selected. If the AVP failed the second test, then it was reasonable to assume that the AVP failed to work properly sometime during the deployment. The data for that AVP for the deployment was suspect and should not have been used. The test needed to be repeated. All monitors deployed were in accurate and working condition.

In this study, an unreasonable low reading of PM 2.5 is any value below 0. An unreasonable high reading of PM 2.5 is 35 $\mu g/m^3$. To ensure accuracy, the readings should be within our set range of 0 to 35 $\mu g/m^3$. To ensure precision, the readings for the respective weeks would fall within the similar ranges, not including any outliers or unexpected interruptions. For example, during week 2 the speed will be set to the highest, this means all the readings should be similar to assess precision.

[6] IQAir, 2023

[7] Zamora et al., 2020

The digital monitor displays various screens that show different indoor and outdoor AQI levels, as well as concentrations of PM 2.5 and CO_2. On the screen, it also displays visual cues and prompts that represent air quality levels. For example, during red or purple air quality, a character with a mask is displayed and shows a message regarding the air quality.

2. Medifyair MA-50 and MA-112 HEPA air filters

   These are the models that the Philadelphia Department of Health offered to childcare providers. The two filters differ in unit size but follow the same filter purification process. Linked is the manual to further understand the purification process using the HEPA H13 and activated carbon filters to remove tiny airborne particles, odors, and smoke. *https://cdn.shopify.com/s/files/1/0093/5378/9487/files/MA-112-US-rev082423.pdf?v=1693130533*

3. Daily Provider Log Form (See appendix A)

   Distributed to each participant was a electronic "Daily Provider Log Form" which required daily completion and electronic delivery to WHE staff before midnight of the next day. The electronic forms included :

   A) Date
   B) Workday start-time
      a) Time the first child check-in for the day
   C) Workday end-time
      a) Time the last child checked-out for the day
   D) Number of children in the classroom
   E) Number of staff in the classroom
   F) Filter speed
   G) Inquiries about windows
   H) AQI Reading for the day
      a) Number
      b) Color
      I) Changes in daily schedule

   All data and information collected during the training and study period were uploaded and backed up to WHE database via Outlook up to three years. All data collected for participants were transcribed to their individual Site Project sheet (See appendix B) for results.

4. Airnow.gov

   AirNow is a partnership of the U.S. Environmental Protection Agency, the National Oceanic and Atmospheric Administration (NOAA), the National Park Service, NASA, the Centers for Disease Control, and tribal, state, and local air quality agencies[8]. It serves as an online and phone application resource to report outdoor air quality data for one's local area, as well as at the state and country levels.

Data Handling

All data was manually reviewed by WHE staff and entered into an individual provider log. After the initial review, the data was sent to WHE's Quality Assurance Manager and Expert Data Quality Reviewer for final examination. The data was scrutinized to identify any spikes or potential outliers. WHE staff communicated with providers to gain insights into potential reasons for spikes, such as cooking times.

[8] Airnow, n.d.

Results

The data from the eight childcare facilities were reviewed to compare the differences in air quality conditions in the two weeks. Week one served as the ‘as-found’ period, during which the air purifiers operated at speeds 1 or 2, while week two involved operating them at speed 4. Working hours between 8 AM and 2 PM were utilized for data collection in both weeks to maintain uniformity across all sites. Results from the monitoring project revealed changes in air quality conditions within the eight childcare facilities over the two-week study period. The overall averages across all participants indicated a decline in both PM2.5 concentration and AQI from Week 1 to Week 2. Week 1 averaged a PM2.5 concentration of 6.04 and an AQI of 23.79, while Week 2 showed averages of 1.02 for PM2.5 concentration and 4.13 for AQI.

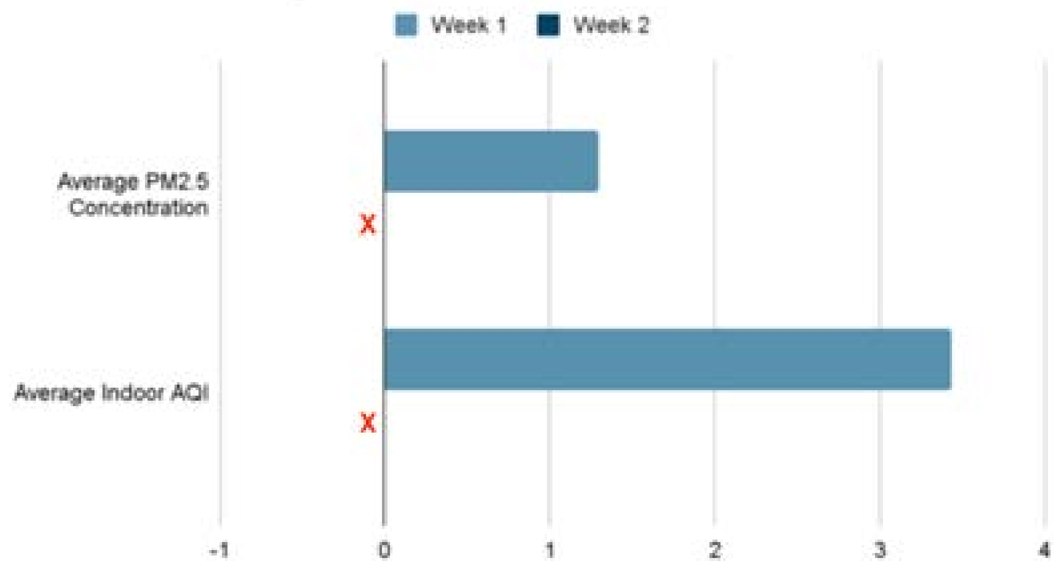
To protect the anonymity of the childcare data, each center is listed by their neighborhood- Hunting Park (HP), Cobbs Creek (CC), Strawberry Mansion (SM), Point Breeze (PB)- followed by a number that denotes a unique identifier for each site.

Table 1.0 HP1 Hourly Data for PM 2.5 (ug/m^3) and Indoor AQI (no units), Days 1-9

Date	Filter Speed	Hour 1 (PM 2.5, Indoor AQI)	Hour 2 (PM 2.5, Indoor AQI)	Hour 3 (PM 2.5, Indoor AQI)	Hour 4 (PM 2.5, Indoor AQI)	Hour 5 (PM 2.5, Indoor AQI)	Hour 6 (PM 2.5, Indoor AQI)	Hour 7 (PM 2.5, Indoor AQI)
Day 1	2	1, 4	1, 4	1, 4	1, 4	1, 4	1, 4	1, 4
Day 2	2	1, 4	1, 4	1, 4	1, 4	1, 4	1, 4	1, 4
Day 3	2	1, 4	1, 4	1, 4	1, 4	1, 4	2, 8	2, 8
Day 4	2	N/D, N/D	N/D, N/D	1, 4	1, 4	1, 4	1, 4	3, 8
Day 5	4	N/D, N/D	N/D, N/D	N/D, N/D	N/D, N/D	N/D, N/D	N/D, N/D	N/D, N/D
Day 6	4	N/D, N/D	N/D, N/D	N/D, N/D	N/D, N/D	N/D, N/D	N/D, N/D	N/D, N/D
Day 7	4	N/D, N/D	N/D, N/D	N/D, N/D	N/D, N/D	N/D, N/D	N/D, N/D	N/D, N/D
Day 8	4	N/D, N/D	N/D, N/D	N/D, N/D	N/D, N/D	N/D, N/D	N/D, N/D	N/D, N/D
Day 9	4	N/D, N/D	N/D, N/D	N/D, N/D	N/D, N/D	N/D, N/D	N/D, N/D	N/D, N/D

Data recordings: (PM 2.5, Indoor AQI)
Day 1-4 represent ‘as-found’ conditions.
Day 5-9 represents the highest speed condition.
N/D: Non-Detected. When non-detected, these values appear as ‘0’ on the Air Visual Pro reports, indicating that the level/measurement of PM 2.5 and/or Indoor AQI is low and non-detected.

Figure 1.0 HP1 Weekly Averages for PM 2.5 (ug/m³) and Indoor AQI (no units), Weeks 1-2



The red X on the graph indicated readings of 0.

Average PM 2.5 concentration Week 1: 1.29 μg/m³
Average Indoor AQI Week 1: 3.43

Average PM 2.5 concentration Week 2: 0 μg/m³
Average Indoor AQI Week 2: 0

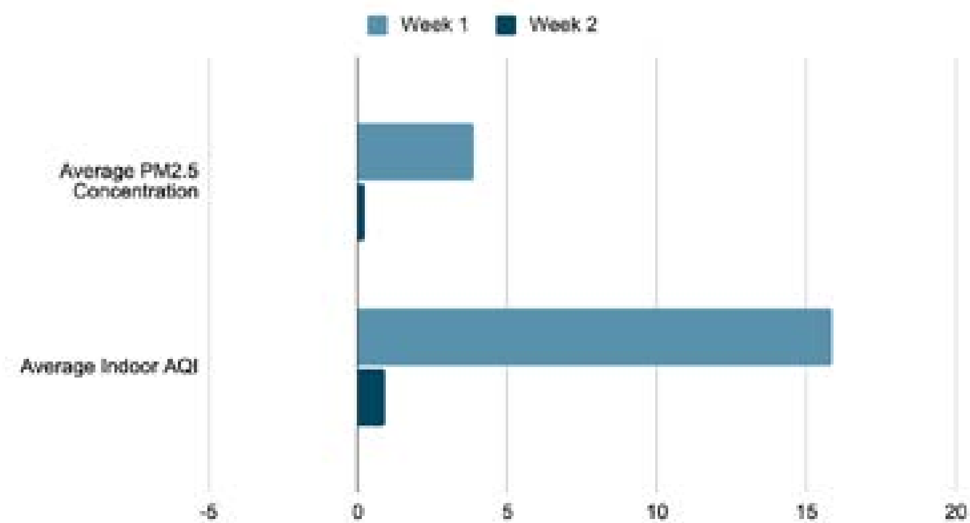
HP1 is a center-based childcare facility. One AirVisual Pro monitor was placed in a classroom with an average student population size of 15 and a teacher size of 2.

Table 2.0 HP2 Hourly Data for PM 2.5 (ug/m^3) and Indoor AQI (no units), Days 1-9

Date	Filter Speed	Hour 1 (PM 2.5, Indoor AQI)	Hour 2 (PM 2.5, Indoor AQI)	Hour 3 (PM 2.5, Indoor AQI)	Hour 4 (PM 2.5, Indoor AQI)	Hour 5 (PM 2.5, Indoor AQI)	Hour 6 (PM 2.5, Indoor AQI)	Hour 7 (PM 2.5, Indoor AQI)
Day 1	2	11, 45	11, 45	14, 55	13, 53	10, 41	8, 33	8, 33
Day 2	2	8, 33	7, 29	6, 25	4, 17	2, 8	1, 4	1, 4
Day 3	2	1, 4	N/D, N/D	1, 4	N/D, N/D	N/D, N/D	1, 4	1, 4
Day 4	2	1, 4	N/D, N/D	N/D, N/D	N/D, N/D	N/D, N/D	N/D, N/D	N/D, N/D
Day 5	4	N/D, N/D	N/D, N/D	N/D, N/D	N/D, N/D	N/D, N/D	N/D, N/D	N/D, N/D
Day 6	4	2, 8	2, 8	N/D, N/D	N/D, N/D	N/D, N/D	N/D, N/D	N/D, N/D
Day 7	4	2, 8	2, 8	N/D, N/D	N/D, N/D	N/D, N/D	N/D, N/D	N/D, N/D
Day 8	4	N/D, N/D	N/D, N/D	N/D, N/D	N/D, N/D	N/D, N/D	N/D, N/D	N/D, N/D
Day 9	4	N/D, N/D	N/D, N/D	N/D, N/D	N/D, N/D	N/D, N/D	N/D, N/D	N/D, N/D

Data recordings: (PM 2.5, Indoor AQI)
Day 1-4 represent 'as-found' conditions.
Day 5-9 represents the highest speed condition.
N/D: Non-Detected. When non-detected, these values appear as '0' on the Air Visual Pro reports, indicating that the level/measurement of PM 2.5 and/or Indoor AQI is low and non-detected.

Figure 2.0 HP2 Weekly Averages for PM 2.5 (ug/m^3) and Indoor AQI (no units), Weeks 1-2



Average PM 2.5 concentration Week 1: 3.89 μg/m^3
Average Indoor AQI Week 1: 15.89

Average PM 2.5 concentration Week 2: 0.23 μg/m^3
Average Indoor AQI Week 2: 0.91

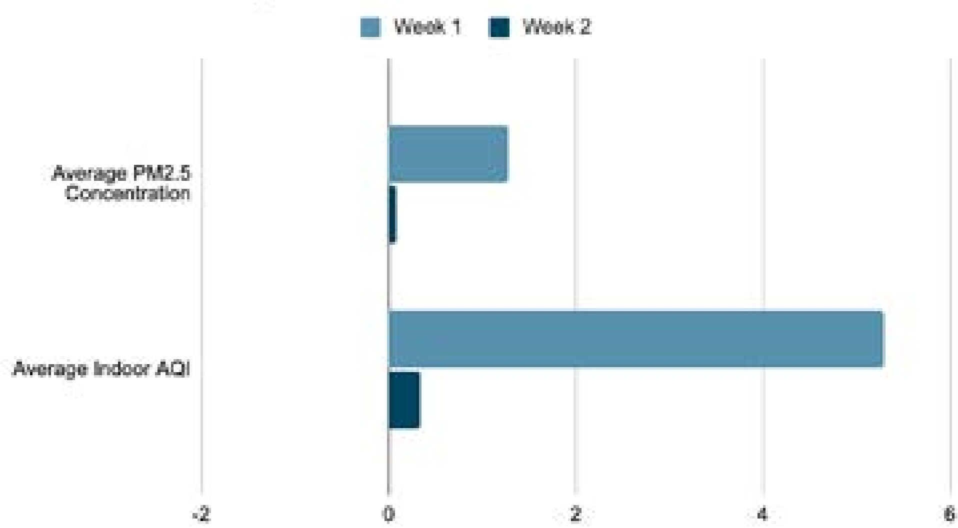
HP2 is a center-based childcare facility. One AirVisual Pro monitor was placed in the open common room with an average student population size of 45 and a teacher size of 8.

Table 3.0 HP3 Hourly Data for PM 2.5 (ug/m^3) and Indoor AQI (no units), Days 1-9

Date	Filter Speed	Hour 1 (PM 2.5, Indoor AQI)	Hour 2 (PM 2.5, Indoor AQI)	Hour 3 (PM 2.5, Indoor AQI)	Hour 4 (PM 2.5, Indoor AQI)	Hour 5 (PM 2.5, Indoor AQI)	Hour 6 (PM 2.5, Indoor AQI)	Hour 7 (PM 2.5, Indoor AQI)
Day 1	2	2, 8	2, 8	1, 4	1, 4	1, 4	1, 4	1, 4
Day 2	2	1, 4	1, 4	1, 4	1, 4	1, 4	N/D, N/D	N/D, N/D
Day 3	2	N/D, N/D	1, 4	4, 17	5, 21	4, 17	4, 17	2, 8
Day 4	2	N/D, N/D	N/D, N/D	N/D, N/D	N/D, N/D	N/D, N/D	2, 8	N/D, N/D
Day 5	4	N/D, N/D	N/D, N/D	N/D, N/D	N/D, N/D	N/D, N/D	N/D, N/D	N/D, N/D
Day 6	4	N/D, N/D	N/D, N/D	N/D, N/D	N/D, N/D	N/D, N/D	N/D, N/D	N/D, N/D
Day 7	4	N/D, N/D	N/D, N/D	N/D, N/D	N/D, N/D	N/D, N/D	N/D, N/D	N/D, N/D
Day 8	4	N/D, N/D	N/D, N/D	N/D, N/D	1, 4	N/D, N/D	2, 8	N/D, N/D
Day 9	4	N/D, N/D	N/D, N/D	N/D, N/D	N/D, N/D	N/D, N/D	N/D, N/D	N/D, N/D

Data recordings: (PM 2.5, Indoor AQI)
Day 1-4 represent 'as-found' conditions.
Day 5-9 represents the highest speed condition.
N/D: Non-Detected. When non-detected, these values appear as '0' on the Air Visual Pro reports, indicating that the level/measurement of PM 2.5 and/or Indoor AQI is low and non-detected.

Figure 3.0 HP3 Weekly Averages for PM 2.5 (ug/m^3) and Indoor AQI (no units), Weeks 1-2



Average PM 2.5 concentration Week 1: 1.28 µg/m^3
Average Indoor AQI Week 1: 5.29

Average PM 2.5 concentration Week 2: 0.08 µg/m^3
Average Indoor AQI Week 2: 0.34

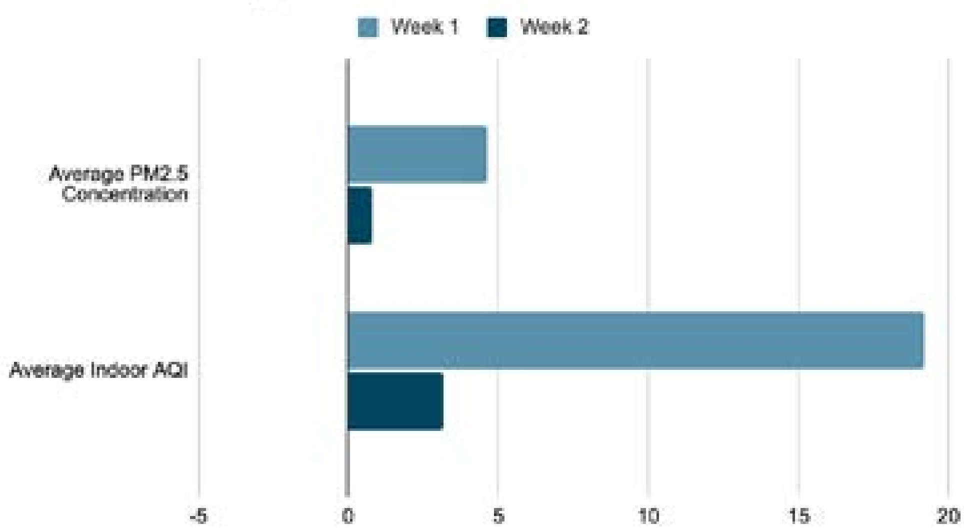
HP2 is a center-based childcare facility. One AirVisual Pro monitor was placed in the open common room with an average student population size of 30 and a teacher size of 6.

Table 4.0 SM1 Hourly Data for PM 2.5 (ug/m^3) and Indoor AQI (no units), Days 1-9

Date	Filter Speed	Hour 1 (PM 2.5, Indoor AQI)	Hour 2 (PM 2.5, Indoor AQI)	Hour 3 (PM 2.5, Indoor AQI)	Hour 4 (PM 2.5, Indoor AQI)	Hour 5 (PM 2.5, Indoor AQI)	Hour 6 (PM 2.5, Indoor AQI)	Hour 7 (PM 2.5, Indoor AQI)
Day 1	2	4, 17	3, 12	4, 17	5, 21	5, 21	6, 25	5, 21
Day 2	2	4, 17	5, 21	3, 12	3, 12	4, 17	3, 12	4, 17
Day 3	2	2, 8	4, 17	5, 21	5, 21	5, 21	9, 37	9, 37
Day 4	2	2, 8	2, 8	6, 25	6, 25	5, 21	6, 25	5, 21
Day 5	4	4, 17	N/D, N/D	N/D, N/D	N/D, N/D	1, 4	1, 4	1, 4
Day 6	4	N/D, N/D	N/D, N/D	1, 4	N/D, N/D	N/D, N/D	3, 12	4, 17
Day 7	4	N/D, N/D	N/D, N/D	N/D, N/D	N/D, N/D	1, 4	1, 4	1, 4
Day 8	4	N/D, N/D	N/D, N/D	N/D, N/D	N/D, N/D	N/D, N/D	2, 8	N/D, N/D
Day 9	4	N/D, N/D	N/D, N/D	N/D, N/D	7, 29	N/D, N/D	N/D, N/D	N/D, N/D

Data recordings: (PM 2.5, Indoor AQI)
Day 1-4 represent 'as-found' conditions.
Day 5-9 represents the highest speed condition.
N/D: Non-Detected. When non-detected, these values appear as '0' on the Air Visual Pro reports, indicating that the level/measurement of PM 2.5 and/or Indoor AQI is low and non-detected.

Figure 4.0 SM1 Weekly Averages for PM 2.5 (ug/m^3) and Indoor AQI (no units), Weeks 1-2



Average PM 2.5 concentration Week 1: 4.61 µg/m^3
Average Indoor AQI Week 1: 19.18

Average PM 2.5 concentration Week 2: 0.77 µg/m^3
Average Indoor AQI Week 2: 3.17

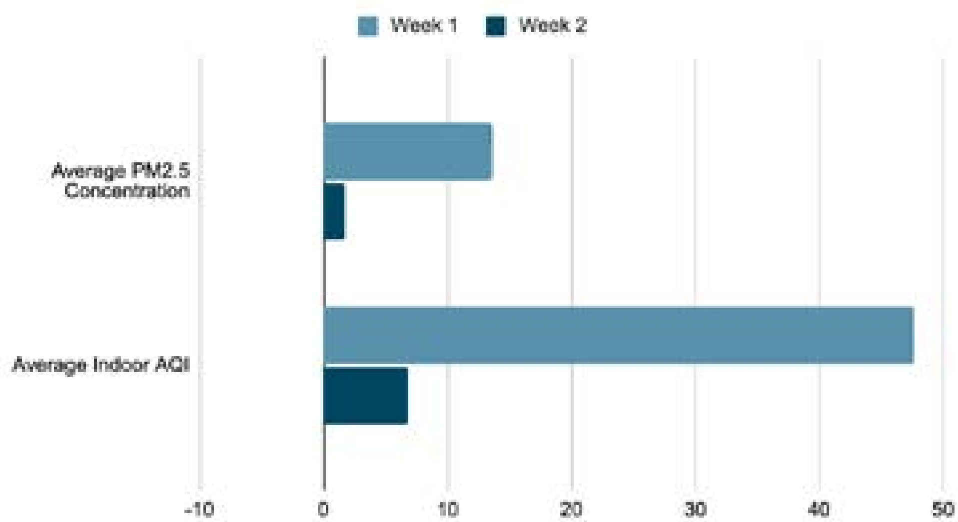
SM1 is a home/family-based childcare facility. One AirVisual Pro monitor was placed in the living room common area with an average student population size of 3 and a teacher size of 1.

Table 5.0 CC1 Hourly Data for PM 2.5 (ug/m^3) and Indoor AQI (no units), Days 1-9

Date	Filter Speed	Hour 1 (PM 2.5, Indoor AQI)	Hour 2 (PM 2.5, Indoor AQI)	Hour 3 (PM 2.5, Indoor AQI)	Hour 4 (PM 2.5, Indoor AQI)	Hour 5 (PM 2.5, Indoor AQI)	Hour 6 (PM 2.5, Indoor AQI)	Hour 7 (PM 2.5, Indoor AQI)
Day 1	2	7, 29	7, 29	9, 37	10, 41	11, 45	11, 45	12, 50
Day 2	2	15, 57	11, 45	10, 41	10, 41	10, 41	9, 37	8, 33
Day 3	2	12, 20	16, 59	16, 59	17, 61	15, 59	15, 57	14, 55
Day 4	2	10, 41	20, 68	22, 72	20, 68	14, 55	11, 45	11, 45
Day 5	4	3, 12	4, 17	3, 12	3, 12	2, 8	2, 8	3, 12
Day 6	4	2, 8	1, 4	1, 4	1, 4	1, 4	1, 4	2, 8
Day 7	4	N/D, N/D	1, 4	1, 4	3, 12	3, 12	2, 8	3, 12
Day 8	4	1, 4	2, 8	2, 8	2, 8	2, 8	1, 4	1, 4
Day 9	4	1, 4	1, 4	1, 4	1, 4	1, 4	1, 4	1, 4

Data recordings: (PM 2.5, Indoor AQI)
Day 1-4 represent 'as-found' conditions.
Day 5-9 represents the highest speed condition.
N/D: Non-Detected. When non-detected, these values appear as '0' on the Air Visual Pro reports, indicating that the level/measurement of PM 2.5 and/or Indoor AQI is low and non-detected.

Figure 5.0 CC1 Weekly Averages for PM 2.5 (ug/m^3) and Indoor AQI (no units), Weeks 1-2



Average PM 2.5 concentration Week 1: 13.59 µg/m^3
Average Indoor AQI Week 1: 47.68

Average PM 2.5 concentration Week 2: 1.71 µg/m^3
Average Indoor AQI Week 2: 6.89

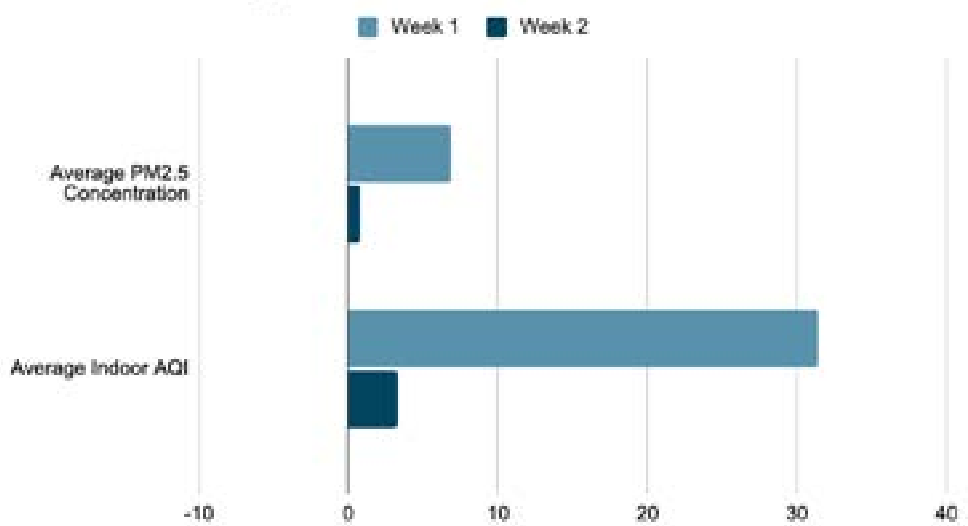
CC1 is a center-based childcare facility. One AirVisual Pro monitor was placed in a classroom with an average student population size of 15 and a teacher size of 2.

Table 6.0 CC2 Hourly Data for PM 2.5 (ug/m^3) and Indoor AQI (no units), Days 1-9

Date	Filter Speed	Hour 1 (PM 2.5, Indoor AQI)	Hour 2 (PM 2.5, Indoor AQI)	Hour 3 (PM 2.5, Indoor AQI)	Hour 4 (PM 2.5, Indoor AQI)	Hour 5 (PM 2.5, Indoor AQI)	Hour 6 (PM 2.5, Indoor AQI)	Hour 7 (PM 2.5, Indoor AQI)
Day 1	2	1, 4	6, 25	5, 21	4, 17	7, 29	15, 57	9, 37
Day 2	2	N/D, N/D	N/D, N/D	9, 37	8, 33	7, 29	6, 25	6, 25
Day 3	2	7, 29	10, 41	10, 41	13, 53	7, 29	7, 29	6, 25
Day 4	2	5, 21	9, 37	13, 53	14, 53	12, 50	10, 41	9, 37
Day 5	4	N/D, N/D	1, 4	N/D, N/D	N/D, N/D	N/D, N/D	N/D, N/D	N/D, N/D
Day 6	4	N/D, N/D	1, 4	1, 4	1, 4	1, 4	1, 4	1, 4
Day 7	4	N/D, N/D	1, 4	1, 4	1, 4	2, 8	2, 8	1, 4
Day 8	4	1, 4	1, 4	1, 4	1, 4	1, 4	2, 8	1, 4
Day 9	4	N/D, N/D	1, 4	1, 4	2, 8	1, 4	1, 4	N/D, N/D

Data recordings: (PM 2.5, Indoor AQI)
Day 1-4 represent 'as-found' conditions.
Day 5-9 represents the highest speed condition.
N/D: Non-Detected. When non-detected, these values appear as '0' on the Air Visual Pro reports, indicating that the level/measurement of PM 2.5 and/or Indoor AQI is low and non-detected.

Figure 6.0 CC2 Weekly Averages for PM 2.5 (ug/m^3) and Indoor AQI (no units), Weeks 1-2



Average PM 2.5 concentration Week 1: 6.89 μg/m^3
Average Indoor AQI Week 1: 31.36

Average PM 2.5 concentration Week 2: 0.83 μg/m^3
Average Indoor AQI Week 2: 3.31

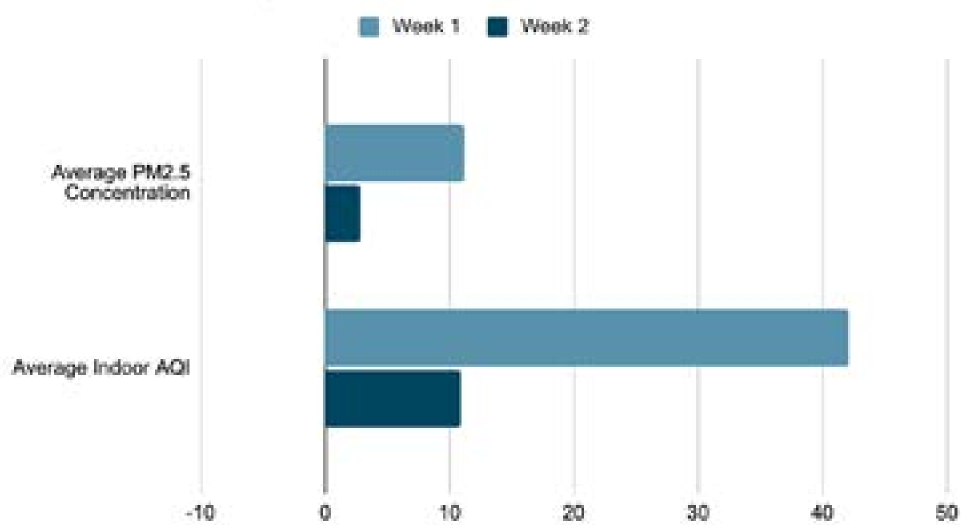
CC2 is a center-based childcare facility. One AirVisual Pro monitor was placed in a classroom with an average student population size of 18 and a teacher size of 6.

Table 7.0 PB1 Hourly Data for PM 2.5 (ug/m^3) and Indoor AQI (no units), Days 1-9

Date	Filter Speed	Hour 1 (PM 2.5, Indoor AQI)	Hour 2 (PM 2.5, Indoor AQI)	Hour 3 (PM 2.5, Indoor AQI)	Hour 4 (PM 2.5, Indoor AQI)	Hour 5 (PM 2.5, Indoor AQI)	Hour 6 (PM 2.5, Indoor AQI)	Hour 7 (PM 2.5, Indoor AQI)
Day 1	2	12, 50	11, 45	7, 29	20, 68	20, 68	9, 37	9, 37
Day 2	2	15, 57	6, 25	5, 21	7, 29	6, 25	6, 25	6, 25
Day 3	2	14, 55	8, 33	7, 29	8, 33	8, 33	8, 33	7, 29
Day 4	2	11, 45	8, 33	7, 29	15, 57	22, 72	28, 84	22, 72
Day 5	4	10, 41	22, 72	2, 8	N/D, N/D	N/D, N/D	1, 4	1, 4
Day 6	4	4, 17	4, 17	N/D, N/D	N/D, N/D	1, 4	1, 4	1, 4
Day 7	4	3, 12	N/D, N/D	4, 17	N/D, N/D	2, 8	1, 4	1, 4
Day 8	4	4, 17	1, 4	2, 8	7, 29	3, 12	3, 12	2, 8
Day 9	4	8, 33	3, 12	2, 8	1, 4	2, 8	1, 4	1, 4

Data recordings: (PM 2.5, Indoor AQI)
Day 1-4 represent 'as-found' conditions.
Day 5-9 represents the highest speed condition.
N/D: Non-Detected. When non-detected, these values appear as '0' on the Air Visual Pro reports, indicating that the level/measurement of PM 2.5 and/or Indoor AQI is low and non-detected.

Figure 7.0 PB1 Weekly Averages for PM 2.5 (ug/m^3) and Indoor AQI (no units), Weeks 1-2



Average PM 2.5 concentration Week 1: 11.14 µg/m^3
Average Indoor AQI Week 1: 42.07

Average PM 2.5 concentration Week 2: 2.80 µg/m^3
Average Indoor AQI Week 2: 10.94

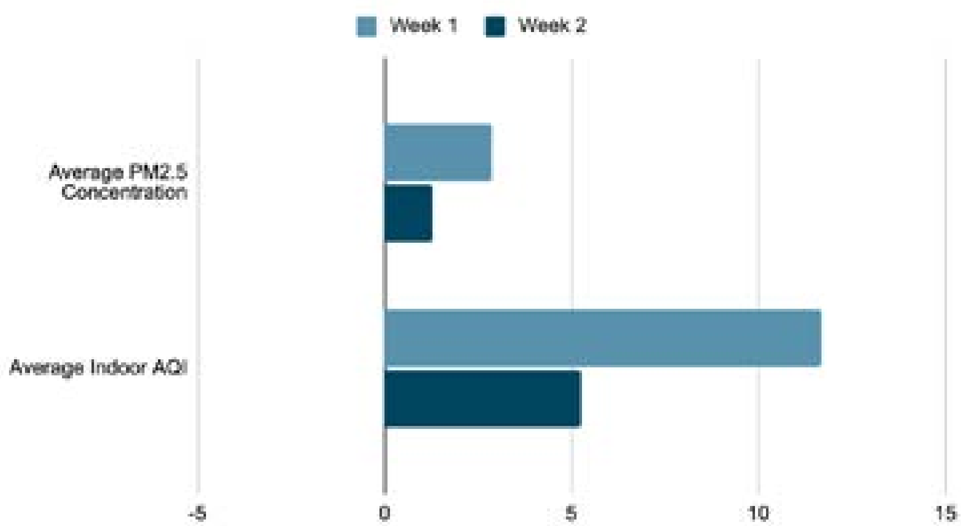
PB1 is a family/home-based childcare facility. One AirVisual Pro monitor was placed in the living room with an average student population size of 3 and a teacher size of 1.

Table 8.0 PB2 Hourly Data for PM 2.5 (ug/m^3) and Indoor AQI (no units), Days 1-9

Date	Filter Speed	Hour 1 (PM 2.5, Indoor AQI)	Hour 2 (PM 2.5, Indoor AQI)	Hour 3 (PM 2.5, Indoor AQI)	Hour 4 (PM 2.5, Indoor AQI)	Hour 5 (PM 2.5, Indoor AQI)	Hour 6 (PM 2.5, Indoor AQI)	Hour 7 (PM 2.5, Indoor AQI)
Day 1	2	6, 25	5, 21	5, 21	4, 17	3, 12	3, 12	2, 8
Day 2	2	5, 21	4, 17	4, 17	4, 17	3, 12	3, 12	3, 12
Day 3	2	3, 12	2, 8	2, 8	2, 8	2, 8	2, 8	2, 8
Day 4	2	3, 12	2, 8	2, 8	1, 4	1, 4	1, 4	1, 4
Day 5	4	N/D, N/D	2, 8	1, 4	N/D, N/D	N/D, N/D	N/D, N/D	N/D, N/D
Day 6	4	N/D, N/D	N/D, N/D	N/D, N/D	1, 4	1, 4	N/D, N/D	N/D, N/D
Day 7	4	N/D, N/D	N/D, N/D	N/D, N/D	N/D, N/D	N/D, N/D	N/D, N/D	N/D, N/D
Day 8	4	4, 17	4, 17	3, 12	2, 8	2, 8	1, 4	1, 4
Day 9	4	1, 4	1, 4	2, 8	11, 45	6, 25	1, 4	1, 4

Data recordings: (PM 2.5, Indoor AQI)
Day 1-4 represent 'as-found' conditions.
Day 5-9 represents the highest speed condition.
N/D: Non-Detected. When non-detected, these values appear as '0' on the Air Visual Pro reports, indicating that the level/measurement of PM 2.5 and/or Indoor AQI is low and non-detected.

Figure 8.0 PB2 Weekly Averages for PM 2.5 (ug/m^3) and Indoor AQI (no units), Weeks 1-2



Average PM 2.5 concentration Week 1: 2.86 μg/m^3
Average Indoor AQI Week 1: 11.71

Average PM 2.5 concentration Week 2: 1.29 μg/m^3
Average Indoor AQI Week 2: 5.26

PB2 is a center-based childcare facility. One AirVisual Pro monitor was placed in a common room with an average student population size of 9 and a teacher size of 2.

Discussion

The results of the pilot project provide insights into the impact of Medifyair Air Filters on reducing PM 2.5 concentrations in childcare centers, particularly in the context of vulnerable populations such as young children.

Participants HP1, CC1, CC2: In the 9-day study period, participants from the same organization displayed varying outcomes in PM 2.5 concentrations and Indoor Air Quality (IAQ). HP1 exhibited a substantial reduction in average PM 2.5 from 1.29 μg/m^3 in Week 1 to 0 μg/m^3 in Week 2, with corresponding improvements in IAQ. CC1 initially had higher PM 2.5 concentrations at 13.59 μg/m^3 in Week 1, decreasing to 1.71 μg/m^3 in Week 2, demonstrating a notable improvement. CC2 started with a moderate PM 2.5 concentration of 6.89 μg/m^3 in Week 1, declining to 0.83 μg/m^3 in Week 2, indicating a positive trend in air quality.

In the post-followup interview, HP1, CC1, and CC2 expressed curiosity about the impact of indoor air quality on health and a keen interest in understanding the connection between air quality practices and well-being. The participant affirmed that staff felt more secure knowing the air filters effectively filtered out particulates. Maintenance of the air filters posed no significant challenges, with easy filter changes and a quieter fan operation noted at lower speeds. Overall, engagement in the project demonstrated a positive impact on both awareness and practices related to indoor air quality management.

Participants HP2 and HP3: During the 9-day study period, participants HP2 and HP3, both from the same organization, demonstrated improvements in PM 2.5 concentrations and Indoor Air Quality (IAQ). HP2 started with an average PM 2.5 concentration of 3.89 μg/m^3 in Week 1, reducing to 0.23 μg/m^3 in Week 2, reflecting a substantial enhancement. Similarly, HP3 exhibited a decrease from 1.28 μg/m^3 in Week 1 to 0.08 μg/m^3 in Week 2, indicating a commendable improvement in air quality.

In the post-followup, both sites shared a common theme of limited prior awareness of indoor air quality. The monitoring aspect of the research project heightened their awareness, prompting regular checks and a conscious effort to observe changes in air quality based on activities. Despite not noticing significant changes during varying air filter speeds, proactively introduced airflow when the monitor indicated unfavorable conditions. Both HP2 and HP3 maintained consistent use of the air filters post-project, emphasizing their commitment to sustaining improved air quality. The collective experience of HP2 and HP3 showcases the positive impact of the research project on participants' awareness and practices related to indoor air quality management within their organization.

Participant SM1: Throughout the 9-day study period, SM1 demonstrated notable improvements in PM 2.5 concentrations and Indoor Air Quality (IAQ). Starting with an average PM 2.5 concentration of 4.61 μg/m^3 in Week 1, there was a reduction to 0.77 μg/m^3 in Week 2. A parallel improvement was observed in the Indoor Air Quality (IAQ), with the average AQI dropping from 19.18 in Week 1 to 3.17 in Week 2.

In the post-followup interview, SM1 revealed a moderate level of awareness regarding indoor air quality before the research project. The introduction of monitors increased their consciousness about practices that could impact air quality. Despite not actively monitoring air quality before participating, the research project heightened SM1's awareness and consideration of factors influencing indoor air quality. Post-project, SM1 maintained consistent use of the air filters, reflecting a commitment to sustaining improved air quality. The experience of SM1 highlights the project's impact on raising awareness and encouraging consistent practices related to indoor air quality management.

Participant PB1: During the 9-day study period, PB1 demonstrated improvements in PM 2.5 concentrations and Indoor Air Quality (IAQ). The average PM 2.5 concentration decreased from 11.14 μg/m³ in Week 1 to 2.80 μg/m³ in Week 2, with a corresponding improvement in the average Indoor AQI from 42.07 to 10.94.

In the post-followup interview, PB1 expressed a heightened awareness of indoor air quality facilitated by the research project. The introduction of monitors enabled PB1 to make informed decisions, such as opening windows or doors to introduce fresh air. Monitoring air quality during activities like cooking contributed to an improved understanding of indoor air sources. PB1 observed noticeable changes in air quality during the two weeks when the air filters were running at different speeds. The preference for speed 4 was evident, with PB1 noting its effectiveness in removing particles and enhancing overall air quality. Post-project, PB1 maintained consistent use of the air filters, emphasizing daily and continuous operation. Regarding the well-being of children and staff, PB1 reported no problems, attributing the positive outcome to regular filter changes every 30 days.

Participant PB2: Throughout the 9-day study period, PB2 showcased positive outcomes in PM 2.5 concentrations and Indoor Air Quality (IAQ). The average PM 2.5 concentration decreased from 2.86 μg/m^3 in Week 1 to 1.29 μg/m^3 in Week 2, accompanied by an improvement in the average Indoor AQI from 11.71 to 5.26. In the post-followup interview, PB2 highlighted a pre-existing awareness of indoor air quality, driven by personal health consciousness. The introduction of monitors further heightened awareness about the quality of air within the facility. PB2 noticed changes in air quality during the two weeks when the air filters were running at different speeds.

Post-project, PB2 maintained consistent use of the air filters, emphasizing increased usage driven by the observed impact. The visual cues provided by the colors on the monitors played a role in ensuring the continuous operation of the air filters.

Overall, the data indicates a decrease in PM 2.5 concentrations across all participating childcare centers from Week 1 (as-found conditions) to Week 2 (operating air purifiers at the highest speed). On average, there was a decline from 6.04 μg/m^3 to 1.02 μg/m^3 in PM 2.5 concentrations. Individual facilities displayed even more pronounced reductions, demonstrating the effectiveness of Medifyair Air Filters. The observed reduction in PM 2.5 concentrations is crucial for the respiratory health of children and staff within childcare centers. Lower PM 2.5 levels are associated with a decreased risk of short-term health issues, including respiratory irritation, and contribute to the prevention of long-term conditions such as asthma and other respiratory ailments. Concurrent with the decline in PM 2.5 concentrations, the Indoor Air Quality (IAQ) also exhibited improvement. The average IAQ dropped from 23.79 in Week 1 to 4.13 in Week 2. This improvement suggests that the Medifyair Air Filters contribute not only to the reduction of PM 2.5 but also overall air quality improvement. Enhanced IAQ influences the health and well-being of children and staff, reducing the risk of respiratory issues and other health problems associated with poor air quality.While the overall trend indicates a reduction in PM 2.5 concentrations, there is variability among childcare centers. Some facilities experienced higher initial concentrations, and their subsequent reductions were more pronounced. Understanding these variations can provide insights into the effectiveness of air filters in different environmental contexts. The variability underscores the importance of considering specific factors influencing indoor air quality, such as the initial outdoor pollution levels, facility design, whether cooking takes place and student population size. Tailoring interventions based on these factors can optimize the efficacy of air quality improvement measures.

The findings offer practical recommendations for childcare centers aiming to enhance indoor air quality The ability to operate air purifiers at higher speeds in Week 2 resulted in a more effective PM 2.5 reduction. This suggests that childcare centers can achieve optimal air quality benefits by maximizing the use of air purifiers during peak occupancy hours. Other recommendations include proper maintenance of the air filters with consistent filter changes and identifying and managing indoor sources that impact indoor air quality. Indoor sources include animal hair, dust, and dander; off-gassing from furniture and carpet; VOCs from paint, cleaning products, and air fresheners; mildew; and cooking devices.

Bias And Limitations

The study encounters biases and limitations that warrant consideration. First, variations in the duration for which childcare centers had the Medifyair units, distributed by the Philadelphia Health Department at different times, introduce discrepancies in the age and condition of the air filters. Additionally, the lack of strict protocols for changing filters and the absence of a requirement for sites to initiate the project with new filters contribute to potential variability in filter cleanliness and efficiency. Not all sites started and ended the air monitoring on the same day which also contributes to potential variability in the data. Furthermore, selection bias is also present by which air filters were distributed to childcare providers by request.

Second, the act of providers observing the sensor cues on the monitors introduces the possibility of bias. Providers may consciously or unconsciously alter their behaviors to align with perceived favorable readings, potentially influencing the study outcomes.

Third, the presence of cooking activities in home/family-based childcare introduces spikes in PM2.5 concentrations, impacting the accuracy of the data. The study does not control for specific cooking practices, and variations in cooking frequency and methods among participants may contribute to fluctuations in the collected data.

Lastly, the study acknowledges the diversity in protocols among childcare facilities, including differences in allowing shoes inside and variations in cleaning practices and products. These disparities introduce confounding variables that may influence indoor air quality.

Conclusion

In conclusion, the pilot project demonstrates the benefits of Medifyair Air Filters in reducing PM 2.5 concentrations in childcare centers especially when operating at the highest filter speed. The findings underscore the importance of measures to address optimal indoor air quality, particularly in settings with vulnerable populations. The potential health implications, coupled with practical recommendations, provide a solid foundation for future research and informed decision-making in childcare facility management and public health initiatives. Future research projects can expand on the impacts of CO2 levels as an indicator of HVAC efficiency and effectiveness, measure humidity levels, and ensure adequate ventilation to avoid mold growth over time. Additionally, examining health outcomes such as reduced incidences of respiratory asthma, COVID-19, RSV, and the flu from better indoor air quality would contribute valuable insights into the optimal use of air filters.

Recommendations for Childcare

1. Run the Medifyair filters in childcare centers year-round during business hours at level 4 speed to ensure optimal air quality where children and staff spend the most time.
2. Adhere to regular filter replacement as per the unit's guidelines and instructions.
3. Consider relocating the air filter near the kitchen during cooking to reduce particulates resulting from this activity.
4. Invest in air quality sensors for consistent monitoring, promoting awareness, and maintaining indoor air quality.
5. Perform daily checks of outdoor Air Quality Index (AQI).
6. Implement measures to reduce source pollution, such as using walk-off mats and removing shoes to minimize off-gassing and indoor sources.
7. Ensure proper and adequate ventilation.
8. WHE recommends distribution and use of air filters in both commercial and family-based early learning centers, particularly those located in environmental justice communities with higher-than-average asthma rates in children.

Acknowledgements

AUTHORED BY

Randy Persaud, MPH, WHE Assistant Project Manager, Program Assistant

WITH CONTRIBUTIONS FROM

Michelle Naccarati-Chapkis, WHE Executive Director

Samantha Hernandez, MPH, WHE Healthy Early Learning Coordinator, Quality Assurance Officer

Lorna Rosenberg, MS, WHE Healthy Buildings Program Manager

Chanel Palmer, WHE Research Assistant, Communications Assistant

REVIEWED BY

Ned Ketyer, MD, FAAP, Pediatric Alliance, PC; Editor of The PediaBlog, AAP Council on Environmental Health

Daniel Grzybek, Engineer on Nuclear Reactor Safety Systems for the Nimitz class of US Navy Aircraft Carriers

Dr. Margaret (Peggy) Slota, PhD, Professor and Director of Graduate Studies for nursing doctoral students, Georgetown University

Norm Anderson, Environmental Health Toxicologist, Expert Data Quality Reviewer

References

1) Xing, Yu-Fei et al. "The impact of PM2.5 on the human respiratory system." Journal of thoracic disease vol. 8,1 (2016): E69-74. doi:10.3978/j.issn.2072-1439.2016.01.19

2) "Particulate Matter (PM) Pollution | US EPA." Environmental Protection Agency (EPA), 2024, https://www.epa.gov/pm-pollution.

3) Airnow, https://www.airnow.gov/aqi/aqi-basics/extremely-high-levels-of-pm25/.

4) Serrat, Leo. "Philadelphia's Air Quality Report 2020." Phila.gov, September 2020, https://www.phila.gov/media/20210930085223/AQR_2020_FINAL.pdf.

5) Garrow, James. "Free Air Purifiers for Early Childhood Education Centers and Schools! | Department of Public Health." Phila.gov, 3 April 2023, https://www.phila.gov/2023-04-03-free-air-purifiers-for-early-childhood-education-centers-and-schools/.

6) IQ Air, 2021, https://cms.iqair.com/sites/default/files/documents/AVPro_Indoor_User_Manual_v3.3en_092721.pdf?_gl=1*4kw9ew*_ga*MTQyMDkyNTM2OS4xNzA1Njk2NDcz*_ga_L8T9FHWX08*MTcwNTkzMjA3My4yLjEuMTcwNTkzMjI1My41NC4wLjA.

7) Zamora, Misti Levy et al. "One Year Evaluation of Three Low-Cost PM2.5 Monitors." Atmospheric environment (Oxford, England : 1994) vol. 235 (2020): 117615. doi:10.1016/j.atmosenv.2020.117615

8) "About AirNow." AirNow.gov, n.d., https://www.airnow.gov/about-airnow/.

Appendix

Appendix A

Daily Log Sheet

Air Quality, Childcare Daily Log Sheet

Women For a Healthy Environment
Healthy Childcare Champions

1. Full name

2. Phone number

3. E-mail address

4. Workday start-time
TIME THE FIRST CHILD CHECKED-IN FOR THE DAY

5. Workday end-time
TIME THE LAST CHILD CHECKED-OUT FOR THE DAY

Enter your answer

6. Number of children in the facility today

Enter your answer

7. Number of staff in the facility today

Enter your answer

8. Speed of filter for today

- ○ 1
- ○ 2
- ○ 3
- ○ 4

9. Were the window(s) open today? If yes, please report the approximate amount of hours. If no, leave blank.

Enter your answer

10. AQI (NUMBER) reading for today

Enter your answer

11. AQI (COLOR) reading for today

- ◯ Green
- ◯ Yellow
- ◯ Orange
- ◯ Red

12. Please report any issues with the filters here, if any

Enter your answer

12. Please report any issues with the filters here, if any

Enter your answer

13. Any changes in daily schedule or events which might influence indoor air quality?

(i.e. cooking, broken air conditioning or heater, rain day, outside issue like a fire etc.)

- ◯ Cooking
- ◯ Broken air conditioning or heater
- ◯ Rain day
- ◯ Outside issue
- ◯ Other

Appendix B

Site Project Sheet

AIR QUALITY STUDY, AIRTHINX
WOMEN FOR A HEALTHY ENVIRONMENT
Lorna Rosenburg and Randy Persaud

SITE PROJECT SHEET

FACILITY INFORMATION

FACILITY NAME	FACILITY TYPE	FACILITY ADDRESS	FACILITY CONTACT

Facility staff that received the training: ____________________

INITIAL ASSESSMENT

CO-LOCATION RESULTS:
- XX

NEIGHBORHOOD WALK AROUND:
- XX
- XX
- XX

DEVICE(S) INFORMATION

AIR FILTERS:
- **Registration #:** __________
- **Location in the facility:** ____________

AIR MONITOR:
- **Location in the facility:** ____________

DESCRIPTION: __________________

PM 2.5 OUTDOOR MONITOR:
- **Location of closest monitor:** ____________

RESULTS

DATE	# of children (include # per age group)	# of staff	FILTER SPEED	WINDOW INFORMATION	AQI #	AQI COLOR	REPORTED ISSUES WITH FILTER	REPORTED CHANGES

IQAir AirVisual Pro

Indoor Air Quality Monitor

Designed to measure indoor air quality inside homes, businesses, schools and other public facilities. Monitors air pollution generated indoors by activities such as cooking, smoking, wood burning, interior decoration and renovation. Also tracks the ingress of ambient air pollution from traffic, industry, agriculture, dust storms and wildfires.

Features & benefits

- Large 5" (12.7 cm) color display shows real-time and last 24 hours of indoor air quality
- Measures smoke and fine dust (PM2.5), carbon dioxide (CO2), temperature and relative humidity
- Displays outdoor data from paired AirVisual Outdoor monitor or public air quality monitoring station
- Internet connectivity with build-in Wi-Fi
- See your data on your phone, tablet or desktop computer with free web and iOS and Android apps
- AirVisual Pro accuracy has been verified by US government AQ-SPEC air sensor validation program
- Displays outdoor weather data and air quality forecast

Manage, visualise and share your air quality data

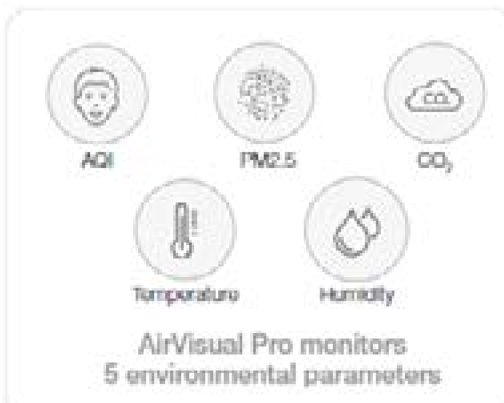
Bringing the AirVisual Pro online is quick and easy. Connect to a standard power outlet. Register and connect to the internet with the AirVisual app. See your data in less five minutes on the real-time app and the optional web dashboard.

GET IT ON Google Play | Download on the App Store

Pair an AirVisual Outdoor monitor with a nearby public station. Integrate your data into your website, public digital display or export it for further analysis.

Better health through better air

The AirVisual Pro is a comprehensive solution to monitor air quality and optimize health and wellbeing. Historic air quality data over hours, days and months gives context to air quality challenges. Real-time alerts and recommendations based on indoor and outdoor air quality comparisons, provide the basis for empowering recommendations.



Use the AirVisual Pro to see invisible threats in your air and understand where they come from.

Learn more: **iqair.com**