PARTICULATE MATTER 2.5 EXPOSURE OF UNHOUSED INDIVIDUALS IN TUCSON, AZ

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Rationale

- Outdoor $PM^{2.5}$ is a common air pollutant, identified as a significant contributor to adverse health. [4]
- Less is known about the exposure of individuals experiencing homelessness (IEH) and potential health effects.
- IEH face increased exposure susceptibilities due to their increased time outdoors, barriers to healthcare, and limited ability to seek shelter. [1]

Objectives

- Assess $PM^{2.5}$ Exposure Among IEH
- Characterize $PM^{2.5}$ Exposure
- Evaluate Personal Exposure Variations
- Highlight Potential Health Risks
- Address Gaps in Research

Affiliations

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Conclusion

While this research is currently ongoing, current analysis of data has determined:

- Sensor- IEH study participants experienced high peaks of $PM^{2.5}$
- exposure during daytime hours.
- Survey - most participants are not generally satisfied with their air quality.
- Most participants report instances of interacting with air pollution and noticing adverse symptoms.

Introduction

Individuals Experiencing Homelessness

- **23 of every 10,000** people in the United States were identified as homeless, an increase of 18% from 2023.[5]
- 2018-2023 homelessness in Pima County **increased 60%.** [1]
- Compared to general population, IEH are **more likely to have chronic illness** and have a **decreased lifespan of 12 years.** [5]

$PM^{2.5}$

- **Composition:** organic, mineral, and endotoxin compounds, liquid or solid form.[8]
- **Abundance:** related to seasonal and environmental factors: weather, human activity, and geographic location.[8]
- **Threat:** respiratory inflammation through its ability penetrate deep into the respiratory system and cause oxidative stress. [8]
  - **13th** leading cause of mortality worldwide.[12]
  - Responsible **4 million deaths** globally: cardiopulmonary illnesses such as heart disease, respiratory infections, chronic lung disease, cancers, and preterm births.[11]

Project Timeline

- Built community connections and trust at Z Mansion via weekly volunteering.
- Earned Certified Community Health Specialist Certificate in Homeless Healthcare
- University of Arizona Institutional Review Board Approval Process
- Spring 2024 Data Collection
- Winter 2025 Data Collection

Ethical Considerations

There is a long history of unethical research and exploitation of IEH.[7] This study employed the following considerations:

- Fair compensation
- Researcher focus on practicing consent a boundary setting at every step to foster trust and mutual respect.
- Cultural sensitivity: trauma-informed language
- Researcher centering needs of community rather than research agenda while volunteering at Z Mansion.

Environmental Justice Lens

- Air pollution disproportionately affects marginalized and underserved populations. especially IEH.[10,6]
- The experience of being unhoused is not a personal tragedy, rather an outcome of a social failure.
- This study centers the importance of autonomy and choice for IEH.

Methodology

Recruitment: Z Mansion Feeding Project

✓ Self identify as being an IEH

✓ Have access to a mobile phone

- Personal Air Quality Monitoring Using Portable AirBeam 3 Sensor:
  - Measures $PM^{2.5}$ through light scattering samples. Communicates via bluetooth connection to smartphone.
  - Calibrated via (Aerosol Spectrometer 11-D, Grimm Aerosol Technik)
  - Collection Period: semi-continuous data collection for 7 days.
- In-person Interview-style surveys:
  - Topics: perceived air quality concerns, preexisting health conditions, housing history, and physical symptoms.
- Real-time air quality monitoring using portable sensors and survey-based for a fall and spring cohort.

Current Takeaways

- A majority of participants have concerns about air pollution in their environment.
- Participants demonstrated high excited and engagement.
- Participants were very reliable at returning sensor AirBeam 3 in good condition. Many found ways to return the AirBeam 3 with a full charge.

Survey Data

Results as of 3/31/2025 N=7

Age

- Avg = **52**

Gender

- **83%** Male
- **17%** Female

Duration in Pima County

- **67%** reported residing in Pima county 10+ years

Number of Nights Sleeping Outside Per Week

- Min: **3**
- Avg: **4.8**
- Max: **7**

Current Length of homelessness

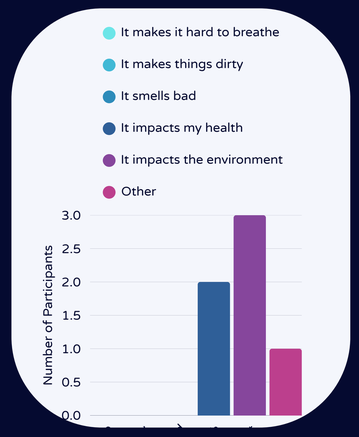
- **100%** reported chronic homelessness (unhoused for 12 consecutive months or more).

Preexisting Health Conditions

- **71%** reported having a preexisting chronic mental or physical health condition.
- **71%** reported a previous diagnosis of a respiratory condition (asthma, pnemonia, bronchitis, ect.)

Current Knowledge and Concerns on Air Pollution

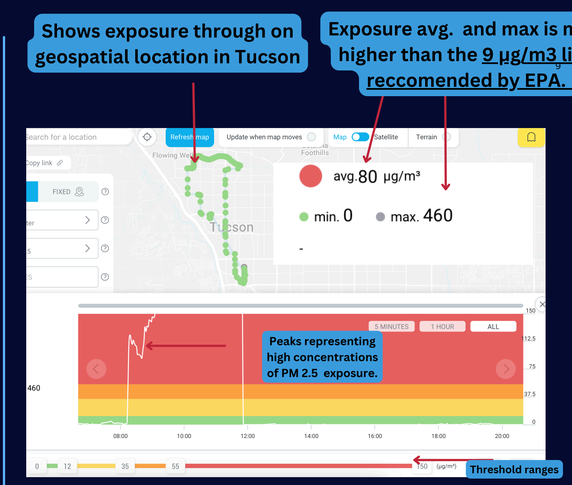
- **83%** reported being **"very concerned"** about air pollution.
- **67%** reported **"vehicle emissions"** as the most concerning air pollution source to them.
- **67%** reported feeling like air pollution has negatively impacted their health at some point.
- **83%** reported having experiences where air pollution exposure triggered health symptoms (i.e, wheezing, coughing, difficulty breathing).



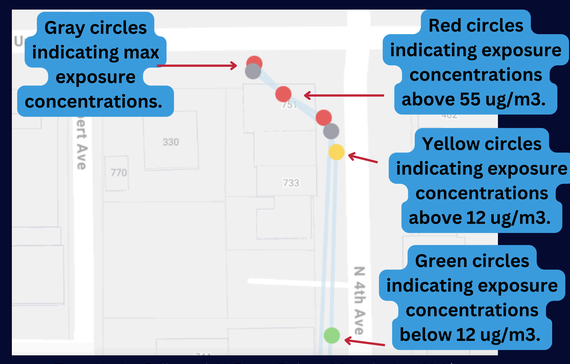
EPA STANDARD: 9 µg/m3 limit reccomended.

Scan for References

AirBeam Sensor Data



Map and Graph of Collected AirBeam 3 data via AirCasting App.



Zooming in: Collected AirBeam 3 data. Map depicts N 4th Ave. and University Blvd in Tucson, AZ, a highly populated residential and commerce area.

	Length (min)	Minimum µg/m3	Maximum µg/m3	Avg µg/m3
Data Set 1	812	0	460	79.69
Data Set 2	6,604	0	408	4.34
Data Set 3	790	0	414	9.95
Data Set 4	420	0	173	12.73
Data Set 5	4846	0	446	6.46
Data Set 6	815	0	604	41.12