



**How Participatory Air Quality Sensing Shapes Participants' Exposure Experiences:
Perceptions and Challenges of Mitigating Exposure Pre-Sensor Distribution**

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Abstract:

Air pollution is a serious problem in Salt Lake County driven by natural and anthropogenic processes that are amplified by its unique topography and geography (Pope et al., 1999). From 2009-2020, Salt Lake County was designated a nonattainment area for PM_{2.5} pollution, meaning that the area was in violation of National Ambient Air Quality Standards set by the Environmental Protection Agency (USEPA, 2020). This is concerning because pollutants, such as PM_{2.5}, have numerous adverse health impacts (Beard et al., 2012; Hammoud et al., 2010; Pope III et al., 2008; Utah Division of Air Quality, 2017). Local studies have also found that outdoor PM_{2.5} pollution negatively affects indoor air quality (Hegde et al., 2020; Mendoza et al., 2021). While air pollution impacts everyone, it does so disproportionately. Research shows that air pollution disproportionately impacts the west side of Salt Lake County due to closer proximity to pollution sources such as heavy industry and freeways (Lin et al., 2018). The west side is also located on topographically low elevations, which are subject to higher concentrations of PM_{2.5} pollution (Pope et al., 1999).

There has been little research done to study the exposure experiences and perceptions of those most impacted by air pollution on the west side. Therefore, our summer research focused on examining how participatory air quality sensing shapes participants' exposure experiences and decision making related to their air pollution exposure. The exposure experience framework guiding our research is grounded in three pillars 1) embodied health experiences, 2) personal exposure science (like participatory air quality sensing), and 3) decision making. We conducted an intervention using the citizen science method of participatory air quality sensing by distributing seven indoor PM_{2.5} sensors to seven households on the westside of Salt Lake County (Figure 1) and engaging them in the scientific process of monitoring and reporting their air quality data for four weeks. In addition, we conducted pre- and post-interviews to better understand participants' perceptions of and experiences with air quality before receiving a sensor and after conducting participatory air quality sensing in their own homes.

My research focus for this study was conducting, transcribing, translating, and analyzing (by way of qualitatively coding; see Figure 2) the seven pre-interviews. I conducted a two-cycle coding analysis of the pre-interview data and three themes emerged from that process. The preliminary results of my data analysis were that:

1. Most participants had the perception that indoor air quality is impacted by the outdoor air and, therefore, difficult for them to control and/or mitigate their household exposures to. Participants identified some uncontrollable outdoor factors that impact indoor air quality

were: industrial activity, car traffic, neighbors smoking, military activity, and firefighter training. Participants also shared factors they do have control over to mitigate exposure such as individual-level behaviors like opening windows while cooking, keeping pets outside, changing air filters and possibly moving.

Participant quotes:

“For me, the outside air quality is the inside air quality because of the swamp cooler...pumping in outside smog and smoke and anything else that’s going on in the valley at the time”

“[Indoor air pollution] is something contradictory because we have a lot of refineries in the state. One no longer knows whether it’s the inside or outside, we no longer know and it can be both”

2. Most participants expressed a perception that pollution sources near the home were particularly concerning (e.g., list a couple of examples of sources near homes that were mentioned), along with other potential pollution sources not near the home due to the belief that air quality can travel across distances and linger/concentrate in parts of the valley near participants’ homes. Some pollution sources identified were: refineries, Kennecott, Magnesium Corp of America, incinerators, and car traffic.

Participant quotes:

“Car traffic is the most apparent one, like you can just smell it. It’s awful and it’ll also linger in our home and our home will just smell like emissions. It’s not fun, we want to move”

“Over there is a factory, sometimes even the cars during the snowy weather would appear brown”

3. Renting participants expressed challenges with protecting their household members against indoor air pollution due to barriers related to their renter status (e.g., landlords not making necessary updates to the housing structure such as to ventilation/filtration systems thus contributing to air quality issues in the home).

Participant quotes:

“I have almost 12 years living in this apartment, but the air ducts have never been cleaned... the owner is very irresponsible. The apartment is in very bad conditions, but rent is expensive everywhere”

“The pipes did not work well there; a bad smell of gas came out. That’s why we got out of there because the owner never did anything about it”

Our preliminary findings shed light on participants' perceptions of and experiences with air quality in their homes, particularly the challenges and barriers that they faced in protecting their households from air pollution at the start of our study. Our study builds upon the findings of Grineski and Hernandez (2010) which found that poor quality rental housing impacted children’s asthma and that landlords were a significant factor in maintaining unhealthy household conditions because we found that renter status prevented our participants from mitigating and protecting themselves from exposure to poor household conditions which they believed contribute to indoor air pollution. Therefore, legislators should recognize landlords as a factor

that contributes to indoor air pollution exposure and enforce interventions that protect renters. Such as housing codes that ensure all homes have adequate ventilations systems or create a subsidy program to help all members of the public afford high-efficiency filters for homes. Overall, these findings call for collective action because tackling the problem of air pollution requires a multifaceted approach. Indoor and outdoor air quality cannot be solved through individual actions solely; we must approach this issue as a collective that engages public citizens, community organizations, industries, and government entities from the local to federal level. More action-driven research is needed in the communities most impacted by air pollution in particular as they are the ones experiencing it firsthand and where collective action can begin.

Figure 1: Map of Case Study Area in Salt Lake County, Utah

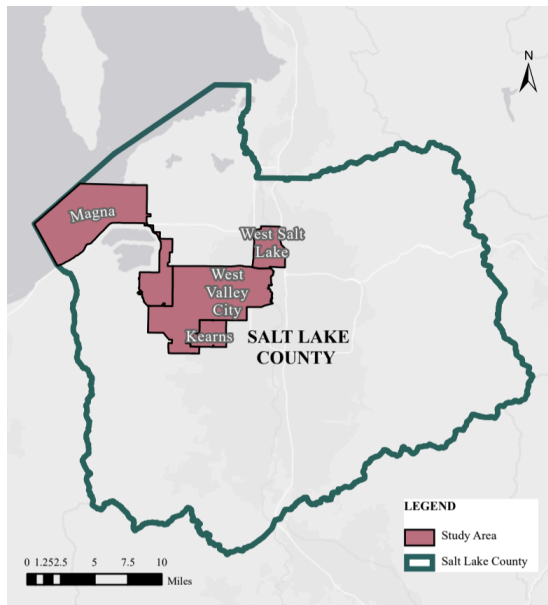
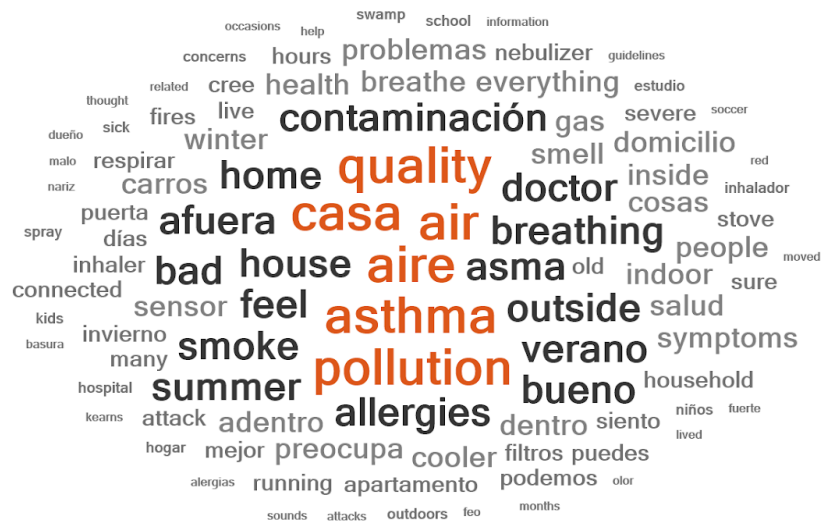


Figure 2: Code word cloud



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