SMART CITIES

Public Perception of Air Pollution in Portland, Oregon

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Summary

This report summarizes the results of the Smart City PDX Public Perception of Air Pollution survey. This survey was designed to gain a better understanding of public perception of air pollution, and public attitudes toward science and the environment in Portland, Oregon. The goal of this work is to inform responsive public engagement strategies.

Sample

Data was collected from a random sample of Portland residents (n=1,000)[1] over a period of 6 weeks in the spring of 2020 (March 4 through April 14)[2] using an online survey. A quota sampling method was used to ensure the sample reflected the racial (~79% white) and sex (50% female) characteristics of Portland. **Given the large sample size and demographics of our sample, we are confident that results are generalizable to the Portland population as a whole**. Complete demographic information for the sample and more methods details are included in the appendix.

Acknowledgements

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[1] Sample size was determined based on a confidence level of 99%, confidence interval of 4, and population of 653,115.
[2] Data were collected during the initial stages of the coronavirus crisis in the United States and in the state of Oregon. A global pandemic may have influenced participant responses regarding their understanding of air pollution as a risk.

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Executive Summary

Policy Priorities: The environment ranks 4th as a policy priority, below the economy, healthcare costs, and education. Air pollution ranks 1st among environmental concerns, followed by pollution in the ocean, freshwater pollution, and climate change. .

Confidence in Science: Portlanders have an overall neutral confidence in science and technology to solve environmental problems; however, most participants agreed that "most environmental problems can be solved by applying more or better technology."

Locus of Concern: Portlanders care about environmental issues because of the implications for the biosphere (plants and animals) and other humans more than for themselves; they view the environment as fairly fragile and vulnerable to negative effects from human activity.

Public Knowledge: Portlanders do not feel like they know very much about air pollution in their own neighborhoods, but many believe it is easy or very easy for them to tell how polluted the air in their neighborhood is. Industrial sources were seen as the biggest source of pollution, followed by personal vehicles.

Scientific Knowledge: Portlanders believe that scientists and government agencies understand the air pollution in their neighborhood moderately well. Groups assumed to know the most are: ODEQ and scientists. Groups assumed to know the least are: city/local government and the federal government. Very few (5.8%) Portlanders believe that it is difficult for scientists / experts to assess the air pollution in their neighborhoods

Risk Assessments: Very few (14.7%) Portlanders believe that air quality in Portland is better now that it has been in the past, and only 15.2% believe air quality in their neighborhoods is better. Additionally, only 1/3 of Portlanders worry about the health effects of air pollution often (i.e. 4+ times in the last 6 months). Even though air quality is not seen as getting better, Portlanders do not, on average, see air pollution as a severe risk, and do not see themselves as susceptible to the effects of poor air quality.

Support for Sensors: Support for sensors in/near homes, neighborhoods, schools, and traffic areas is very high; highest support for major traffic areas. For those stating a preference, high quality (but fewer) sensors are preferred to lower quality (but more) sensors.

Trust in Information Sources: Air quality scientists and the UO system are the top two most trusted sources for air pollution information. State and federal government are the least trusted sources.

Information Seeking: Search engines and government websites are the most common sources of information. Current levels of air pollution is the most commonly searched for information. Particulate matter in the air is the most important information, compared to other types. The most liked infographic was a color-coded chart that labels air quality in any given area from good (green) to hazardous (dark red)

Engagement Preferences: Most Portlanders prefer a deficit-model approach and getting information from a website or via email. Portlanders are not likely to attend a public forum on air quality or talk to policymakers about air pollution in their neighborhood

Public Policy Priorities

In an effort to better understand how environmental issues ranked compared to other public policy issues for Portlanders, participants were asked to rank a list of nine (9) public policy issues, including: economy, education, terrorism, environment, immigration, jobs, crime, military, and healthcare. Overall, **the environment is the 4th most important issue** (defined by the mean, M=4.04, and the top 5 issues selected by participants), and the environment ranked in the top 5 policy issues for most participants (72%). The economy, healthcare[3], and education was ranked above environmental issues for most participants.

FIGURE 1: Public Policy Priorities, Ranks 1-5
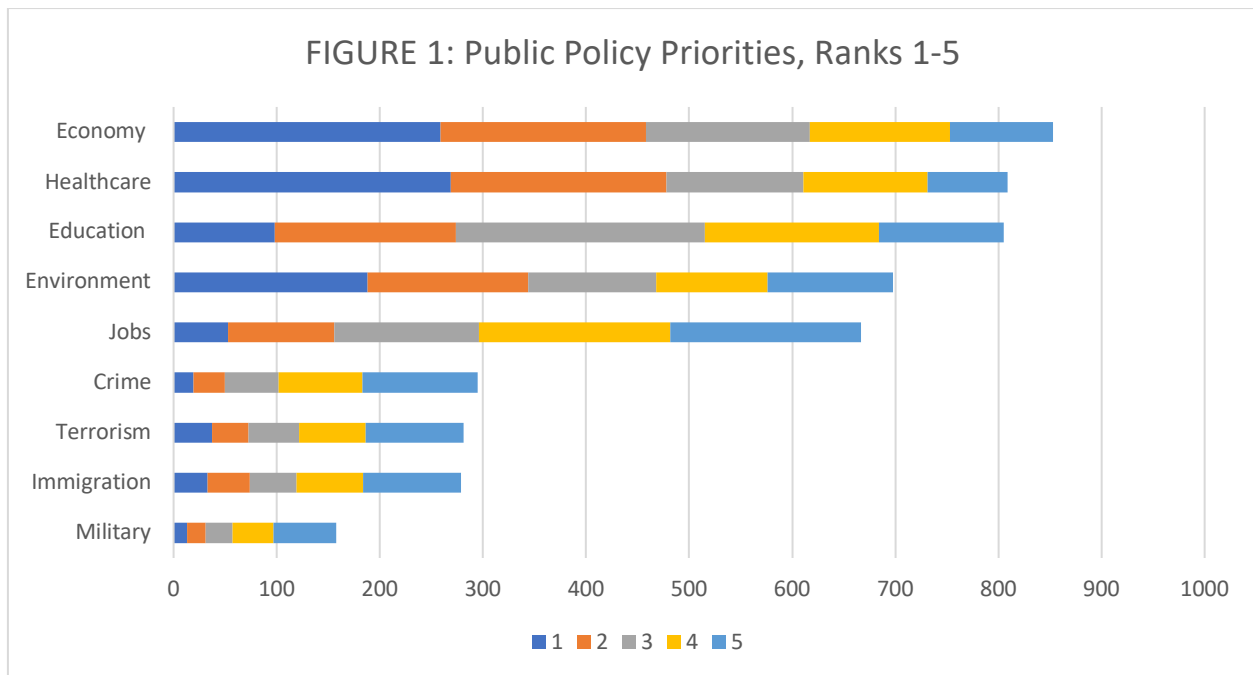
Demographic Differences

Liberals and females are significantly more likely to rank the environment higher than other policy priorities[4] compared to conservatives and males. Education, income, age, and race were not significant predictors, indicating they may not be important demographic factors to consider regarding prioritizing the environment.

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[3] Data collection began in early March 2020 in the early stages of coronavirus outbreaks in the United States. Data collection continued throughout the initial outbreaks in Oregon and social distancing procedures and concluded on April 14, 2020. This may have influenced participant perception of healthcare as a policy priority.

[4] A regression analysis was run using demographic variables (education, income, political ideology, sex, age, and race) as predictors for prioritizing the environment ($R^2 = 0.195$, $p < 0.001$). Political ideology ($B = 0.989$, $p < 0.001$) and biological sex ($B = -0.328$, $p < 0.05$) were the only significant predictors. Education, income, and race were not significant.

Environmental Policy Priorities

In an effort to better understand how people in Portland prioritize air pollution compared to other environmental issues, participants were asked to rank a list of twelve (12) environmental issues, including: pollution in water (ocean, freshwater), climate change, clean energy, recycling, endangered species, garbage and waste management, extreme storms, fossil fuels, fracking, and mining. Overall, air pollution was ranked as the 3rd most important environmental issue (defined by the mean value for air pollution, M=3.21), and **air pollution was ranked in the top five environmental issues by 82.6% of participants**.

FIGURE 2: Public Policy Priorities, Rank 1-5
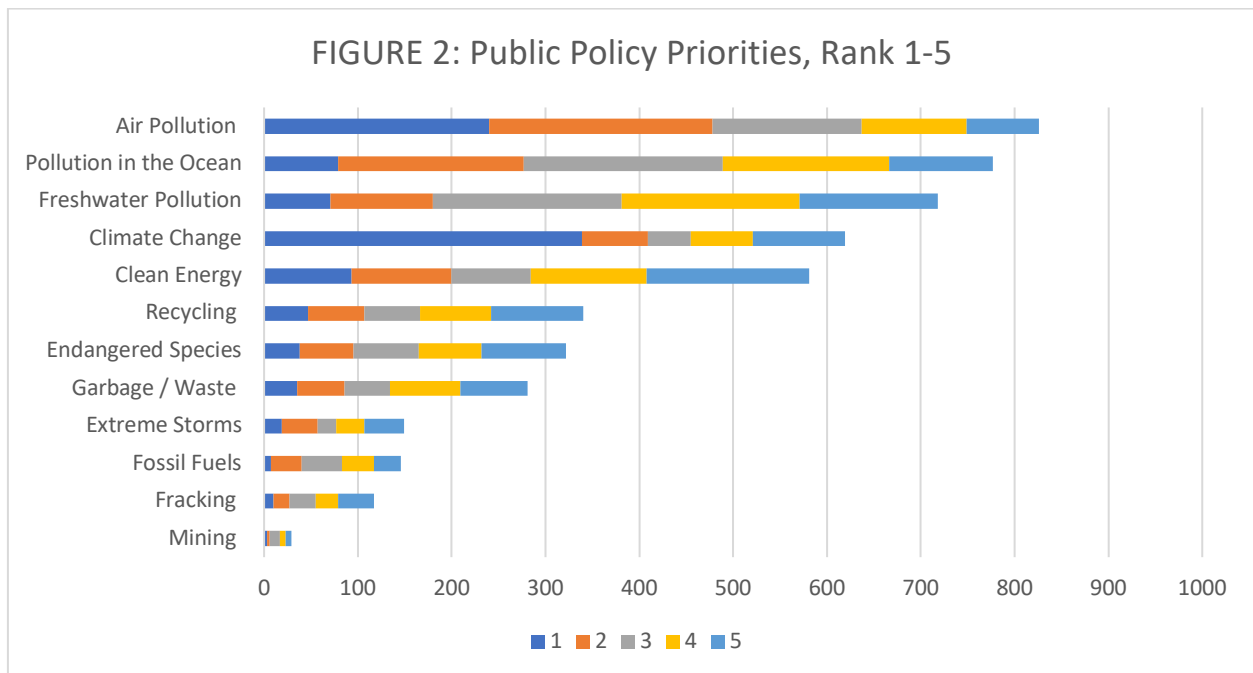
Demographic Differences

Conservatives, non-white participants, and those with lower education were significantly more likely to rank air pollution as a top environmental policy issue[5] compared to liberals, white participants, and those with higher education. This might reflect the higher ranking of climate change as an environmental concern for groups like liberals, making air pollution somewhat lower on the list of policy concerns.

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[5] A regression analysis was run using demographic variables (education, income, political ideology, sex, age, and race) as predictors for prioritizing the environment ($R^2 = 0.036$, $p < 0.01$). Race ($B = 0.479$, $p < 0.01$), political ideology ($B = -0.256$), and education ($B = 0.141$, $p < 0.001$) were the only significant predictors.

Confidence in Science & Technology

Confidence in the ability of science and technology to solve environmental problems was measured using a pre-existing 10-item scale[6] (α = 0.80), where participants indicated their level of agreement to a list of statements using a 5-point Likert scale. Items were averaged to create a single "confidence" index for each participant.

On average, **participants had neutral opinions regarding whether or not science and technology could solve environmental problems** (M=2.98, SD=0.694)[7]. However, most participants agreed that "most environmental problems can be solved by applying more or better technology." Most participants disagreed with the statement "humans will eventually learn enough about how nature works to be able to control it." Single-item statistics are included in Table 1.

TABLE 1: Confidence in Science & Technology Single Item Statistics		
Survey Item	**Mean**	**Std. Dev.**
Most environmental problems can be solved by applying more and better technology.	**3.43**	**1.107**
Science & technology will eventually solve our problems with pollution, overpopulation, and diminishing resources.	3.04	1.149
Science & technology do as much environmental harm as good *(reverse coded)*	2.96	1.110
Modern science will NOT be able to solve our environmental problems *(reverse coded)*	3.17	1.135
We cannot keep counting on science and technology to solve our environmental problems *(reverse coded)*	2.72	1.244
Humans will eventually learn how to solve all environmental problems	2.81	1.156
The belief that advances in science and technology can solve our environmental problems is completely wrong and misguided *(reverse coded)*	3.30	1.181
Humans will eventually learn enough about how nature works to be able to control it	**2.42**	**1.217**
Science & technology cannot solve grave threats to our environment *(reverse coded)*	3.05	1.162
Modern science will solve our environmental problems	2.95	1.081

Demographic Differences

Males and younger adults had significantly higher levels of confidence in science and technology[8] than females and older adults.

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[6] See appendix for more detail and citation information.

[7] All 10 confidence items were averaged to create a single confidence index for participants.

[8] A regression analysis was run using demographic variables (education, income, political ideology, sex, age, and race) as predictors for confidence in science and technology (R^2 = 0.042, $p < 0.001$). Biological sex (B = -0.251, $p < 0.001$) and age (B = -0.038, $p < 0.05$) were the only significant predictors.

Environmental Attitudes & Beliefs

Motives

Research shows that people have varying reasons to care about the environment, including Biospheric (concern for animals/the environment), Egoistic (concern for self), and Social-Altruistic (concern for other humans) motives. Participants were grouped into one of seven (7) categories according to which of the three motives they were mostly motivated by. **Most participants cared about environmental issues because of the implications for the biosphere (plants and animals) and other humans more than the implications for themselves.**

FIGURE 3: Participants Grouped According to Motives
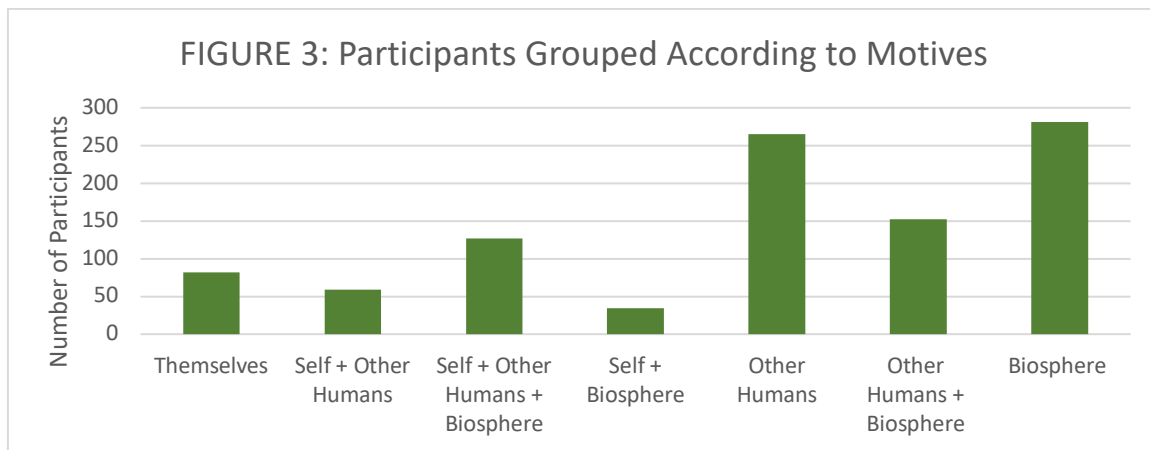
Activism

On average, Portlanders are inclined toward activism for environmental causes[9].

Demographic Differences

Liberals and females are more inclined toward environmental activism[10] compared to moderates/conservatives[11] and males[12].

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[9] An index was created averaging the likelihood of participants engaging in different activist behaviors (donating money to environmental campaigns, persuading others that the environment is important, etc.), giving each participant an 'activism' score. Overall, participants are inclined toward environmental activism (M=3.45, SD=0.903).

[10] A regression analysis was run using demographic variables (education, income, political ideology, sex, age, and race) as predictors for activism (R^2 = 0.143, p < 0.001). Political ideology (B = -0.285, p <0.001) and sex (B = 0.139, p <0.01) were the only significant predictors.

[11] A one-way ANOVA was run to compare three ideological groups ((very)liberal, moderate, and (very)conservative) (F(2, 993)=64.570, p<0.001). Liberals (M=3.77, SD=0.724) were more inclined to engage in environmental activism than moderates (M=3.42, SD=0.876) and conservatives (M=2.95, SD=0.985).

[12] An independent samples t-test was run to compare the mean scores of males (M=3.36, SD=0.911) and females (M=3.53, SD=0.888) (t(995)=-3.096, p<0.001).
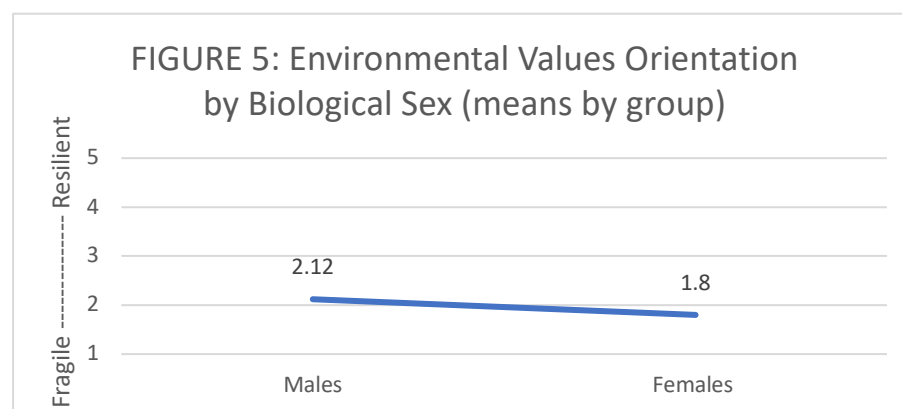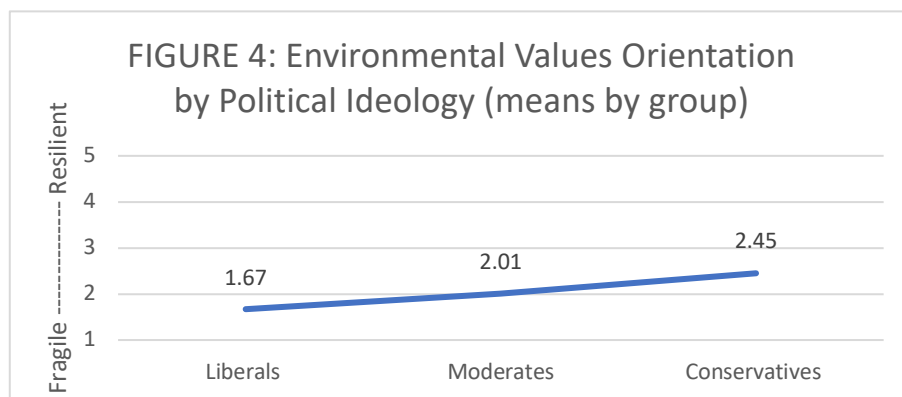
Values Orientation

In an effort to understand how Portlanders think about the relationship between humans and the environment, particularly regarding how resilient they believe nature to be in relation to human activity, participants were shown a series of statements about that relationship and asked to indicate their level of agreement.

Overall, participants viewed the environment as fairly fragile and vulnerable to negative effects from human activity.

Demographic Differences

Liberals and females see the environment as more fragile than conservatives and males[13]. Importantly, all participants (on average) viewed nature as somewhat fragile. However, liberals and females view it as slightly *more* fragile than conservatives and males.

FIGURE 4: Environmental Values Orientation by Political Ideology (means by group)

FIGURE 5: Environmental Values Orientation by Biological Sex (means by group)

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[13] A regression analysis was run using demographic variables (education, income, political ideology, sex, age, and race) as predictors for views on the resiliency of nature (R^2 = 0.178, p < 0.001). Political ideology (*B* = 0.285, p <0.001) and sex (*B* = -.276, p <0.01) were the only significant predictors. One-way ANOVA was run to compare the mean scores of ideological groups ($F_{(2,993)}$=84.00, p<0.001). An independent samples t-test was run to compare the means scores of both sexes ($t_{(995)}$=6.053, p<0.001).

Air Quality Knowledge

Personal Knowledge

FIGURE 6: SELF-REPORTED AIR QUALITY KNOWLEDGE - NEIGHBORHOD

good amount / a lot
22%

nothing / very little
45%
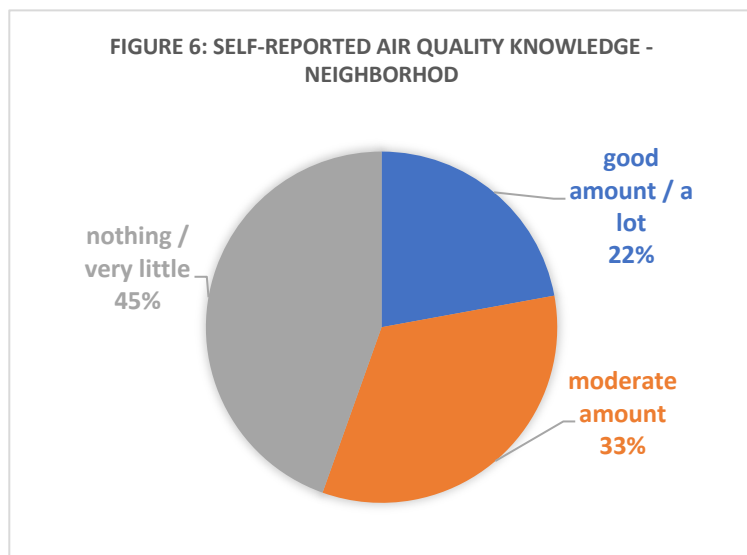
moderate amount
33%

Overall, **participants did not feel like they knew very much about air pollution in their own neighborhoods**: only 22% report that they know 'a good amount' or 'a lot' about the air quality in their neighborhoods. One third (33.3%) report knowing 'a moderate amount' and 44.5% report knowing nothing or very little.

Despite not reporting to know a lot about the air quality in their neighborhoods, most participants believed it was fairly easy for them to know. Less than one fifth (18.8%) of participants find it difficult to get a sense of the air pollution in their neighborhoods. Approximately two fifths (40.7%) believe it is neither easy nor difficult, or selected 'I don't know.' **A large portion (40.2%) believe it is easy or very easy for them to tell how polluted the air in their neighborhood is**.

Most participants believe industrial sources to be the biggest source of air pollution in Portland, followed by personal vehicles[14].

Industry	• 40%
Personal Vehicles	• 36%
Other	• 24%

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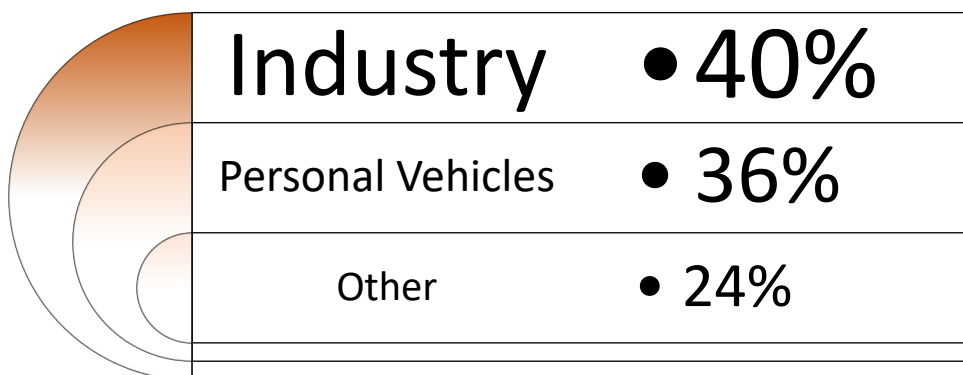
[14] Participants were given a list of pollution sources and asked to indicate the largest one (selecting one only). Percentages reflect the percentage of participants who named that item the #1 source of air pollution. Other categories included: heavy duty trucks (7.4%), commercial interests (6.0%), construction (4.5%), busses (2.3%), logging (2.0%), and agriculture (1.5%).

Most people report knowing the air pollution outside is at a level that is a risk to their health[15] by **receiving a news report or alert**. Other widely used methods of determining poor air quality include the air looking hazy. Less than half of participants use major events, smells, or difficulty breathing to tell them about air quality.

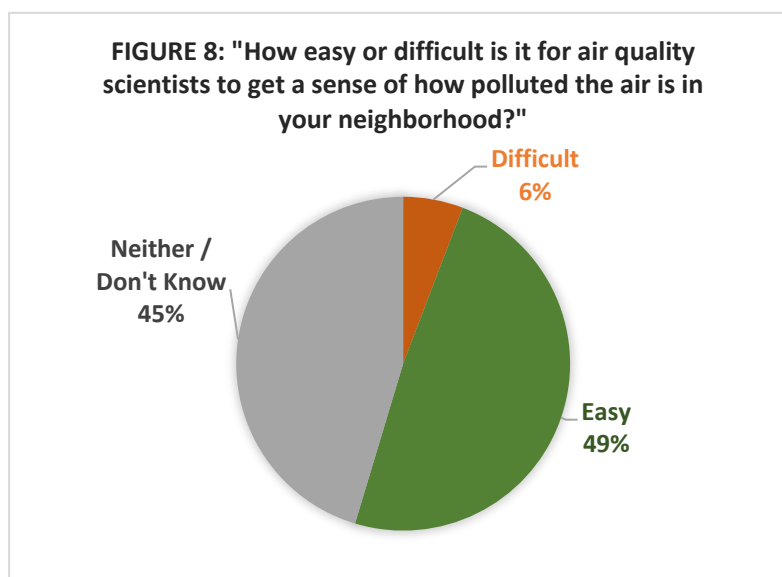FIGURE 7: Indicators of Poor Air Quality
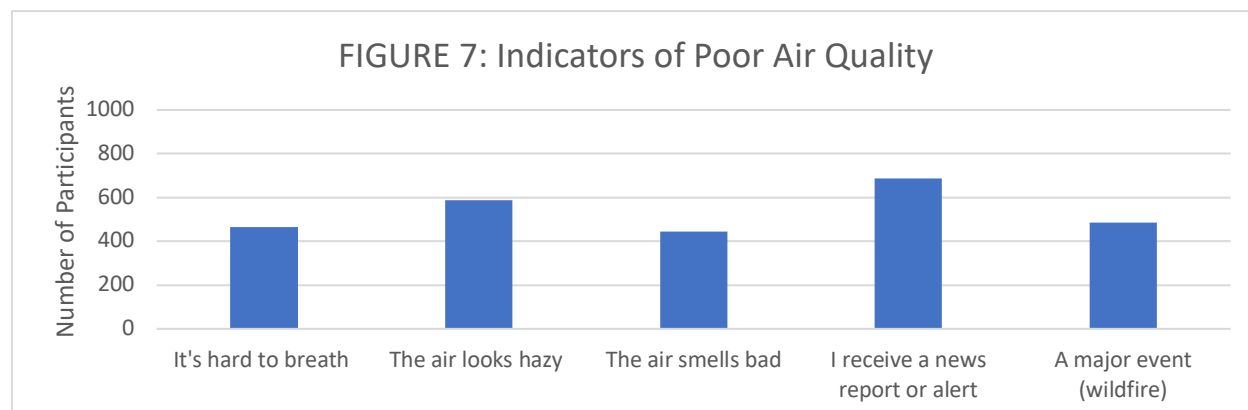
A small number of participants (45, or 4.5%) selected 'other' and entered text for other indicators. The most popular alternative methods for determining air quality include:
- A weather app / looking it up online (e.g. WeatherBug, phone app, AQI, "I google it")
- Friends, social media
- Physical effects (dust and grime on surfaces, plants dying, seeing too many cars)

Scientific Knowledge

Almost half of participants (48.8%) believe it is easy or very easy for scientists to measure the air pollution in their neighborhoods. Slightly less than half (45.3%) believe it is neither easy nor difficult (or didn't know). **Only 5.8% of participants believe it is difficult for scientists/experts to assess the air pollution in their neighborhoods**.

FIGURE 8: "How easy or difficult is it for air quality scientists to get a sense of how polluted the air is in your neighborhood?"

Difficult 6%

Neither / Don't Know 45%

Easy 49%

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[15] Participants were given a list of possible indicators and asked to 'select all that apply,' making overlap possible.

Government Knowledge

Overall, participants believe that scientists and most government agencies understand the air pollution issues in their neighborhood moderately well. The groups believed to know the most include Oregon's Department of Environmental Quality (M=3.30, SD=1.166) and air quality scientists (M=3.27, SD=1.203). The groups believed to know the least include the federal government (M=2.38, SD=1.148) and local government (M=2.84, SD=1.108).


FIGURE 9: "HOW WELL DO THE FOLLOWING GROUPS UNDERSTAND AIR POLLUTION" BY POLITICAL IDEOLOGY
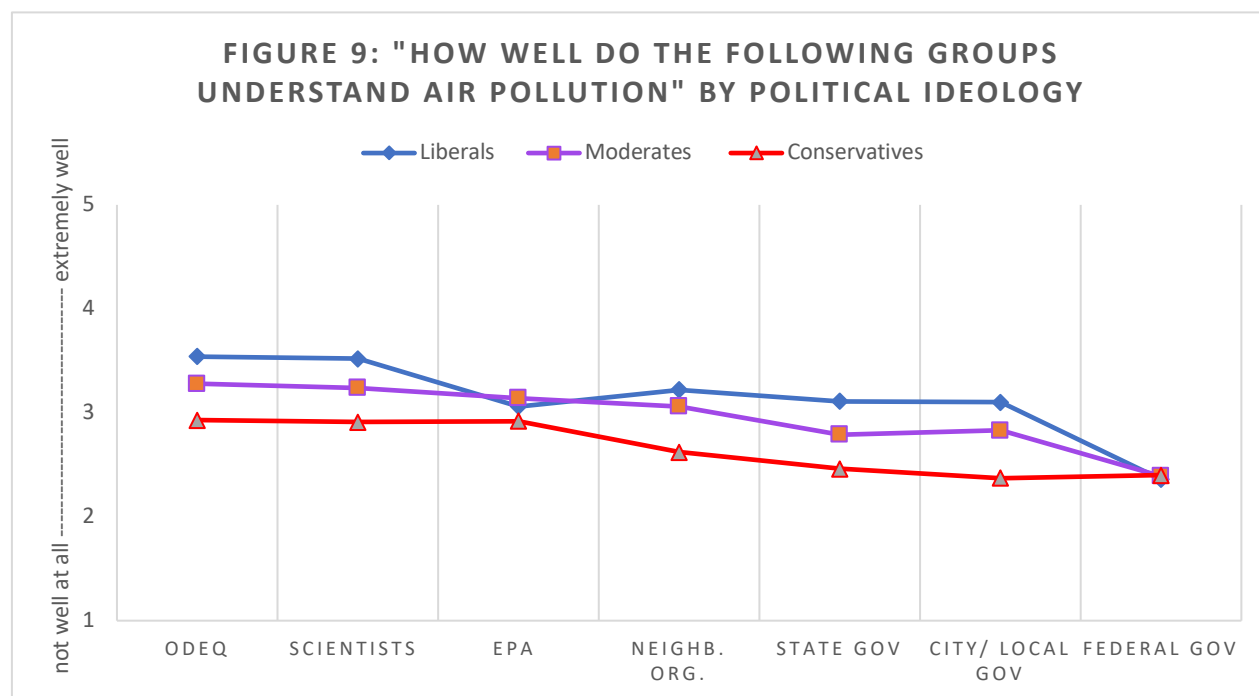
Demographic Differences

Liberals had a significantly more positive view of external sources' knowledge of air pollution than moderates or conservatives for most groups[16], including: ODEQ, scientists, local neighborhood organizations, state government, and local/city government. No significant differences in views of external groups' knowledge was found for liberals, moderates, and conservatives for the EPA or federal government.

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[16] A one-way ANOVA was run comparing liberals ('liberal' and 'very liberal'), moderates, and conservatives ('conservative' and 'very conservative') according to their perception of each group's knowledge of air quality. An alpha level of 0.05 was used to determine significance. Mean scores for each ideological group for each information source is detailed in Figure 9.

Air Pollution Risk Perceptions

Air Quality Over Time

Better: 14.7%
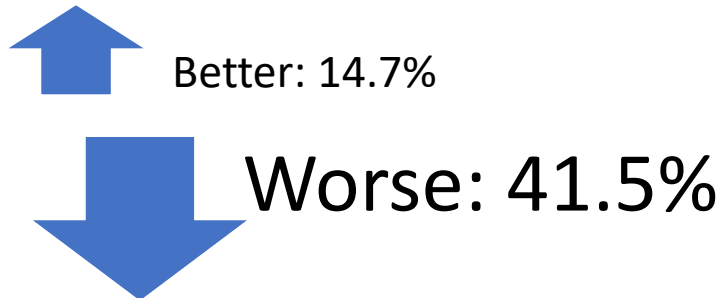
Worse: 41.5%

Most participants either believed that air quality is the same (or selected 'I don't know') in Portland now compared to prior years (43.7%), or they believed it's getting worse (41.5%). **Only 14.7% believed that air quality <u>in Portland</u> is better now than it has been in the past**.

By contrast, the majority of participants believe the air quality in their neighborhoods to be the same (or they selected 'I don't know') (58.9%). Approximately one quarter (25.8%) believe air quality in their neighborhood is getting worse. **Only 15.2% believe air quality <u>in their neighborhood</u> is better now compared to prior years**.

Salience

Participants think about and feel upset about air pollution somewhat infrequently. On average, they report thinking and feeling upset about air pollution 1-3 times in the last 6 months. One third (32.6%) report never worrying about the health effects of air pollution; one third (32.6%) worried about health effects 1-3 times in the last 6 months; and one third (34.8%) report worrying about health effects 4 or more times.
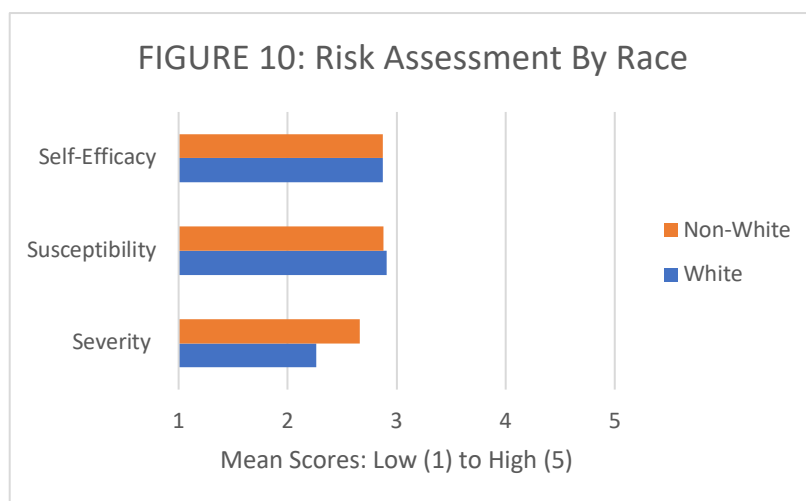
Demographic Differences

Air pollution is more salient for liberals, females, older people, and non-whites compared to conservatives, men, younger people, and whites[17].

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[17] A regression analysis was run using demographic variables (education, political ideology, income, biological sex, age, and race) to predict salience of air pollution (R^2 = 0.084, p < 0.001). Political ideology (B=-.253, P<.001), sex (B=.168, P<.05), age (B=-.060, P<.01), and race (B=.229, P<.05) were all significant predictors.

Overall Risk Assessment

According to the *Extended Parallel Process Model,* people process risks along four primary dimensions: perceived severity (severity of the consequences of a risk), susceptibility (likelihood of experiencing the risk), self-efficacy (an individuals' capability to protect themselves from the risk), and response-efficacy (how effective a given action will be in protecting them). Low perceived severity and susceptibility can lead to people underestimating risks, while high perceived severity and susceptibility with low efficacy can lead to a fear-control response. We measured the first three dimensions[18].

Overall, participants do not feel that air pollution is a significant risk. They do not view air pollution as severe (M=2.35, SD=1.11), they do not see themselves as susceptible to health effects from poor air quality (M=2.91, SD=1.14), and they have neutral-low self-efficacy (M=2.87, SD=0.86).

FIGURE 10: Risk Assessment By Race

Demographic Differences

While the sample as a whole assesses air pollution as not very risky, there are some interesting demographic differences in risk assessment[19]:

- Risk severity: **liberals, those with lower income, females, and non-white participants are more likely to see air pollution as a more severe risk**, compared to conservatives, those with higher income, men, and whites.

- Susceptibility**: liberals, those with lower income, and older adults are more likely to see themselves as susceptible to air pollution**, compared to conservatives, those with higher income, and younger adults.

- Self-Efficacy: **conservatives are more likely to have higher self-efficacy regarding protecting themselves from air pollution** compared to liberals.

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[18] Measuring response-efficacy requires identifying a specific action. As we did not have specific individual-level actions for participants to assess, we did not measure response-efficacy.

[19] A regression analysis was run using demographic variables (education, political ideology, income, biological sex, age, and race) to predict risk assessment variables, including severity ($R^2 = 0.076$, $p < 0.001$), susceptibility ($R^2 = 0.038$, $p < 0.001$), and self-efficacy ($R^2 = 0.021$, $p < 0.001$). Only significant demographic variables for each risk assessment are reported above.

Support for Sensors

The vast majority of participants have some level of support for having sensors in their homes (92.5%), in their neighborhoods (93.7%), in major traffic areas (96.2%), and near schools (95%).

FIGURE 11: Support for Sensors by Location
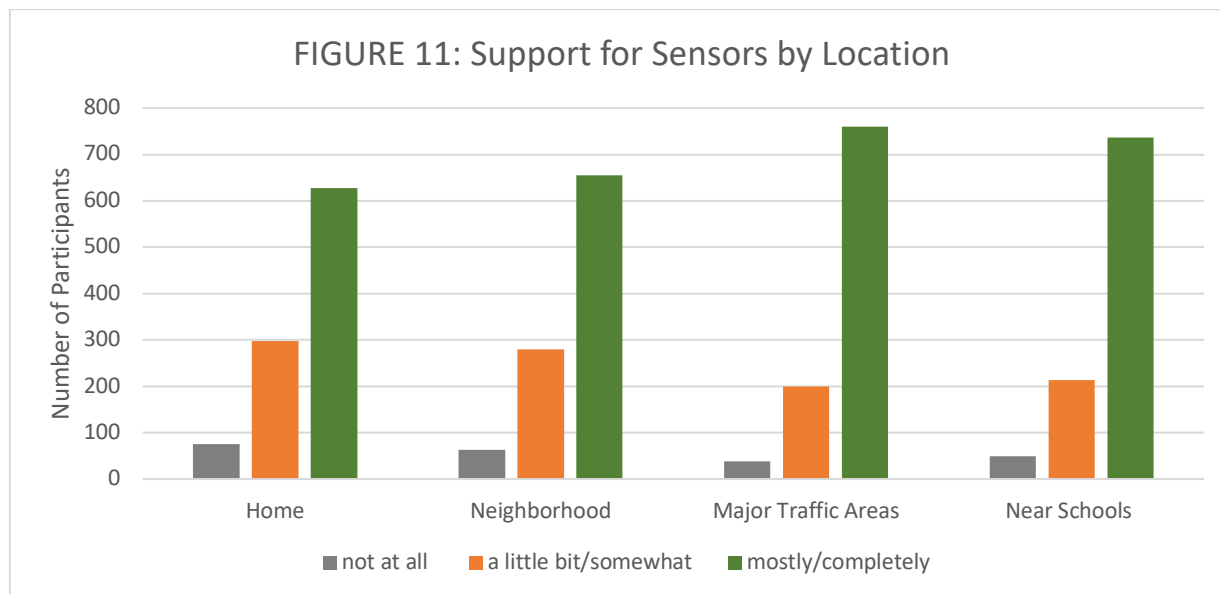
When asked to choose between high-quality sensors in fewer locations or low-quality sensors in many locations, **most participants either preferred high-quality sensors (46%) or did not have a preference (23.1%).** About one third (30.9%) preferred low-quality sensors in many locations.


FIGURE 12: SENSOR PREFERENCES
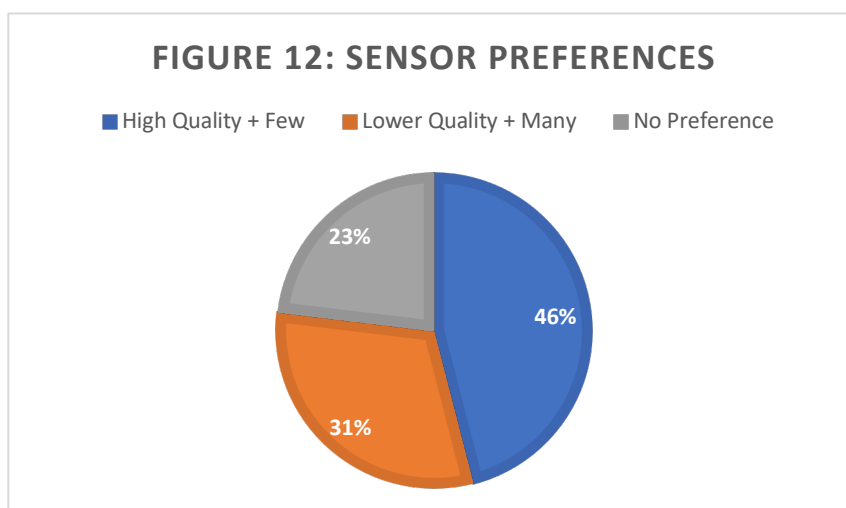
Information Seeking & Satisfaction

Information Seeking Behavior

Most participants report not looking for air quality information very often. Almost half (47.6%) say they haven't looked for AQ information in the last six months, and one third (32.8%) say they have only looked 1-3 times. Only one fifth (19.6%) say they have looked for air quality information 4 or more times in the last 6 months.
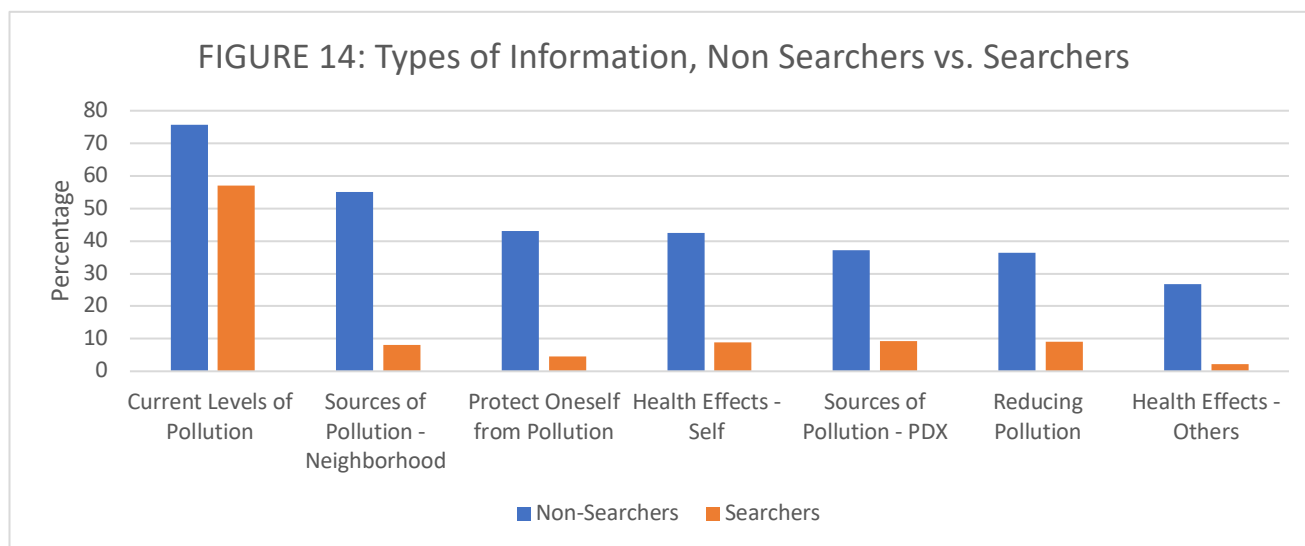
Sources of Information

Among who say they have not looked for air quality information in the last six months (n=476), they indicate that if they were to look up such information, they would primarily use search engines (76.3%) and government websites (47.5%). Those who have looked for air quality information (n=524) report doing so using online search engines (50.9%) and government websites (21.2%)[20].

FIGURE 13: Information Sources, Non Searchers vs. Searchers
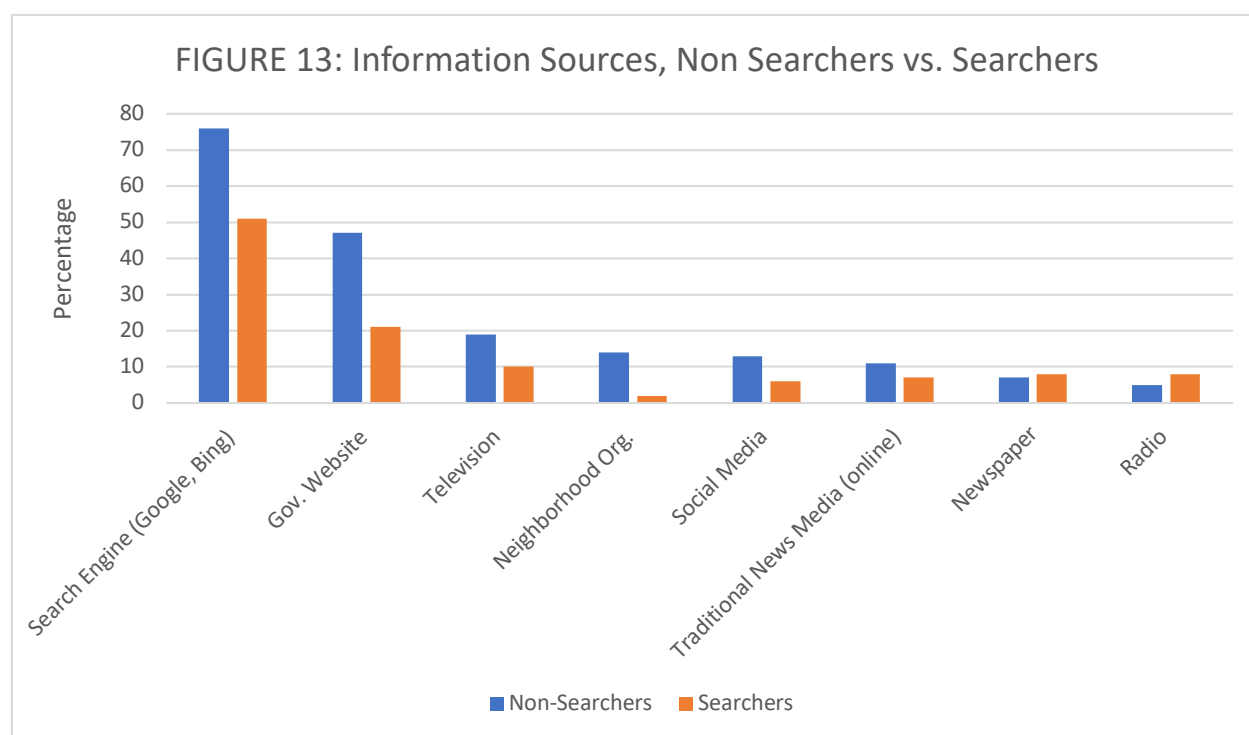
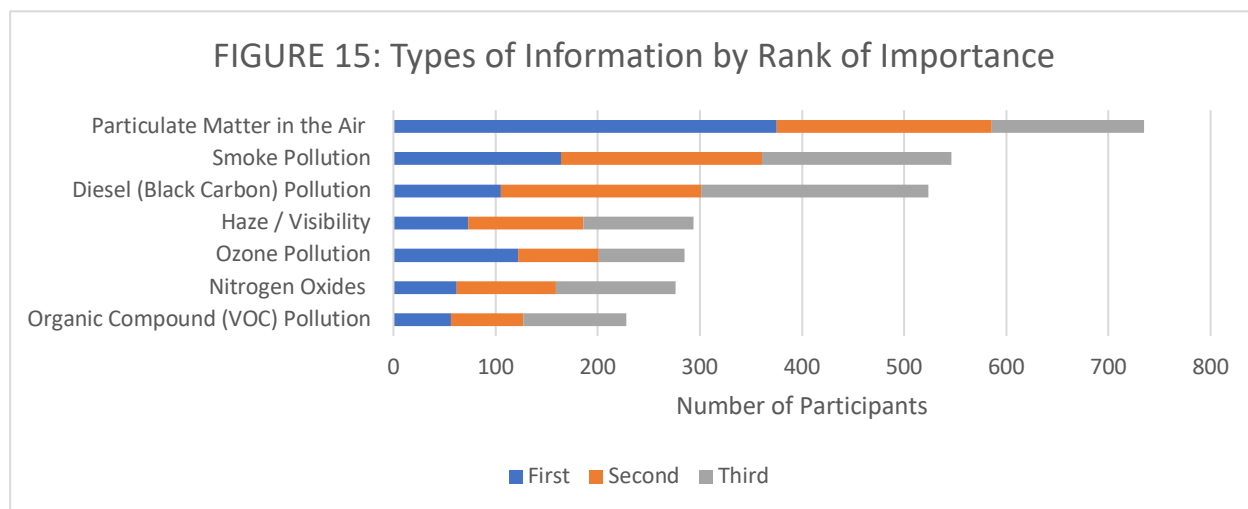[20] Note regarding percentages: participants who indicated they 'never' looked for AQ information (blue bar in figure) were given a 'select all that apply' option to give a better sense of potential information outlets. Participants who had looked for information in the last 6 months (1-3 times, 4-6 times, 7-9 times, 10+ times) were asked to select one outlet that they primarily use.

Types of Information

Those who say they have not looked for information in the last 6 months (n=476) indicate that, if they were to look for information, they would primarily look for the **current levels of air pollution** (75.6%) and sources of air pollution in their own neighborhoods (55%). Those who have looked for air quality information (n=524) report that they primarily look for current levels of air pollution (56.9%)[21].

FIGURE 14: Types of Information, Non Searchers vs. Searchers

Participants were asked to rank types of information according to how important it is to them. Particulate matter, smoke pollution, and diesel were ranked the most important, while VOCs and nitrogen oxides were seen as least important.

FIGURE 15: Types of Information by Rank of Importance

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[21] Note regarding percentages: participants who indicated they 'never' looked for AQ information (blue bar in figure) were given a 'select all that apply' option to give a better sense of what information they would be interested in. Participants who had looked for information in the last 6 months (1-3 times, 4-6 times, 7-9 times, 10+ times) were asked to select one type of information they typically look for.

Satisfaction with Information

All participants were asked how satisfied they were with the information that is available to them about air pollution. **Half of participants didn't have an opinion** ('neither dissatisfied nor satisfied') (50%); of those who indicated a satisfaction level, **most were satisfied or very satisfied** (37.6%). A small minority were (very) dissatisfied (12.4%).

Among those who had looked for information in the last 6 months, we ran an independent samples t-test to see if satisfaction regarding available information is significantly different according to the two most commonly used information sources: search engines and government websites. **No significant differences in satisfaction were found between people who use online search engines** (M=3.28, SD=0.929) **and those who use government websites** (M=3.42, SD=0.900) (t(376)=-1.407, p=0.160).

Those who indicated that they were dissatisfied (or selected 'neither') were asked how the information available to them could be improved. Those who indicated that they were satisfied were asked what they liked most about the information that is available to them. Below is a brief summary of some of the more frequent responses[22].

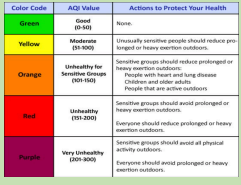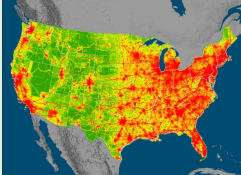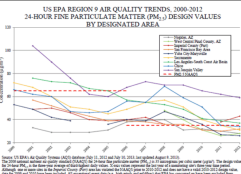| "What do you like most?"	"What could be improved?"
Easy to find, access	Provide more information, more often
Easy to understand	Make information easier to find
Information that's reliable / accurate	Increase accessibility and outlet options (e.g. Nextdoor, an app)
Knowing what I can *do*	
Maps, color schemes	Make it easier to understand
Trends to compare	Make it more localized
Identifies sources	More reliabile / unbiased (avoid 'hype')
Clear, detailed information	More details / in-depth information
Concise (simple), current	

Demographic Differences

Males were significantly more satisfied with the information that is available to them (M=3.36, SD=0.814) than females (M=3.20, SD=0.824)[23].

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[22] For a complete list of qualitative responses, contact the lead researcher.

[23] A regression analysis was run using demographic variables (education, political ideology, income, biological sex, age, and race) to predict satisfaction with information sources (R^2 = 0.014, p < 0.05). Sex was the only significant predictor (B = -.143, p<0.01). A t-test was run as a follow-up to compare mean scores for males and females (reported above) (t(995)=3.151, p<0.01).

Format of Information

Participants were given four graphics for receiving air quality information and asked how much they liked each graphic (from "like a great deal" (1) to "dislike a great deal" (5)). The most popular graphic (M=1.63, SD=0.864) is a color-coded guide that labels air quality in any given area from good (green) to hazardous (dark red). The least popular graphic (M=2.86, SD=1.201) is a chart that shows air pollution levels over time.

TABLE 2: Infographic Preferences, Ranked			
Rank	Description	Sample Images Provided	Demographic Notes
Most Liked	A color-coded guide that labels air quality in any given area from good (green) to hazardous (dark red)		*Females liked the color-coded guide slightly more than males, though both groups liked it.*
2nd most liked	A heat map that displays areas of good air quality and poor air quality.		*Younger people (ages 18-54) liked this graphic more than older people (ages 55+).*
3rd most liked	A graphic that smiles to indicate good air quality and frowns to indicate poor air quality.		*High school graduates liked this grahpic the most (M=2.34) compared to groups with other education levels.*
Most Disliked	A chart that shows air pollution levels over time.		*Malesliked the trend chart slightly more than females, though both groups tended to 'neither like nor dislike' the graphic.*

Notably, the means scores for likeability for all images are above "neither like nor dislike" (3). However, the high standard deviations of the smiley graphic (M=2.54, SD=1.18) and the trend chart indicate there is enough dislike of them that they should be avoided if other image options (e.g. a color-coded guide) are available and appropriate.
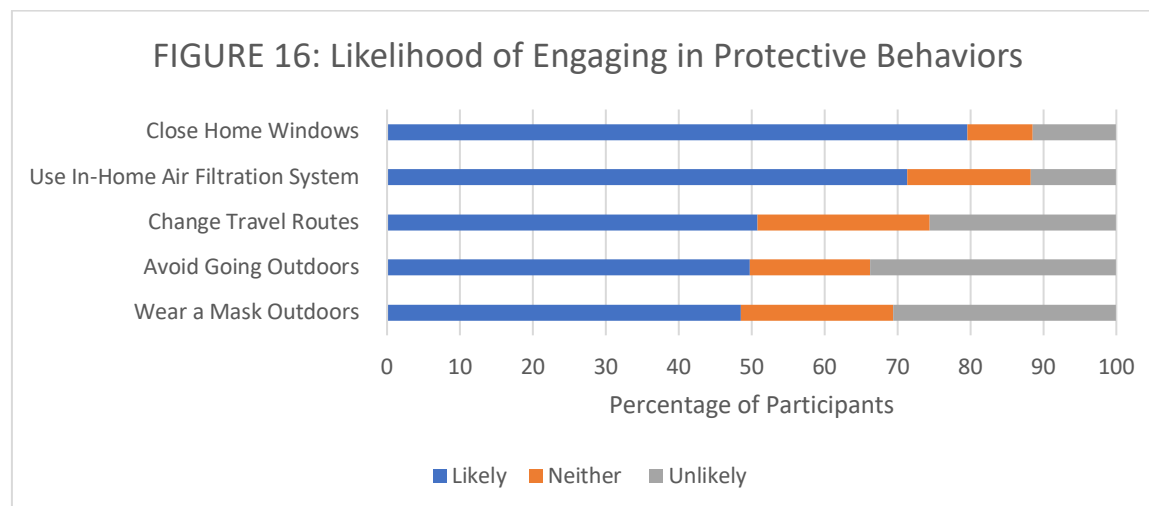
Demographic Differences

Demographic differences are noted in the chart above[24].

---

[24] Regression analyses were run using demographic variables (education, political ideology, income, biological sex, age, and race) to predict likability of each graphic, including: color-coded guide (R^2 = 0.026, $p < 0.001$), heat map (R^2 = 0.028, $p < 0.001$), smile graphic (R^2 = 0.035, $p < 0.001$), and trend chart (R^2 = 0.036, $p < 0.001$). Additional analyses (e.g. ANOVA, t-tests) were used to further investigate significant demographic predictors. The most notable are referenced above.

Likelihood of Acting on Information

Participants were told to imagine that they were given information that air pollution levels near their home could be dangerous for their health, and asked how likely they would be to engage in a list of protective behaviors. The most likely behavior for all participants was closing windows in the home, the least likely was wearing a mask outdoors.

FIGURE 16: Likelihood of Engaging in Protective Behaviors

Demographic Differences

Demographic differences[25] for each behavior are as follows:

- Closing Windows: Liberals, females, and older adults more likely to close windows than conservatives, men, and younger adults
- In-Home Filtration: Younger adults and **those with higher income are more likely to use in-home filtration** than older adults and those with lower income.
- Travel Route: Liberals, females, and older adults are more likely to change their travel routes than conservatives, men, and younger adults.
- Avoiding Outdoors: Females and older participants are more likely to avoid going outdoors than males and younger participants.
- Wearing a Mask: **Non-whites are significantly more likely than whites to wear a mask**.

Overall, liberals, females, and older adults are more likely to engage in protective behaviors than conservatives, men, and younger adults[26].

---

[25] Regression analyses were run using demographic variables (education, political ideology, income, biological sex, age, and race) to predict likelihood of engaging in each behavior, including closing home windows ($R^2 = 0.033$, $p < 0.001$), using in-home filtration systems ($R^2 = 0.035$, $p < 0.001$), changing one's travel route ($R^2 = 0.036$, $p < 0.001$), avoiding the outdoors ($R^2 = 0.060$, $p < 0.001$), and wearing a mask ($R^2 = 0.017$, $p < 0.01$).

[26] Each protective behavior was combined into a mean score for each participant. A regression analysis was run using demographic variables (education, political ideology, income, biological sex, age, and race) to predict the average likelihood of engaging in protective behaviors ($R^2=0.032$, $p<0.001$).

Trust in Institutions & Information Sources

Participants were asked to indicate how much they trusted various organizations / industries to give them information about the air pollution in their own neighborhoods.

FIGURE 17: Trust in Institutions as Sources of Air Pollution Information
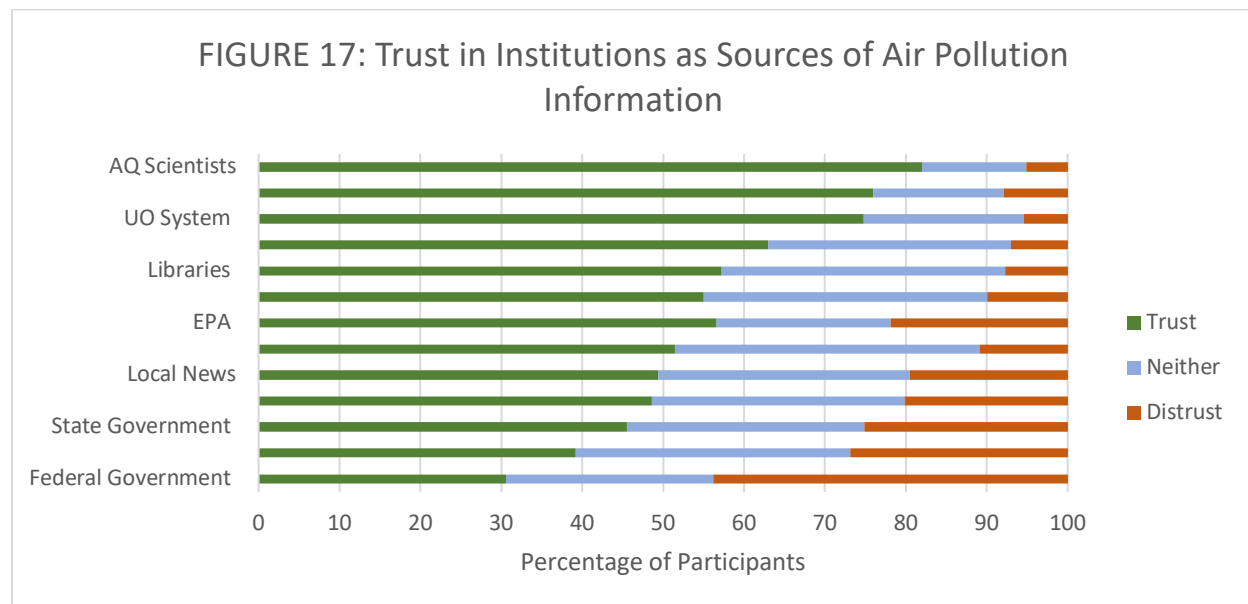
Demographic Differences

Demographic differences were examined for the most and least trusted outlets[27]. We find:

- o **Liberals have significantly more trust in air quality scientists** than moderates or conservatives[28].
- o Liberals[29] and females[30] trust ODEQ more than conservatives and men.
- o **Older adults are slightly more likely to trust national news** than younger adults[31].
- o **Conservatives had significantly more trust in the federal government** than moderates or liberals[32].

---

[27] Regression analyses were run using demographic variables (education, political ideology, income, biological sex, age, and race) to predict likelihood of trusting the most and least trusted institutions as information sources, including air quality scientists ($R^2 = 0.052$, $p < 0.001$), ODEQ ($R^2 = 0.053$, $p < 0.001$), national news outlets ($R^2 = .015$, $p < 0.05$), and the federal government ($R^2 = .028$, $p < 0.001$). Follow-up analyses (ANOVA, t-tests) were conducted to further examine demographic differences as needed (see footnotes for details).

[28] A one-way ANOVA ($F_{(2, 993)} = 21.760$, $p < 0.001$) found a significant difference between all three ideological groups, including liberals (M=4.36, SD=0.834), moderates (M=4.15, SD=0.864), and conservatives (M=3.88, SD=0.981).

[29] A one-way ANOVA ($F_{(2, 993)} = 15.486$, $p < 0.001$) found a significant difference between liberals (M=4.19, SD=0.844), moderates (M=3.96, SD=0.973), and conservatives (M=3.75, SD=1.089).

[30] An independent samples t-test ($t(995) = -2.949$, $p < 0.01$) found a significant difference between males (m=3.90, SD=1.022) and females (m=4.08, SD=0.908).

[31] A correlation was run for age and trust in national news (r=0.041, $p < 0.05$).

[32] A one-way ANOVA ($F_{(2, 992)} = 8.289$, $p < 0.001$) found a sig. difference for liberals (M=2.57, SD=1.216), moderates (M=2.82, SD=1.199), and conservatives (M=2.96, SD=1.186).

Engagement Preferences

Communication Mediums

Participants were asked to rank their most preferred communication mediums (to be communicated with about air quality). **Getting information on a website was the most preferred**[33] medium, followed by receiving information via email. **The least preferred medium was attending a public forum and talking one-on-one with policymakers**.

FIGURE 18: Communication Medium Preferences
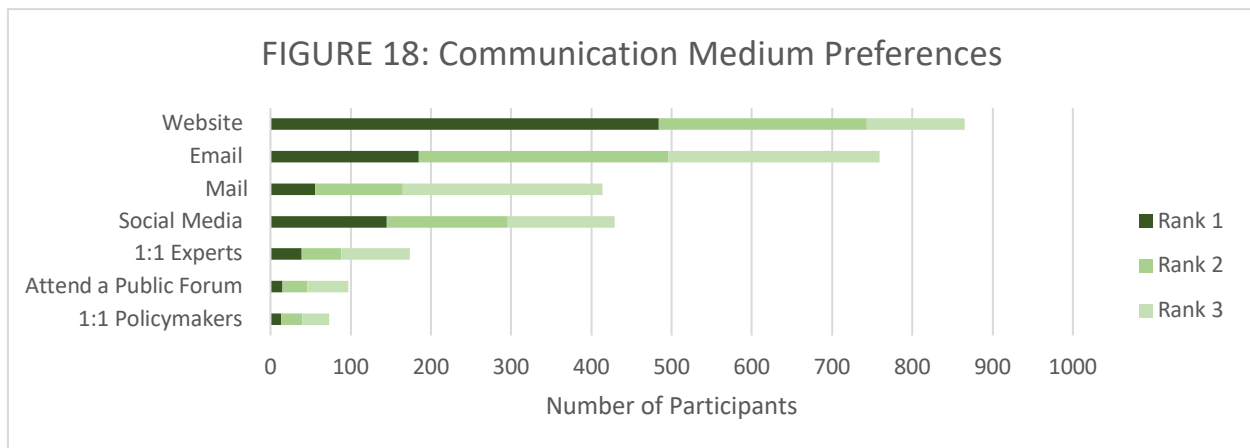
Demographic Differences

A few significant demographic differences for medium preference were observed[34]:
- **Websites are ranked particularly high among all demographic groups**[35].
- Older people (55+) rank email slightly higher than younger people (18-24)[36]
- Younger people (18-34) rank social media slightly higher than older people (65-84)[37]

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[33] Defined by the number of participants who ranked the medium in their top three most preferred. Mean scores slightly differ with the 'top three' categorization for the two least preferred options. Mean scores are: website (M=1.83, SD=1.147), email (M=2.62, SD=1.336), mail (M=3.86, SD=1.585), social media (M=3.95, SD=2.093), talking one-on-one with experts (M=4.57, SD=1.411), talking one-on-one with policymakers (M=5.57, SD=1.322), attending a public forum (M=5.60, SD=1.526).

[34] Regression analyses were run using demographic variables (education, political ideology, income, biological sex, age, and race) to predict medium preference. Follow up analyses (ANOVA, t-tests) were run to further examine differences between demographic groups; significant results are noted here.

[35] The only significant demographic predictor for websites was biological sex. Males (M=1.73, SD=1.155) prefer websites slightly more than females (M=1.93, SD=1.131) (t(932)=-2.627, $p<0.01$); however, both groups rank websites as their first or second choice (on average).

[36] F(7, 929)=11.061, $p<0.001$; significant differences were found between those who are 18-24 and those who are 55-64 ($p<0.001$), 65-74 ($p<0.001$), and 75-84 ($p<0.01$).

[37] F(7,929)=11.009, $p<0.001$; significant differences were found between younger (18-24 and 25-34) and older (65-74 and 75-84) ($p<0.001$) participants.

Science communication research has identified four models of engaging the public with scientific information, including:

- **Deficit Model**: Using one-way communication from experts to lay audiences with the ultimate goal of disseminating information.
- **Dialogue Model**: Using two-way communication between experts and lay audiences to foster understanding between both groups.
- **Participation Model**: Having lay audiences be actively involved in decision-making about the directions and policy implications of science.
- **Lay Expertise Model**: Knowledge of lay audiences is integrated into our understanding of and decision-making surrounding a phenomenon.

To understand Portlander's preferences for each model, participants were asked to indicate their agreement to a series of statements for each model[38]. Survey scales were reduced to items that maximized reliability and those items are reported here. For a complete list of survey items, see Appendix A.

Participants preferred receiving information (the deficit model) the most

(M=3.35, SD=0.980). Participation (M=2.64, SD=1.159), Dialogue (M=2.35, SD=1.083), and Lay Expertise (M=2.06, SD=1.027) models were, on average, not preferred.

FIGURE 19: Model of Engagement Preference - Mean Scores
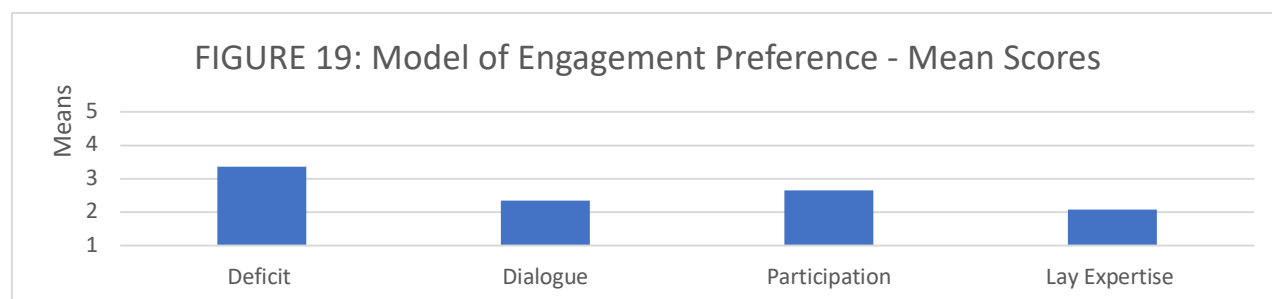
Demographic Differences

- Liberals have a higher preference for the deficit model than moderates or conservatives[39]
- Non-whites have a higher preference for lay expertise than whites[40], though both groups tend to not prefer that model.

---

[38] Indexes were created by computing a mean score for each participant for each model and using survey items that maximized reliability of each index (maintaining a minimum of three items per index). Reliability of each scale is fairly high: deficit (α=0.755), dialogue (α=0.872), participation (α=0.920), and lay expertise (α=0.878).

[39] One-Way ANOVA: $F_{(2, 993)}$=24.220, p<0.001; Liberals (M=3.59, SD=0.855); Moderates (M=3.29, SD=0.978); Conservatives (M=3.04, SD=1.083).

[40] Ind. Samples T-Test: t(998)=-4.749, p<0.001; whites (M=1.99, SD=0.999), non-whites (M=2.36, SD=1.078)

Likelihood of Civic Action

Participants were asked how likely they were to do a number of civic engagement activities, including: attending a meeting / public forum, sign an online petition, vote for a candidate dedicated to improving Portland's air quality, testify in front of policymakers, support dedicating city funding to improving air quality, and support a fee/tax to raise funding dedicated to improving air quality in Portland.

Comparatively**, Portlanders are most likely to vote for a candidate that is dedicated to improving air quality in Portland** compared to other action items. They are least likely to testify in front of policymakers about the air quality in their neighborhoods. For detailed descriptive statistics for each action, see Table 3.

| TABLE 3: Likelihood of Civic Action, Descriptive Statistics			
Action	*Sample Mean / SD*	*Likely (percentage)*	*Unlikely (percentage)*
Vote for a Candidate Dedicated to Improving Air Quality	**3.71 (SD=1.129)**	**64.1**	**12.2**
Sign an Online Petition	3.63 (SD=1.228)	63.4	19.3
Support Dedicating City Funding	3.49 (SD=1.226)	58.7	20.2
Support a Fee / Tax	3.08 (SD=1.305)	42.0	29.4
Attend a Meeting / Public Forum	2.59 (SD=1.223)	27.4	51.0
Testify to Policymakers About the Air Quality in Neighborhood	**2.40 (SD=1.276)**	**21.2**	**55.1**

Appendix: Methods

Data Cleaning

Participants were compensated up to $5 for their time. Data collection and participant compensation was managed by the survey company *Qualtrics*. Data were cleaned using two (2) attention check questions embedded in the survey; participants who failed one or both attention checks were removed from the sample. Participants who displayed a pattern of not reading the questions thoroughly (e.g. straight-lining) were also removed. On average, participants took 27.39 minutes to complete the survey. Data were analyzed by the lead researcher using the Statistical Package for the Social Sciences (SPSS).

Demographics

Age | The average age of participants was 35-44.
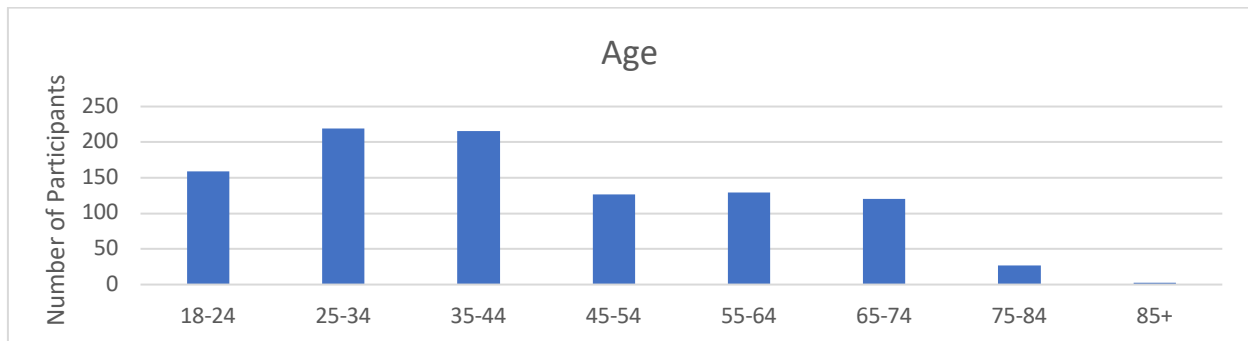
Race | Our sample[41] was primarily white (79%) and non-Hispanic (93%). Other racial identities included: Asian (9.1%), black (6%), American Indian / Alaskan Native (5.9%), Native Hawaiian / Pacific Islander (1.2%), and "other" (2%).

Biological Sex | Our sample included male (49.7%), female (50%), and intersex (0.3%) adults.

Political Identity | Participants subscribed to varying political parties (41.1% Democrat, 21.4% Republican, and 37% Independent) and ideologies (37.8% Liberal, 39.8% Moderate, and 22.4% Conservative).

Language | Our sample is primarily English speaking (97.2%), followed by Spanish (1%), Vietnamese (0.3%), Indian (Hindi, Bengali, etc.) (0.3%), Russian (0.2%) and 'other' (0.6%).

Civic Engagement | Our sample is fairly civically engaged: 72.4% voted in the last presidential election and 65.5% voted in the last local election.

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[41] Participants were asked to 'select all that apply' for racial categories, making overlap between categories possible.

Education |
Education levels
ranged from 'less
than high school'
(3.4%) to doctoral
degrees (2%). The
average level of
education for our
sample was 'some
college'.
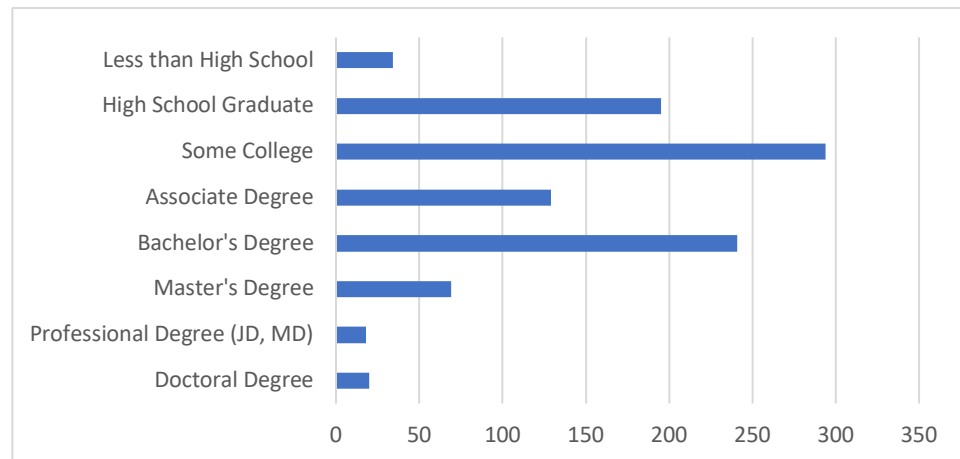
Income | Income of participants ranged from less than $10k per year (8.4%) to $100k or more
(15.8%). The average household income of our participants was $40k-49.9k per year, with
substantial variability (M=5.00, SD=2.21).
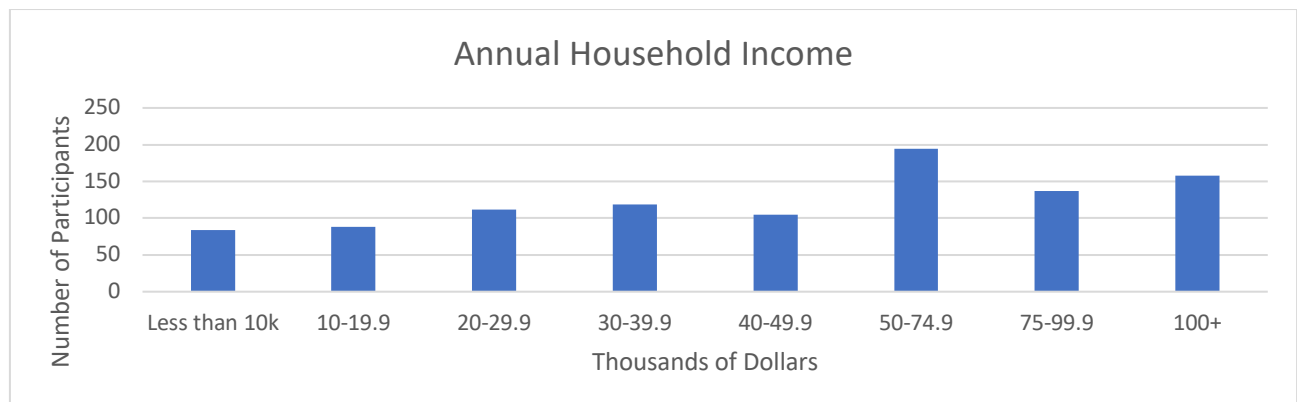
Time Lived in Portland | Approximately half of participants have lived in Portland 10 or more
years (50.2%), followed by less than 1 year (22.6%) and 1-3 years (10.9%). On average,
participants have lived in Portland 4-6 years.

Marital Status | Approximately half of participants are either married (37.4%) or living with a
partner (13.5%). One third have never been married (33%). Some are living with a romantic
partner (15.3%) or divorced/separated (13%).

Children | About one third (31.1%) of participants have children under the age of 18 living in
their household. Of those with children in their household, 76% had children 12 years or
younger.

Family Health | Most participants (and their family members) do <u>not</u> suffer from chronic upper
respiratory illness (70.6%).

Prioritizing the Environment, Air Quality

PRIOR_ISSUES: Below is a list of public policy issues. Please rank the issues below according to how important they are *to you*, with the most important issue at the top and the least important issue at the bottom. (question & categories adapted from Pew Research Center)
- ◊ Economy
- ◊ Healthcare
- ◊ Education
- ◊ Terrorism
- ◊ Environment
- ◊ Immigration
- ◊ Jobs
- ◊ Crime
- ◊ Military

PRIOR_ENVIRO: Below is a list of environmental and energy issues. Please rank the issues below according to how important they are *to you*, with the most important issue at the top. (question adapted from Pew Research Center; categories taken from EPA)
- ◊ Air pollution
- ◊ Pollution in the ocean
- ◊ Freshwater pollution (lakes, rivers, and aquifers)
- ◊ Clean energy
- ◊ Climate change
- ◊ Endangered species
- ◊ Fracking
- ◊ Fossil fuels
- ◊ Extreme storms (hurricanes, tornados, etc.)
- ◊ Garbage / waste management
- ◊ Recycling
- ◊ Mining

Confidence in Science & Technology (Milfont & Duckitt, 2010)

SCI: Please indicate how much you agree or disagree with the following statements about science and technology.

Strongly Disagree	Disagree	Neither Disagree nor Agree	Agree	Strongly Agree

◊   Most environmental problems can be solved by applying more and better technology.
◊   Science and technology will eventually solve our problems with pollution, over population and diminishing resources.
◊   Science and technology do as much environmental harm as good.
◊   Modern science will NOT be able to solve our environmental problems
◊   We cannot keep counting on science and technology to solve our environmental problems.
◊   Humans will eventually learn how to solve all environmental problems.
◊   The belief that advances in science and technology can solve our environmental problems is completely wrong and misguided.
◊   Humans will eventually learn enough about how nature works to be able to control it.
◊   Science and technology cannot solve the grave threats to our environment.
◊   Modern science will solve our environmental problems.

Environmental Motives (Schultz, 2001)

ENV_MOT: People can be concerned about environmental problems for many different reasons. Please rate each of the following items from 1 (not important) to 5 (supreme importance) in response to the question: I am concerned about environmental problems because of the consequences for:

Not at all important	A little bit important	Moderately important	Very important	Extremely important

_____ Plants   _____ Me   _____ People in my community
_____Marine Life   _____My Lifestyle   _____ All people
_____Birds   _____ My health   _____ Children
_____ Animals   _____ My future   _____ My children

Environmental Attitudes / Activism (Milfont & Duckitt, 2010)

Strongly Disagree	Disagree	Neither Disagree nor Agree	Agree	Strongly Agree

ENV_ACT: Please indicate how much you agree or disagree with the following statements.

◊ If I ever receive extra income, I will donate some monies to an environmental organization.
◊ I would LIKE to join and actively participate in an environmentalist group.
◊ I would NOT get involved in an environmental organization.
◊ I would NOT go out of my way to help environmental campaigns.
◊ I often persuade others that the environment is important.
◊ I would never try to persuade others that environmental protection is important.

Environmental Values Orientation (Gangaas et al., 2015)

ENV_VAL: Please indicate how much you agree or disagree with the following statements.

Strongly Disagree	Disagree	Neither Disagree nor Agree	Agree	Strongly Agree

◊ The balance in nature is delicate and easily upset
◊ Humans are severely abusing the environment
◊ The so-called 'ecological crisis facing humans has been greatly exaggerated
◊ Plants and animals have the same rights to life on earth as humans
◊ The balance of nature is sufficiently stable to withstand the impacts from a modern industrial society
◊ If things continue on their present course, we will soon experience a major ecological catastrophe
◊ Human ingenuity will ensure future life and living conditions on Earth

Air Quality Knowledge (*written by research team*)

KNOW_SELF_1: How much would you say you know about the air quality in <u>your neighborhood</u>?

| Nothing | Very Little | A Moderate Amount | A Good Amount | A Lot |

KNOW_SELF_2: How do you know if the air pollution outside is at a level that is a risk to your health? Select all that apply.

◊ It's hard to breathe
◊ The air looks hazy
◊ The air smells bad
◊ I receive news reports or alerts
◊ A major event occurs, like a fire
◊ Other:_____

KNOW_OTHERS: How well do the following groups understand the air pollution issues in <u>your neighborhood</u>?

| Not well at all | Not very well | Well | Very well | Extremely well | I Don't Know |

◊ Air quality scientists
◊ Oregon's Department of Environmental Quality
◊ The City of Portland / Local government
◊ Oregon State government
◊ Federal Government
◊ Environmental Protection Agency
◊ Local Neighborhood Association or Organization (e.g. APANO, Neighbors for Clean Air, Living Cully, etc.)

KNOW_SOURCE: To the best of your knowledge, what is the biggest source of air pollution in your neighborhood? Check one.

◊ Heavy duty trucks
◊ Construction
◊ Commercial
◊ Industrial sources
◊ Busses
◊ Agriculture
◊ Logging
◊ Personal Vehicles/cars
◊ Other:

KNOW_COMPLEX_SELF: How easy or difficult is it for <u>you</u> to get a sense of how polluted the air is in <u>your neighborhood</u>?

| Very Difficult | Difficult | Neither Difficult nor Easy | Easy | Very Easy | I Don't Know |

KNOW_COMPLEX_OTHERS: How easy or difficult is it for <u>air quality scientists and experts</u> to measure the air pollution in <u>your neighborhood</u>?

| Very Difficult | Difficult | Neither Difficult nor Easy | Easy | Very Easy | I Don't Know |

Air Quality Risk Perceptions (*Some items written by research team, others adapted from the Extended Parallel Process Model – EPPM – (noted in text) (Witte, 1992)*)

POLL_1: How would you rate the overall air quality in Portland now compared to prior years?

| Much worse | A little worse | About the same | A little better | Much better | I Don't Know |

POLL_2: How would you rate the overall air quality in your neighborhood now compared to prior years?

| Much worse | A little worse | About the same | A little better | Much better | I Don't Know |

SALIENCE_EPPM: In the last 6 months, how often have you:

| Never | 1-3 times | 4-6 times | 7-9 times | 10 or more times |

- ◊ Thought about air pollution
- ◊ Felt upset by air pollution
- ◊ Felt that air pollution was dangerous to your health
- ◊ Worried about the effects of air pollution on your health

EPPM: Please indicate how much you agree or disagree with the following statements about air pollution.

Strongly Disagree	Disagree	Neither Disagree nor Agree	Agree	Strongly Agree	I don't know

EPPM_SEVERITY

◊ I believe that air pollution in my neighborhood is severe.
◊ I believe that air pollution in my neighborhood is serious.
◊ I believe that air pollution in my neighborhood is significant.

EPPM_SUSCEPTIBILITY

◊ I am at risk for suffering from air pollution.
◊ It is likely that I will suffer from air pollution
◊ It is likely that I will suffer health problems because of air pollution.

EPPM_SELF_EFFICACY

◊ I feel confident that I can protect myself from air pollution.
◊ Protecting myself from air pollution is easy to do.
◊ Protecting myself from air pollution is convenient.

Support for Sensors (*written by research team*)

The City of Portland, in Partnership with Portland State University, has been testing air quality sensors in Portland to measure air pollution. Please indicate how much you support sensors being placed:

Not at all | A little bit | Somewhat | Mostly | Completely

- ◊ Near your home
- ◊ In your neighborhood
- ◊ In major traffic areas
- ◊ Near schools
- ◊ Other:

There are two different types of air pollution sensors:

(1) **High-quality air pollution instruments** provide the best scientific data. However, they are expensive, require power and space and time to maintain and calibrate, so regulators and scientists can only monitor a few areas of Portland at a time.

(2) **Low-quality pollution sensors** provide scientific data that is less reliable and informative. However, they are more cost effective and easier to use, so regulators and scientists can monitor many more areas in Portland at a time.

Given the information above, if you had to choose between using high-quality sensors in fewer locations, or placing low-quality sensors in many locations, which would you prefer?

- ● High-quality sensors in a few locations
- ● Low-quality sensors in many locations
- ● I don't have a preference

Information Seeking / Satisfaction (*written by research team*)

INFO_LOOK: How many times have you looked for information about air pollution in the last 6 months?

| Never | 1-3 times | 4-6 times | 7-9 times | 10 or more times |

IF "Never" is SELECTED: If you *were* to look for information about air pollution, where would you go? Select all that apply.
- ◊ Television
- ◊ Radio
- ◊ Newspapers
- ◊ Social media
- ◊ Online search engine (Google, Bing)
- ◊ Government website (EPA, Oregon.gov, etc.)
- ◊ Traditional news media – online
- ◊ Local Neighborhood Association or Organization (e.g. APANO, Neighbors for Clean Air, Living Cully, etc.)

IF "Never" is SELECTED: If you were to look for information about air pollution, what type of information would you look for? Select all that apply.
- ◊ Current levels of air pollution
- ◊ Sources of air pollution in your neighborhood
- ◊ Sources of air pollution in Portland
- ◊ How you can protect yourself from air pollution
- ◊ How you can reduce air pollution
- ◊ How air pollution might be affecting your health
- ◊ How air pollution might be affecting the health of others
- ◊ OTHER: _____

IF "Never" is NOT SELECTED: When you look for information about air pollution, where do you go?
- ◊ Television
- ◊ Radio
- ◊ Newspapers
- ◊ Social media
- ◊ Online search engine (Google, Bing)
- ◊ Government website (EPA, Oregon.gov, etc.)
- ◊ Traditional news media – online
- ◊ Local Neighborhood Association or Organization (e.g. APANO, Neighbors for Clean Air, Living Cully, etc.)

When you look for information about air pollution, what type of information do you look for?
- ◊ Current levels of air pollution
- ◊ Sources of air pollution in your neighborhood
- ◊ Sources of air pollution in Portland
- ◊ How you can protect yourself from air pollution
- ◊ How you can reduce air pollution
- ◊ How air pollution might be affecting your health
- ◊ How air pollution might be affecting the health of others
- ◊ OTHER: _____

INFO_SAT: How satisfied are you with the information that is available to you about air pollution?

Very Dissatisfied	Dissatisfied	Neither Dissatisfied nor Satisfied	Satisfied	Very Satisfied
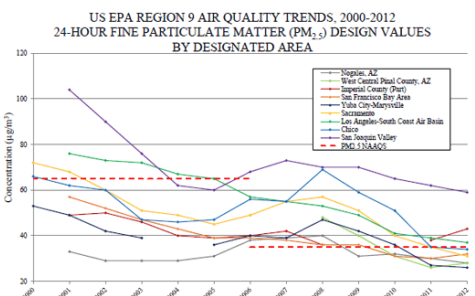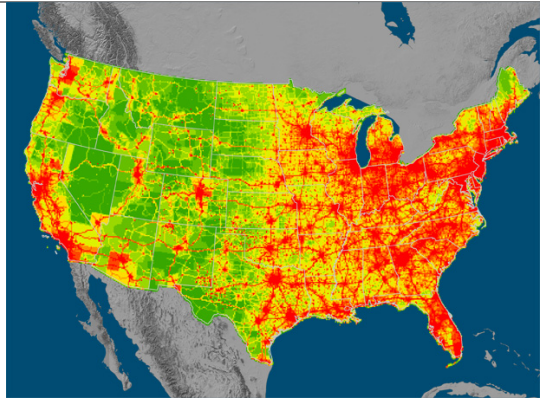
How could the information available to you be improved? [Text Box]

What do you like the most about the information that is available to you? [Text Box]

If you were to be given information about the levels of air pollution in your area, what information is the most important? Rank the types of information below from the most to the least important.

- ◊ Particulate matter in the air
- ◊ Diesel (black carbon) pollution
- ◊ Smoke pollution
- ◊ Haze/visibility
- ◊ Nitrogen oxides pollution
- ◊ Volatile Organic Compound (VOC) pollution
- ◊ Ozone pollution
- ◊ Other:_____

INFO_ACT: Air pollution information can be provided in a lot of different formats. We want to know what format you prefer. Please indicate how much you like or dislike the following designs.

Smiley / Sad Face	Raw Point PM Data

AQ Index Values – Color Coded	Heat Map

INFO_ACT: Imagine you were given information about the current air pollution levels near your home, and it indicated that the air pollution outside could be dangerous to your health. How likely or unlikely are you to do the following:

Extremely Unlikely	Unlikely	Neither Unlikely nor Likely	Likely	Extremely Likely

◊ Change your transportation or travel routes to avoid highly polluted areas
◊ Wear a mask or other protective equipment when you go outdoors
◊ Avoid going outdoors altogether
◊ Close the windows in your home
◊ Use an air filtration system in your home
◊ Other: _____

Engagement Preferences

COMM: We would like to know how to better communicate with you about air quality. Please rank the options below from your most to least preferred.

- ◊   Getting information on a website
- ◊   Receiving information via email
- ◊   Getting information in the mail
- ◊   Talking one-on-one with experts
- ◊   Talking one-on-one with policymakers
- ◊   Getting information and updates on social media (Twitter, Facebook, Instagram, etc.)
- ◊   Attending a meeting or public forum about air quality

ACT: How likely are you to:

Extremely Unlikely	Unlikely	Neither Unlikely nor Likely	Likely	Extremely Likely

- ◊   Attend a meeting or public forum about air quality
- ◊   Sign an online petition to improve the air quality in Portland
- ◊   Vote for a candidate that is dedicated to improving Portland's air quality
- ◊   Testify in front of policy makers about air quality in your neighborhood
- ◊   Support dedicating City funding to improving air quality in Portland
- ◊   Support a fee or tax to raise funding dedicated to improving air quality in Portland

ENG_PREF: Indicate the extent to which you agree or disagree with the following statements.

Strongly Disagree	Disagree	Neither Disagree nor Agree	Agree	Strongly Agree

ENG_PREF_DEFICIT

- ◊   I usually get information about air pollution because I actively look for it.
- ◊   I am interested in getting more information about air pollution in my neighborhood.
- ◊   I am interested in getting more information about air pollution in Portland.

ENG_PREF_DIALOGUE

◊ I would like to have a one-on-one conversation with an air quality expert or scientist about air pollution.
◊ I would like to tell an air quality expert or scientist about my experience with air pollution.
◊ I have questions about air pollution that can only be answered by talking directly with an air quality expert or scientist.

ENG_PREF_LAY EXPERTISE

◊ I have valuable insights that would help scientists and policymakers better understand air pollution in Portland.
◊ Scientists would have a better understanding of air pollution in Portland if they talked to me.
◊ Scientists would have a better understanding of air pollution in Portland if they talked to people like me.

ENG_PREF_PARTICIPATION

◊ I would like to be involved in decision-making about the research being conducted about air pollution in Portland.
◊ I would like to be involved in decision-making about how my community uses scientific data about air pollution in Portland.
◊ I would like to be involved in decision-making about how my community can improve local air quality and reduce air pollution.

Trust in institutions *(items written by research team)*

TRUST_INST: How much do you trust the following people and institutions to give you information about air pollution in your neighborhood?

Completely Trust	Somewhat Trust	Neither Trust nor Distrust	Somewhat Distrust	Completely Distrust

◊   The University of Oregon system (Portland State, University of Oregon, Oregon State, etc.)
◊   Portland Community Colleges
◊   Air quality scientists
◊   Oregon's Department of Environmental Quality
◊   The City of Portland / Local government
◊   State government
◊   Federal government
◊   Environmental Protection Agency
◊   Libraries
◊   Nonprofit Organizations
◊   Local Neighborhood Association or Organization (e.g. APANO, Neighbors for Clean Air, Living Cully, etc.)
◊   Local news outlets (newspapers, television, online)
◊   National news outlets (newspapers, television, online)

Demographics

Finally, we want to know a little bit more about you. Your individual information will not be shared with or reported to anyone outside of the research team, and will never be used to identify you in any way.

ZIP: What is your current zip code? [text enter]

ZIP_TIME: How long have you lived in that zip code?

- ◊ Less than 1 year
- ◊ 1-3 years
- ◊ 4-6 years
- ◊ 7-9 years
- ◊ 10 or more years

URB_RUR: Would you describe the area in which you live as urban or rural?

- ◊ Urban
- ◊ Rural

OR_TIME: How long have you lived within the state of Oregon?

- ◊ Less than 1 year
- ◊ 1-3 years
- ◊ 4-6 years
- ◊ 7-9 years
- ◊ 10 or more years

MAR: What is your marital status?
Married
Living with a partner
Divorced / separated
Widowed
Never been married

KID: Are there any children under the age of 18 living in your household?
Yes
No

IF YES: Are any of those children 12 or younger?

Yes
No

FAM_HEALTH: Do you or anyone in your family suffer from chronic upper respiratory illness (e.g. asthma)?

        Yes
        No

CIVIC_1: Did you vote in the last presidential election?

        Yes
        No

CIVIC_2: Did you vote in the last local election?

        Yes
        No

EDUC: What is the highest level of school you have completed or the highest degree you have received?
- ◊ Less than high school
- ◊ Highschool graduate
- ◊ Some college
- ◊ Associate degree (2-year)
- ◊ Bachelor's degree (4-year)
- ◊ Master's degree
- ◊ Professional degree (JD, MD)
- ◊ Doctoral degree

RACE: What is your race? (Select all that apply)
- ◊ White
- ◊ Black or African American
- ◊ American Indian or Alaska native
- ◊ Asian
- ◊ Native Hawaiian or pacific islander
- ◊ Hispanic or Latino
- ◊ Other

LANG: What is the language you are most comfortable speaking?

- English
- Vietnamese
- Spanish
- Indian language (Hindi, Bangali, etc.)
- Italian
- Mandarin/Cantonese

- Russian
- French
- Other: _____

PARTY: Generally speaking, do you usually think of yourself as a:
- ◊ Republican
- ◊ Democrat
- ◊ Independent

IF 'independent' is SELECTED: You selected 'Independent.' Which political party do you *lean* toward?
> Lean Republican
> Lean Democrat
> Independent

IDEO: Generally speaking, do you think of yourself as a:

| Very Liberal | Liberal | Moderate | Conservative | Very Conservative |

IF 'Moderate' is SELECTED: You selected 'moderate.' Which political ideology do you *lean* toward?
> Lean Liberal
> Lean Conservative

INC: What was your entire household income last year before taxes?

- ◊ Less than $10,000
- ◊ $10,000 to $19,999
- ◊ $20,000 to $29,999
- ◊ $30,000 to $39,999
- ◊ $40,000 to $49,999
- ◊ $50,000 to $74,999
- ◊ $75,000 to $99,999
- ◊ $100,000 or more

AGE: What is your year of birth? [drop-down menu]

SEX: What is your biological sex?

- ◊ Male
- ◊ Female
- ◊ Intersex

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References

Gangaas, K. E., Kaltenborn, B. P., & Andreassen, H. P. (2015). Environmental attitudes associated with large-scale cultural differences, not local environmental conflicts. *Environmental Conservation*, *42*(1), 41–50. https://doi.org/10.1017/S0376892914000125

Milfont, T. L., & Duckitt, J. (2010). The environmental attitudes inventory: A valid and reliable measure to assess the structure of environmental attitudes. *Journal of Environmental Psychology*, *30*(1), 80–94. https://doi.org/10.1016/j.jenvp.2009.09.001

Schultz, W P. (2001). The structure of environmental concern: concern for self, other people, and the biosphere. *Journal of Environmental Psychology*, *21*(4), 327–339. https://doi.org/10.1006/jevp.2001.0227

Suldovsky, B., McGreavy, B., & Lindenfeld, L. (2018). Evaluating Epistemic Commitments and Science Communication Practice in Transdisciplinary Research. *Science Communication*, *40*(4), 499–523. https://doi.org/10.1177/1075547018786566

Witte, K. (1992). Putting the fear back into fear appeals: The extended parallel process model. *Communication Monographs*, *59*(4), 329–349. https://doi.org/10.1080/03637759209376276