Data Analysis

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2023-05-16

# Methods

## Survey

Table : Demographic profile (unadjusted) of survey respondents.

| **Characteristic** | **N = 1,1001** |
| --- | --- |
| Sex/Gender |  |
| Male | 529 (48%) |
| Female | 565 (51%) |
| Other | 4 (0.4%) |
| No answer | 2 (0.2%) |
| Age |  |
| 18:24 | 125 (11%) |
| 25:34 | 192 (17%) |
| 35:44 | 204 (19%) |
| 45:54 | 198 (18%) |
| 55:64 | 171 (16%) |
| 65+ | 208 (19%) |
| No answer | 2 (0.2%) |
| Race/Ethnicity |  |
| American Indian/Native American or Alaska Native | 15 (1.4%) |
| Asian | 49 (4.5%) |
| Hispanic or Latino or Spanish Origin of any race | 109 (9.9%) |
| Black or African American | 119 (11%) |
| Native Hawaiian or Other Pacific Islander | 3 (0.3%) |
| White or Caucasian | 723 (66%) |
| Other | 21 (1.9%) |
| Two or More | 57 (5.2%) |
| No answer | 4 (0.4%) |
| Educational |  |
| Some high school | 47 (4.3%) |
| High school graduate or GED | 418 (38%) |
| Associate degree | 178 (16%) |
| Bachelor's degree | 246 (22%) |
| Master's degree | 132 (12%) |
| Doctorate or terminal degree | 28 (2.5%) |
| Other | 40 (3.6%) |
| No answer | 11 (1.0%) |
| 1n (%) | |

## Data Analysis

### Weighting

Prior to analysis, individual survey responses were weighted so that marginal proportions of the survey (Table ) matched national level benchmarks from the 5-year 2021 American Community Survey (ACS) on sex/gender, age group, race/ethnicity, and education level (Table ). Weights on gender were developed by re-coding “female” and “other” responses as “non-male” because the ACS only provides binary response options for sex. Using this approach, responses from both “female” and “other” respondents have the same marginal weight. Kennedy et al. (2022) provide substantial discussion on the treatment of sex and gender in survey adjustment. Due to small subpopulation sample sizes within the Race/Ethnicity variable, Race/Ethnicity were recoded as White or Caucasian and Non-white categories. Weights were developed by poststratification raking using the American National Election Study (ANES) weighting algorithm implemented in the *anesrake* R package (DeBell and Krosnick 2009; Pasek 2018).

Table : Marginal survey and target population proportions and marginal weighted values.

| **Variable** | **Value** | **Unweighted N** | **Unweighted %** | **Target %** | **Weighted N** | **Weighted %** |
| --- | --- | --- | --- | --- | --- | --- |
| Sex/Gender | Male | 529 | 48.1 | 49.0 | 539.1 | 49.0 |
| Not Male | 569 | 51.7 | 51.0 | 560.9 | 51.0 |
| No answer | 2 | 0.2 |  |  |  |
| Age | 18:24 | 125 | 11.4 | 11.9 | 130.6 | 11.9 |
| 25:34 | 192 | 17.5 | 17.7 | 195.1 | 17.7 |
| 35:44 | 204 | 18.5 | 16.6 | 183.1 | 16.6 |
| 45:54 | 198 | 18.0 | 16.3 | 179.2 | 16.3 |
| 55:64 | 171 | 15.5 | 16.8 | 184.4 | 16.8 |
| 65+ | 208 | 18.9 | 20.7 | 227.6 | 20.7 |
| No answer | 2 | 0.2 |  |  |  |
| Race/Ethnicity | White | 723 | 65.7 | 62.4 | 686.3 | 62.4 |
| Non-white | 373 | 33.9 | 37.6 | 413.7 | 37.6 |
| No answer | 4 | 0.4 |  |  |  |
| Education | Some high school | 47 | 4.3 | 7.8 | 85.8 | 7.8 |
| High school graduate or GED | 418 | 38.0 | 49.4 | 543.7 | 49.4 |
| Associate degree | 178 | 16.2 | 8.3 | 91.3 | 8.3 |
| Bachelor's degree | 246 | 22.4 | 19.4 | 213.7 | 19.4 |
| Master's degree | 132 | 12.0 | 8.3 | 91.3 | 8.3 |
| Doctorate or terminal degree | 28 | 2.5 | 1.3 | 14.7 | 1.3 |
| Other | 40 | 3.6 | 5.4 | 59.5 | 5.4 |
| No answer | 11 | 1.0 |  |  |  |

### Models

We developed three different proportional odds models (Agresti 2002) to assess factors associated with a respondent’s (1) self-described knowledge of PFAS (4 repsonses ranging from “I’ve neve heard of it, and don’t know what it is” to “I’m confident I know what it is”); (2) awareness of potential sources of PFAS (5 responses ranging from “Not at all familiar” to “Extremely Familiar”); and (3) intention to change use of items assosciated with PFAS (5 responses ranging from “will never change” to “have already changed”). Dependent variables included Sex/Gender, Age, Race/Ethnicity, Education, and awareness of community exposure to PFAS (Yes, No, Not Sure). All models were fit using the survey package in R version 4.2.1 (Lumley 2004; R Core Team 2022).

# Results

A majority of respondents have no knowledge (41.1%) or are unsure (47.4%) if their community has been exposed to PFAS. Only 11.5% responded that they knew their community has been exposed to PFAS. When asked to describe knowledge level about PFAS, 45.1% responded that they have never heard of it and don’t know what it is. An additional 31.6% responded they have heard of PFAS, but don’t know what PFAS are.

When asked about awareness of PFAS sources, between 45.0% and 51.1% of responses were not familiar with the given source at all. In comparison only 5.9% to 9.2% of responses indicated they were extremely familiar with the indicated source.

Table : Summary of weighted survey responses.

| **Question** | **Response** | **Percent Response, SE** | **Mean Response, SE** |
| --- | --- | --- | --- |
| To your knowledge, has your community been exposed to PFAS? | Yes | 11.5, 1 |  |
| No | 41.1, 1.6 |  |
| Not sure | 47.4, 1.6 |  |
| How would you describe your knowledge about PFAS as an environmental contaminant? | I've never heard of it, and don't know what it is | 45.1, 1.6 |  |
| I've heard of it or seen it somewhere, but don't know what it is | 31.6, 1.5 |  |
| I think I know what it is | 17.2, 1.2 |  |
| I'm confident I know what it is | 6.2, 0.8 |  |
| What percentage of the U.S. population do you think has been exposed to PFAS? |  |  | 53.6, 0.7 |
| How familiar are you with the following items as potential sources of PFAS? |  |  |  |
| Drinking Water | Not at all familiar | 45.8, 1.6 |  |
| Slightly familiar | 19.7, 1.3 |  |
| Moderately familiar | 17.1, 1.2 |  |
| Very familiar | 9.2, 0.9 |  |
| Extremely familiar | 8.2, 0.9 |  |
| Public waterways near waste disposal sites | Not at all familiar | 45.2, 1.6 |  |
| Slightly familiar | 18.3, 1.3 |  |
| Moderately familiar | 20, 1.3 |  |
| Very familiar | 10.7, 1 |  |
| Extremely familiar | 5.9, 0.8 |  |
| Soils near waste disposal sites | Not at all familiar | 46.3, 1.6 |  |
| Slightly familiar | 20.2, 1.3 |  |
| Moderately familiar | 17.5, 1.2 |  |
| Very familiar | 10.1, 0.9 |  |
| Extremely familiar | 5.9, 0.8 |  |
| Dairy products | Not at all familiar | 51.1, 1.6 |  |
| Slightly familiar | 16.3, 1.2 |  |
| Moderately familiar | 15.3, 1.2 |  |
| Very familiar | 10, 0.9 |  |
| Extremely familiar | 7.3, 0.8 |  |
| Fresh produce | Not at all familiar | 50.3, 1.6 |  |
| Slightly familiar | 14.5, 1.1 |  |
| Moderately familiar | 16.1, 1.2 |  |
| Very familiar | 11.7, 1 |  |
| Extremely familiar | 7.4, 0.8 |  |
| Freshwater fish | Not at all familiar | 48.7, 1.6 |  |
| Slightly familiar | 16.4, 1.2 |  |
| Moderately familiar | 17.6, 1.2 |  |
| Very familiar | 11.4, 1 |  |
| Extremely familiar | 5.9, 0.7 |  |
| Seafood | Not at all familiar | 48.8, 1.6 |  |
| Slightly familiar | 15.3, 1.2 |  |
| Moderately familiar | 17.7, 1.2 |  |
| Very familiar | 9.9, 1 |  |
| Extremely familiar | 8.3, 0.9 |  |
| Food packaging | Not at all familiar | 48.1, 1.6 |  |
| Slightly familiar | 16.2, 1.2 |  |
| Moderately familiar | 16.9, 1.2 |  |
| Very familiar | 11.8, 1 |  |
| Extremely familiar | 7, 0.8 |  |
| Non-stick cookware | Not at all familiar | 47, 1.6 |  |
| Slightly familiar | 16.9, 1.2 |  |
| Moderately familiar | 16.8, 1.2 |  |
| Very familiar | 12.8, 1.1 |  |
| Extremely familiar | 6.5, 0.8 |  |
| Personal hygiene products | Not at all familiar | 46.6, 1.6 |  |
| Slightly familiar | 14.7, 1.1 |  |
| Moderately familiar | 18.2, 1.3 |  |
| Very familiar | 12.6, 1 |  |
| Extremely familiar | 8, 0.9 |  |
| Household products (fabrics, cleaning products, paints and sealants) | Not at all familiar | 45, 1.6 |  |
| Slightly familiar | 16, 1.2 |  |
| Moderately familiar | 18.7, 1.3 |  |
| Very familiar | 12.3, 1 |  |
| Extremely familiar | 7.9, 0.9 |  |
| Fire extinguising foam | Not at all familiar | 50.7, 1.6 |  |
| Slightly familiar | 14.7, 1.1 |  |
| Moderately familiar | 15.8, 1.2 |  |
| Very familiar | 11.7, 1 |  |
| Extremely familiar | 7.1, 0.8 |  |
| Fertilizers from wastewater plants | Not at all familiar | 45.9, 1.6 |  |
| Slightly familiar | 17.1, 1.2 |  |
| Moderately familiar | 17, 1.2 |  |
| Very familiar | 11.9, 1 |  |
| Extremely familiar | 8.1, 0.9 |  |

## Model Results

We did not find evidence for any association between Sex, Race/Ethnicity, and Education with self-described knowledge about PFAS (Table ). The odds that someone in the 35:44 age bracket responded with a higher self-assessed knowledge level was 1.63 times that of someone in the 18:24 reference group. There is strong evidence that people aware of PFAS exposure in their communities self-report higher levels of knowledge about PFAS. People aware of PFAS exposure in their communities are 3.57 times and 4.35 times more likely to respond with a higher self-asessed knowledge level than those responding “No” or “Not sure” to awareness of PFAS contamination in their communities.

Table : Model 1 results.

| **Characteristic** | **OR12** | **SE2** | **95% CI2** | **p-value** |
| --- | --- | --- | --- | --- |
| Sex |  |  |  |  |
| Male | — | — | — |  |
| Female | 0.99 | 0.133 | 0.76, 1.29 | >0.9 |
| Other | 0.80 | 0.735 | 0.19, 3.38 | 0.8 |
| Age |  |  |  |  |
| 18:24 | — | — | — |  |
| 25:34 | 1.38 | 0.235 | 0.87, 2.18 | 0.2 |
| 35:44 | 1.63\* | 0.237 | 1.03, 2.59 | 0.039 |
| 45:54 | 1.03 | 0.244 | 0.64, 1.67 | 0.9 |
| 55:64 | 1.09 | 0.255 | 0.66, 1.80 | 0.7 |
| 65+ | 0.94 | 0.259 | 0.57, 1.57 | 0.8 |
| Race/Ethnicity |  |  |  |  |
| White | — | — | — |  |
| Non-white | 0.95 | 0.149 | 0.71, 1.27 | 0.7 |
| Education |  |  |  |  |
| Some high school | — | — | — |  |
| High school graduate or GED | 0.65 | 0.327 | 0.34, 1.23 | 0.2 |
| Associate degree | 0.89 | 0.344 | 0.46, 1.76 | 0.7 |
| Bachelor's degree | 0.98 | 0.341 | 0.50, 1.92 | >0.9 |
| Master's degree | 1.04 | 0.363 | 0.51, 2.12 | >0.9 |
| Doctorate or terminal degree | 1.38 | 0.448 | 0.57, 3.32 | 0.5 |
| Other | 1.56 | 0.474 | 0.61, 3.94 | 0.4 |
| Community PFAS Exposure |  |  |  |  |
| Yes | — | — | — |  |
| No | 0.28\*\*\* | 0.189 | 0.19, 0.41 | <0.001 |
| Not sure | 0.23\*\*\* | 0.203 | 0.16, 0.35 | <0.001 |
| 1\*p<0.05; \*\*p<0.01; \*\*\*p<0.001 | | | | |
| 2OR = Odds Ratio, SE = Standard Error, CI = Confidence Interval | | | | |

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| Figure 1: Average marginal predicted probabilities to the question, “how familiar are you with the following items as potential sources of PFAS contamination?” Horizontal lines indicate the 95% confidence intervals of the marginal predicted probabilities. |

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| Figure 2: Average marginal predicted probabilities to the question, “Please rate your intention to change your use of the following items because of their potential for PFAS contamination.” Horizontal lines indicate the 95% confidence intervals of the marginal predicted probabilities. |

# References

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