Measuring Air Quality with Wearable Devices

Arie Kapteyn
Center for Economic and Social Research, University of Southern California

Htay-Wah Saw
Center for Economic and Social Research (CESR), University of Southern California &
Michigan Program in Survey and Data Science, University of Michigan-Ann Arbor

Bas Weerman
Center for Economic and Social Research, University of Southern California

AVERAGE AIR QUALITY SCORE

AQS 70

Your average score is moderate

484 days 20 hrs

AIR QUALITY SCORE

Updated 11:03 PM

2	3.6	4.7	0.26
PM1	PM2.5	PM10	VOCs

Air is Good

Air quality is considered satisfactory, and air pollution poses little or no risk.

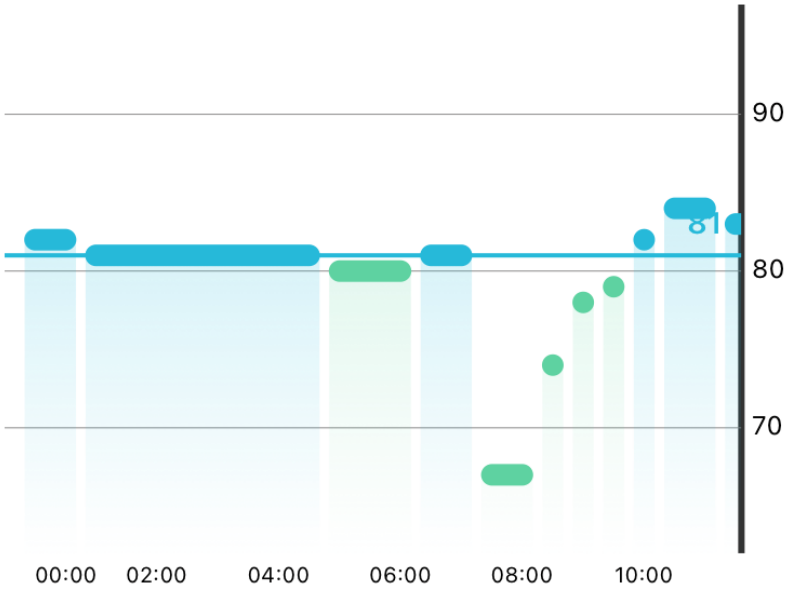
Air quality score

Air is Good

Air quality is considered satisfactory, and air pollution poses little or no risk.

H D W M Y

15 Jun 2022



Outline

- Pilot among 75 UAS respondents at the moment
- Eleven months of data, but it started slowly
- One survey a month and continuous measurement of air quality (if we are lucky)
- Currently planning to grow to at least 150
- Link to external air quality measures from ground stations
- Today: some preliminary results

The Understanding America Study (UAS)

- Established at USC in 2014
- Close to 10,000 panel members
- Address Based Sampling; Tablet+Internet if needed
- Core surveys on economics, psychology, health, government policy…(~5 hours worth per 2 yrs)
- Many additional projects: Covid tracking; Ecological Momentary Assessment; End-of-day recordings; Non-survey measurements (physical activity, diet, pollution, etc.), use paradata on response patterns to measure cognition, etc.

Responses (RR. Consent survey: 76.6%)

	N	%	#
Phone ownership (more than one answer possible)			
Has an Android Phone	257	35%	90
Has an Apple iPhone	257	60%	154
Has a different phone	257	8%	21
Has no phone	257	1%	3
If consented | having smart phone			
Yes	234	65%	152
No	234	32%	75
Not sure	234	3%	7
Reasons for not consenting (more than one answer possible)			
No reason, I just don't want to do it	76	18%	14
I don't want to wear the Atmotube Pollution monitor	76	38%	29
It will take too much time	76	13%	10
have medical or health issues	76	1%	1
It will be too much trouble	76	28%	21
I don't want another app on my phone / I don't use apps	76	8%	6
I can't always get a cell or wireless connection on my phone	76	12%	9
I don't really understand what the project is asking me to do	76	1%	1
It doesn't pay enough	76	18%	14
What I do for a living, or what I do all day, will not allow me to wear a device	76	11%	8
I don't know how to download or use phone apps or I am not sure what they are	76	0%	0
I am concerned about privacy	76	8%	6
Three months or a year is too long, I would do it if it was for a shorter time period	76	14%	11
Some other reason	76	11%	8

Surveys	Respondents
1	26
2	3
3	2
4	16
5	2
9	1
10	3
11	4
Total	57

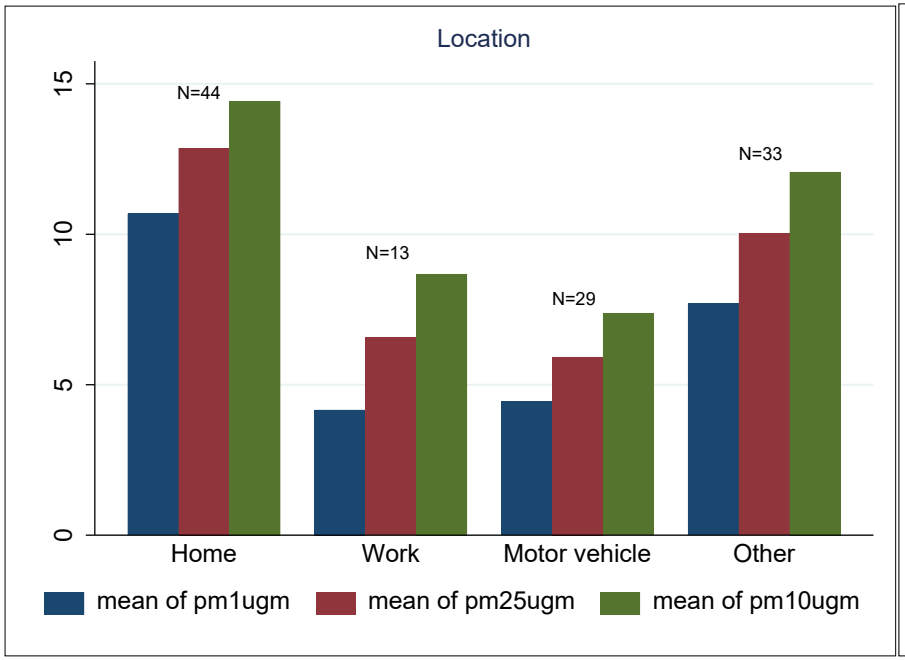
Monthly survey

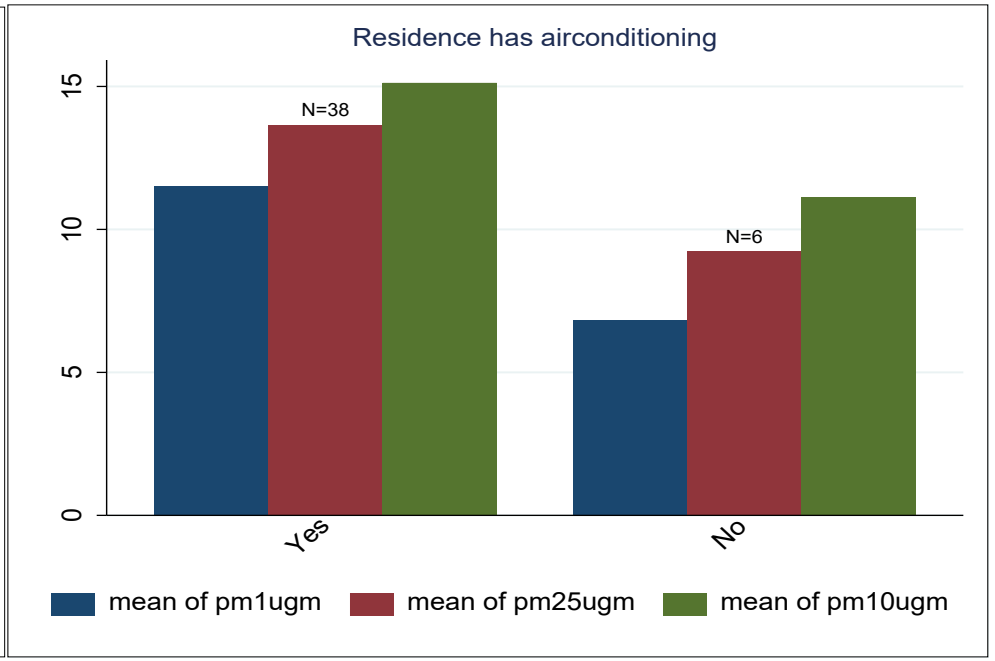
- What kind of dwelling; location (busy street, etc.)
- Perceived air quality inside and in neighborhood
- Use of airconditioning/air filters/type of heating
- Where were they yesterday (30 minute slots): home, work, motor vehicle, other

Survey Summary (All Waves)

	N	%	#
Wore the Atmo tube the whole day yesterday			
Yes	188	73%	137
How safe is the air quality in your home			0
Very unsafe	189	2%	4
Unsafe	189	5%	9
Somewhat unsafe	189	9%	17
Neither safe nor unsafe	189	2%	4
Somewhat safe	189	24%	45
Safe	189	39%	74
Very safe	189	20%	38
How safe is the air quality in your neighborhood			
Very unsafe	188	1%	2
Unsafe	188	0%	0
Somewhat unsafe	188	6%	11
Neither safe nor unsafe	188	4%	8
Somewhat safe	188	28%	53
Safe	188	45%	85
Very safe	188	17%	32
How often check the air quality on Atmo phone app this week			
Multiple times each day	186	26%	48
At least once a day	186	22%	41
About three or four times this week	186	17%	32
One or two times this week	186	14%	26
Never	186	22%	41

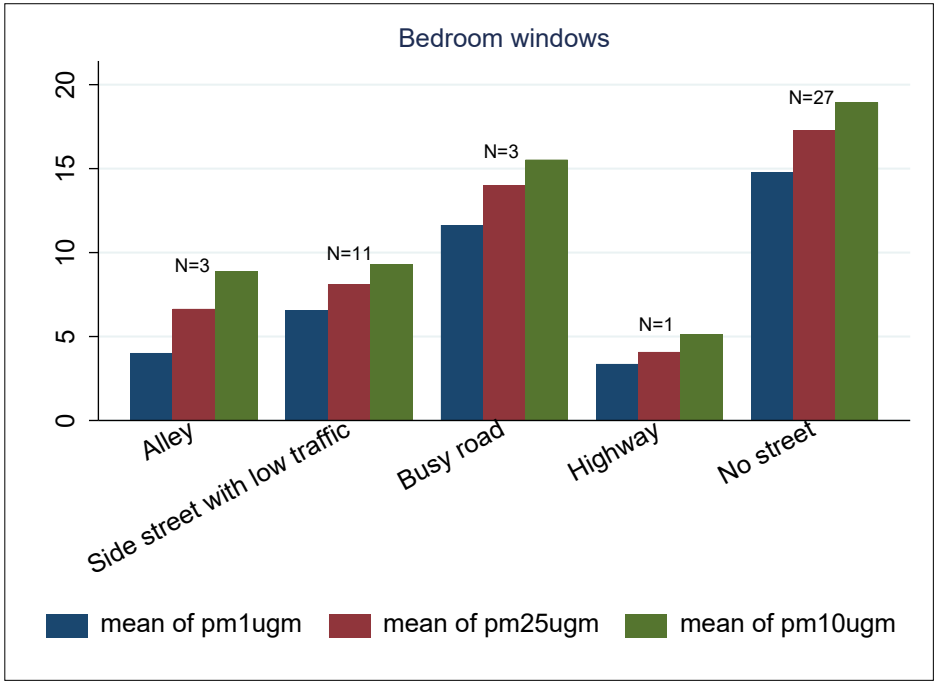
Average Pollution by Location

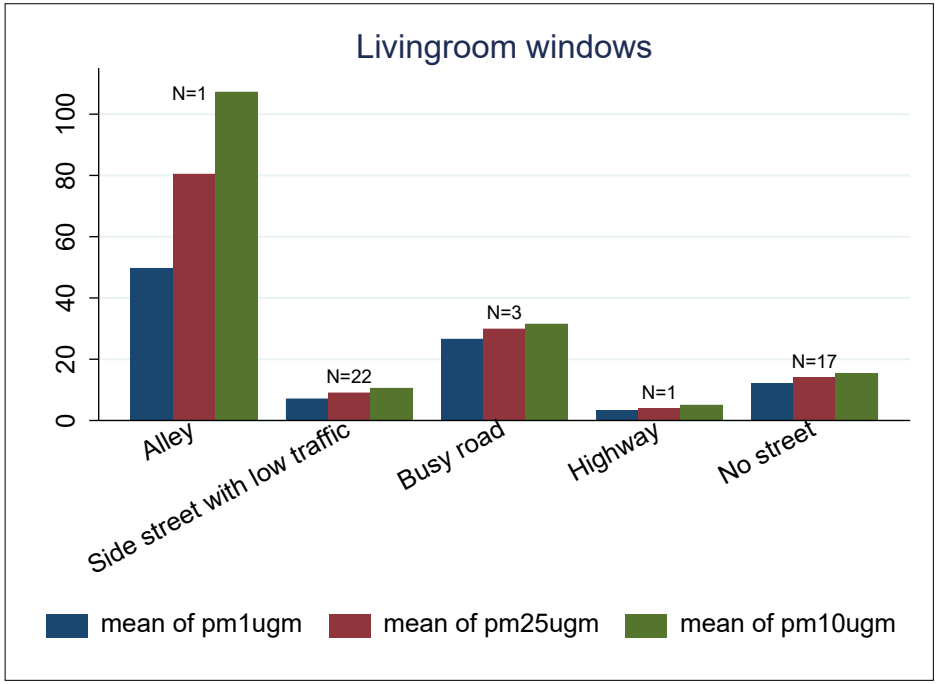




All person-months combined

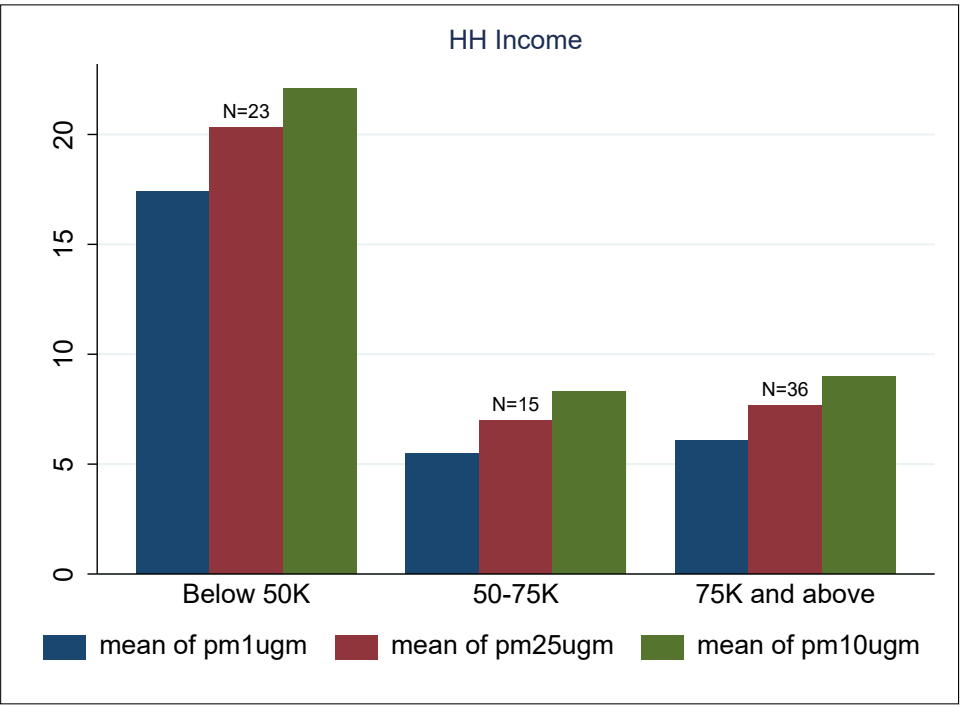
Average Pollution by Location

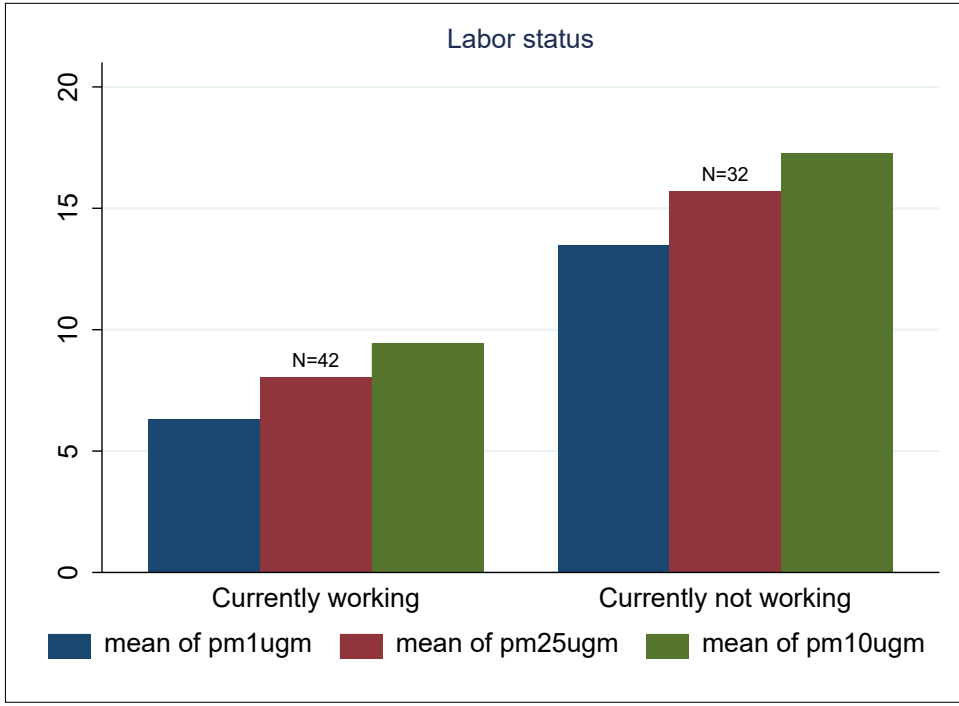




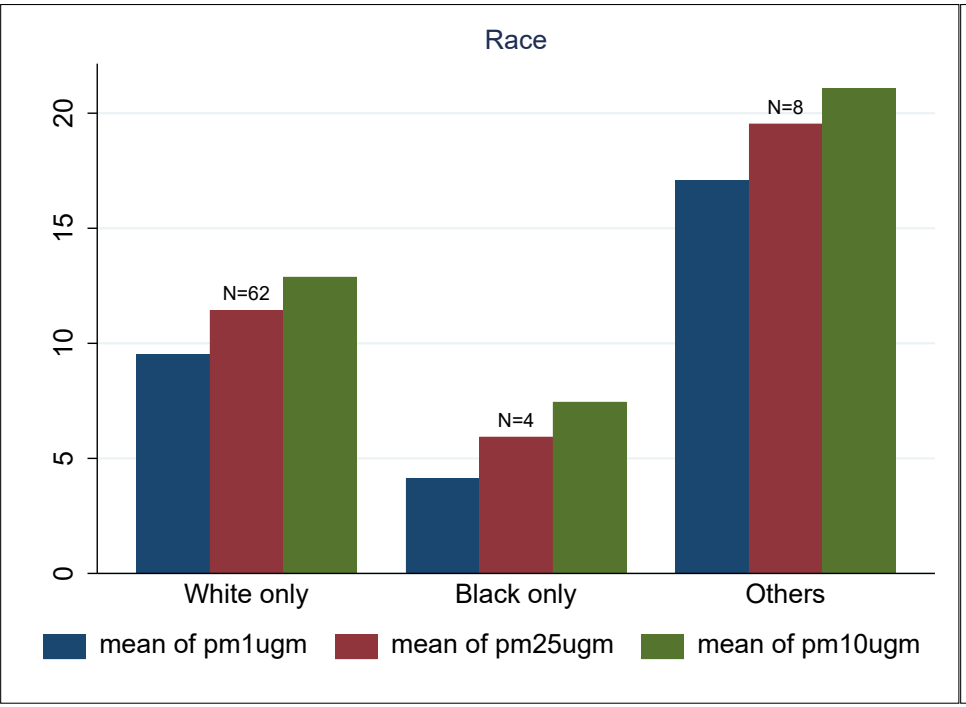
All person-months combined

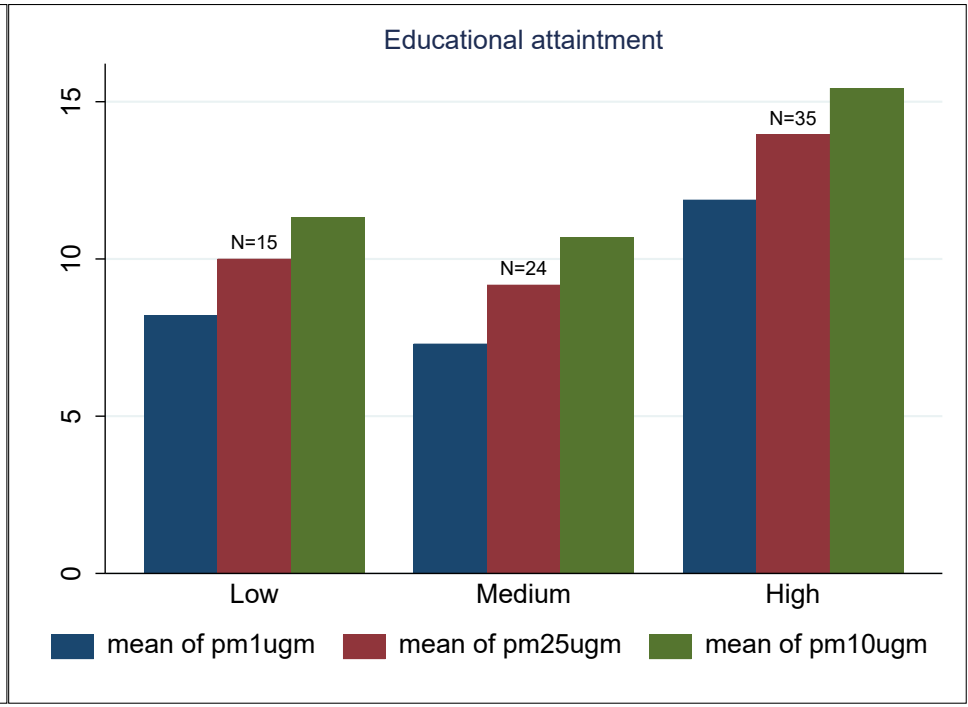
By Background Characteristics



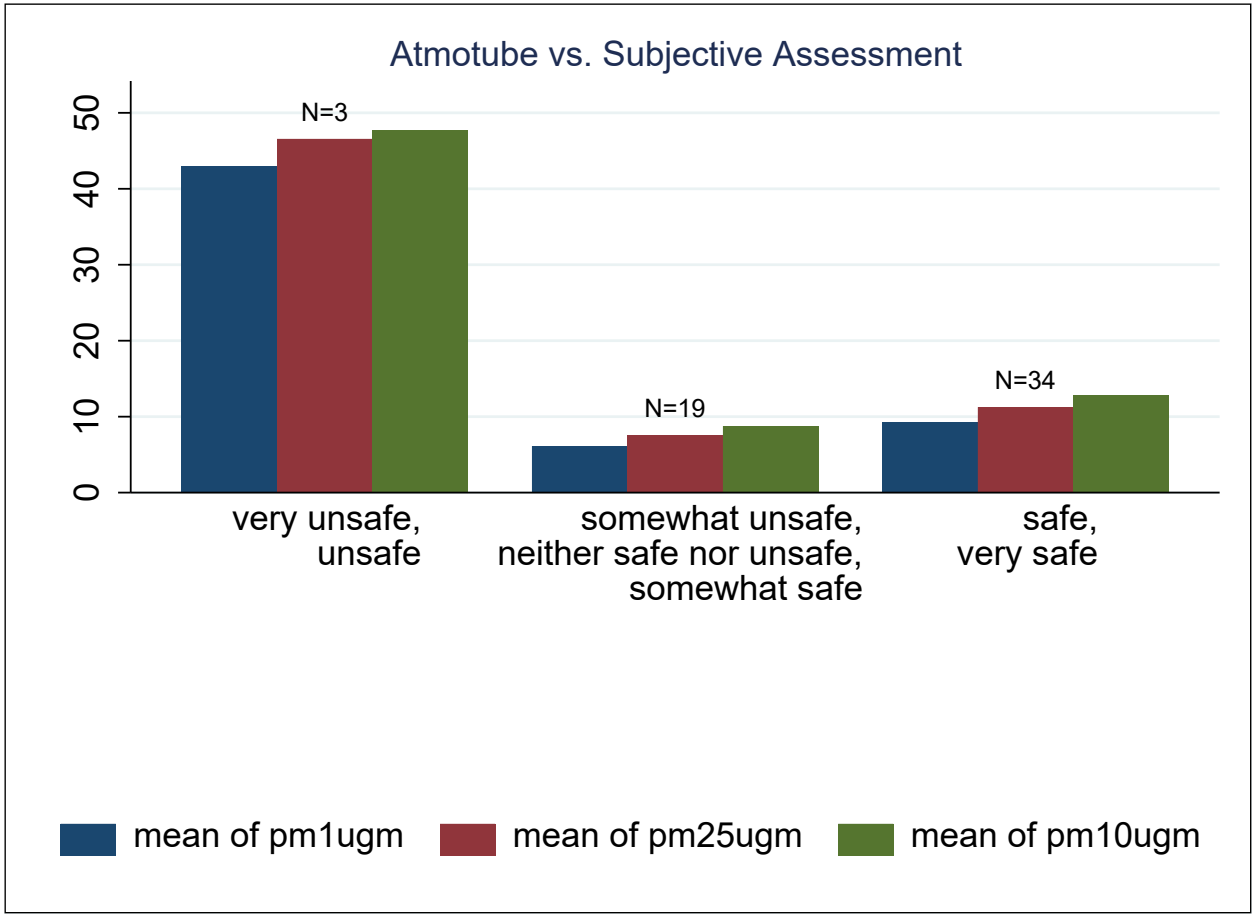


By Background Characteristics





Do People Know their Air Quality?



Question asks about air quality inside

Prospects

- More observations (150-200)
- More months
- Link to data from ground stations (as of November 2022)
- Improve questionnaires, field procedures
- Analysis