

Public perception and concern about heat waves, air and noise pollution in Barcelona



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The most investigated **air pollutants** in the context of personal exposure are particulate matter (PM), nitrogen oxides (NO_x), carbon dioxide (CO₂), ozone (O₃), black carbon (BC), and ultra-fine particles (UFP). Numerous studies show the association between exposure to particulate matter and an increased likelihood of, e.g., cardiovascular or respiratory disease



Cities have higher temperatures than their surrounding areas and urban areas will be affected by **heat waves** more frequently in the future



Motor vehicles, rail traffic, air traffic, and industry are the main sources of **noise pollution**. Adverse health effects include heart disease and sleep and concentration disorders

Introduction

- Concentrations of air pollution, unhealthy levels of noise, and extreme heat days pose significant **health and wellbeing risks** for urban inhabitants.
- In addition to the health effects of environmental risk, an increasing number of studies in the social sciences are inquiring into the **perception, subjective effects, attitudes and coping behaviors** related to environmental risk (Evans et al., 1988; Klæboe et al., 2000).
- **People's risk perceptions and affective responses** are an important antecedent in **coping responses**. Although risk perception alone does not necessarily predict preventive behaviors, individuals with greater risk perceptions are generally more likely to implement risk protection behaviors and support risk protection policies (Inwald et al., 2023).
- Risk perception and concern about the risk can also influence **subjective well-being** (Darçın, 2017). Perceptions of noise pollution, for instance, can influence self-perceived health, self-perceived happiness, and satisfaction with life (Herrera and Cabrera-Barona, 2022)

Related research

- Fifty-eight percent of participants were worried over health effects of **air pollution** with large differences across cities (Barcelona 81%, London 64%, Rome 72%, Vienna 43%, Zurich 33%). In the regression model, sex, having children in the household, levels of physical activity, and NO₂ at the home address were significantly linked to individual concern over health effects of air pollution (Dons et al., 2018)
- Studies on the public perception of **heat waves** show that a significant portion of the population (51%) is aware of heat waves and has a high risk perception to heat waves (Akompab, D et al., 2012; 2013). However, personal concern varies, with many more concerned about societal impacts than personal effects. Risk perception is influenced by factors such as age, income, and living conditions (e.g marital status). Older individuals and those living with others tend to have higher risk perceptions
- There are not many studies on the public perception of **noise pollution**. A study in Finland by Okokon et al. (2015) found that road-traffic noise and exhausts were, respectively, considered high or extreme population-health risks by 22% and 27% of respondents. Knowledge of health risks from traffic noise and noise sensitivity were positively associated with annoyance. Chiarini et al. 2020 found that the subjective perception of noise and pollution varies quite extensively across the investigated countries.

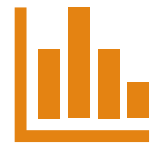
Research objectives

- To study **risk perception** of air pollution, heat waves and noise pollution among urban residents.
- To compare perception of risk between different socio-demographic groups (Which segments are more concerned?)
- To explore differences in risk perception between neighbourhoods in the city

Method

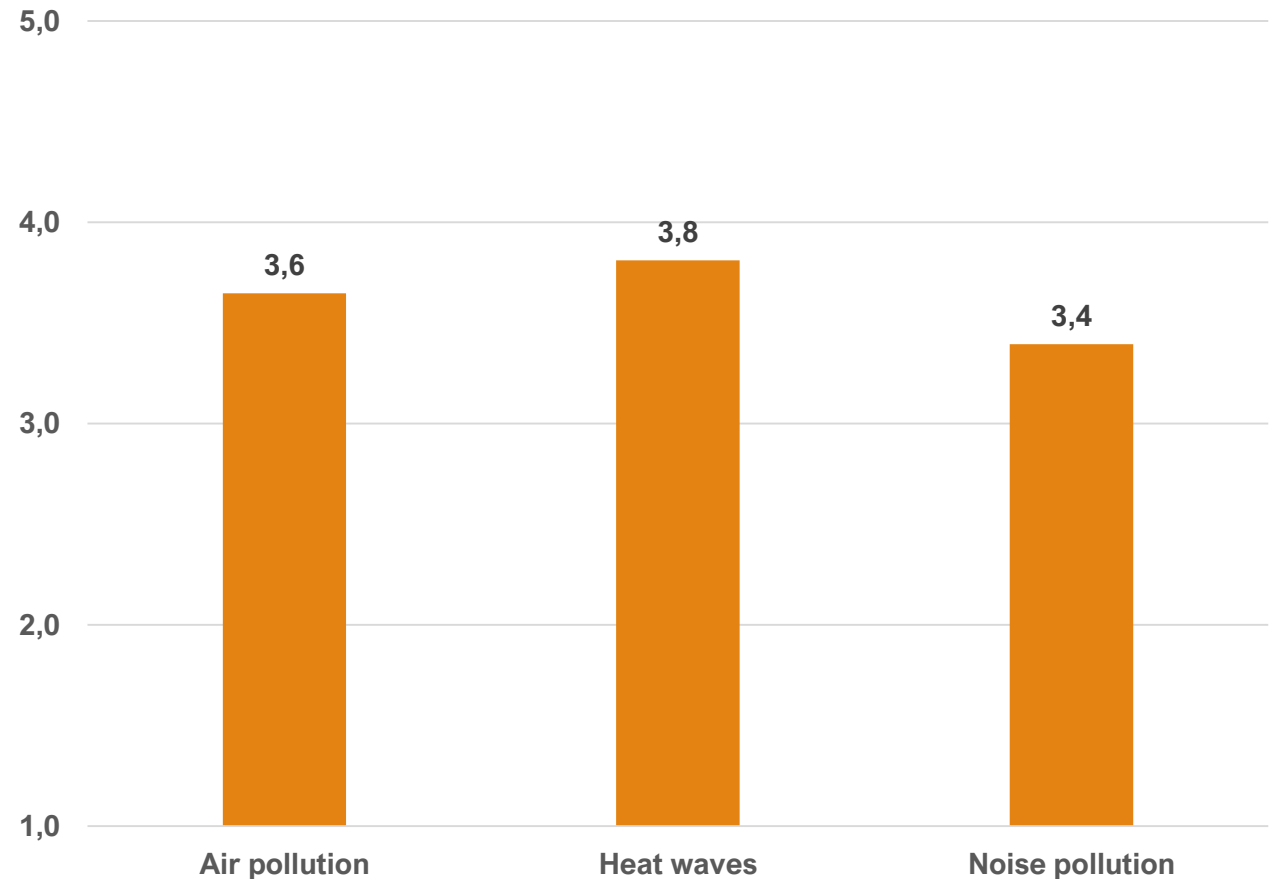
- **Data collection:** We implemented a survey targeting residents of Barcelona (September 2023). The survey was administered to online panel participants (non probabilistic panel). Quota sampling was implemented to ensure a more representative sample of the city's population. A total of 950 valid responses were collected.
- **Measures:** The survey instrument included items and questions adapted from previous studies to measure several dependent and independent variables. In this communication we focus on:
 - **Concern for urban environmental risks** (main dependent variable): Respondents' levels of concern for the three environmental risks was assessed using one item scale (affective response with a cognitive component).
 - **Sociodemographics:** Standard questions were asked to collect information on participants' age, gender, education level, income, and other relevant sociodemographic characteristics.
- **Data analysis** The collected data have been analyzed using descriptive analysis and group comparisons, to examine the relationships among the key variables of interest.

Results

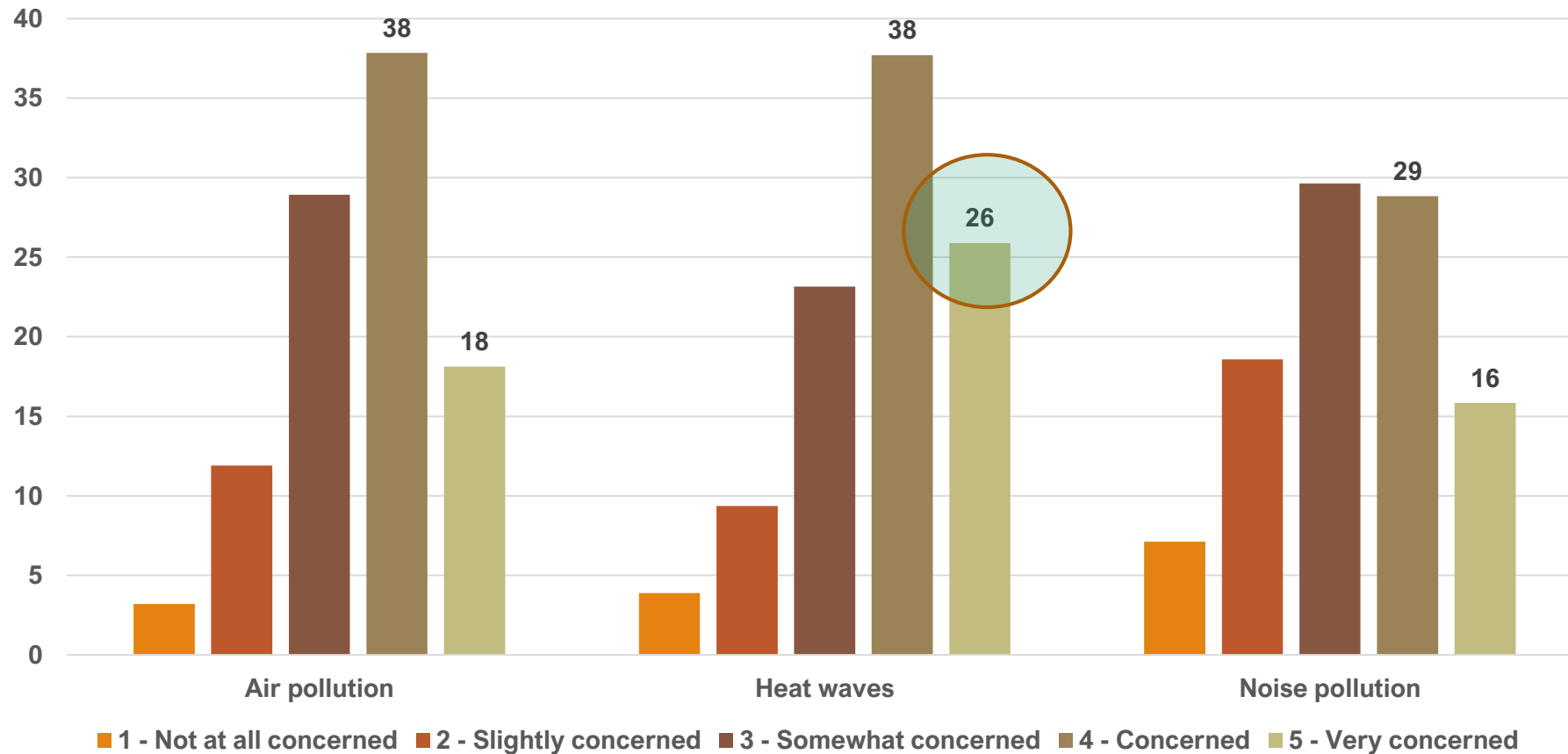


- Respondents reported moderately high levels of concern for all three risks, scoring above the midpoint of the scale.
- There is a significant difference between the concern for the three environmental risks.
 - Heat waves appear to be the greatest concern, with a score of 3.8 on the scale used in the survey.
 - Air pollution is the second highest concern, scoring 3.6 on the scale.
 - Noise pollution is the lowest concern among the three risks presented, with a score of 3.4.

Figure 1. To what extent are you concerned about air pollution, heat wave episodes and noise pollution?
(scale 1 to 5, not at all concerned to extremely concerned)



Friedman		
χ^2	df	p
121	2	< .001



- The % of respondents very concerned about heat waves is significantly higher than the % of respondents very concerned about air or noise pollution

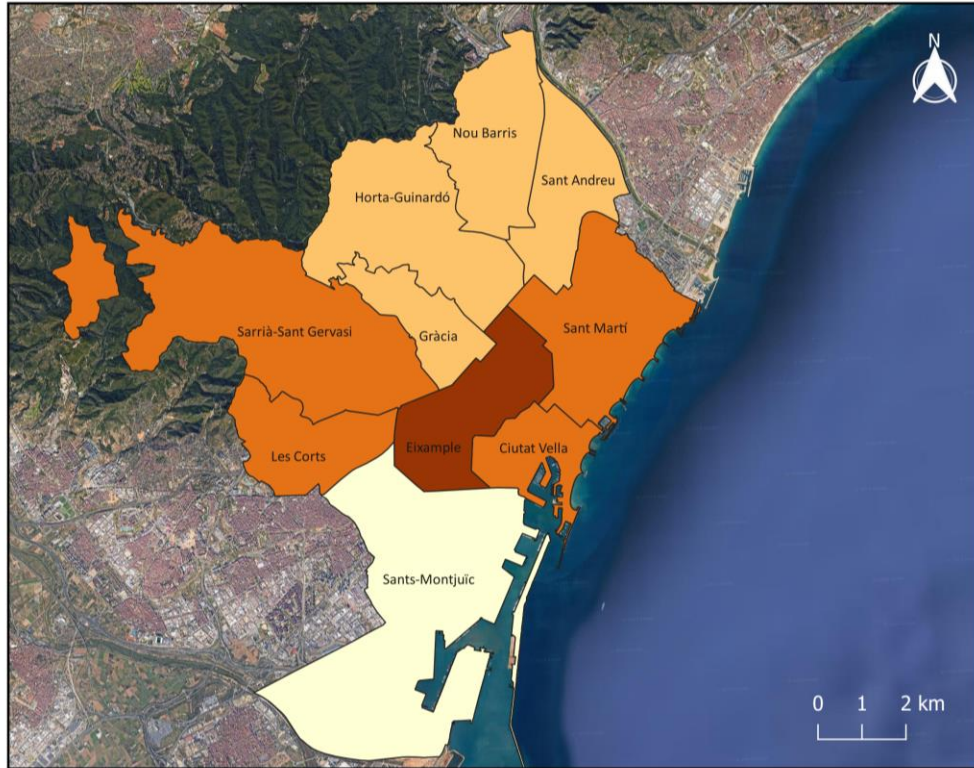
Partial correlations

Control variable			Air pollution	Heat waves	Noise pollution
District	Air pollution	Correlación	1,000	,511	,493
		Significación (bilateral)	.	<,001	<,001
		gl	0	1001	1001
	Heat waves	Correlación	,511	1,000	,360
		Significación (bilateral)	<,001	.	<,001
		gl	1001	0	1001
	Noise pollution	Correlación	,493	,360	1,000
		Significación (bilateral)	<,001	<,001	.
		gl	1001	1001	0

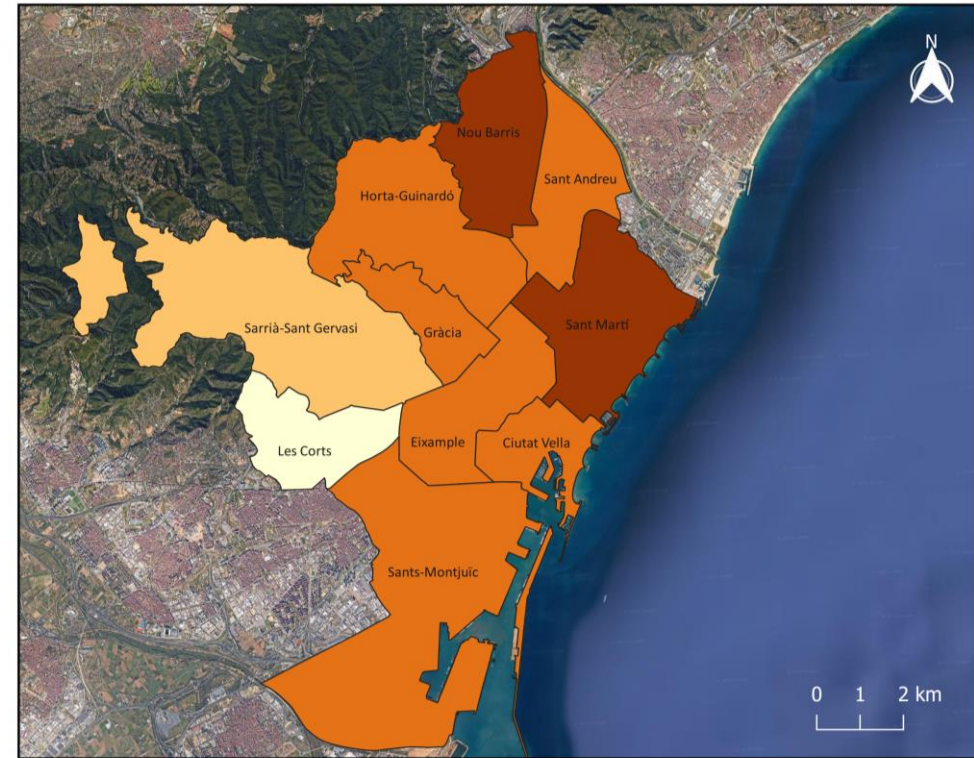
- While the correlations are not extremely high, the positive values and statistical significance across all pairs of risks imply that, in general, people who are concerned about one environmental risk tend to also be concerned about the other risks examined.
- There is a tendency for concern about the three environmental risks to co-occur rather than being completely independent issues.

BY DISTRICT

Air pollution by district (mean), Barcelona, 2023



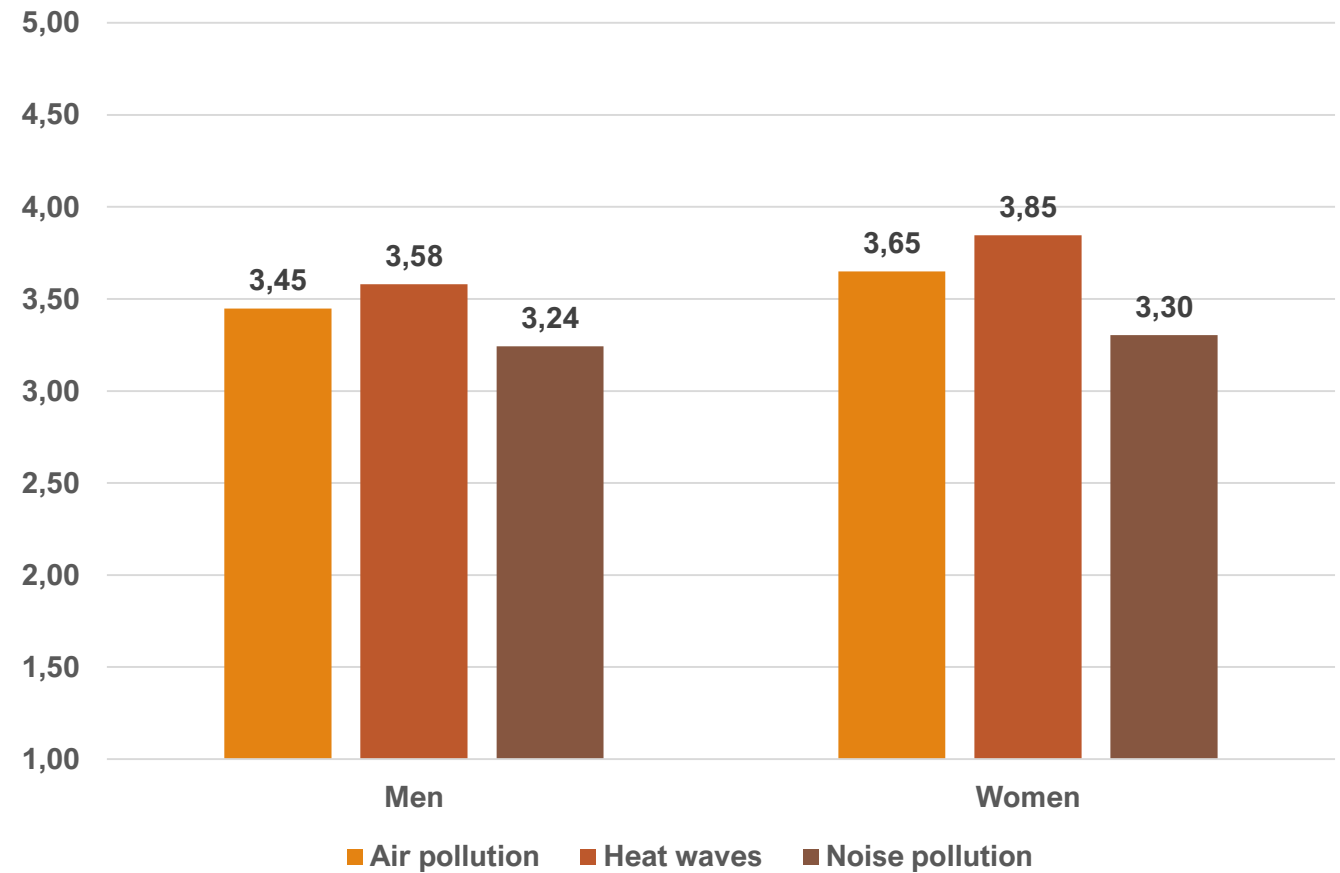
Heat wave by district (mean), Barcelona, 2023



Overall, the data suggests that residents' concerns about the three environmental risks vary across districts. While some districts like Eixample and Sant Martí consistently rank higher for air pollution and heat wave concerns, others like Nou Barris and Ciutat Vella rank higher for specific issues like heat waves and noise pollution, respectively.

MEN and WOMEN

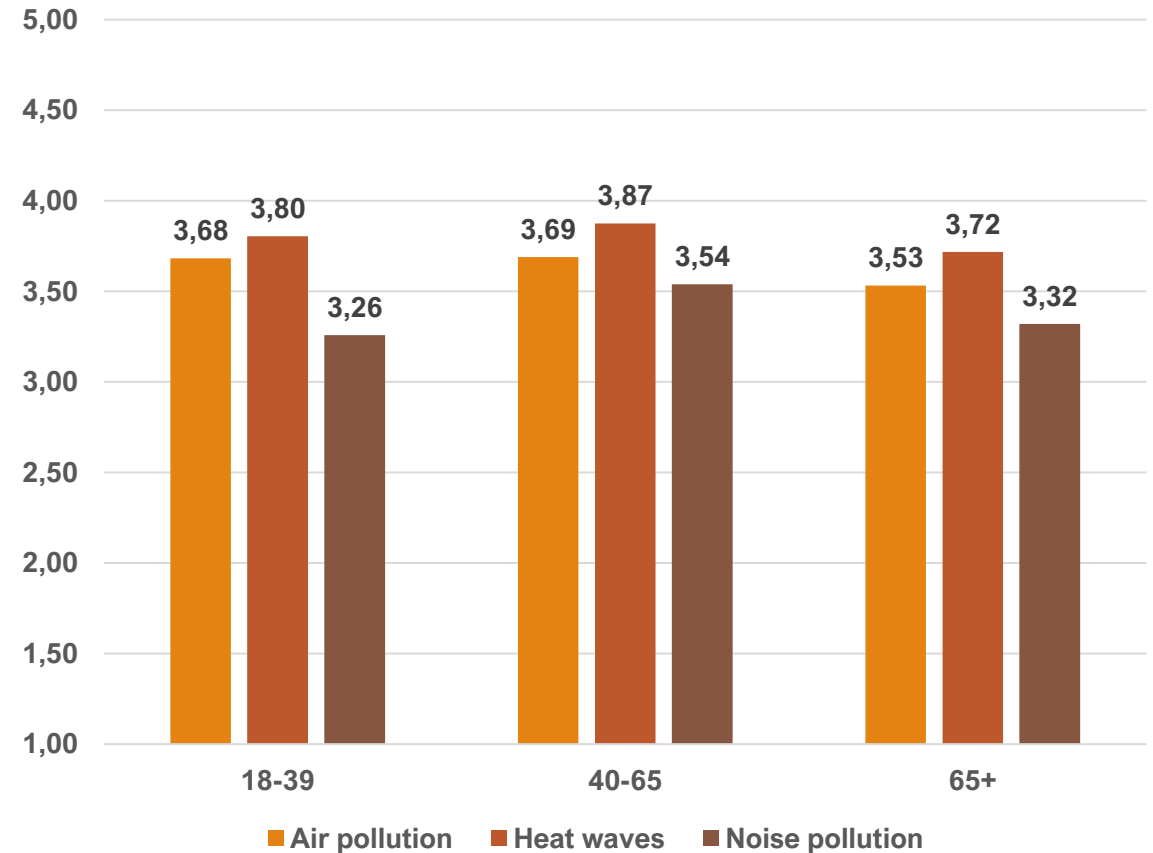
- Overall, the data suggests that across all three environmental risks studied, women tend to report higher levels of concern than men.
- This gender difference is most prominent for heat waves, followed by air pollution, while the disparity is smallest for noise pollution.



	F	p-value
Air pollution	7,8	0,00
Heat waves	11,3	0,00
Noise pollution	1,26	0,28

BY AGE GROUP

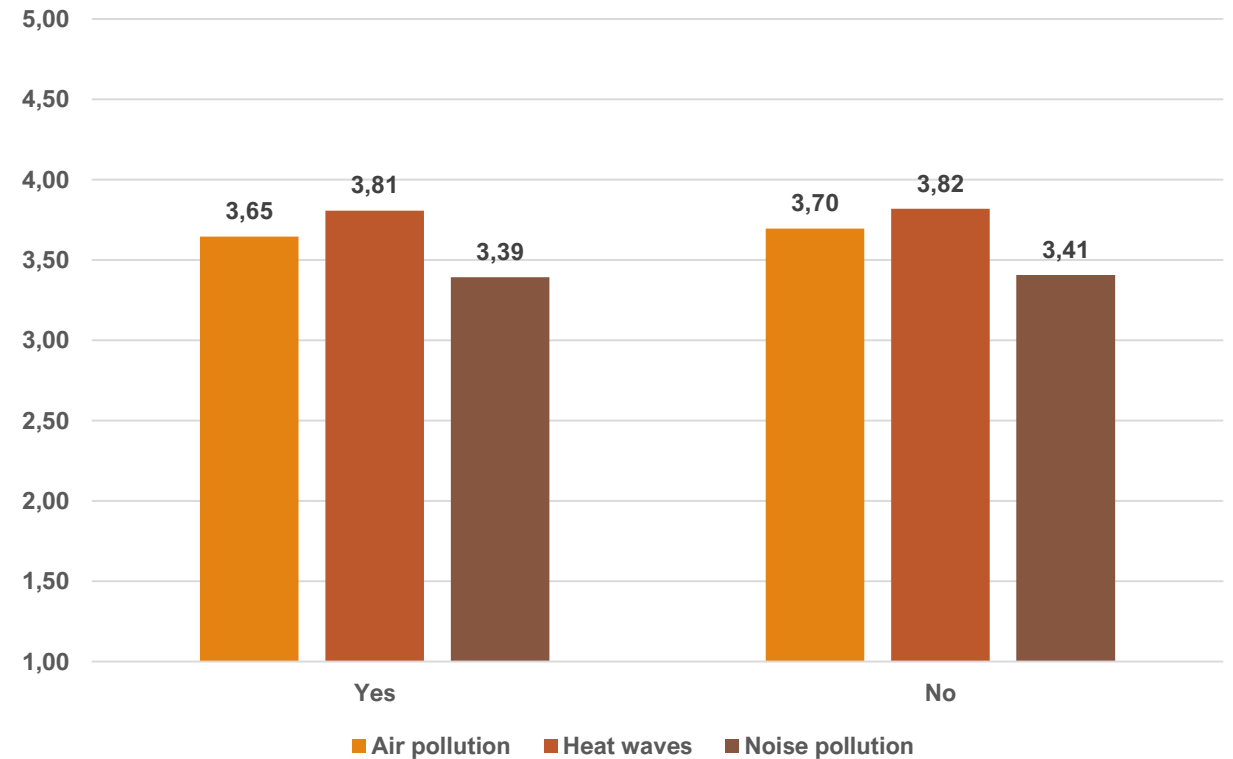
- While all age groups show the highest concern for heat waves and the least for noise pollution, there are slight variations in the levels of concern for the three environmental risks among different age groups.
- 40-65 age group is slightly more concerned about the three environmental risks relative to the other groups



	F	p-value
Air pollution	2,4	0,01
Heat waves	1,9	0,15
Noise pollution	6,2	0,00

THOSE WHO CAN AFFORD CLIMATE CONTROL VS THOSE THAT CANNOT

- Both groups exhibit the highest concern for heat waves and the lowest for noise pollution.
- There is a slight difference in the level of concern for air pollution and noise pollution, with those unable to afford climate control showing a marginally higher concern for air pollution. The differences are not statistically significant



	F	p-value
Air pollution	0,38	0,54
Heat waves	0,01	0,89
Noise pollution	0,02	0,89

Discussion

- Residents exhibit the **highest concern for heat waves** and the lowest for noise pollution, with air pollution falling in between. This is a notable finding, which *might be attributed to the increasing frequency and intensity of extreme heat events in urban areas*, as predicted by climate change models. Air pollution also remains a major concern, consistent with numerous studies that have documented its adverse health effects, particularly in terms of respiratory and cardiovascular diseases.
- This pattern is **consistent across various demographic groups** and districts, although the levels of concern do exhibit **slight variations** based on age, gender, neighborhood and access to climate control.

Discussion

- Individual differences in attributes (gender, race, socioeconomic status, etc.), but also in attitudes and behaviors (from perceptions to lifestyles) are often overlooked determinants of environmental risk exposure and should be better integrated with group- and neighborhood-level characteristics (Kuras & D. M. Hondula & J. Brown-Saracino, 2015)
- We have to better understand how individuals experience environmental risk in urban settings in order to promote more targeted public engagement efforts in the risks from environmental stressors in urban areas might help minimizing the public health risks associated to air pollution, noise and extreme heat.

Thank you

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Social and subjective vulnerability to heatwaves in urban settings (VULNERA)

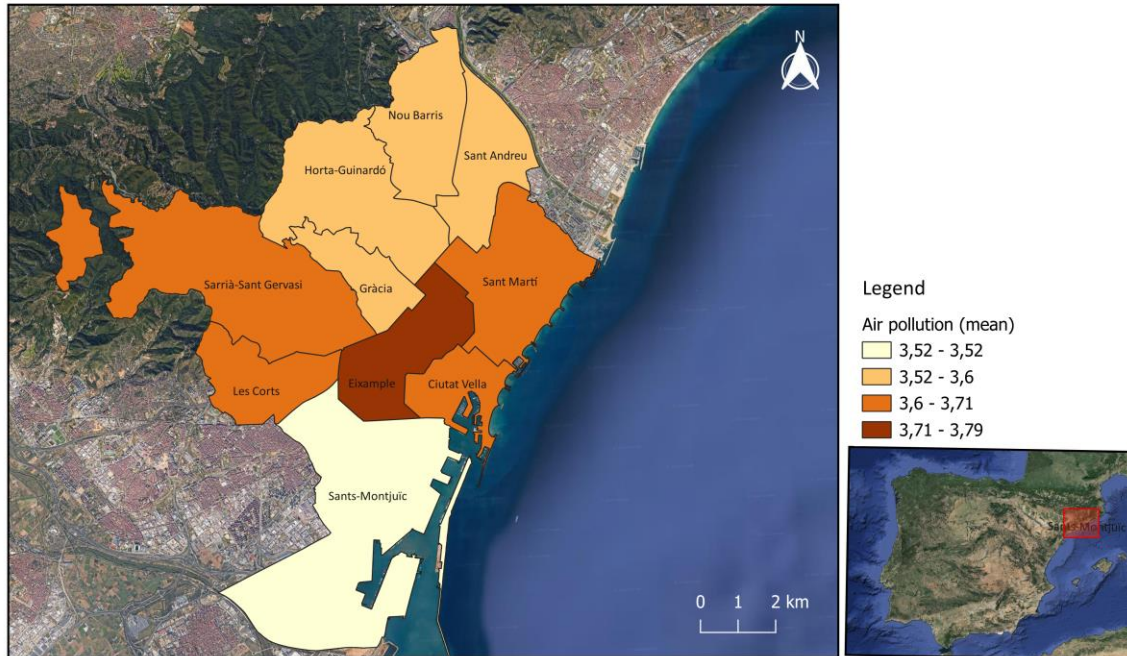
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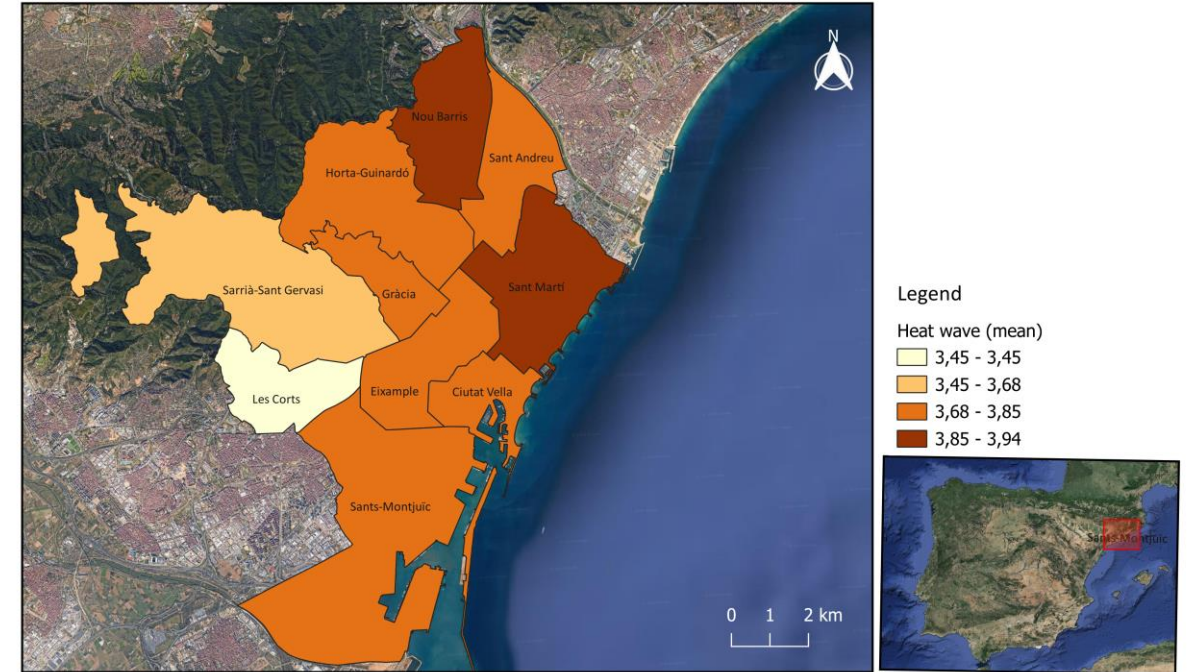
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BY DISTRICT

Air pollution by district (mean), Barcelona, 2023



Heat wave by district (mean), Barcelona, 2023



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