Individual results report

This report collects the results of your participation in the CitieS-Health study. The main idea of the study is to see if attention (measured with a cognitive test), feeling of well-being, stress and quality of sleep are affected by the levels of air pollution of the day. It is also interesting to see if noise and time spent in green or blue spaces affect the results.

NO2 concentrations have been used to measure pollution levels. NO2 is a gas that is emitted from the burning of fossil fuels. In cities, NO2 is a good marker of traffic pollution (in Barcelona it is estimated that 70% of NO2 comes from traffic). Other ways of measuring pollution, such as the level of fine particles, are less specific, since in addition to traffic they can have other origins (for example, Saharan dust, industry, plant debris, etc.). The main reason for selecting the NO2 for the study is that it is a better marker of traffic pollution.

In this personal report you will find information on:

- Pollution levels (NO2):
    - NO2 levels measured by your tube
    - Comparison with the levels of other participants ")
    - NO2 levels measured in city stations
    - NO2 levels estimated with your movements")
- Noise levels and proximity to green or blue spaces in your home Exposure to noise and green or blue spaces estimated with your movements Your daily steps counted by your phone
- Your attention test results
- Your daily data on mood, stress and sleep quality

To preserve your privacy, this report is anonymous and does not contain personal information that allows your identification.

The reports of all the participants have been created automatically and therefore not include an interpretation of your particular data. If you have doubts, let us know and We will organize a session to interpret the graphs and results.

NO2 levels

Results of your tube

Period: 10/24/2020 8am - 10/31/2020 8am

The average NO2 levels measured with the tube you carried for a week are:

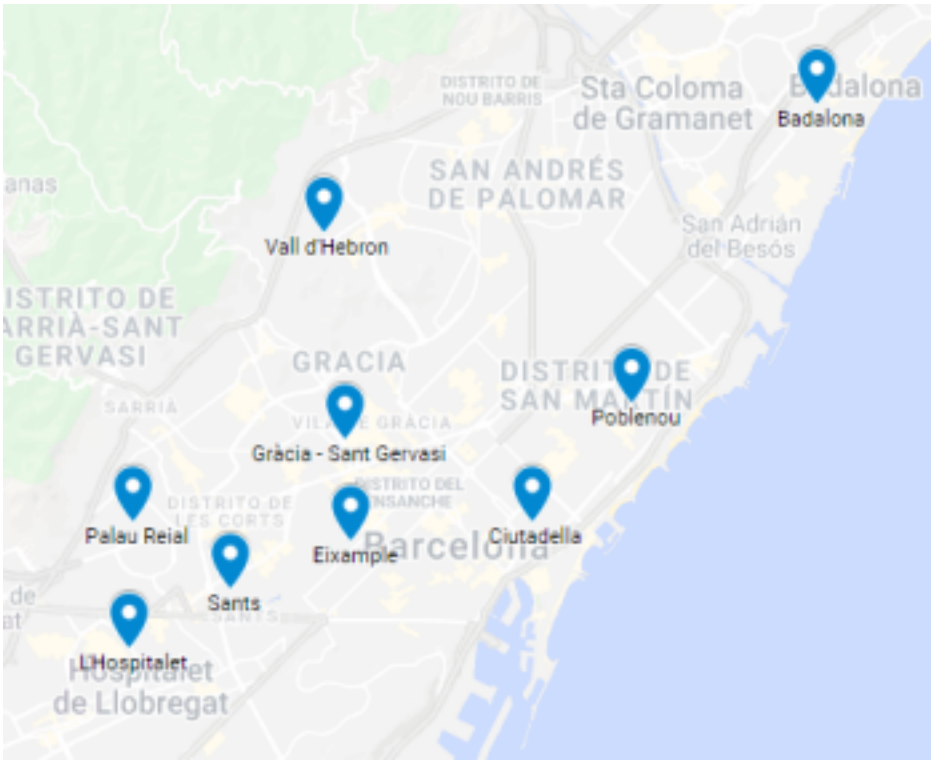
NO_2 *(tubo)*: ***16*** *µg/m*^{3}

The tube only offers a single value for the entire period. It does not allow to see different values for each day.

Both the World Health Organization and the European Union set a maximum for the average annual NO2 levels in cities of 40 µg / m3.

Levels in the city

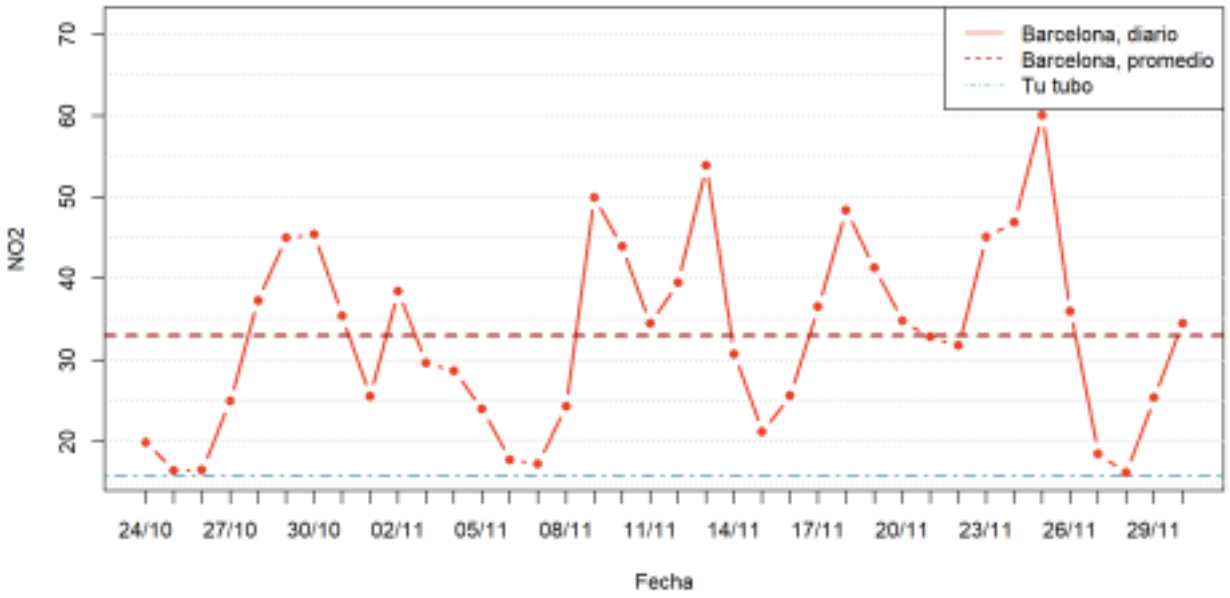
During the period in which you carried tube, the NO2 levels in the city measurement stations from Barcelona were:



NO2
Ciutadella 27
Poblenou 38
Vall d'Hebron 24
Gràcia - St. Gervasi 36
Eixample 40
Sants 27
Palau Reial 22
L'Hospitalet 31
Badalona 35

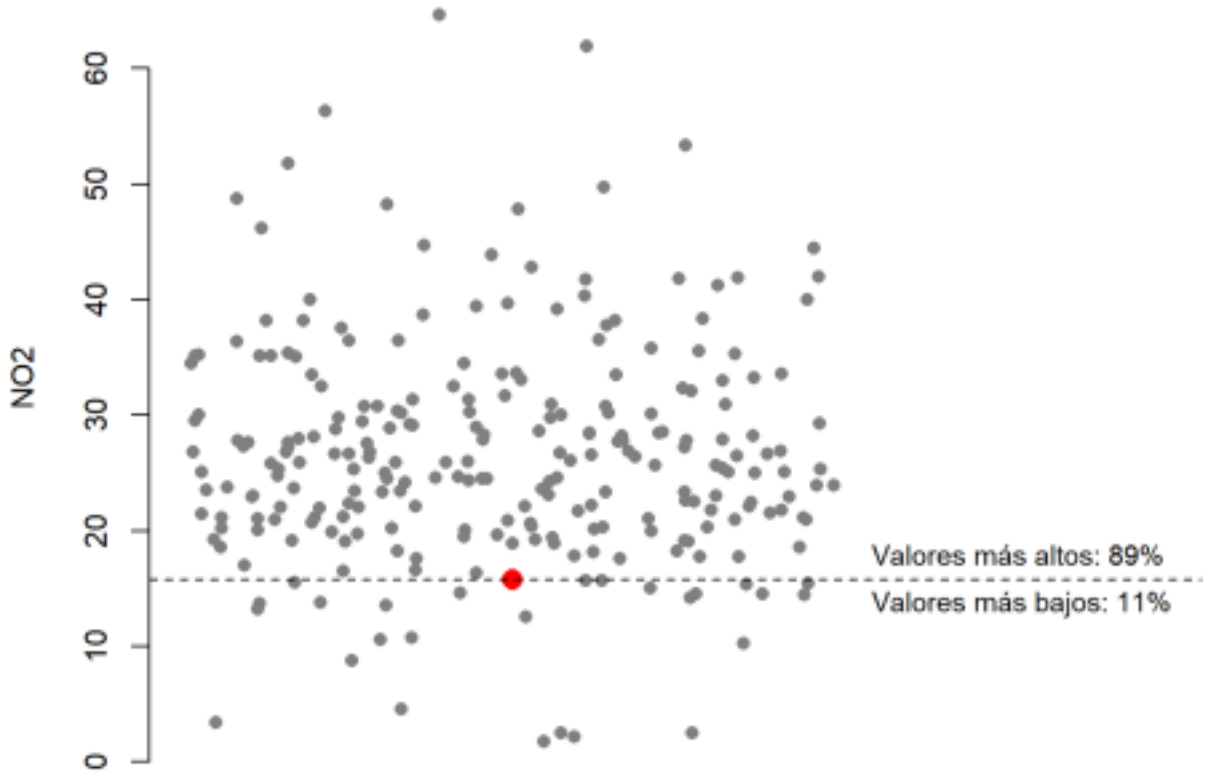
It should be kept in mind that the stations measure pollution levels at a specific point and at street level. The levels of the tube depend on where you have moved, if you have left Barcelona, the height and orientation of your apartment, the ventilation of the spaces indoors, from other indoor NO2 sources (tobacco smoke, gas cooker, wood stove, ...), etc.

Below are the daily levels throughout your participation period, taking the average of the stations in the city of Barcelona.



Niveles de otros participantes

The graph below shows the concentrations in the tubes of the CitieS Health participants. Your point is marked in red. 89% of the participants had higher levels than yours. Keep in mind that the participants carried the tube on different days.



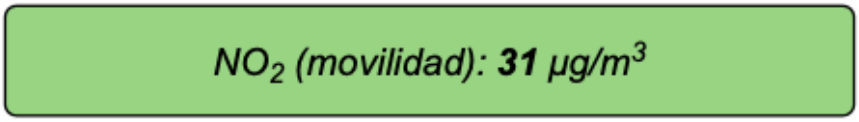
Estimations with your mobility data

Your geolocation data has been crossed with spatio-temporal pollution maps to estimate your exposure to NO2 at all times. The maps used for the city of Barcelona are those created by Lobelia Earth (you can see them in real time here (https: // aire barcelona.lobelia.earth/es/)). For locations outside Barcelona, maps created by the European Union program Copernicus (CAMS European air quality forecasts) have been used.

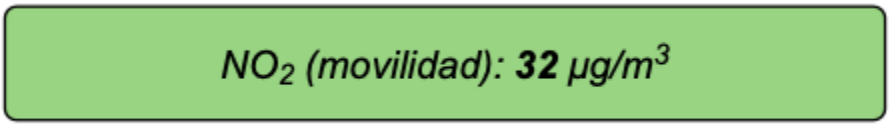
For periods without geolocation data, the information has been completed using the coordinates recorded immediately before or after said period (these periods are marked in blue).

The estimate of your exposure to NO2 based on your geolocation is:

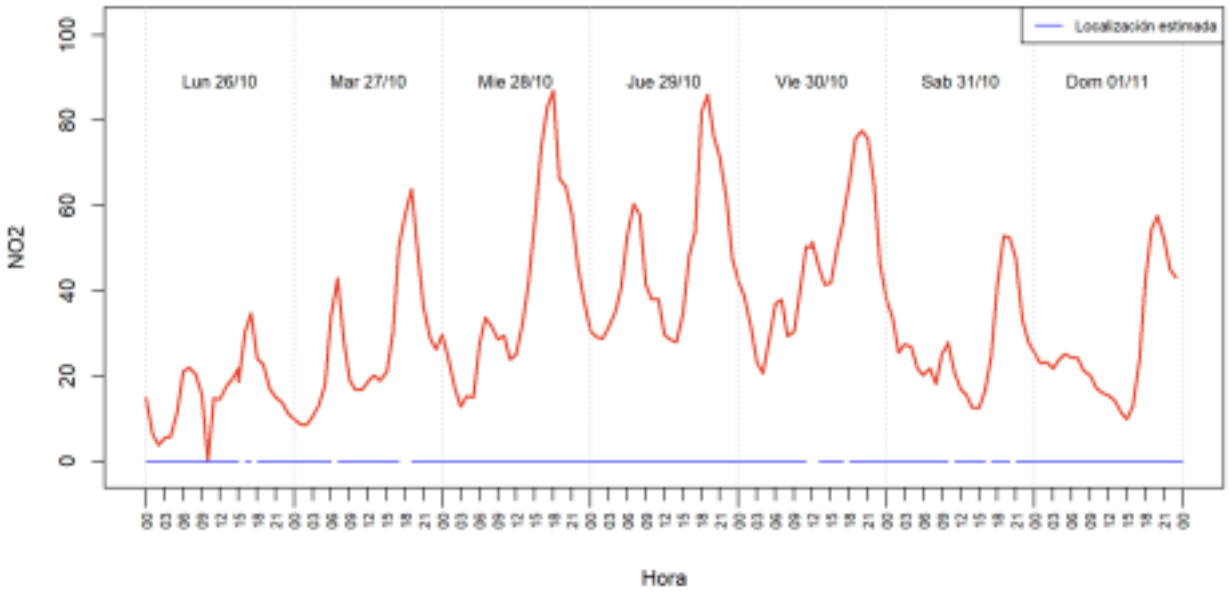
- For the period in which you took the tube (10/24/2020 8h - 10/31/2020 8h):

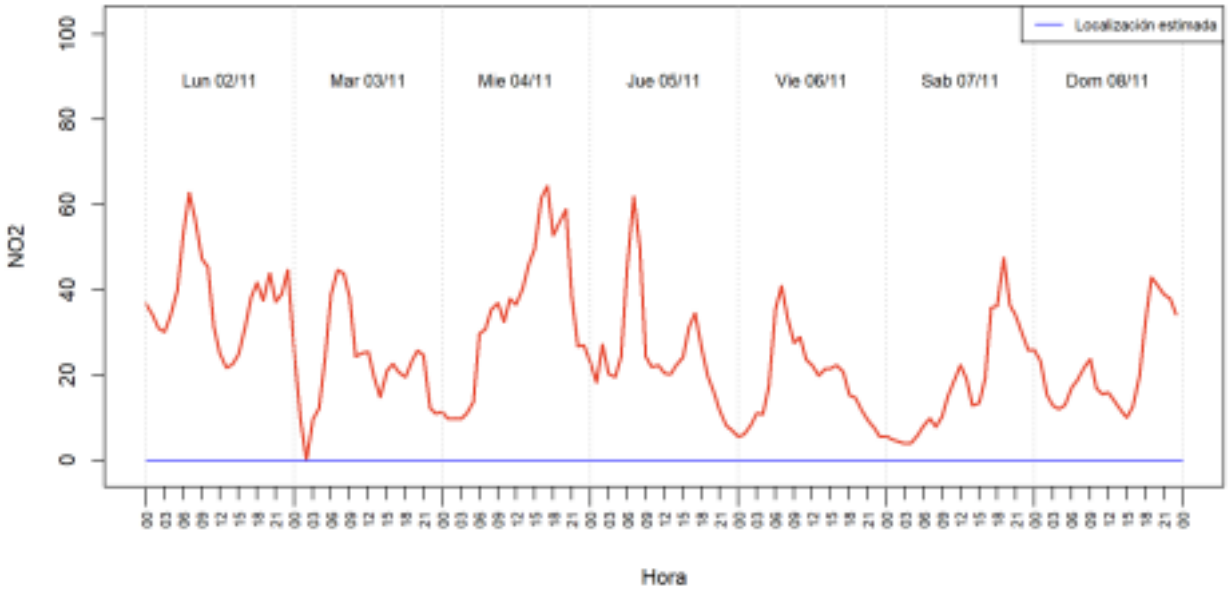


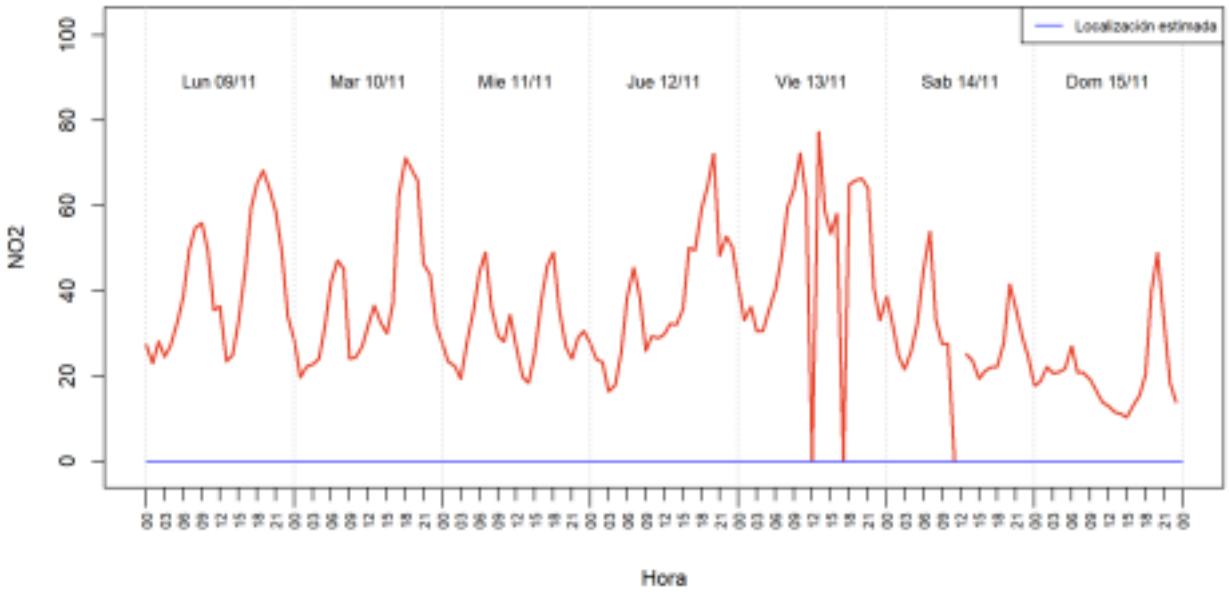
- For the period from when you started the study until it ended (10/23/2020 10:00 PM-11/30/2020 9:00 PM):

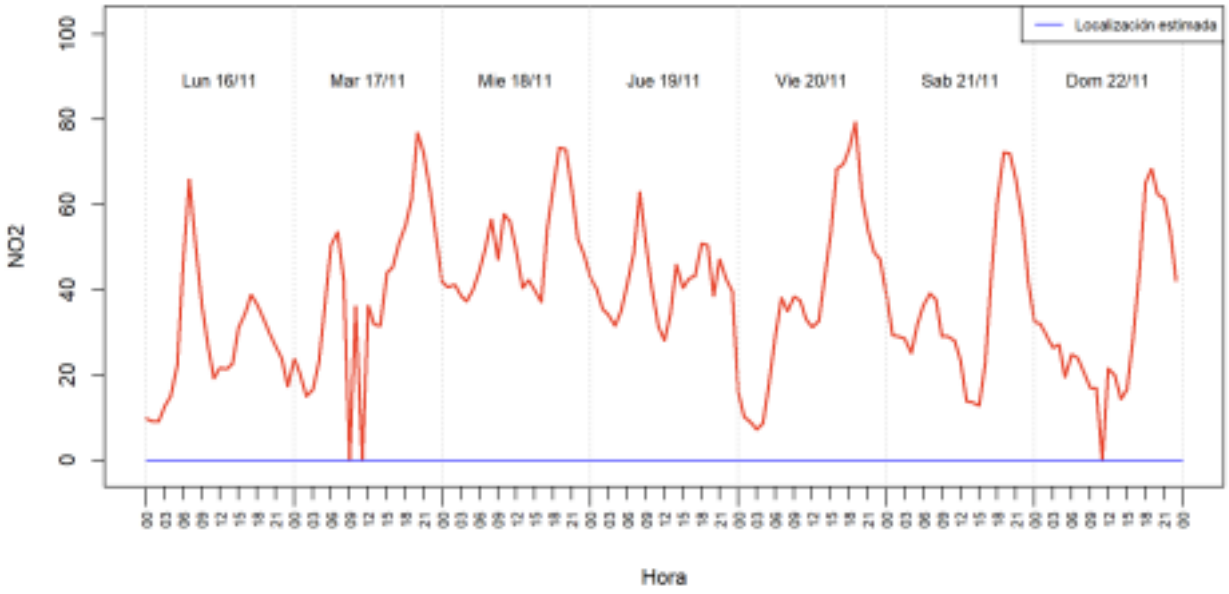


You can then view the estimates continuously for the entire period.


Localización estimada
Lun 26/10
Mar 27/10
Mie 28/10
Jue 29/10
Vie 30/10
Sab 31/10
Dom 01/11
NO2
0
20
40
60
80
100
Hora


Localización estimada
Lun 02/11
Mar 03/11
Mie 04/11
Jue 05/11
Vie 06/11
Sab 07/11
Dom 08/11
NO2
0
20
40
60
80
100
Hora





These values are the result of models that produce predictions and therefore have an associated error (they do not always accurately predict the real levels that we would obtain by measuring it with a sensor). However, they allow you to have an idea of the levels at any point in the city. Keep in mind that the models predict outdoor levels and street level.

Noise and proximity to green / blue spaces in your home

According to the strategic noise map (available here (https://sig.gencat.cat/visors/soroll.html)), the address of your home has daily noise levels above 55 dB (A), which is the The value used by the European Union advises that it should not be exceeded. In our study, 83% of the addresses have higher values.

According to land use maps, your home address has a green space or a blue space (for example, the sea) within 300 m. The World Health Organization recommends that citizens should have access to a green space within 300 meters of their home. In this study, 38% of the participants have access to green or blue spaces within 300 meters.

Noise and green / blue spaces (mobility data)

Crossing your mobility data with the noise maps and green or blue spaces mentioned above, we have calculated how much time you spent in places with noise levels above 55 dB (A) and how much time you spent less than 100 meters from a green space or blue. This information is only available for periods with mobility data.

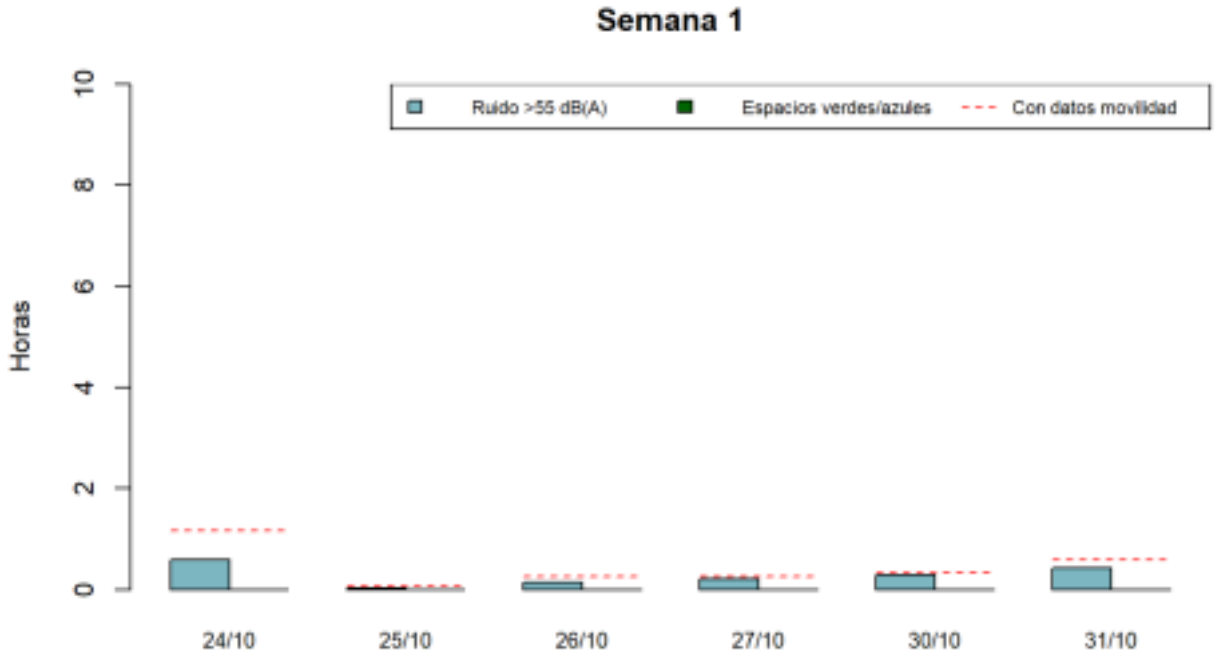
Week 1:

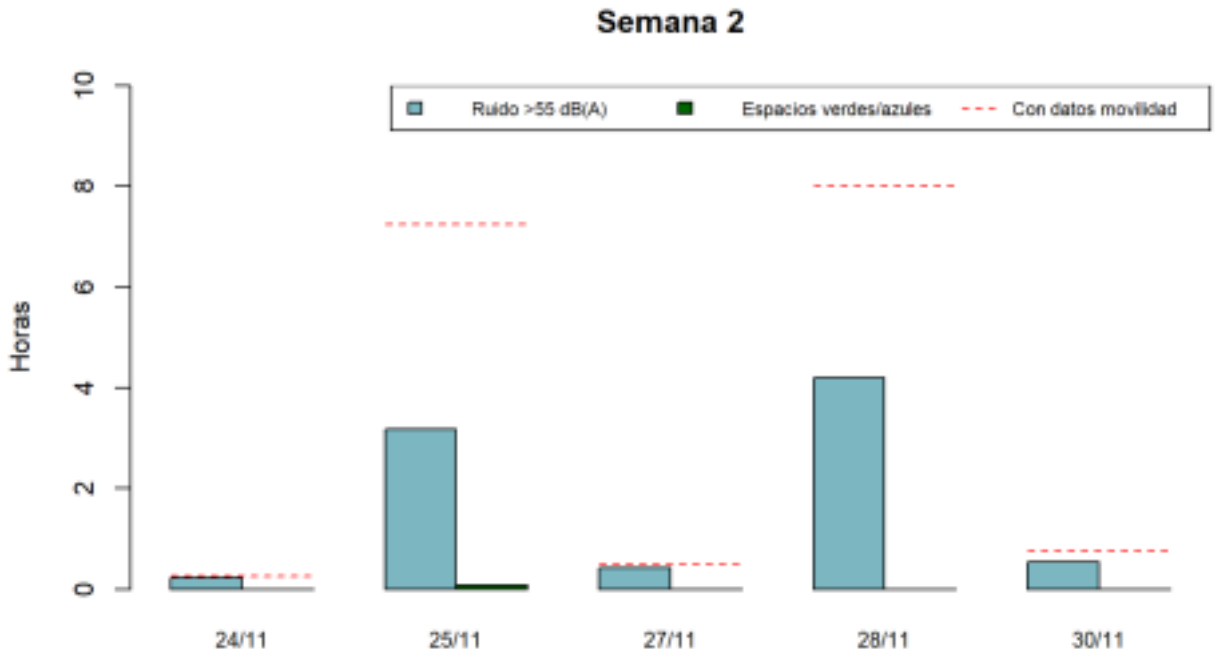
	24/10	**25/10**	**26/10**	**27/10**	**30/10**	**31/10**
Hours with mobility data	**1.17**	**0.08**	**0.25**	**0.25**	**0.33**	**0.58**
Hours with noise> 50dB (A)	**0.59**	**0.03**	**0.15**	**0.21**	**0.30**	**0.43**
Horas en espacios verdes/azules	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

Week 2

	24/11	**25/11**	**27/11**	**28/11**	**30/11**
Hours with mobility data	**0.25**	**7.25**	**0.50**	**8.00**	**0.75**
Hours with noise> 50dB (A)	**0.23**	**3.18**	**0.42**	**4.19**	**0.54**
Horas en espacios verdes/azules	**0.00**	**0.08**	**0.00**	**0.00**	**0.00**

Graphically:

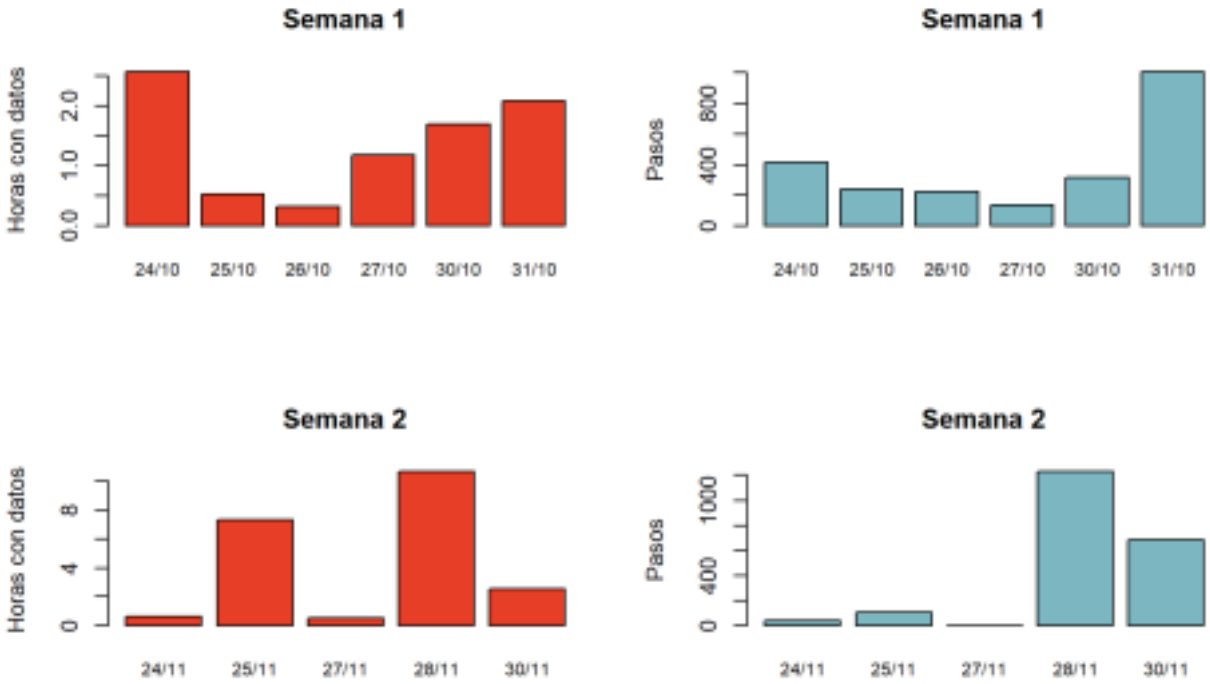




Steps

The number of steps you performed per day was also collected through your phone. Obviously this data is subject to the time this function was activated and the steps you took when you were not carrying the phone are not reflected. Below you can see graphically the steps

recorded on each specific day before answering the daily questions.



Attention test

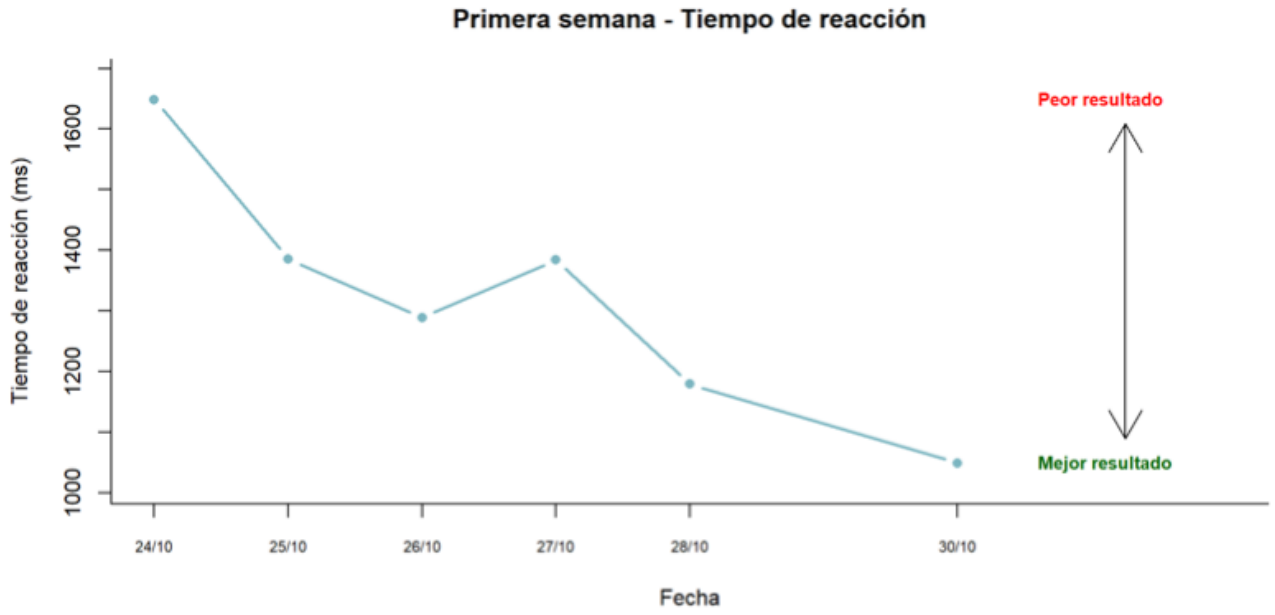
The color test (Stroop test) is a validated test to measure attention. Various parameters can be obtained from it. In particular, our study will use:

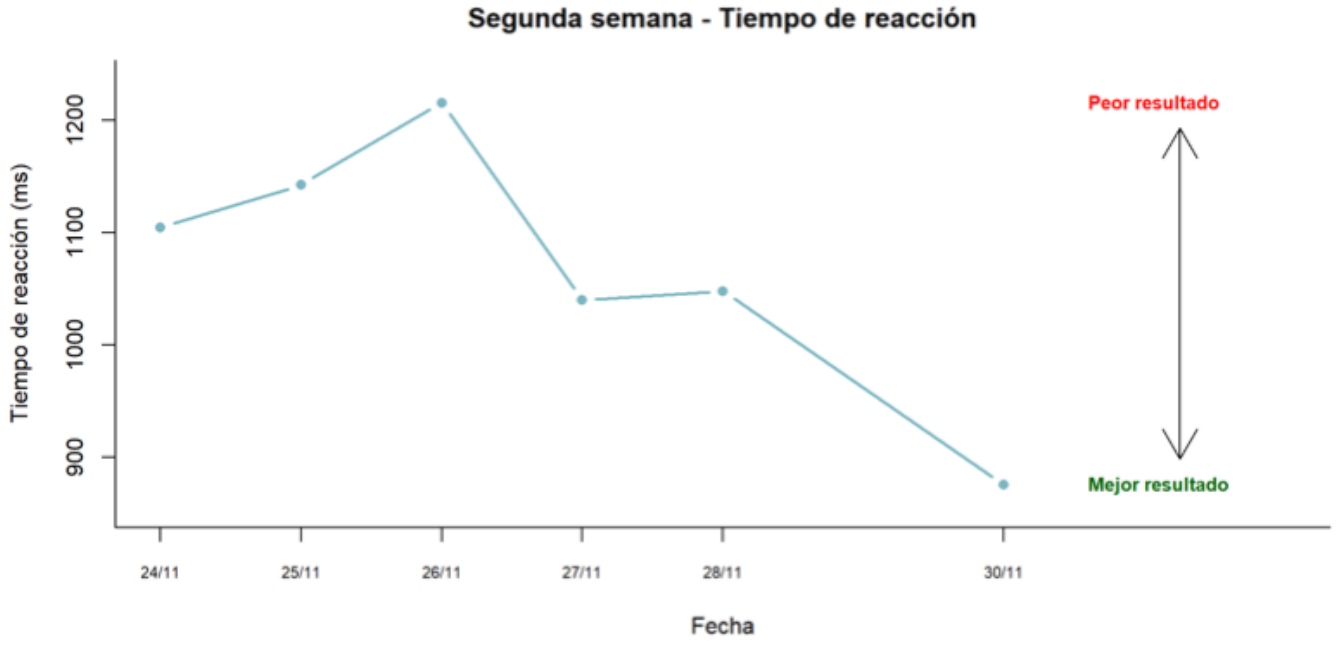
* **Reaction time:** the average reaction time in milliseconds (ms) in the incongruous tests (when the word does not match the color).

* **Cognitive performance:** the daily average of correct responses per minute to inconsistent tests.

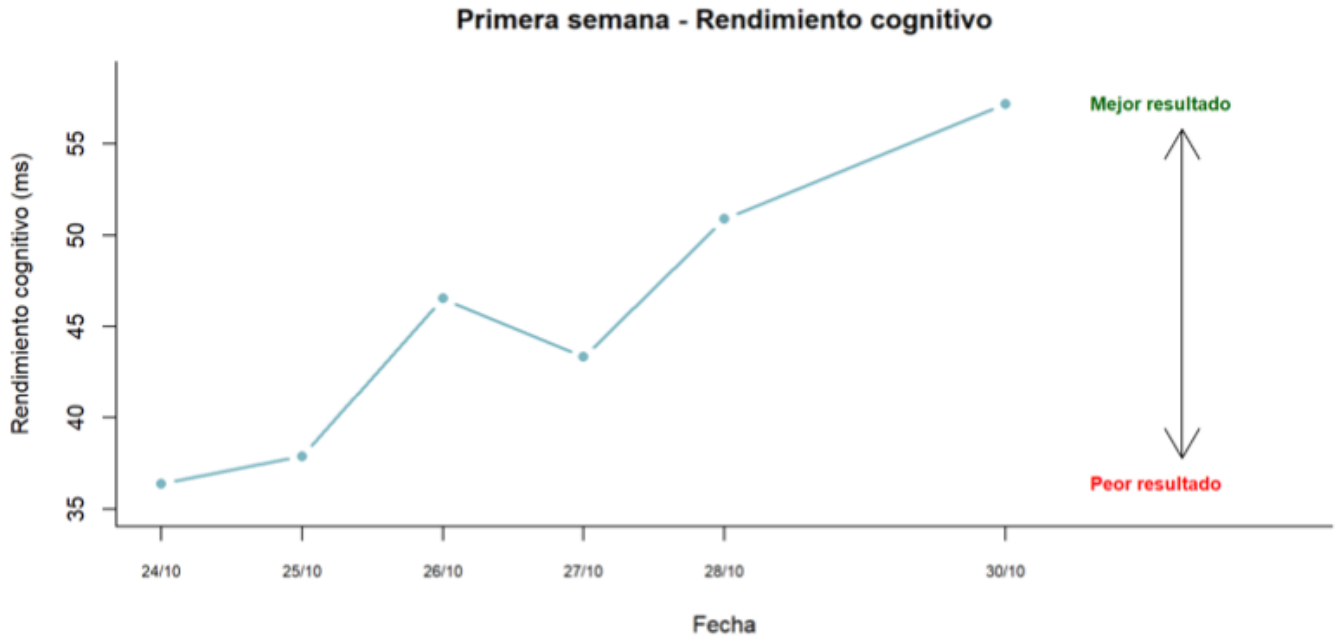
* **Inhibitory control:** the difference in reaction time when the word and the color do not match and when they do match. When the color matches the word, the person is expected to respond faster.

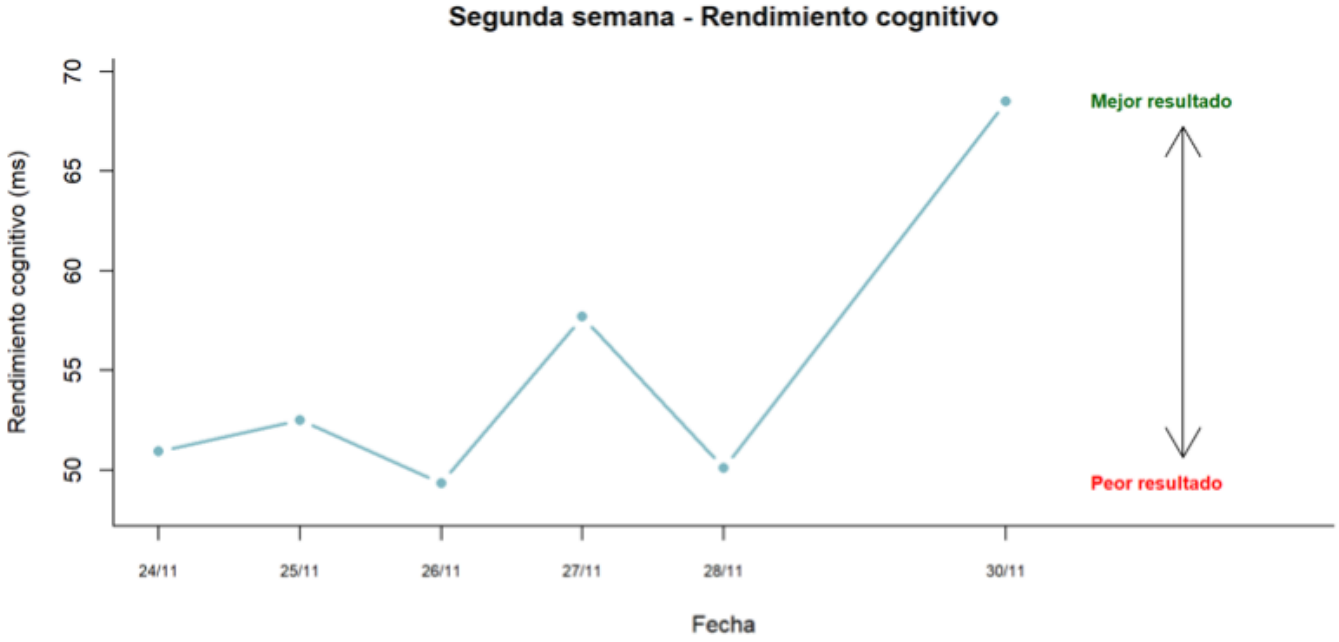
Reaction time



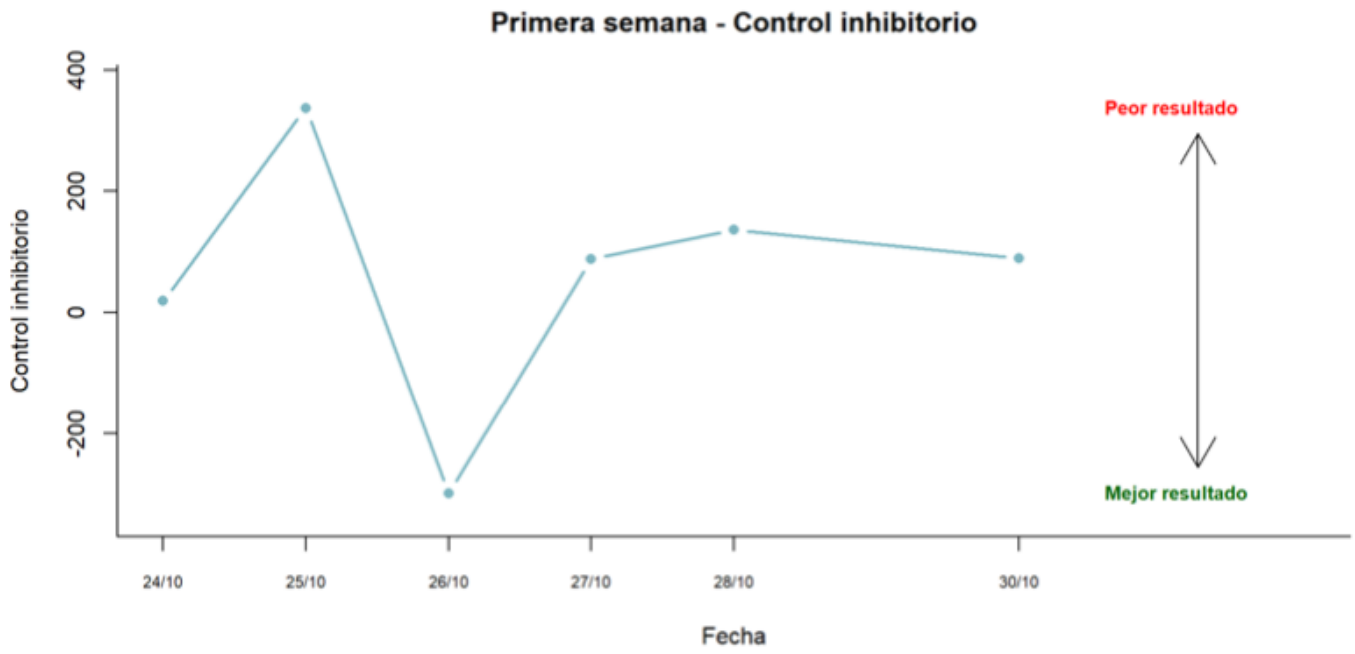


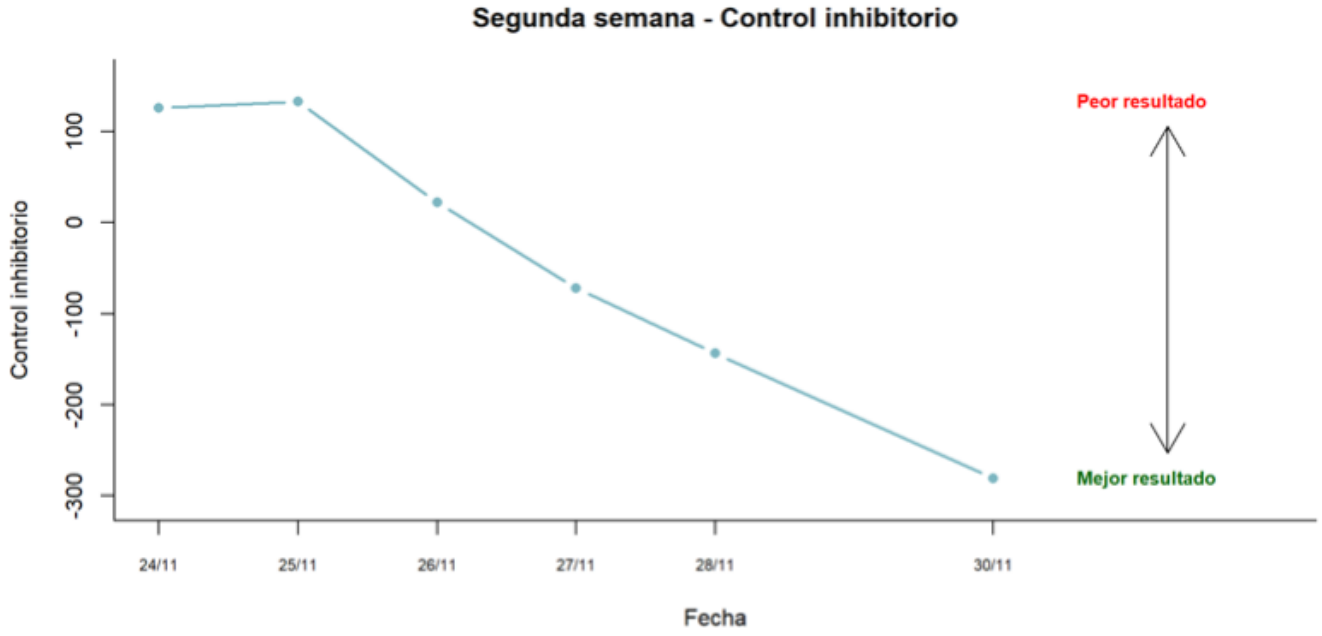
Cognitive performance


Primera semana - Rendimiento cognitivo
Rendimiento cognitivo (ms)
35
40
45
50
55
24/10
25/10
26/10
27/10
28/10
30/10
Fecha
Mejor resultado
Peor resultado


Segunda semana - Rendimiento cognitivo
Rendimiento cognitivo (ms)
50
55
60
65
70
24/11
25/11
26/11
27/11
28/11
30/11
Fecha
Mejor resultado
Peor resultado

Inhibitory control

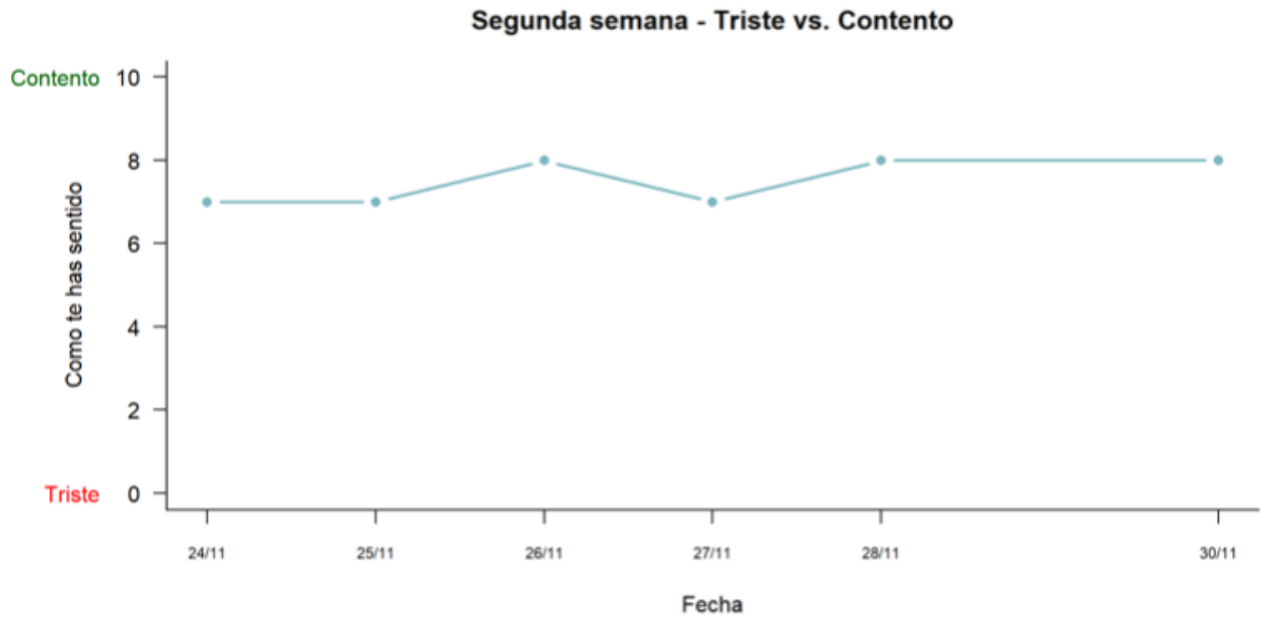


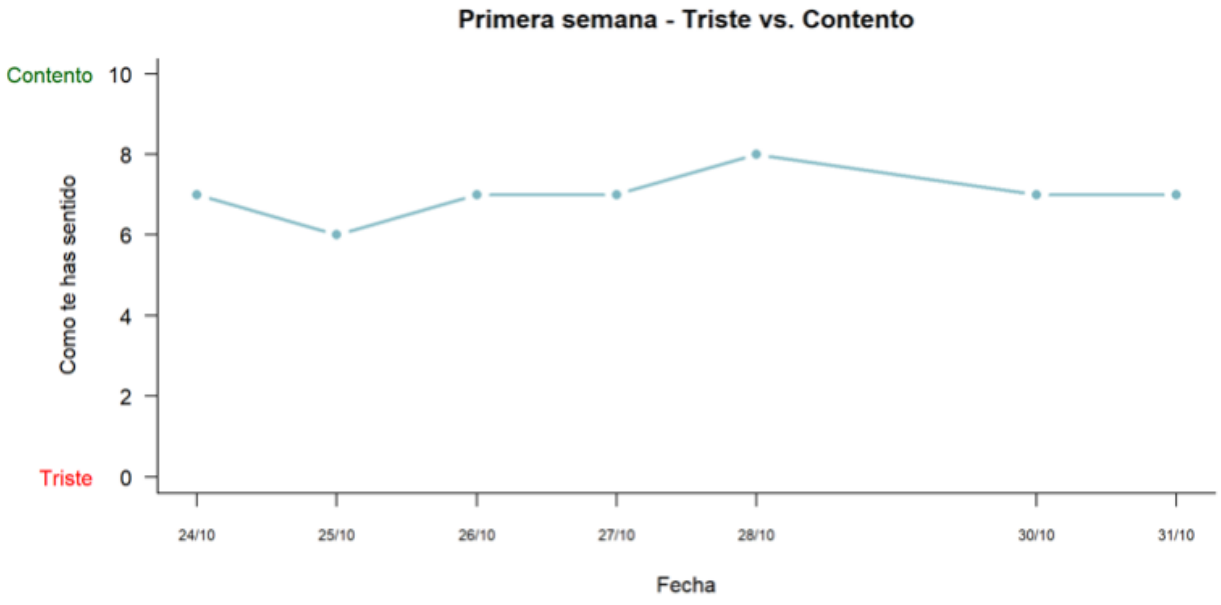


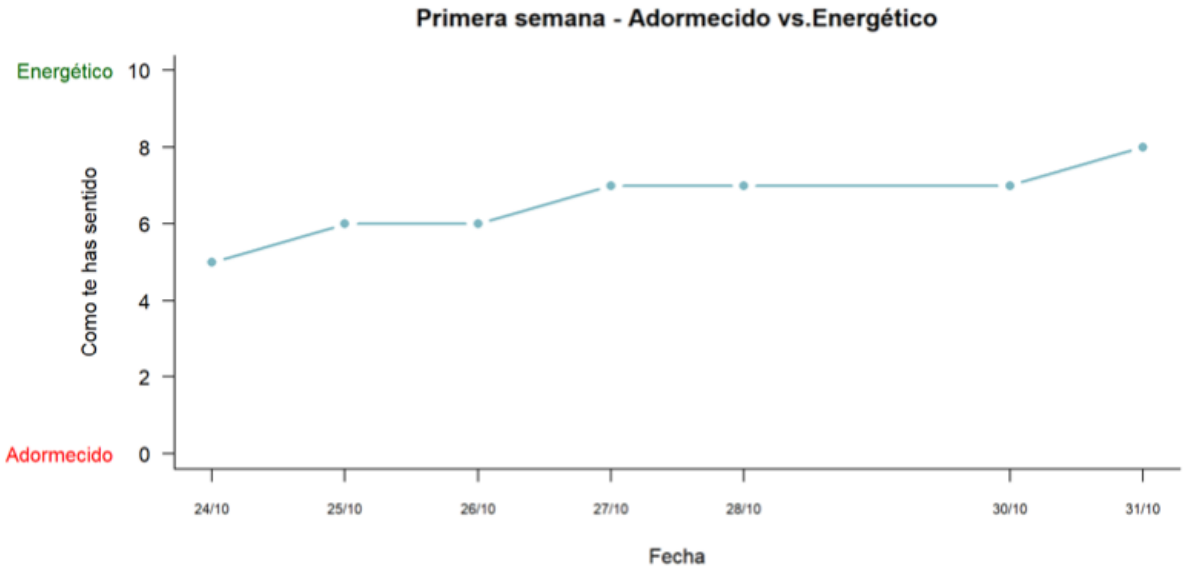
If pollution has an influence on cognitive outcomes, it is expected to be small and only detectable when analyzing data from all participants together. The patterns observed in data from a single person, with a short series of two weeks, should not be interpreted as a cause-effect relationship. The subsequent analysis with the data of all the participants will also control the learning effect, that is, the fact that by getting used to the test the participant improves his results.

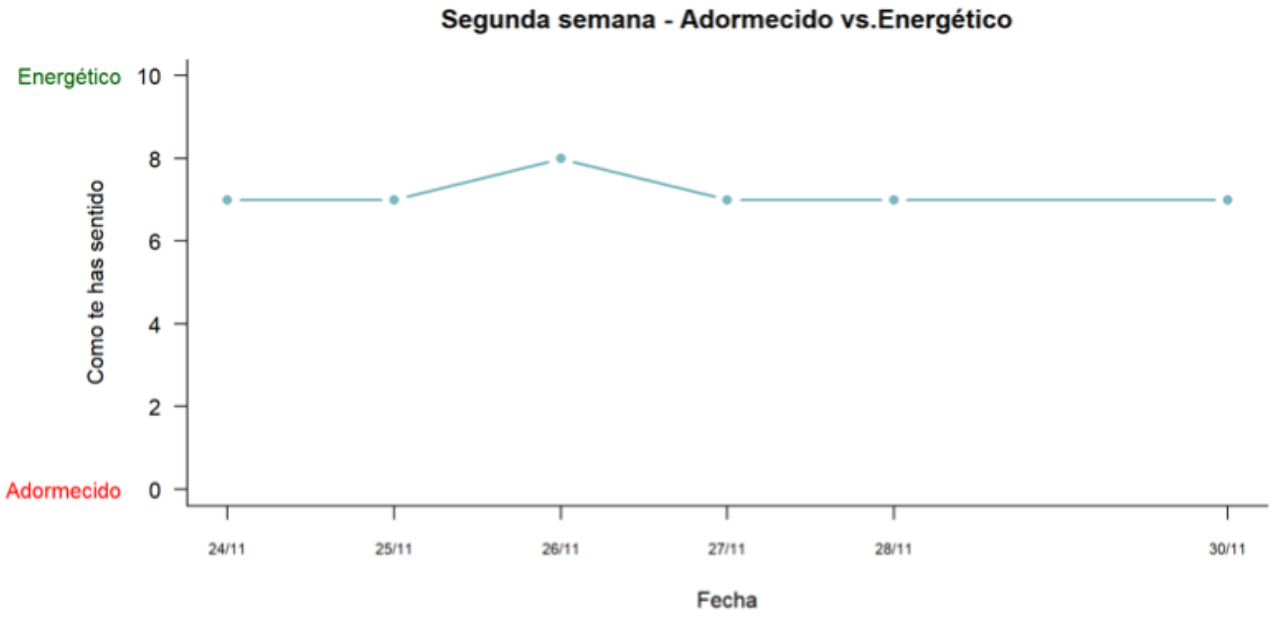
Mood, stress and quality of sleep

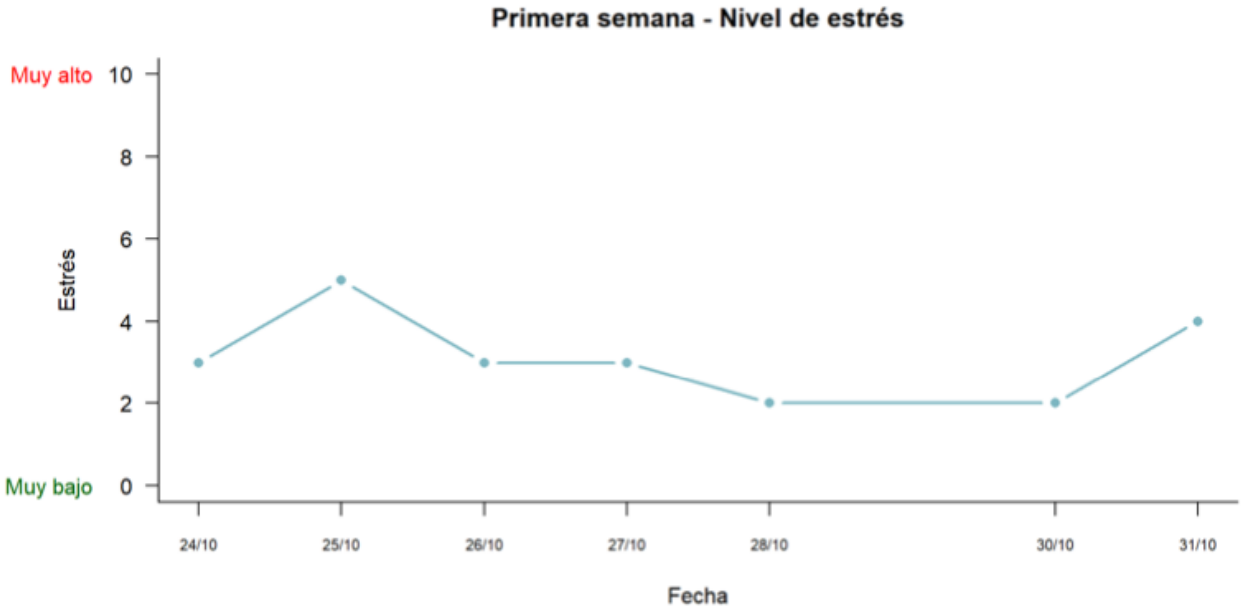
In the daily questionnaire you assessed various aspects regarding how you felt during the day, stress level and quality of sleep. These were the recorded values.

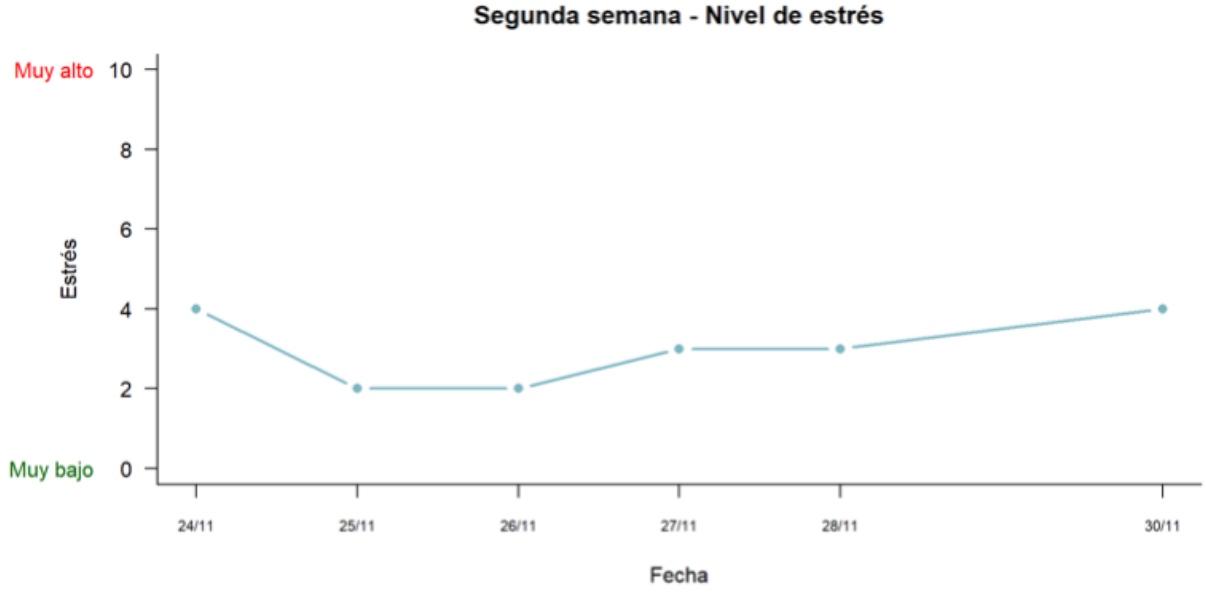


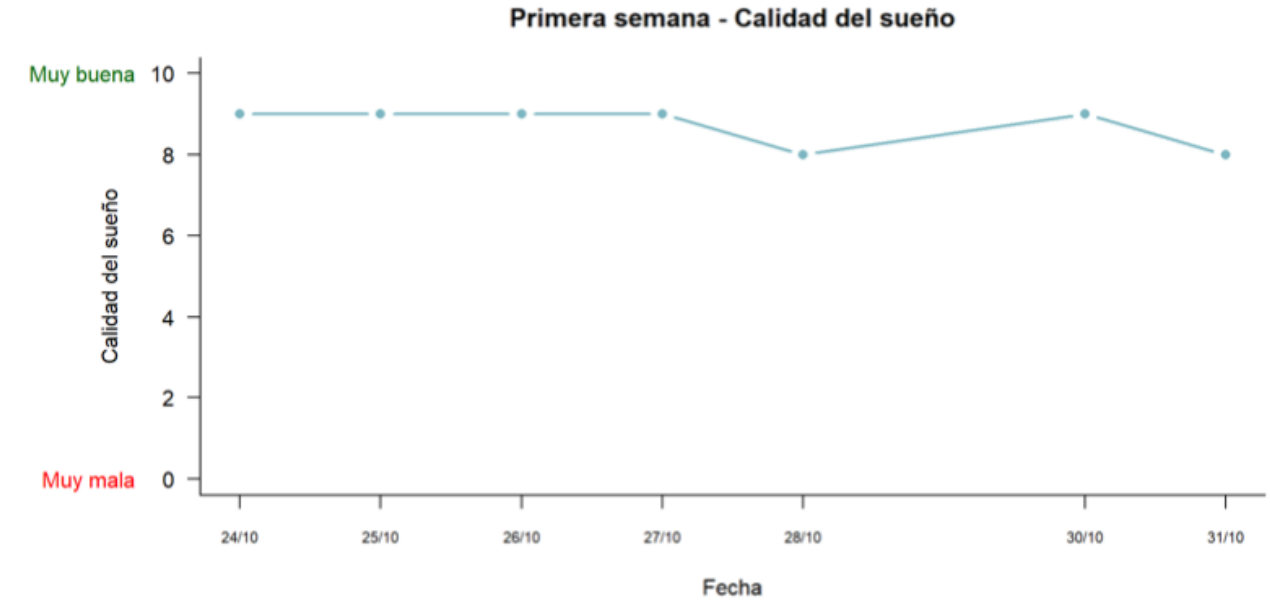


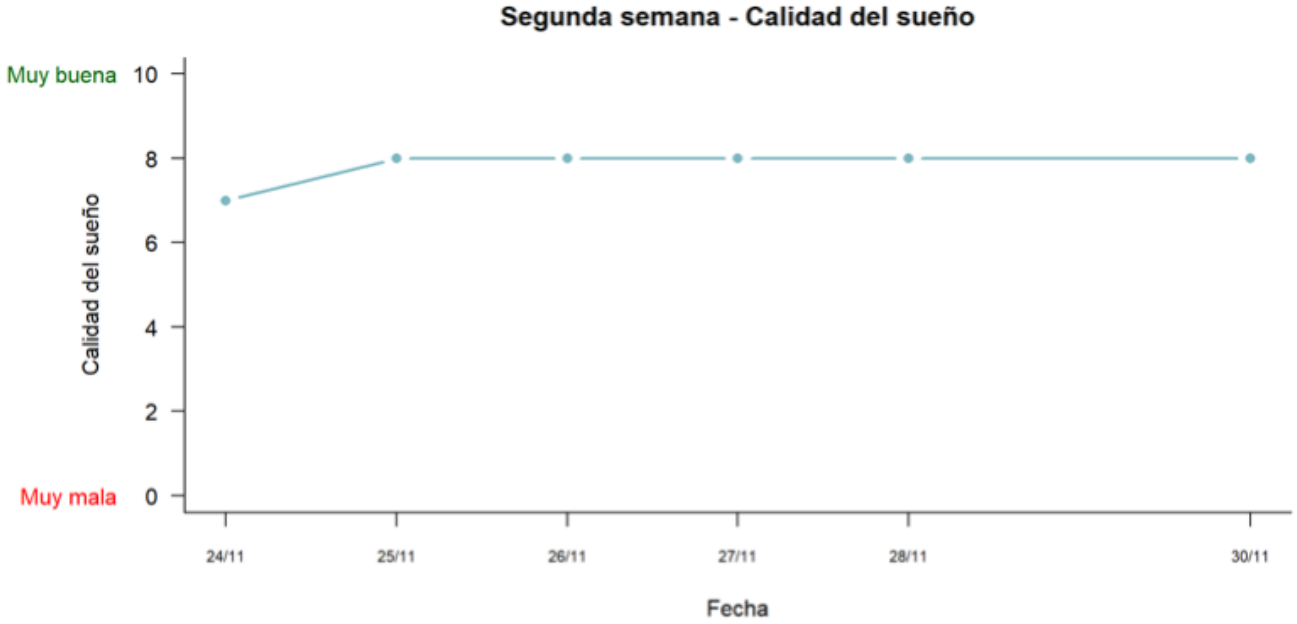

Primera semana - Adormecido vs.Energético
Energético
Adormecido
Como te has sentido
10
8
6
4
2
0
24/10
25/10
26/10
27/10
28/10
30/10
31/10
Fecha


Segunda semana - Adormecido vs.Energético
Energético
Adormecido
Como te has sentido
10
8
6
4
2
0
24/11
25/11
26/11
27/11
28/11
30/11
Fecha


Primera semana - Nivel de estrés
Muy alto
Muy bajo
10
8
6
4
2
0
Estrés
24/10
25/10
26/10
27/10
28/10
30/10
31/10
Fecha

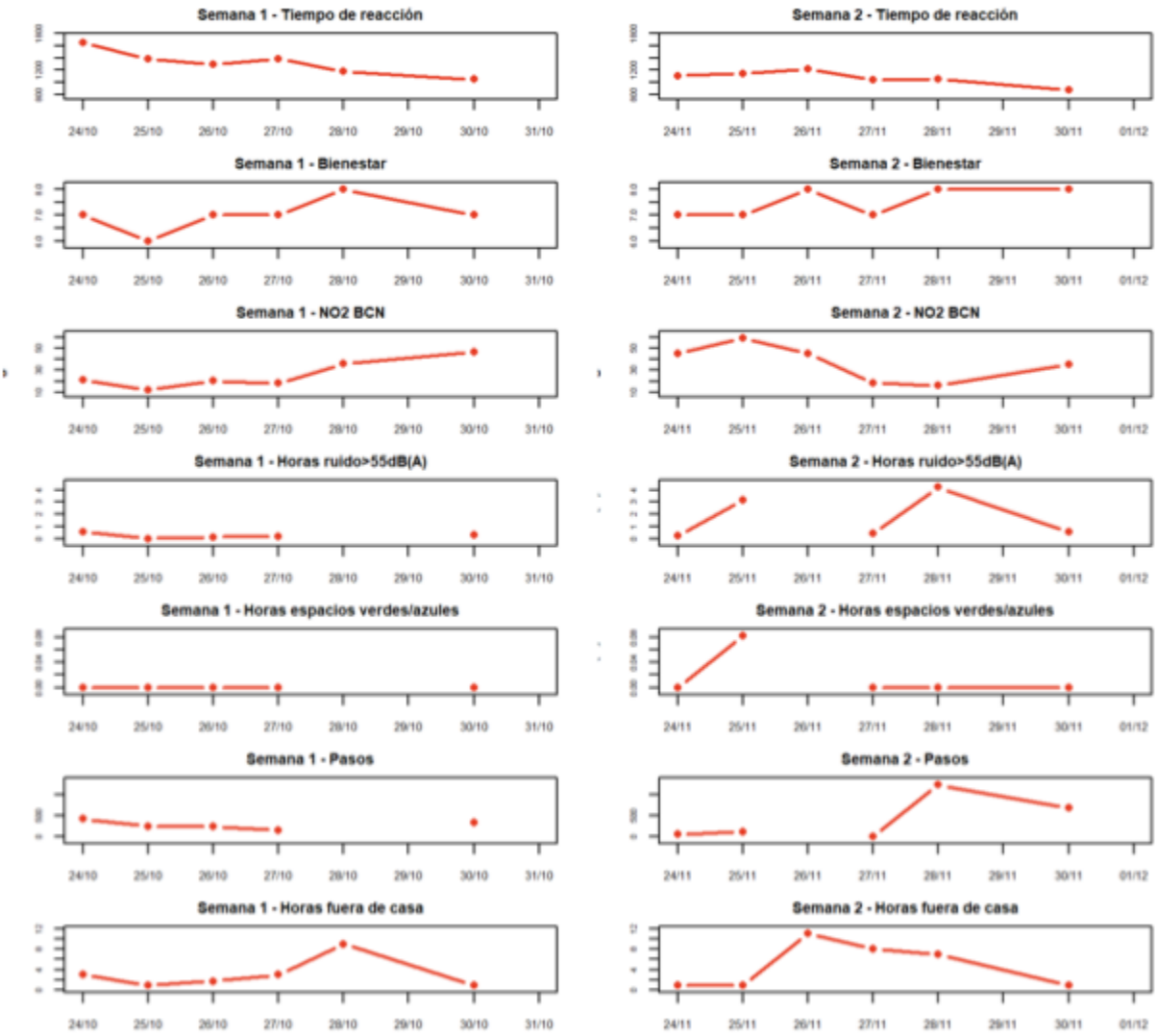

Segunda semana - Nivel de estrés
Muy alto
Muy bajo
10
8
6
4
2
0
Estrés
24/11
25/11
26/11
27/11
28/11
30/11
Fecha


Primera semana - Calidad del sueño
Muy buena
Muy mala
Calidad del sueño
10
8
6
4
2
0
24/10
25/10
26/10
27/10
28/10
30/10
31/10
Fecha


Segunda semana - Calidad del sueño
Muy buena
Muy mala
Calidad del sueño
10
8
6
4
2
0
24/11
25/11
26/11
27/11
28/11
30/11
Fecha

Summary of temporal variability

The following graph includes some of the most relevant variables and their evolution over time.



Next steps

The next step in the project will be to analyze the data of all the participants together, in order to see if there is a relationship between the answers to the questions and the test scores and the levels of air pollution.

Thank you very much for your cooperation!

We will keep you informed of our activities and results.

If you have questions or suggestions about the analysis of the study, please send them to our email: bcn@citieshealth.eu (mailto: bcn@citieshealth.eu)

CitieS Health