A study of potential genetic damages in an urban population, and exposure to ELF-MF
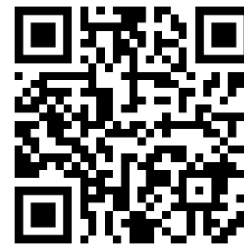
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SCIENSANO: MARYSE LEDENT, EVA DE CLERCQ

NL

FR

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Plan of the presentation

❖ ExpoHealth-1

A multiple exposure study → summary

❖ ExpoHealth-2

Focus on potential DNA damages and exposure to ELF-MF

❖ Main conclusions

Research questions

o Are some participants exposed above the recommended guidelines for the individual environmental stressors?

o Do we observe abnormally high values for exposure or DNA damage in the study population ?

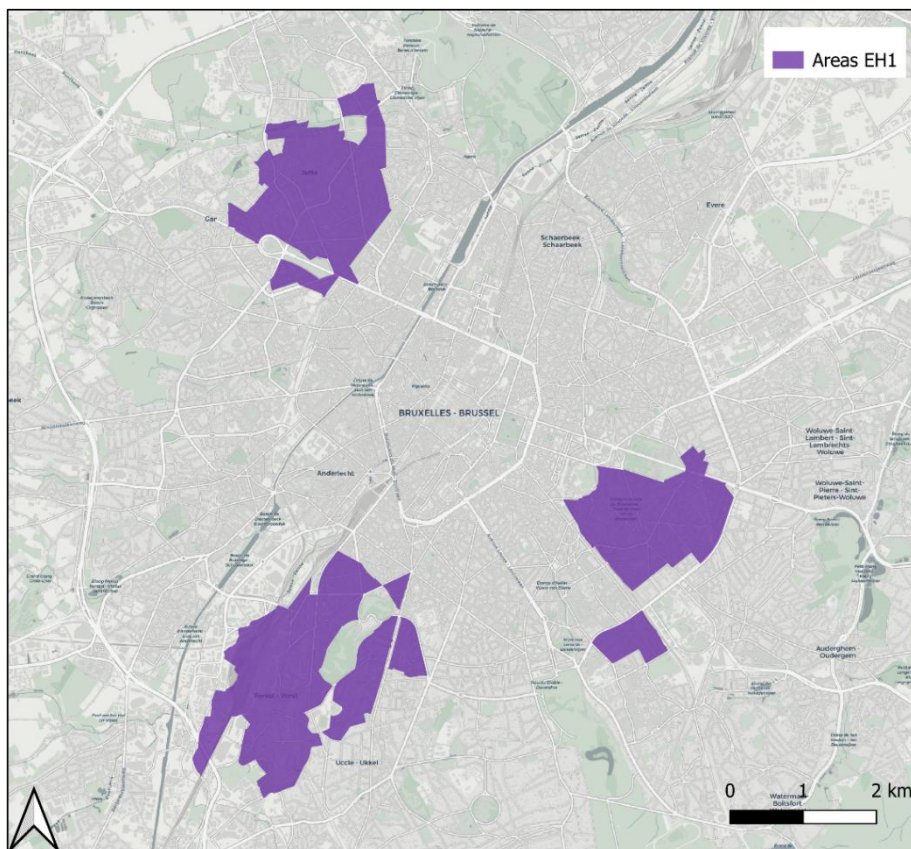o Do we observe more DNA damage in participants with higher exposure values ?

ExpoHealth-1 :
A multiple exposure study
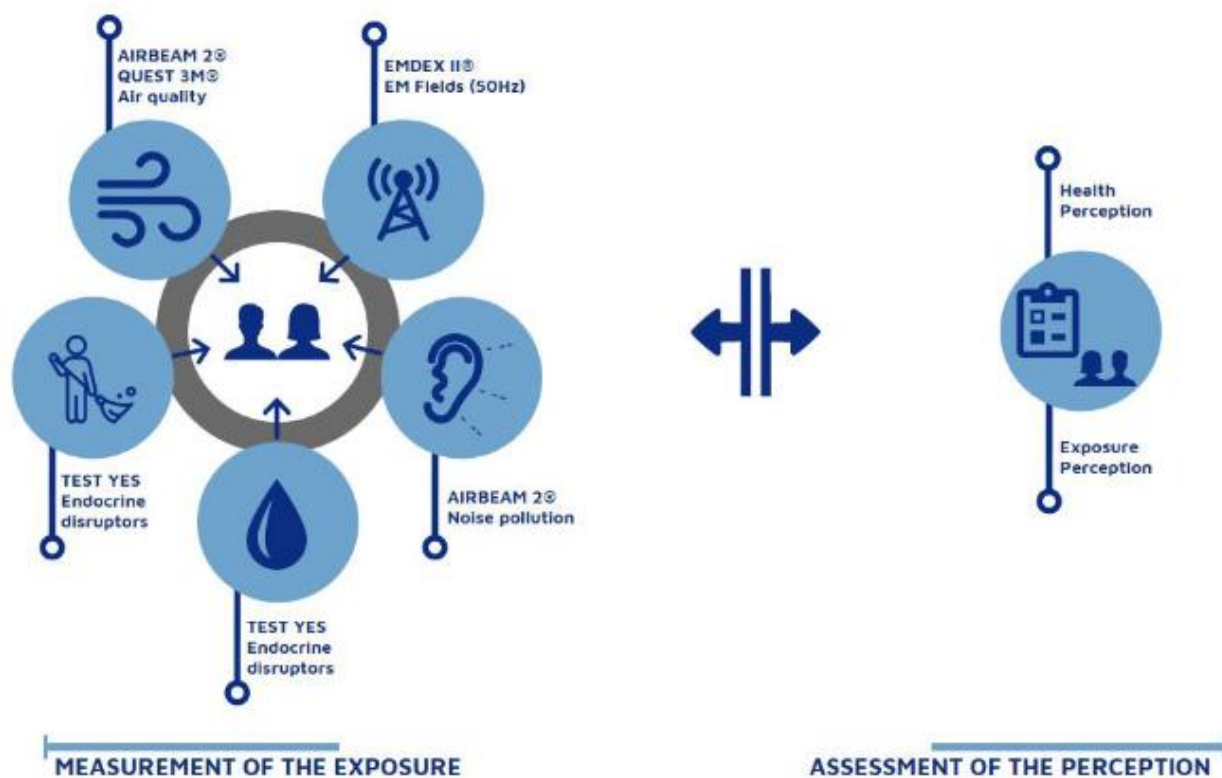
Design by F. Brunin

Protocol described in Salmon et al., 2025

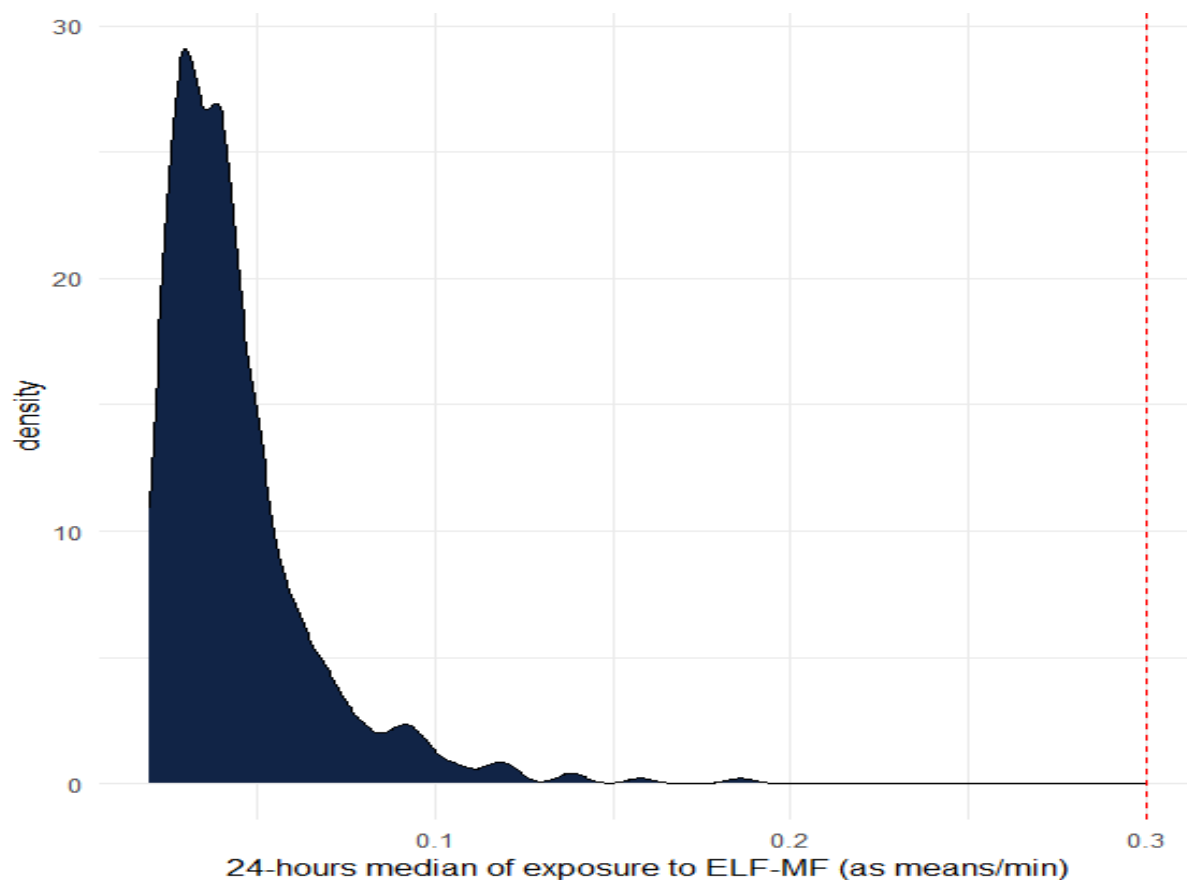# EH-1: area selection

Areas EH1

> **Criteria**
- **Similar environmental factors**
  - Noise,
  - NOx,
  - Access to green spaces,
  - …
- **Similar socio-economic levels**

> **490 inhabitants of the Region Bruxelles-Capitale**
  - 18 to 65 y.o.
  - Non smokers
  - Btw March 2021 and August 2022

EH-1: Daily medians of exposure
(except sleeping hours)


100% below 0.3μT
(red dashed line)

EH-1: Intensity of ELF-MF by ME
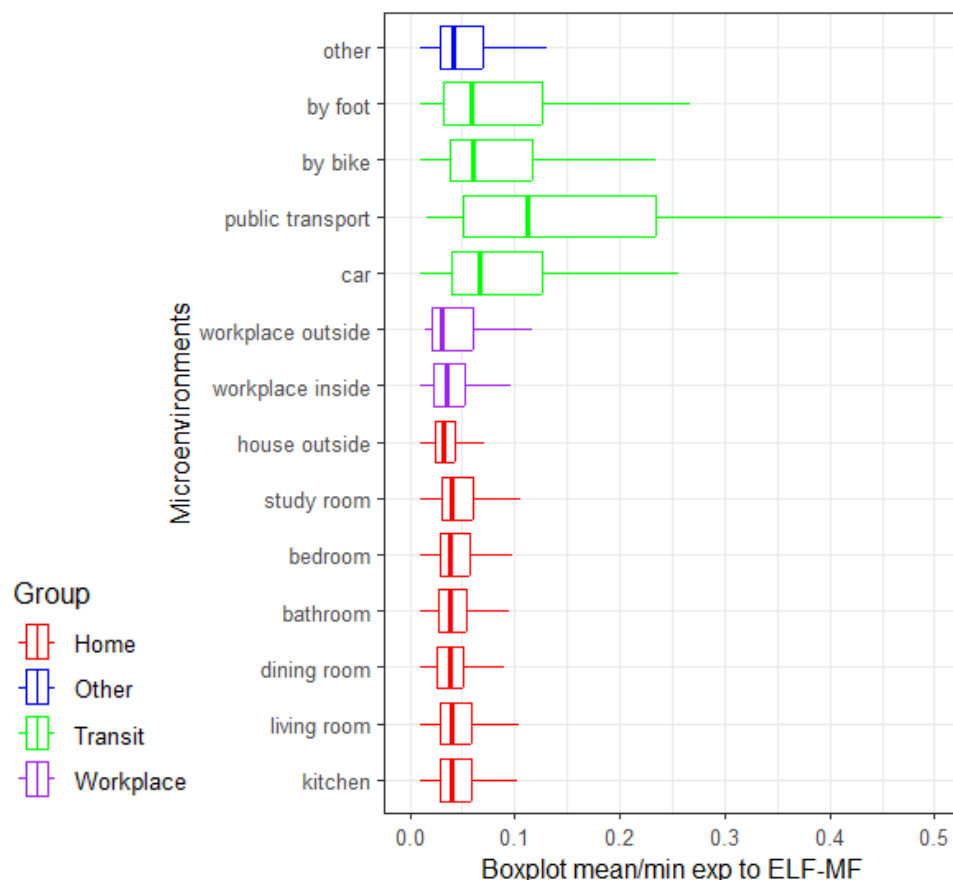
- o Medians by MES are all below 0.12 µT
  - o Median of the total sample is 0.04µT

- o Higher levels and higher heterogeneity observed in public transport

- o Higher levels observed in Transit (all kinds): sources from the way of transport (car, tram, train) and from the web of electricity distribution under our feet

EH-1: Contribution of each ME to the daily exposure
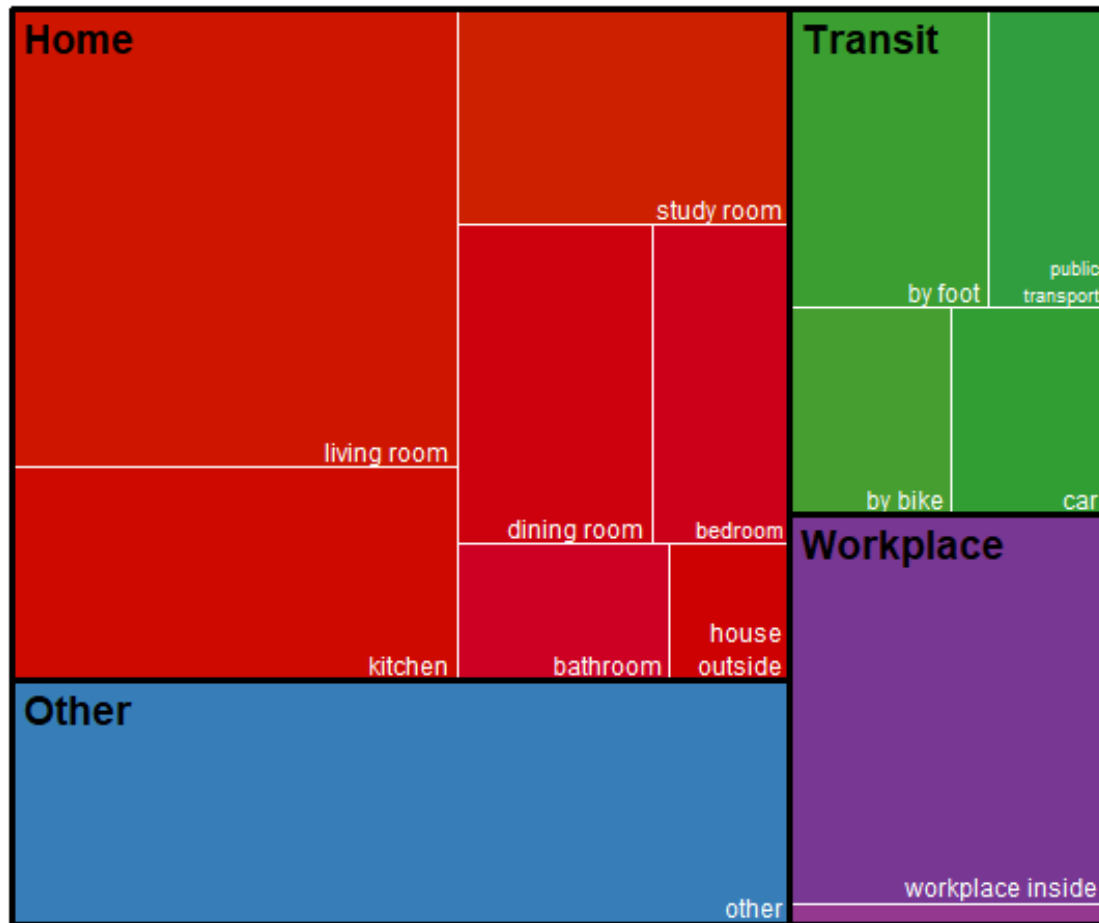
- o Contribution at home (52.2%) mainly influenced by the living room (20.4%), the kitchen (9.5%), and the study room (7.2%) from all Mes contributions

- o Workplace inside contributes to 12.3% of the all MEs contributions

- o All transit together represent 16% of all MEs contributions

- o !! No data during sleeping time for the ELF-MF

ExpoHealth-2:
A study on potential DNA damages

Blood sample:
MANDATORY
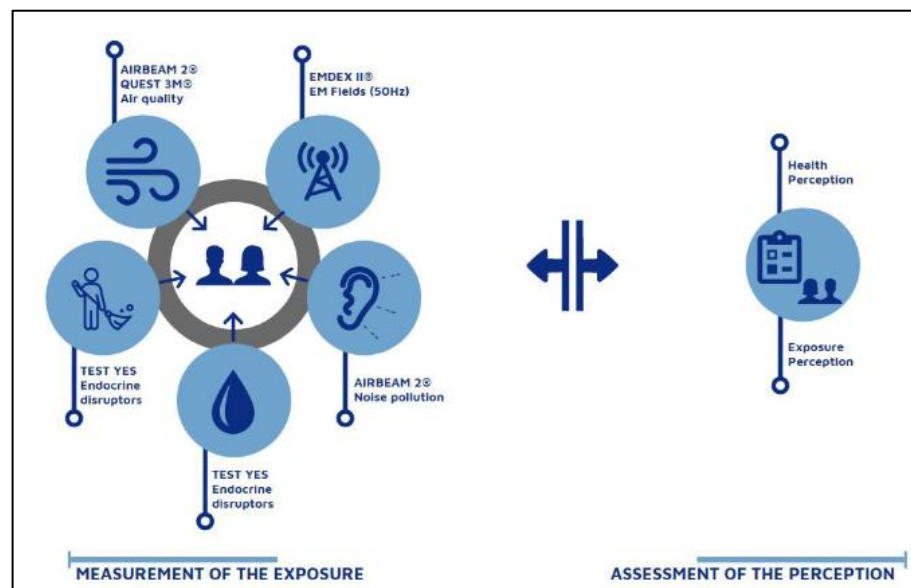
Multiple exposure assessment:
OPTIONAL

DNA testing

➢ **Methodology: Genotoxicity tests**
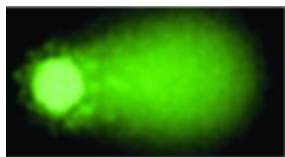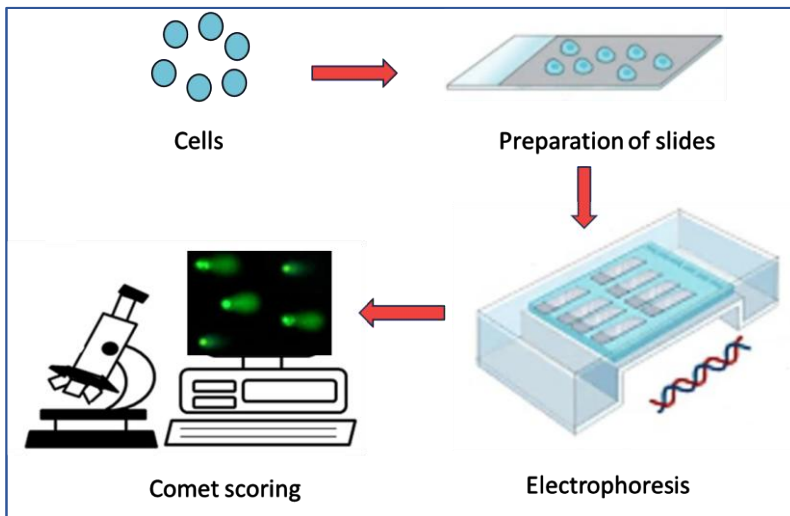
Comet assay

Measure % damaged DNA in comet tail (tail intensity)
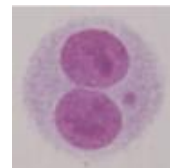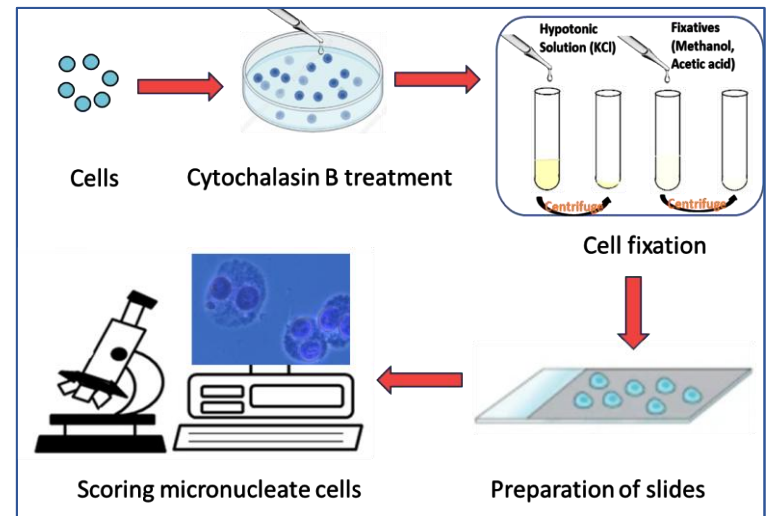
Micronucleus assay

Score the number of Micronucleate cells per 1000 cells (MN frequency)

Study Population EH1 → EH2

ExpoHealth-1		490 participants		
ExpoHealth-2		104 participants		
Data collection	104 blood samples	104 questionnaires		75 pollutant measurements
Data effectively collected	103 Comet Assay / 104 Micronuclei Assay	102 questionnaires	58 effective ELF-MF	75 effective PM 2.5
Final EH-2 database		54 participants		
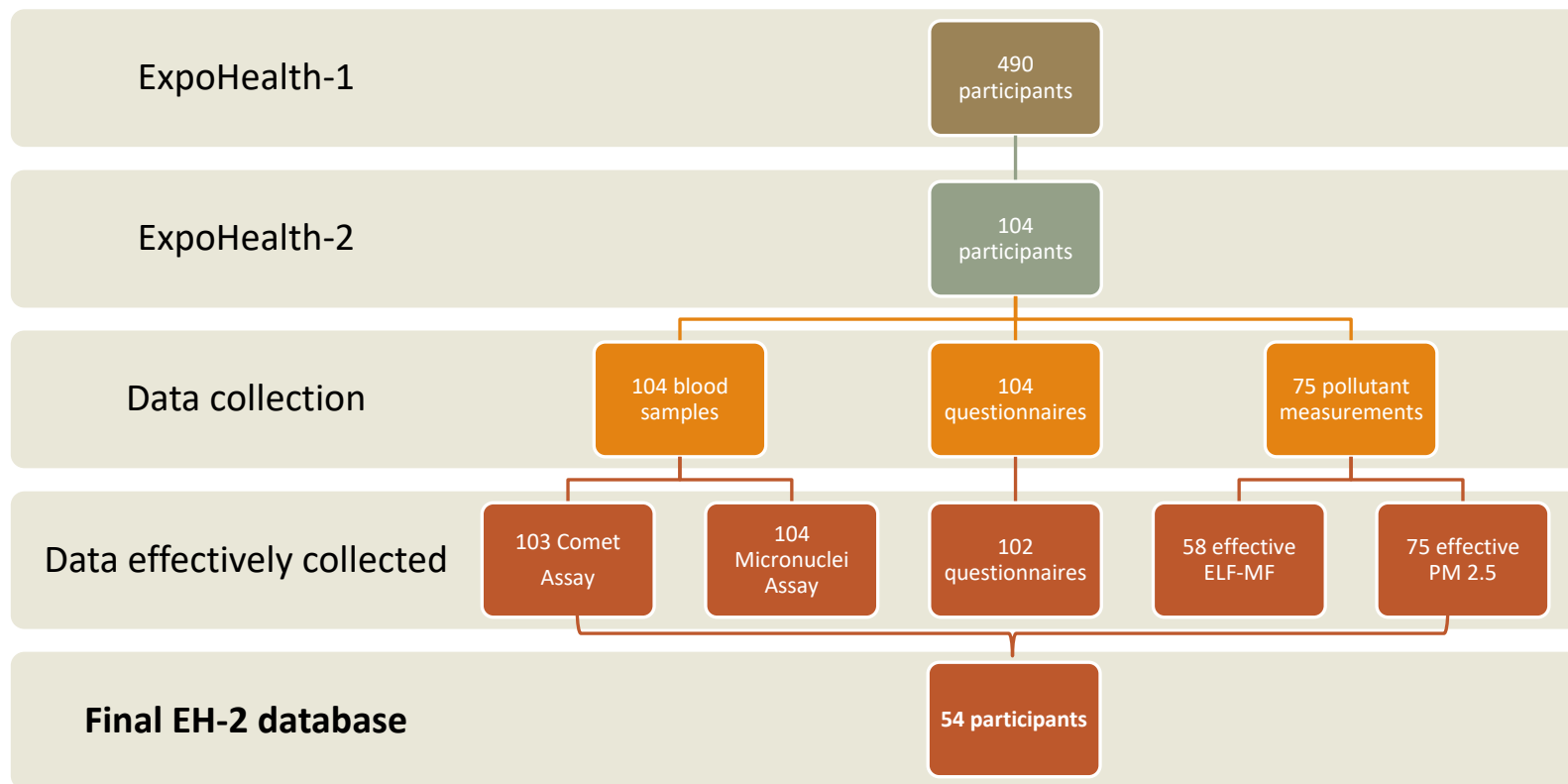
Study population description

VARIABLE	N (EH1)	% (EH1)	N (EH2)	% (EH2)
Gender				
Female	297	**64.7**	34	**63**
Male	162	**35.3**	20	**37**
Age				
[18-29]	24	**5.2**	1	**1.8**
[30-39]	143	**31.2**	12	**22.2**
[40-49]	151	**32.9**	19	**35.2**
[50 and more]	141	**30.7**	22	**40.7**
Equ. Net household income				
[Less than 1500]	145	**31.6**	12	**22.2**
[1501-2500]	248	**54**	30	**55.6**
[More than 2501]	66	**14.4**	12	**22.2**
Diploma				
Secondary school	36	**7.8**	6	**11.1**
University (ba, ma, phd)	423	**92.2**	48	**88.9**
Type of measurements' day				
Usual weekday (as bef. Covid)	255	**55.6**	20	**37**
Teleworking day (bec. Of covid)	154	**33.6**	14	**26**
Other	50	**10.8**	20	**37**

Confounding variables

POTENTIAL CONFOUNDING VARIABLES	N	%
Smoking status		
Non-smoker	38	70.4
Formal or occasional smoker	16	29.6
Amount of X-rays in the last 5 years		
0	8	14.8
1-2	33	61.1
3 +	13	24.1
24-hour exposure to PM2.5 (tertiles)		
Low [0.4 – 6 μg/m^3]	18	33.3
Middle [6 .1– 8.8 μg/m^3]	18	33.3
High [8.9 – 26.5 μg/m^3]	18	33.3
Season		
Summer 2023	4	7.4
Spring 2023	50	92.6

DNA damages assays
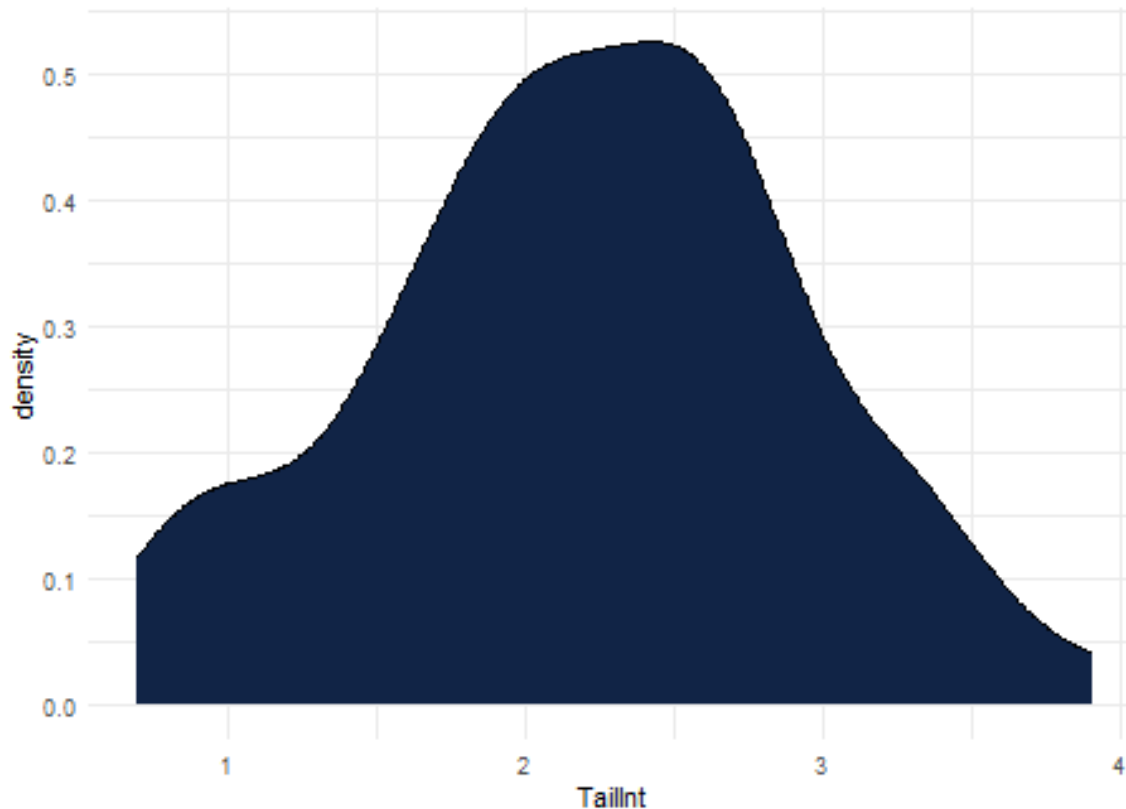
In general public, the background tail intensity falls between 1.6 – 9.9 % (Milić et al., 2021); In Nguyen et al, 2023

Distribution of the Comet Assay results

DNA damages assays
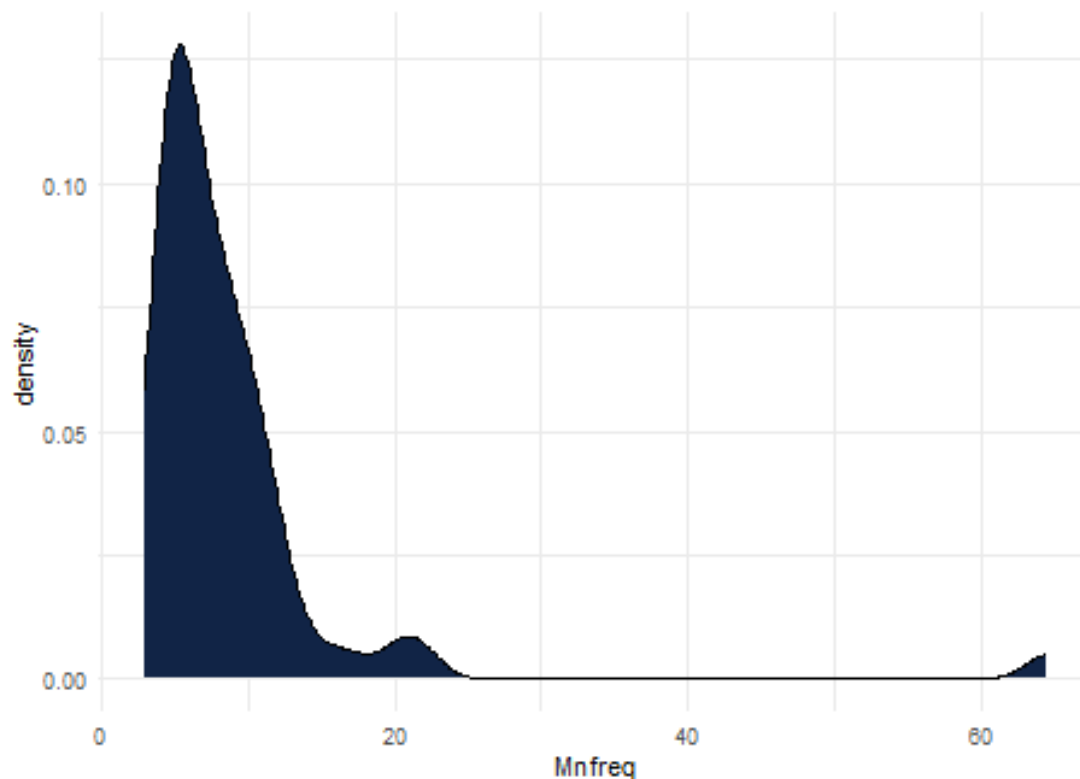
Distribution of the Micronuclei Assay results

Background MN frequency is between 2 – 28 MN cells /1000 BN cells (Fenech et al., 2003) IN Nguyen et al., 2023

Groups of exposure to ELF-MF

TERTILES	Low	Medium	High
Median (µT)	0.03 (0.02-0.03)	0.04 (0.04-0.05)	0.08 (0.06-0.14)

→ *3 tertiles of 24-hour medians of exposure*

Correlation testing
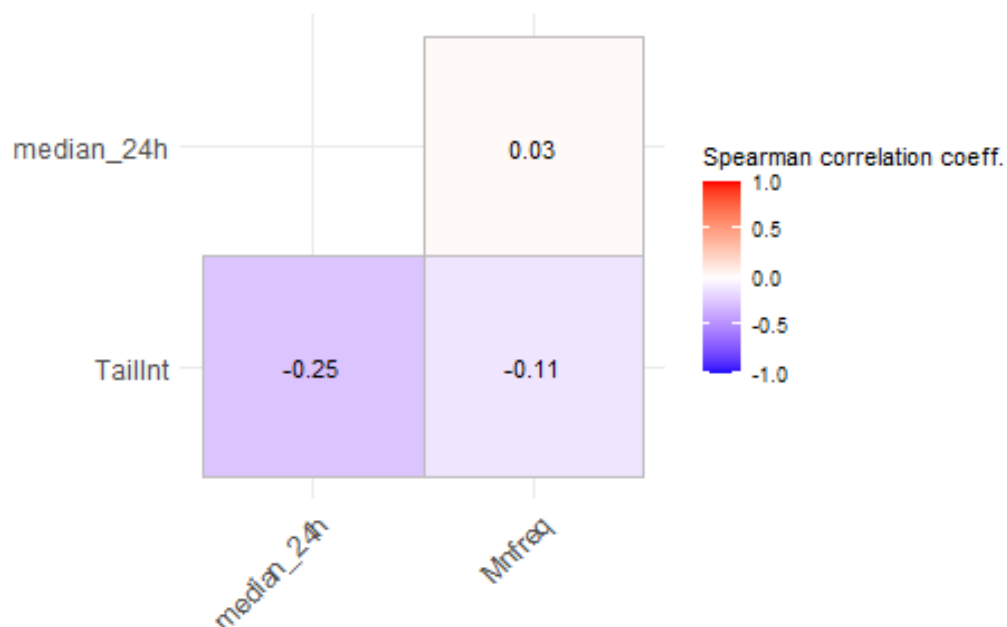
Correlation testing between

Median of exposure to ELF-MF and :

1. MN frequency
2. Tail Intensity

➢ No correlation observed

Association testing between ELF-MF and Comet Assay

	Coefficient	CI 95%	t	Pr>|t|
ELF-MF EXPOSURE				
1st tertile	0	0 - 0	0	
2nd tertile	-0.24	-0.77 - 0.29	-0.89	0.38
3rd tertile	-0.44	-0.87 - -0.00	-1.97	0.06
GENDER				
male	0	0 - 0	0	
female	0.17	-0.24 - 0.58	0.81	0.42
AGE	0.00	-0.02 - 0.03	0.42	0.68
SMOKER STATUS				
non-smoker	0	0 - 0	0	
former or occasionnal smoker	0.13	-0.32 - 0.58	0.57	0.57
SEASON				
Spring 2023	0	0 - 0	0	
Summer 2023	-0.79	-1.89 - 0.31	-1.41	0.17
AMOUNT OF RX ON THE LAST 5 YEARS				
[0]	0	0 - 0	0	
[1 OR 2]	-0.63	-1.18 - -0.07	-2.21	0.03*
[3 OR MORE]	-0.71	-1.43 - 0.01	-1.94	0.06
PM2.5 EXPOSURE				
1st tertile	0	0 - 0	0	
2nd tertile	-0.15	-0.65 - 0.36	-0.57	0.58
3rd tertile	-0.55	-1.04 - -0.07	-2.24	0.03*

Association testing between ELF-MF and Comet Assay

	Coefficient	CI 95%	t	Pr>|t|
ELF-MF EXPOSURE				
1st tertile	0	0 - 0	0	
2nd tertile	-0.24	-0.77 - 0.29	-0.89	0.38
3rd tertile	-0.44	-0.87 - -0.00	-1.97	0.06
GENDER				
male	0	0 - 0	0	

No statistically significant association was observed between higher levels of individual exposure to extremely low frequency electromagnetic fields (ELF-EMF) and DNA damage, as tested using a comet assay.

Results of the GLM for the Micronuclei Assay

	Coeff.	CI 95%	T	Pr>|t|
ELF-MF EXPOSURE				
1st tertile	0	0 - 0	0	
2nd tertile	-0.34	-0.98 - 0.30	-1.03	0.31
3rd tertile	-0.29	-0.79 - 0.21	-1.14	0.26
AGE	0.01	-0.02 - 0.03	0.48	0.63
GENDER				
male	0	0 - 0	0	
female	0.67	0.15 - 1.19	2.53	0.02*
SMOKER STATUS				
non-smoker	0	0 - 0	0	
former or occasionnal smoker	0.44	-0.03 - 0.91	1.83	0.08
SEASON				
Spring 2023	0	0 - 0	0	
Summer 2023	0.16	-1.00 - 1.31	0.27	0.79
AMOUNT OF RX ON THE LAST 5 YEARS				
[0]	0	0 - 0	0	
[1 OR 2]	-0.25	-0.86 - 0.36	-0.81	0.42
[3 OR MORE]	-0.28	-1.09 - 0.54	-0.67	0.51
PM2.5 EXPOSURE				
1st tertile	0	0 - 0	0	
2nd tertile	0.35	-0.22 - 0.93	1.21	0.23
3rd tertile	0.13	-0.45 - 0.71	0.43	0.67

Results of the GLM for the Micronuclei Assay

	Coeff.	CI 95%	T	Pr>|t|
ELF-MF EXPOSURE				
1st tertile	0	0 - 0	0	
2nd tertile	-0.34	-0.98 - 0.30	-1.03	0.31
3rd tertile	-0.29	-0.79 - 0.21	-1.14	0.26

No statistically significant association was observed between higher levels of individual exposure to extremely low frequency electromagnetic fields (ELF-EMF) and DNA damage, as tested using a micronuclei assay.

Conclusions

➢ Brussels inhabitants (EH-1 population) show low levels of exposure to ELF-MF in their daily lives

➢ The higher levels of exposure are found during transit, especially with public transports

➢ When taking time spent by ME into account, home is the biggest contributor (even without sleeping hours)

➢ No association is observed between higher levels of individual exposure and potential DNA damages (// similar results in the workers' study)

Discussion

LIMITS:

➢ <u>EH-1 :</u>
  ➢ Sample not representative of the Brussels population
  ➢ No data during sleeping time

➢ <u>EH-2:</u>
  ➢ Small sample (54 individuals)

Bibliography

Salmon, A. O., Ledent, M., De Clercq, E. M., Vanhoutte, B., & Bouland, C. (2025). Assessment of individual exposure to multiple pollutants (Noise, particulate matter, and extremely low-frequency magnetic fields) related to daily life microenvironments in the brussels capital region : Protocol for a cross-sectional study. *JMIR Research Protocols*, *14*, e69407. https://doi.org/10.2196/69407

Nguyen Ha, 2023, *Investigation on the long-term genetic effects of extremely low-frequency electromagnetic fields,* [PhD Thesis public defense]

Any questions?

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