



Flemish Environment and Health Studies (FLEHS)

Liese Gilles
29/05/2026

STP Consortium and Commissioning party

Consortium

Coordinators



5 universities



Agencies



Commissioning party

Environment Department (DOMG, Flemish government)

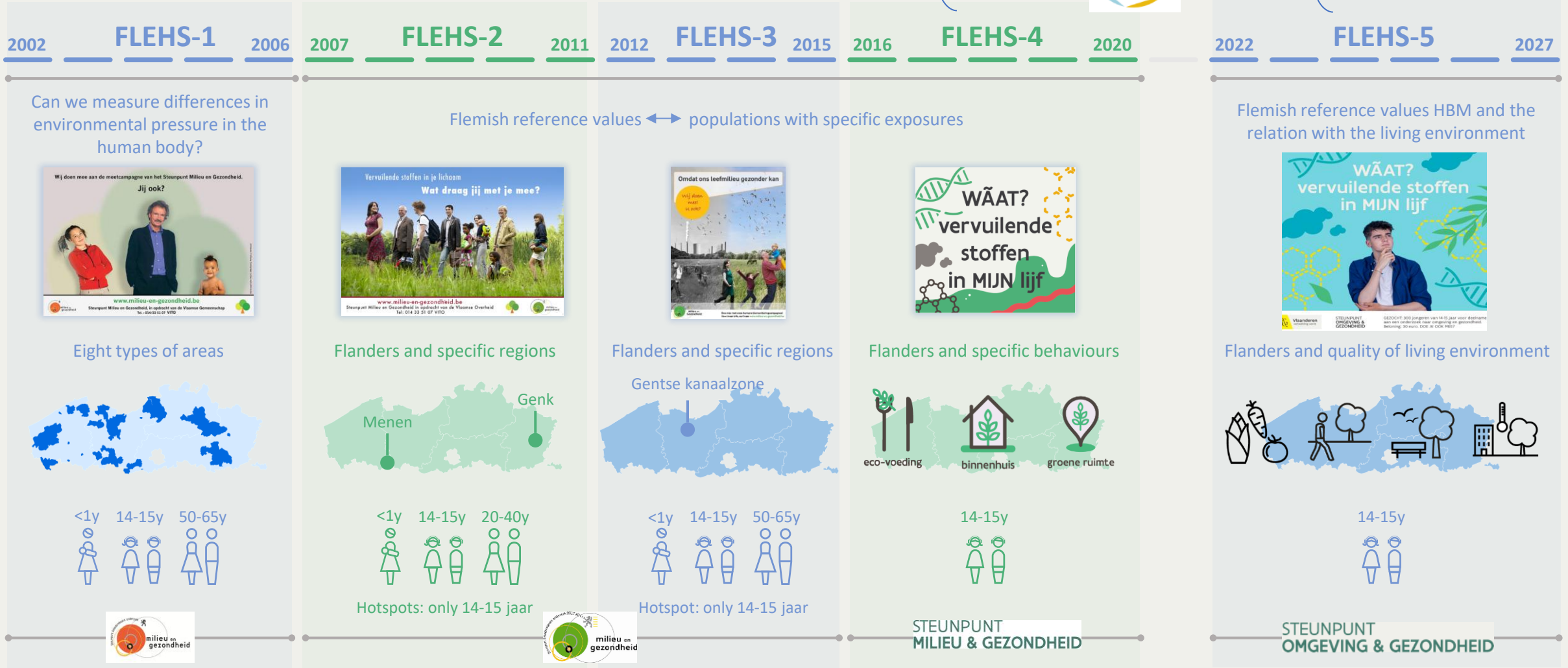
Complemented by financial resources from diverse actors:

- Department Care (DZORG, Flemish government)
- Agency of nature and forests
- Flemish Environment Agency (VMM)
- Public Waste Agency of Flanders (OVAM)

FLEmish E_nvironment & H_ealth S_tudies (FLEHS)



P-A-R-C



FLEHS: Evolution throughout the cycles

Evolution in target population

FLEHS-1



FLEHS-2



FLEHS-3



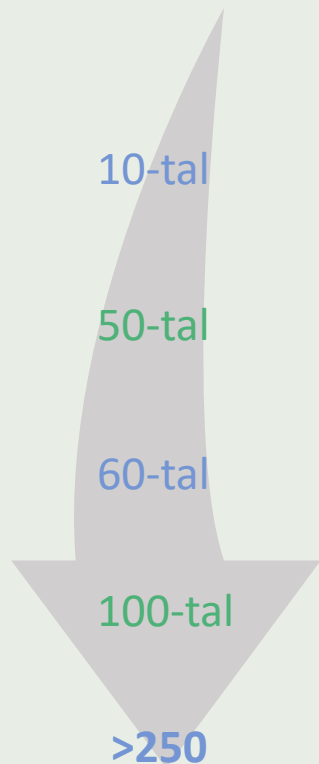
FLEHS-4



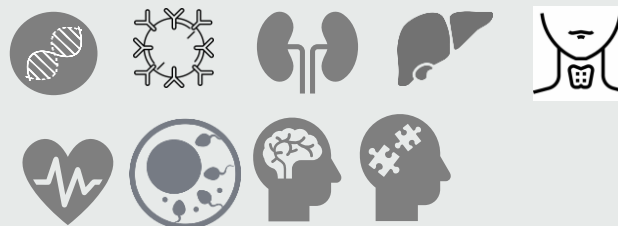
FLEHS-5



Evolution in exposure biomarkers



Evolution in biomarkers of health effects



- Extensive set of health endpoints
- Focus shifted to a broader set of “early” markers of effect → preventive health policy
- Attention to mental health

Shift from chemical exposure to exposome approach



- Nature
- Noise pollution
- Smell
- Heat stress
- Built environment

Objectives of reference HBM in Flanders

- Establish “**Flemish reference values**”
- **Monitor Time trends** in human exposure to environmental pollutants
- Identify factors that influence exposure (**exposure determinants**)
- **Health risk interpretation**
 - Compare exposure levels to health based guidance values
 - Exposure – effect associations
- **Socio-demographic analysis**
 - Attention for vulnerable groups (**social environmental injustice**)
 - Attention for **vulnerable lifestages** (birth, puberty, reproductive age)
- Attention to **known and emerging substances of high concern.**

POLICY SUPPORT

- Defining priorities, and areas of attention
- Developing targeted policy actions
- Evaluation of policy



FLEHS-5 – exposure biomarkers

2022 **FLEHS-5** 2027

Flemish reference values HBM and the relation with the living environment



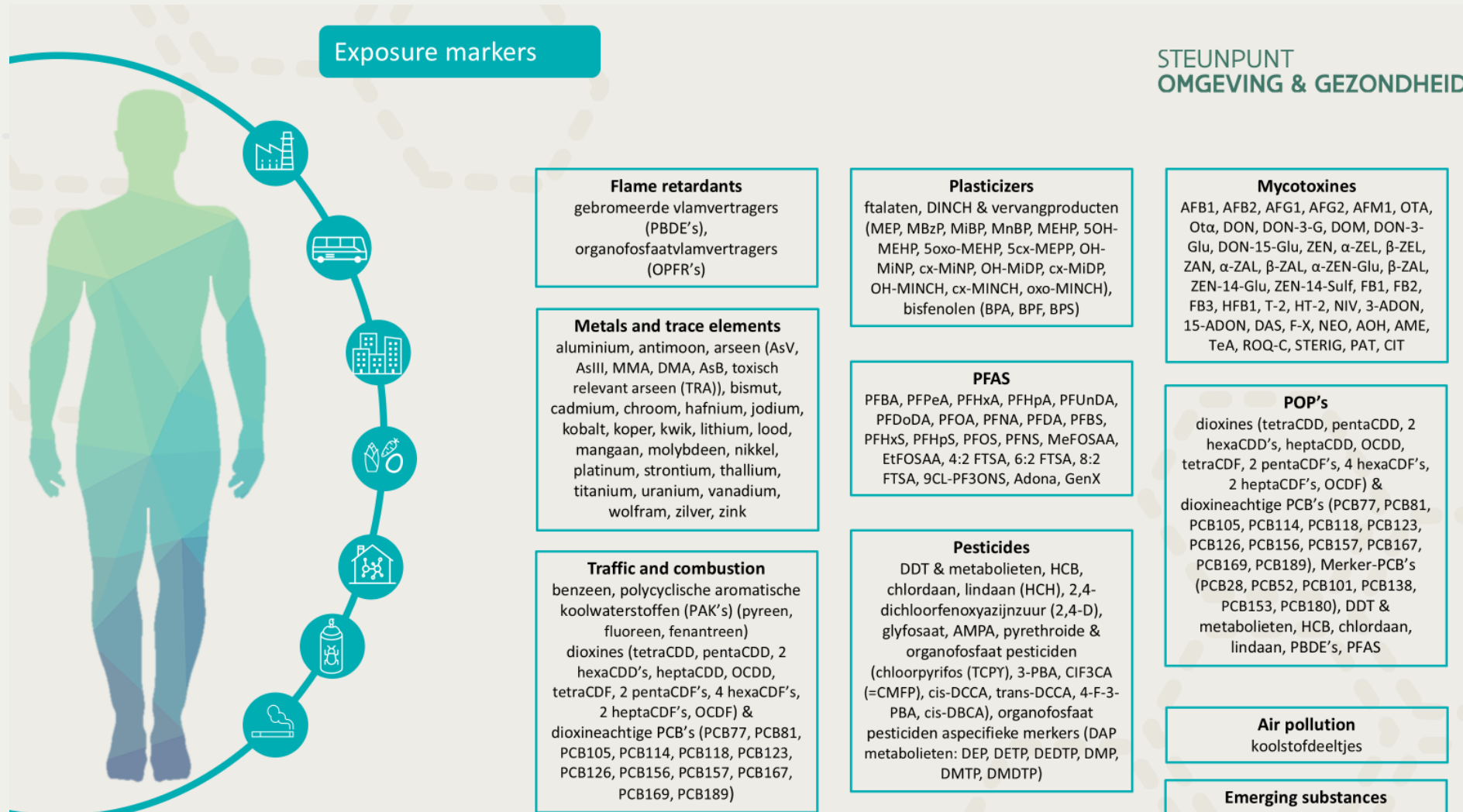
Vlaanderen en kwaliteit leefomgeving



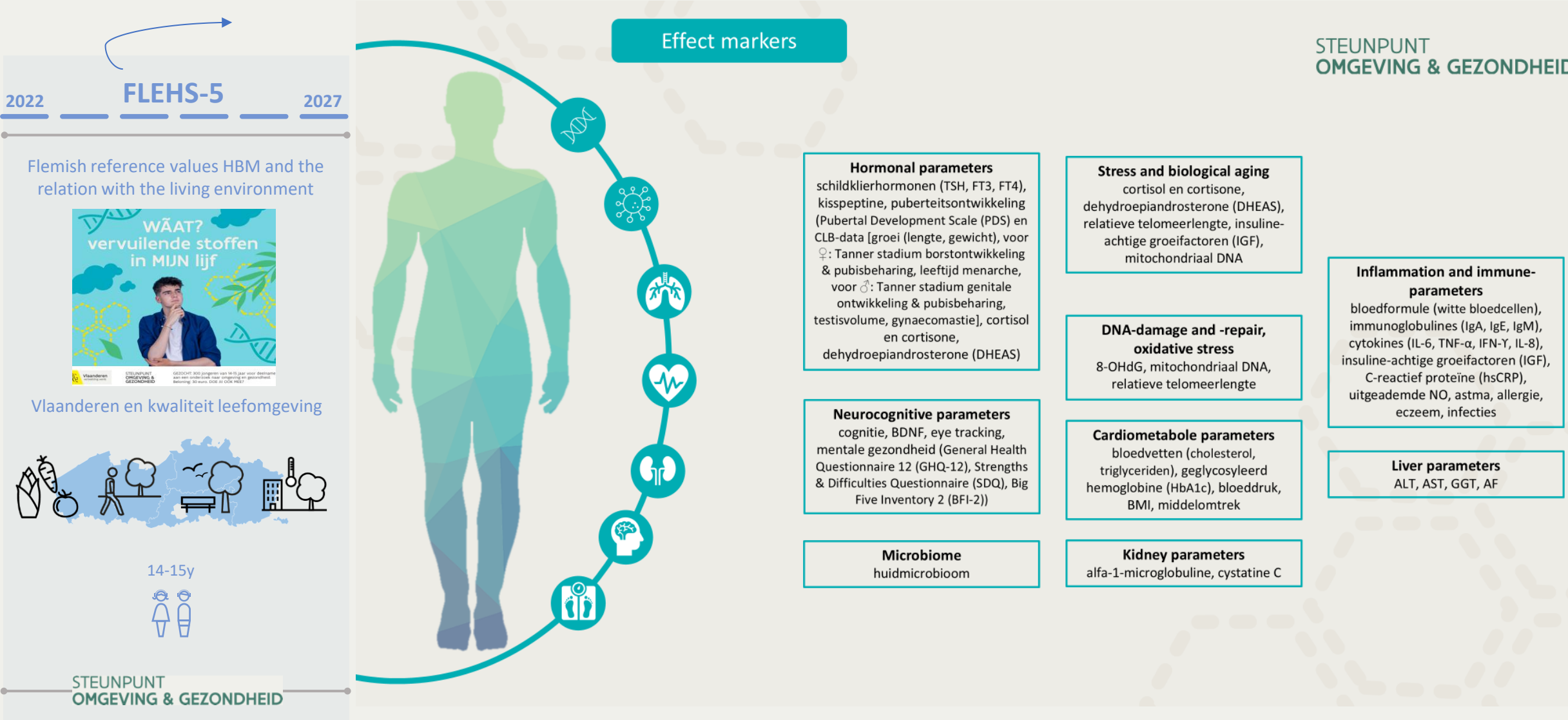
14-15y



STEUNPUNT
OMGEVING & GEZONDHEID



FLEHS-5 – effect biomarkers



Personal environmental sampling

→ Identifying sources and routes of exposure



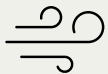
Indoor Environment



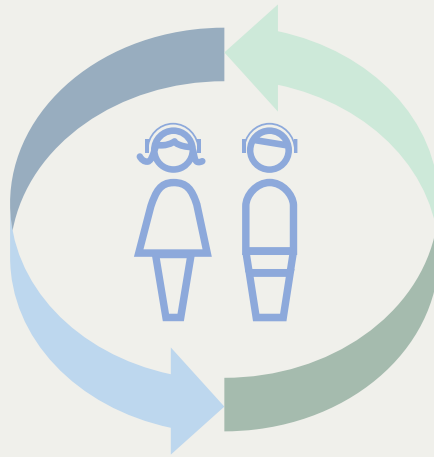
Tap water



House dust



Indoor air
(sensorbox)



Outdoor Environment



Chicken eggs



Soil (from chicken coop)



Compost



Home grown vegetables



Soil (from vegetable garden)

Innovation in FLEHS

Sampling methods

Microsampling (VAMS, Mitra[®])



Statistical analysis (in synergy with PARC)

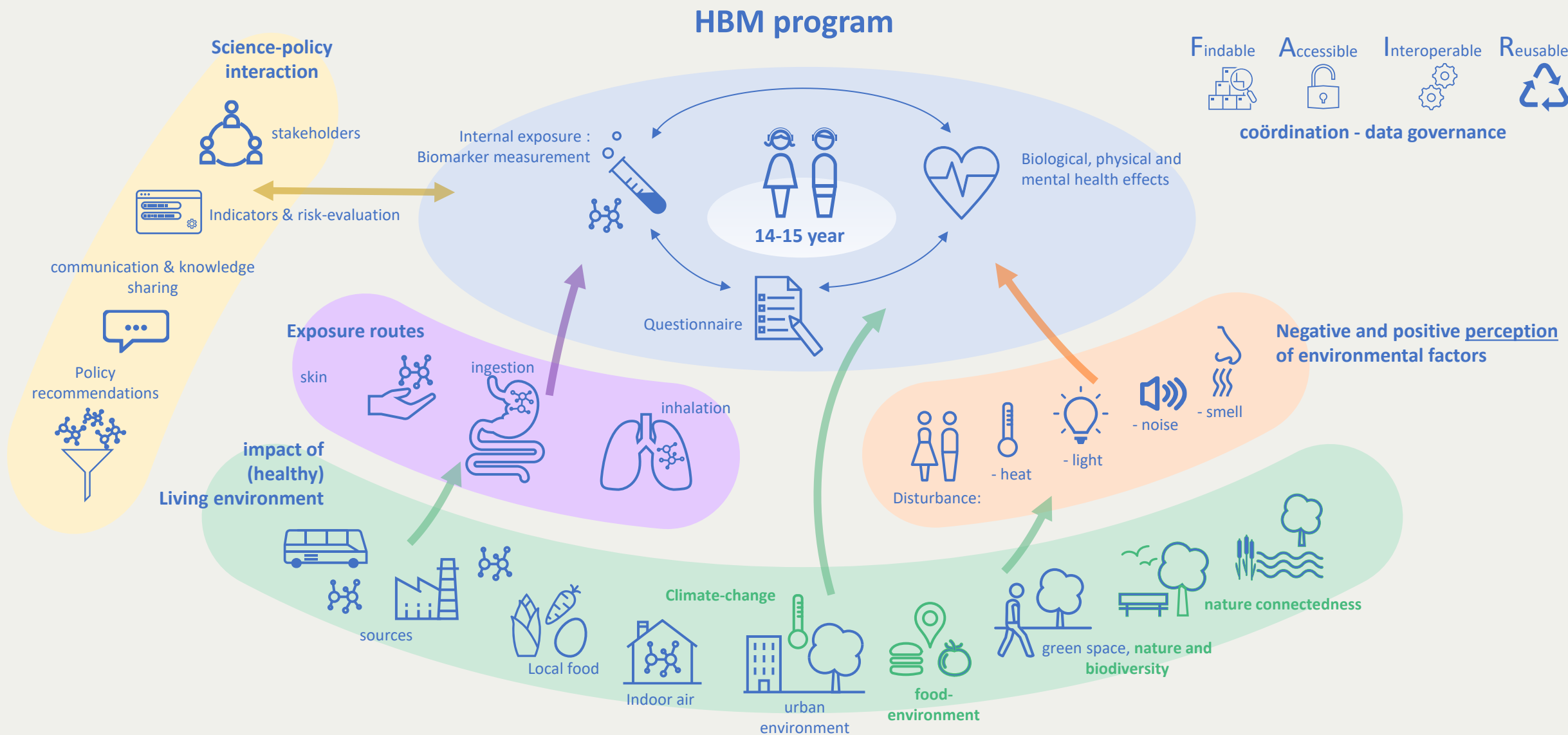
- Multi-pollutant models
- Modelling of the exposure routes
- Spatial analyses

Use of Apps and sensors

sensorbox indoor air

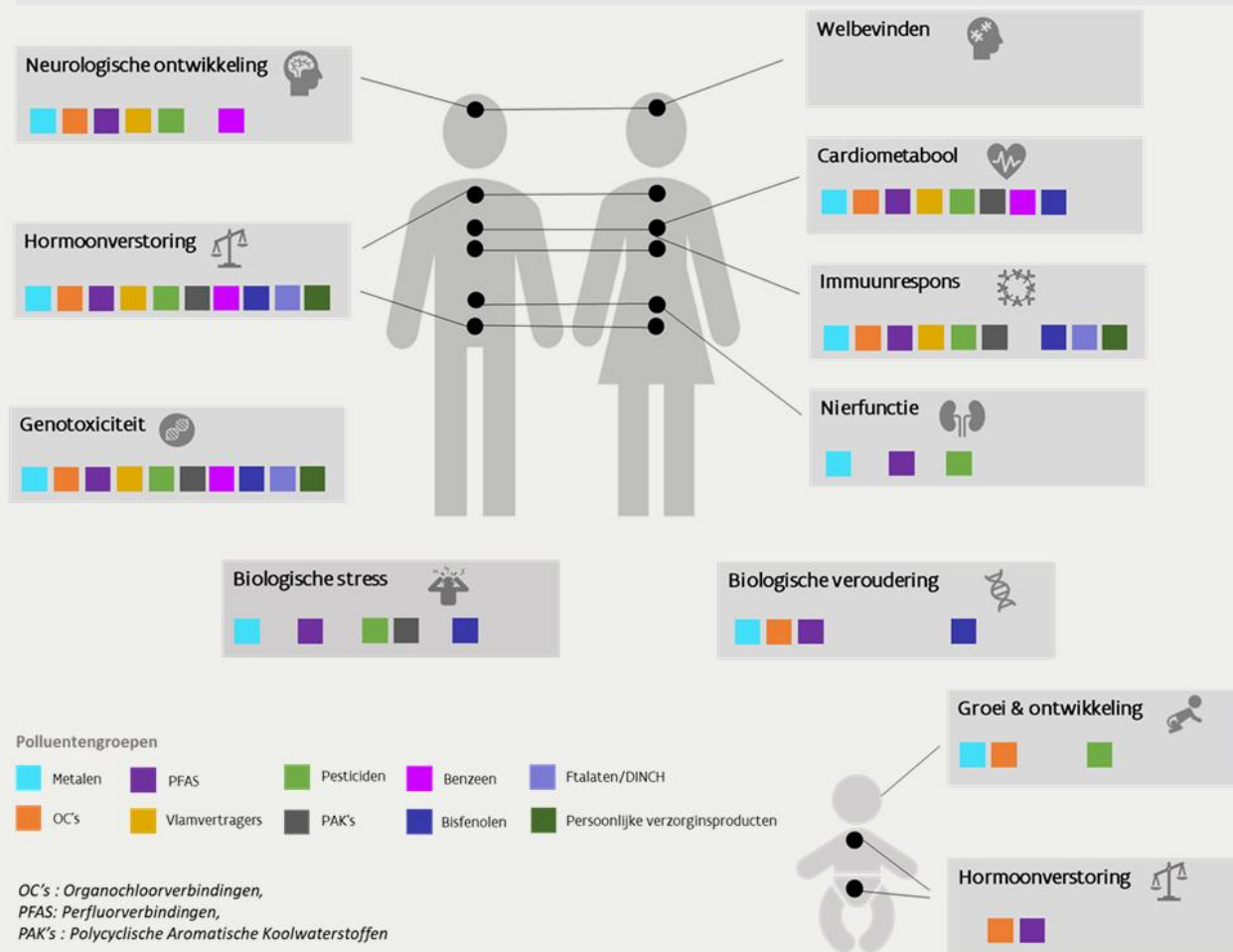


Science policy interaction

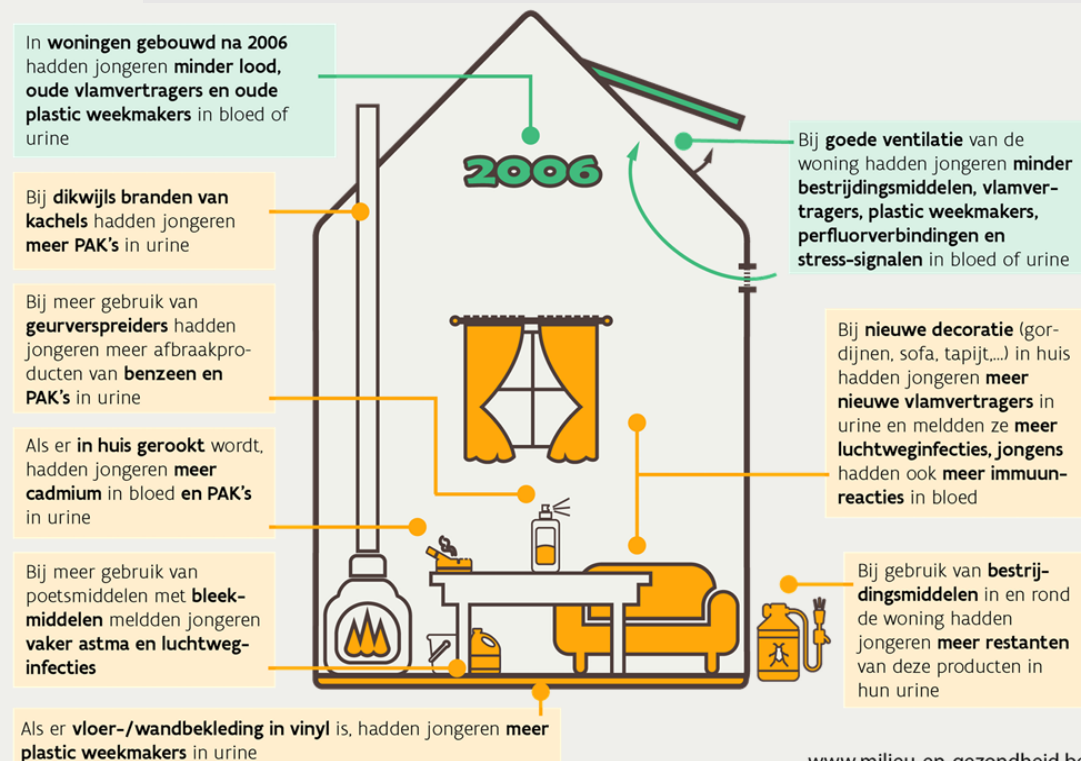


Indicators of FLEHS (illustrations)

Observed exposure levels in the population are significantly associated with a divers set of health effect



How our living environment influences our health



www.milieu-en-gezondheid.be

Flemish HBM dashboard

STEUNPUNT
OMGEVING EN GEZONDHEID

FLEMISH HUMAN BIOMONITORING DATA

Visualisation of aggregated data from the Flemish Environment and Health Studies

nl en



► EXTRA INFO

► DISCLAIMER

► ACKNOWLEDGEMENTS

► SELECT BIOMARKERS

STRATIFICATION
No stratification

STRATA
All

SAMPLING
PERIOD

From 2002

To 2022

LEGEND



only percentiles >LOD/LOQ are displayed. If only P90 and P95 are >LOD/LOQ, the visualisation looks like this:

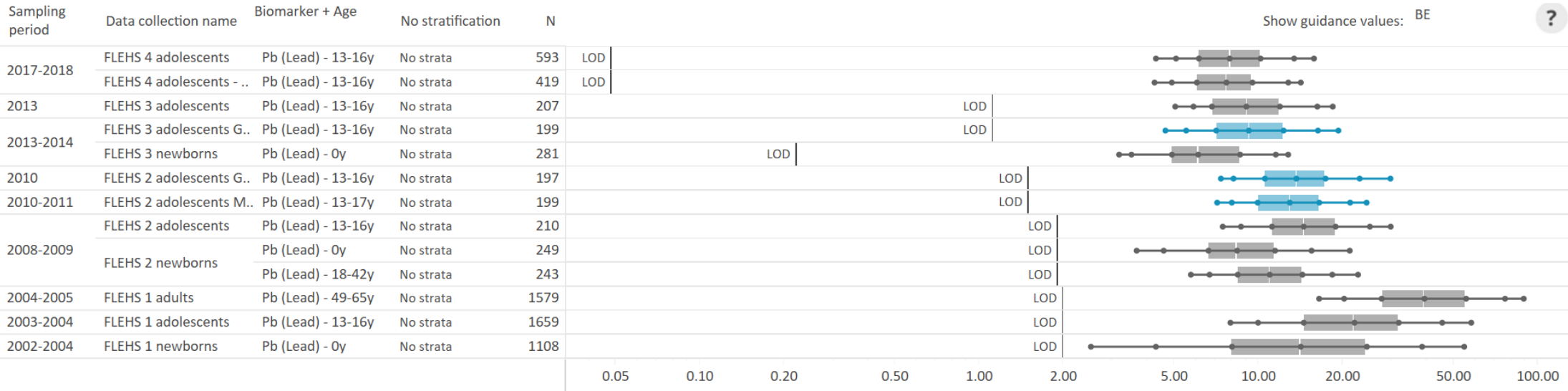


POPULATION

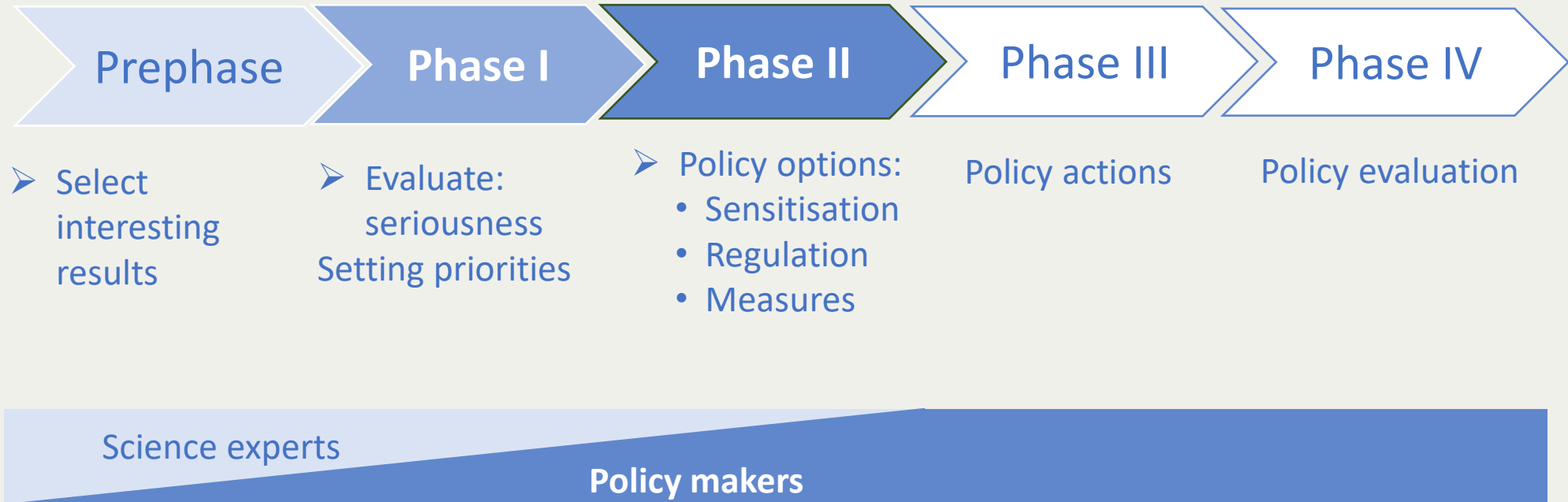
Reference

Hotspot

Distribution of Pb (Lead) concentration in Blood (µg/L)



Phased action plan: translating science to policy



What have 20 years of HBM in Flanders learned us?

What's the impact of the program?



FLEHS-1 (2002 - 2006)

Elevated levels of PCB's, HCB, and DDE in rural areas

Health risks Identified

- Hormone disruption
- Fetal growth impairment
- Asthma

Sources of Exposure Determined

- Locally grown food
- Wood burning

Policy actions taken

- Awareness raising campaigns
- Open fire ban
- Extra pesticide inspections (e.g. DDT)
- Locally grown food
- Expansion of air monitoring networks for dioxins and PCBs.

Reference

Reynders, H. et al. (2017). *Environmental International Journal of Hygiene and Environmental Health*, 220(2), 281–290. ; <https://doi.org/10.1016/j.ijheh.2016.09.013>

What have 20 years of HBM in Flanders learned us? What's the impact of the program?

Flemish Human Biomonitoring (2002–today)

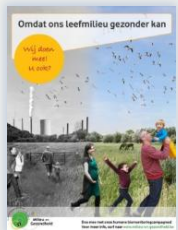
FLEHS-1



FLEHS-2



FLEHS-3



FLEHS-4



Key Findings from HBM

- HBM confirms population-wide exposure to EDCs phthalates, bisphenols, PFAS, including in children and pregnant women.

- Behavioural factors (use of cosmetics, ventilation, cleaning habits, food preparation practices) and environmental determinants (indoor environment) can significantly influence exposure.

=> These HBM results created urgency for a preventive communication strategy, especially ahead of the Belgian National Action Plan on EDCs (NAPED, 2022–2026).

Key Findings from HBM

- HBM campaigns showed widespread PFAS exposure with exceedances of health criteria and links to hormone disruption, metabolic markers, and birth outcomes.

=> PFAS Action plan, the evidence triggered a far-reaching plan with 50 coordinated actions. E.g. expansion of monitoring networks.

Lessons learned

- HBM is essential for identifying unexpected exposure patterns (e.g., higher rural exposure of PCBs).
- HBM is crucial for identifying which behaviours and products most influence exposure.
- Long-term HBM programs are crucial for tracking trends and evaluating policy impact, even when multiple interventions overlap.
- HBM is complementary to other environmental monitoring networks, linking environmental and biological monitoring strengthens policy responses.
- Effective prevention requires simple, targeted, repeated messages rather than complex chemical explanations.
- Multi-channel communication (social media, workshops, healthcare providers) is essential to reach different groups.
- A centralised, government-led coordination increases message consistency and public trust.
- Prevention must be complementary to regulation: citizens cannot reduce exposure alone.

Want to know more?
Check out our video on 20 years of HBM in Flanders



<https://www.youtube.com/watch?v=O4ffRo3zHO4>

Acknowledgements

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Our study participants!