A preliminary estimate of the environmental burden of disease associated with pyrethroid exposure and ADHD in Europe

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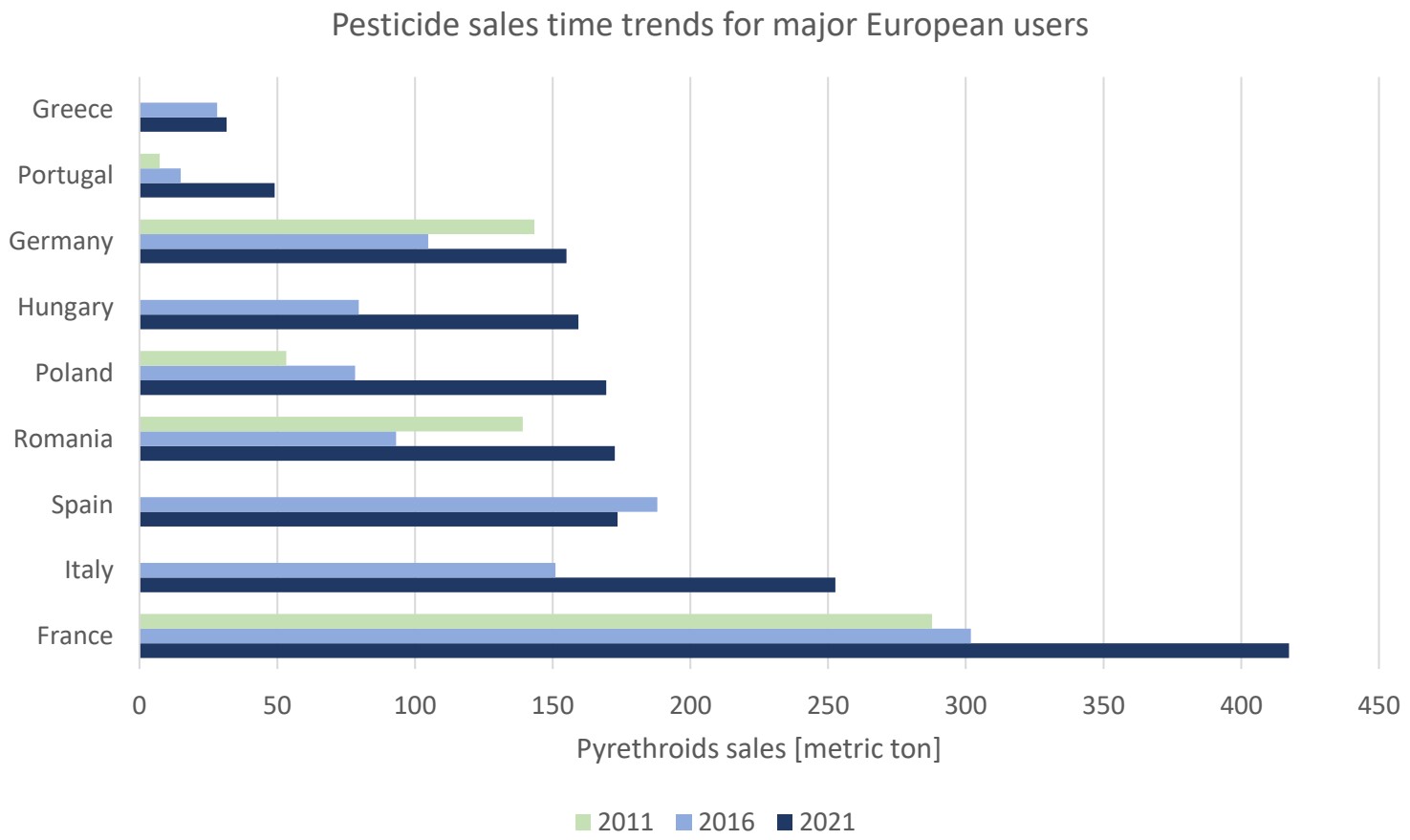
15th of November 2024

PARC

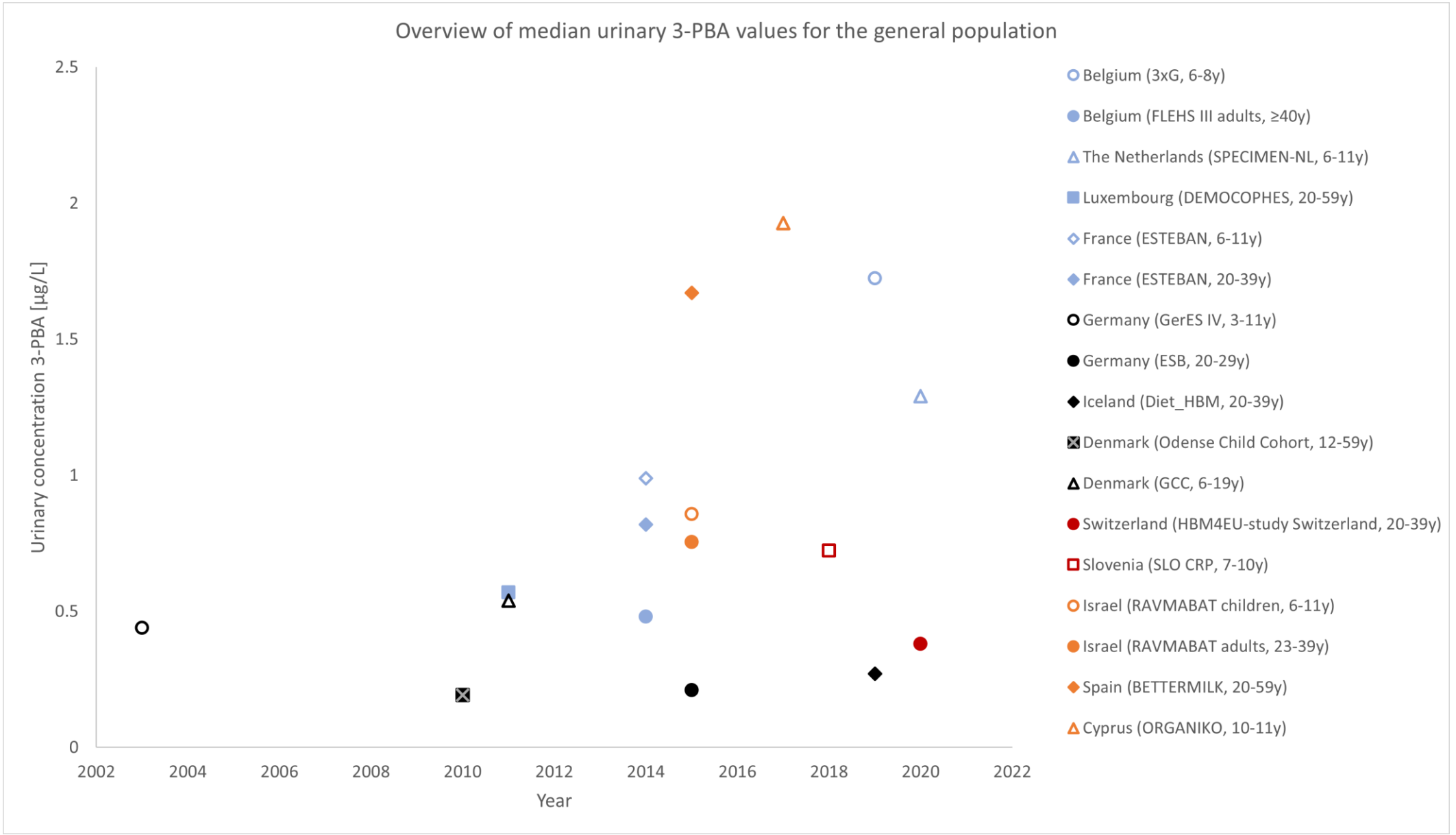
Pyrethroid insecticides

- Pyrethroids (PYRs) → group of synthethic pesticides extensively used (30% global insectide market)
- Use in agriculture, veterinary medicine (scabies, lice), domestic biocides and consumer products
- Based on naturally occurring pyrethrin compounds → assumed to be safer

Fig. Big daisy or *Chrysanthemum cinerariaefolium*



Evolution of pyrethroid exposure in Europe



Health effects associated with pyrethroid exposure

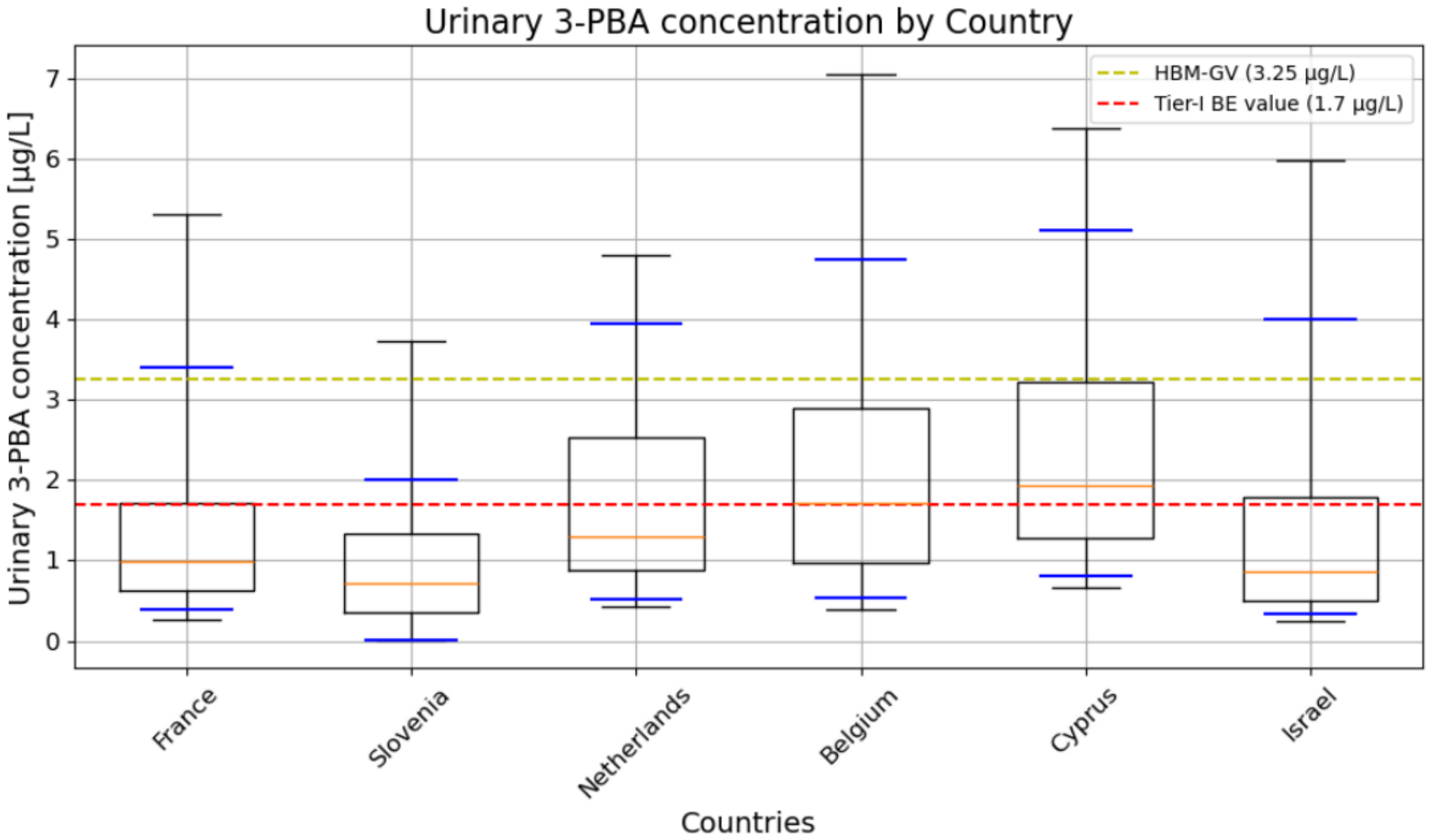
Target organ of the body	Effects	Relevant substances	Adults (men)	Adults (women)	Infants/foetuses
Brain/Neurological system 	Disturbance of neurodevelopment e.g. cognitive deficits	Pyrethroids	X	X	Suspected
		Glyphosate-based herbicides	X	X	More evidence needed
		Organophosphates (Chlorpyrifos/Dimethoate)	X	X	Strong evidence
	Behavioural disorders	Pyrethroids	X	X	Strong evidence
		Organophosphates (as a group)	X	X	Suspected
Blood system 	Childhood leukemia	Pyrethroids/Chlorpyrifos	X	X	Suspected
Endocrine system 	Endocrine disrupting effects	Pyrethroids/Organophosphates (as a group)	Suspected	Suspected	Suspected
		Glyphosate-based herbicides	More evidence needed	More evidence needed	More evidence needed
Immune system 	Immunotoxic effects	Pyrethroids	More evidence needed	More evidence needed	More evidence needed
		Organophosphates (as a group)	Suspected	Suspected	Suspected

Key:

- Strong evidence
- Suspected
- More evidence needed
- (X) Not applicable

PARC How pesticides impact human health and ecosystems in Europe — European Environment Agency

Are European populations at risk?



Burden of disease estimation results: estimates per million inhabitants

Country	PAF (95% CI) [%]	EBD (95% CI) [attributable cases per 10^6 inhabitants]	EBD (95% CI) [DALYs per 10^6 inhabitants]	Attributable health costs per 10^6 inhabitants (95% CI) [million EUR]
France	26 (22 – 30)	1710 (890 – 2589)	21 (6 – 37)	2.4 (1.2 – 3.6)
Iceland	14 (5 – 22)	969 (273 – 1927)	12 (2 – 27)	1.7 (0.5 – 3.5)
Switzerland	17 (6 – 27)	944 (282 – 1701)	12 (2 – 23)	2.0 (0.6 – 3.5)
Germany	10 (-4 – 22)	209 (-67 – 522)	3 (-1 – 7)	0.3 (-0.1 – 0.9)
Israel	25 (19 – 30)	2189 (1188 – 3352)	27 (6 – 49)	2.5 (1.3 – 3.8)

All estimates are made for the age group of 0 – 19 years

On average, 18% of ADHD cases associated with PYR exposure

Discussion

Relatively high disease burden: on average almost 1 in 5 cases associated with PYR exposure

Uncertain results → single ERF used instead of meta-analyzed ERF

- When applying non-EU ERF: PAF decreases from 18% to 7%

Potential underestimation of true burden

- Only ADHD considered in EBD analysis → PYR also associated with ASD and behavioral problems
- Estimation for 0 – 19-year-olds only → 50% of cases persist throughout adult
- 3-PBA taken as proxy for overall PYR exposure → 3-PBA is a metabolite of some but not all PYRs

Few EU-countries with measured adult biomarker levels & inconsistency in timing HBM-studies → greater coverage needed (more HBM-studies)

Thank you to all contributors

For further reading: A preliminary estimate of the environmental burden of disease associated with exposure to pyrethroid insecticides and ADHD in Europe based on human biomonitoring | Environmental Health | Full Text