

# ImproRisk model as an open access risk assessment tool

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## Abstract

ImproRisk is an open-access Risk Assessment model, developed in Cyprus, which contributes to the harmonization of the Dietary Exposure Assessment methodologies across Europe. It is a simple and transparent tool, built in R, for conducting accurate dietary exposure assessments to chemical substances. Aiming to be established as a standardized Risk Assessment tool at European level, the model has been designed to accept occurrence and consumption data, coded according to the EFSA's food classification and description system version 2 (FoodEx2). ImproRisk users are able to estimate dietary exposure to a chemical substance under study at any level of FoodEx2, considering the base term and Process facet (F28). Dietary exposure is estimated at individual level for various population groups and exposure estimates are stratified by different demographic characteristics. In this context, ImproRisk is considered a tool for facilitating decision making, since it provides information regarding the percentage of the population exceeding the health-based guidance value for a specific chemical substance. The objective of this study is to present the model's Risk Assessment outputs from the estimation of the Dietary Exposure to lead, cadmium and mercury in Cyprus.

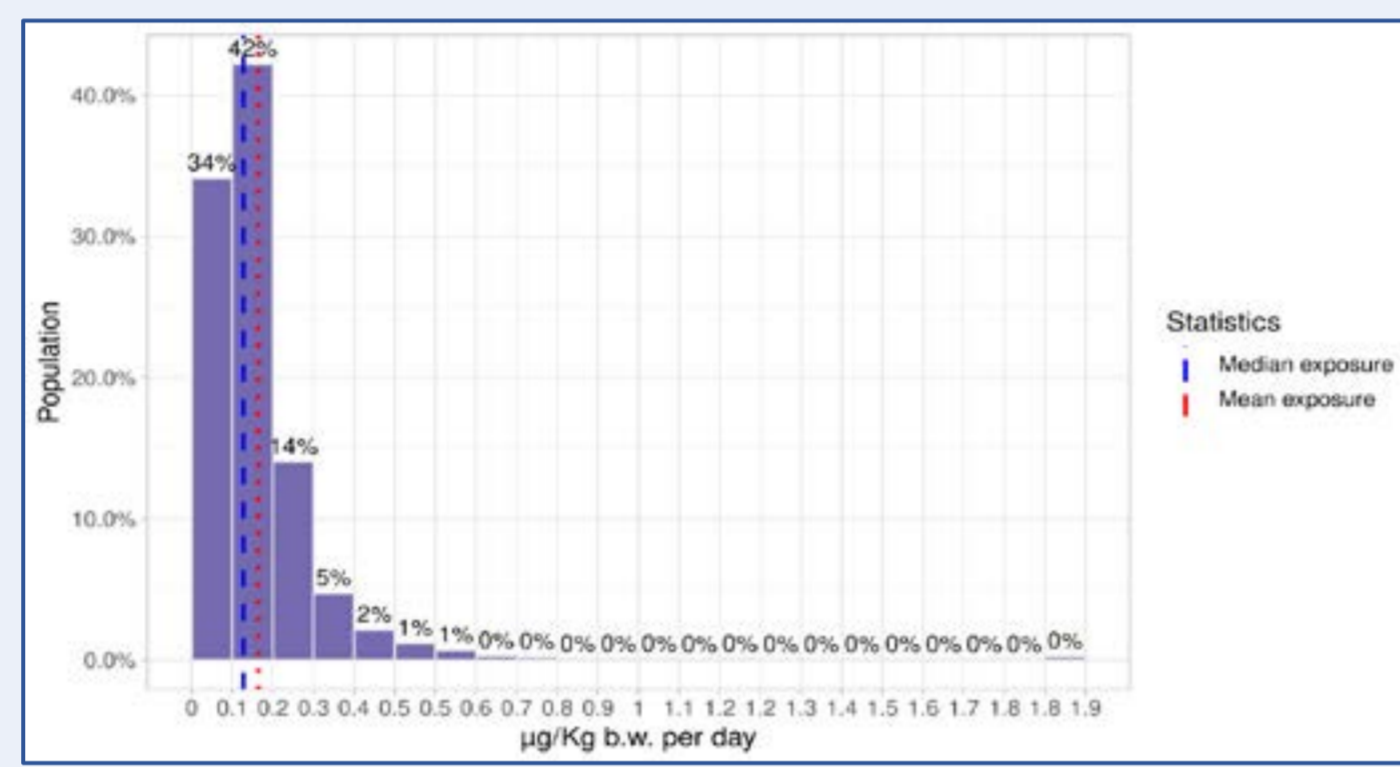
## Risk Assessment Model: IMPRORISK

**ImproRisk** is an open access Risk Assessment Model designed by using the statistical computing language R.

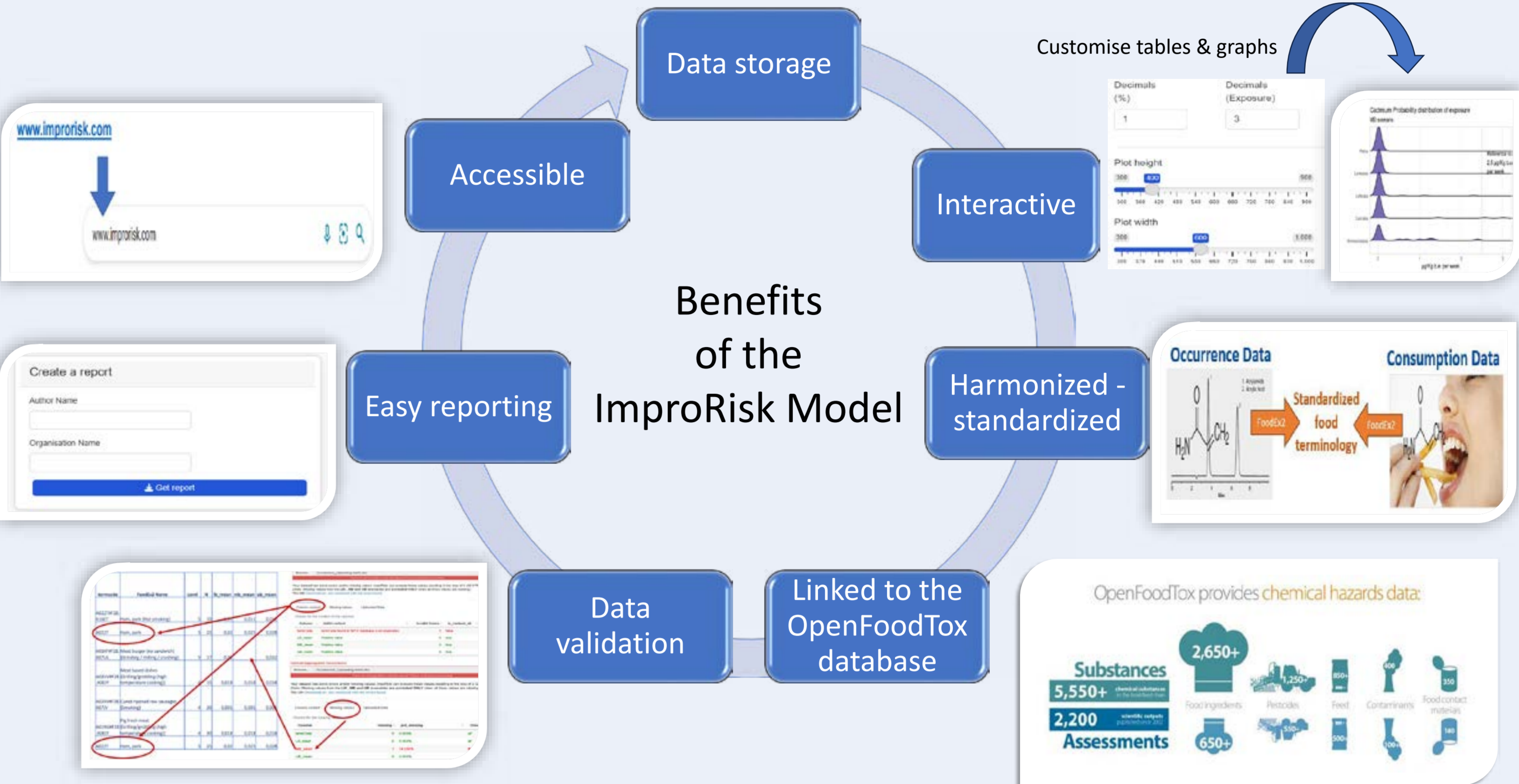
The chronic dietary exposure, at individual level, is estimated using the equation:

$$\text{Exposure } (\mu\text{g}/\text{kg b.w.}) = \frac{\text{Consumption (g of food)} \times \text{Occurrence (mg/kg of food)}}{\text{Body weight (kg)}}$$

**The model performs:** a) estimation of the exposure rate for the population, b) exploration of the effect of demographic characteristics to the estimated exposure, c) calculation of the percentage of the contribution of the different food groups to the total exposure and d) risk characterization.



## Benefits for the Users



## Data inputs:

### Substance info

Substance	Author	Year	Output	Assessment	Qualifier	Value unit	Population
Mercury (Meq)	EFSA CONTAM	2004	38	critical study not identified			Consumers
Mercury (Meq)	EFSA CONTAM	2005	60	TWI (general)		1.0 µg/kg bw/d	Consumers

### Substance Information

Chemical Substance: Cadmium

Substance Category: Contaminant

Reference value: Tolerable Weekly Intake (TWI)

Reference point:

Value (µg/Kg bw): 2.5

Set

### Aggregated Occurrence Data

FoodEx2 Code	FoodEx2 Name	Level	N	% Left censored	LB mean (mg/kg)	MB mean (mg/kg)	UB mean (mg/kg)
A02JA	Cuttlefishes	4	1	1	0.2	0.3	0.4
A00CV	Breakfast cereals	2	1	1	0.02	0.03	0.04
A01BY	Lemons	5	1	1	0.06	0.07	0.08

### Food consumption data

- ImproRisk accommodates EU MENU food consumption data.
- Several demographic characteristics (area, gender, population class) are included.

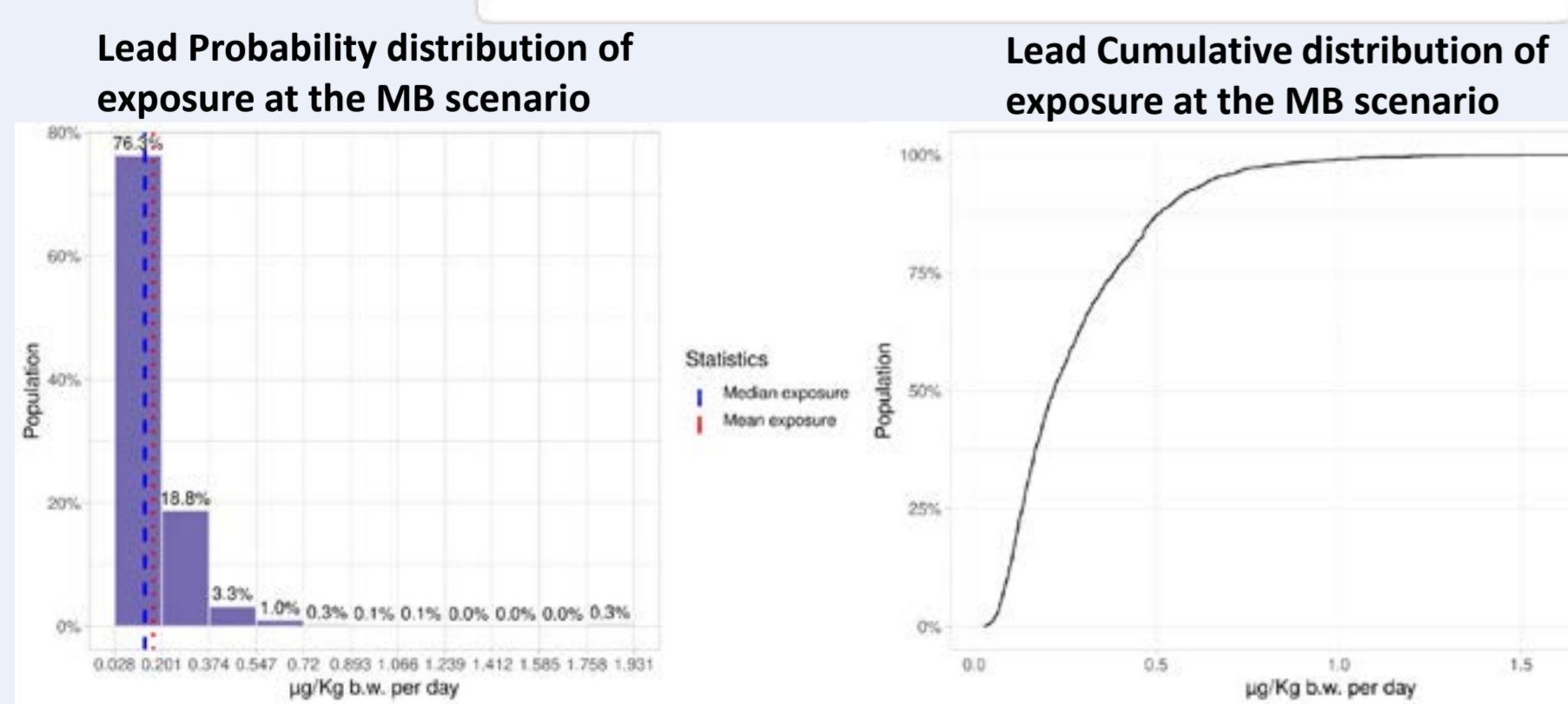
Demographic categories: Infants: 3-11 months, Toddlers: 12-35 months, Children: 3-9 years, Adolescents: 10-17 years, Adults: 18-64 years, Elderly: 65-74 years, Pregnant women.

SERIAL	SUBJECTID	DAY	AMOUNTFOOD	AMOUNTCOOKED	FOODCODE	GENDER	AGE	WEIGHT	AREA	POP_CLASS	WCOEFF
1	300177	20001	1	40	A000DF19.A07PFS28.A07M5	FEMALE	10.44764	31.3	Lefkosia	Adolescents	265
2	300177	20001	1	40	A000DF19.A07PFS28.A07M5	FEMALE	10.44764	31.3	Lefkosia	Adolescents	265

## ImproRisk outputs:

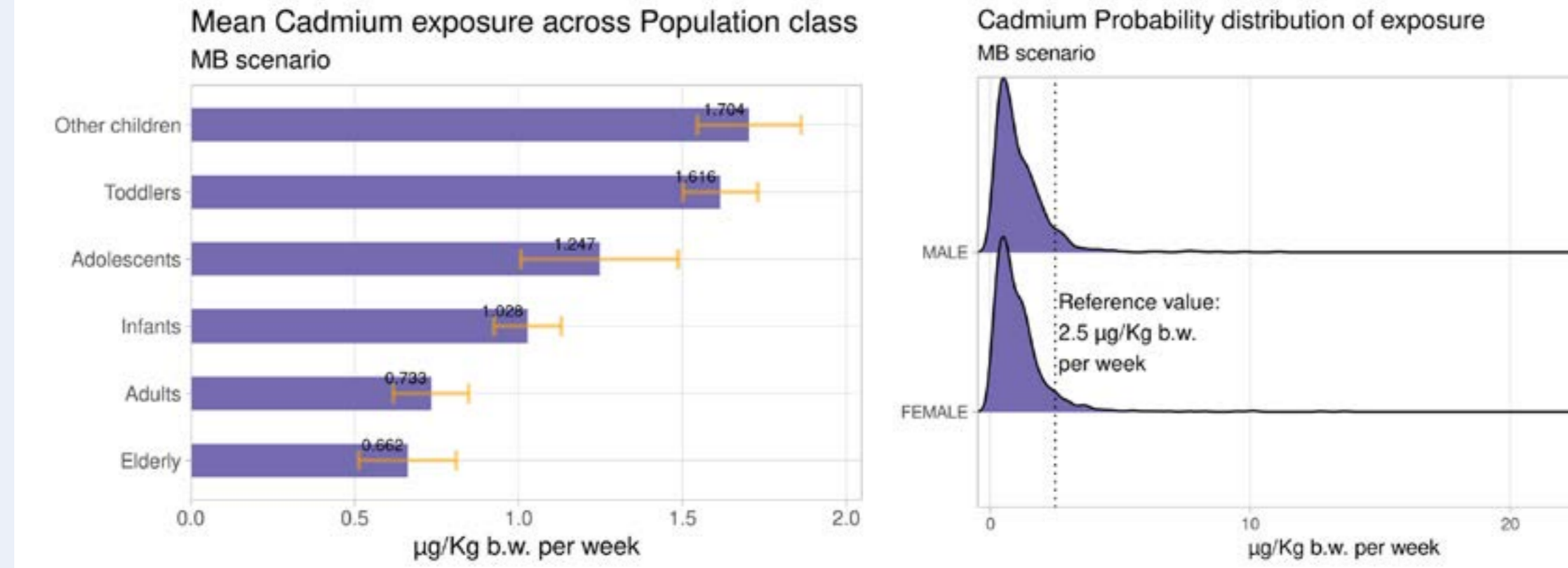
### Dietary Exposure to heavy metals

	LB (µg/Kg b.w. per day)	MB (µg/Kg b.w. per day)	UB (µg/Kg b.w. per day)
Min	0.02	0.028	0.035
Max	1.909	1.931	1.953
Mean	0.136	0.17	0.205
95% C.I.	(0.126 - 0.146)	(0.16 - 0.181)	(0.194 - 0.216)
SD	0.127	0.14	0.155
P25	0.078	0.103	0.124
Median	0.109	0.138	0.169
P75	0.153	0.196	0.230
P95	0.304	0.371	0.44
MoE (Mean)	7.366	5.871	4.874
MoE (P95)	3.292	2.697	2.273

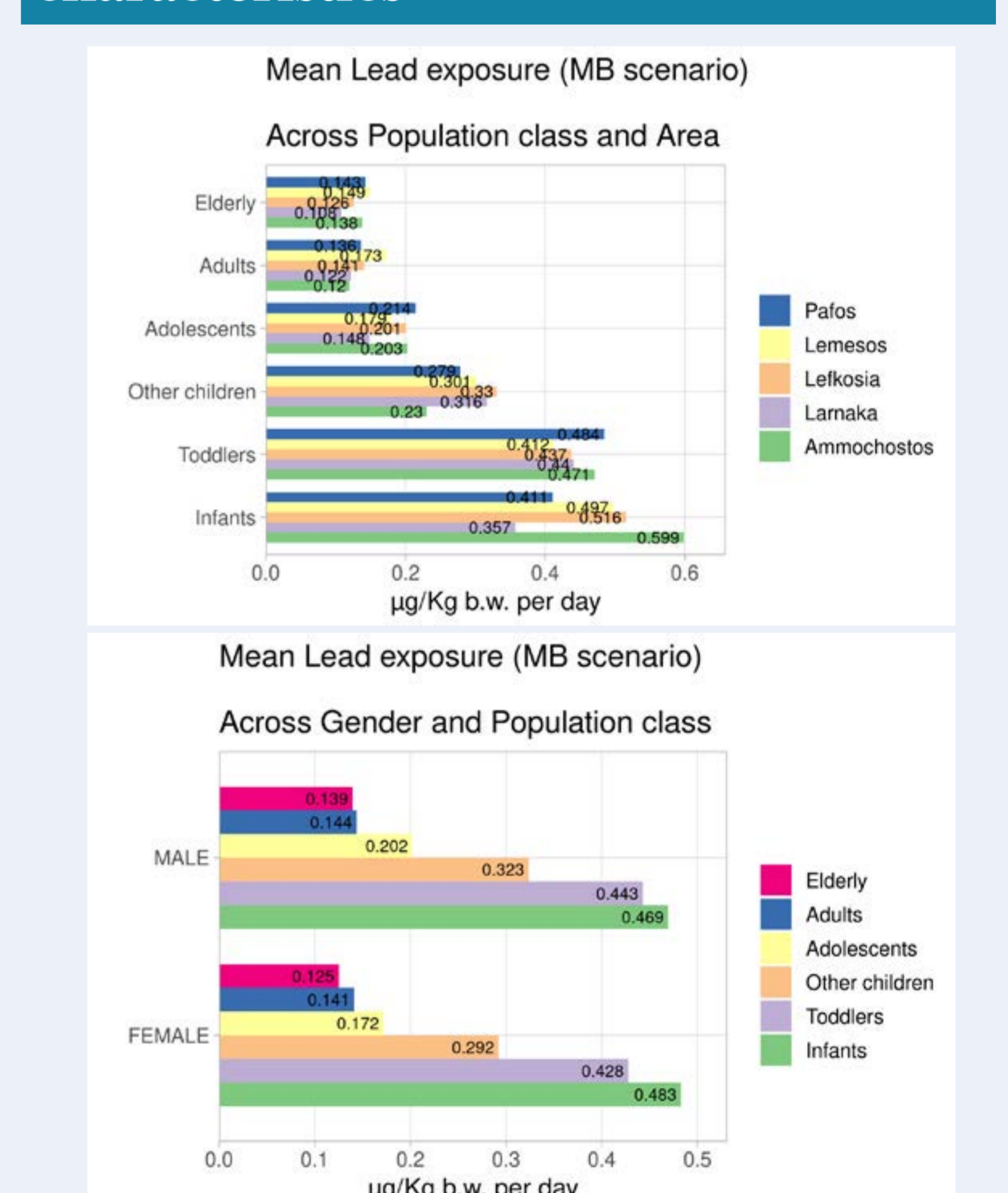


### Exposure statistics by demographic

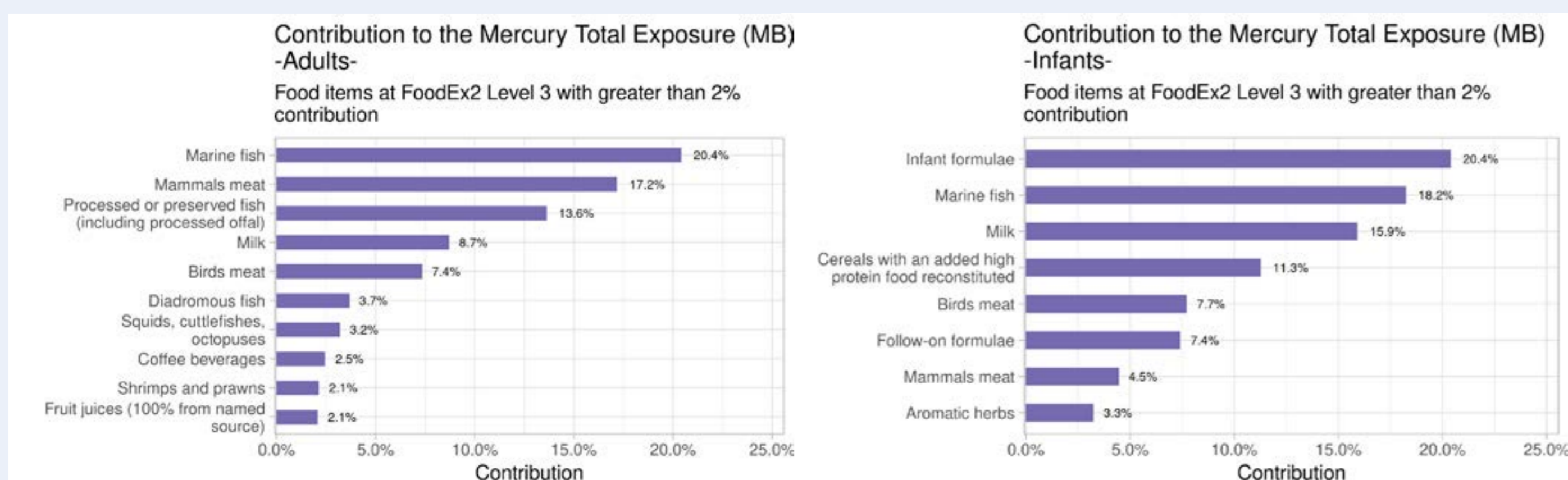
Area	Min	Max	Mean	95% C.I.	SD	P25	Median	P75	P95	MoE (Mean)	MoE (P95)
Ammochostos	0.050	1.336	0.157	(0.138 - 0.176)	0.106	0.085	0.138	0.196	0.328	6.366	3.045
Larnaka	0.028	1.227	0.151	(0.139 - 0.162)	0.104	0.095	0.123	0.174	0.334	6.643	2.991
Lefkosia	0.028	1.267	0.175	(0.165 - 0.186)	0.114	0.103	0.145	0.216	0.391	5.700	2.559
Lemesos	0.030	1.931	0.192	(0.154 - 0.229)	0.209	0.109	0.142	0.207	0.390	5.220	2.567
Pafos	0.043	1.054	0.155	(0.141 - 0.169)	0.084	0.113	0.138	0.185	0.262	6.445	3.818



### Combination of 2 demographic characteristics



### Food Contribution to the population's exposure



### Acknowledgements

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### References

D. Kafouris, E. Christoforou, D. Stephani, A. Sarandi, G. Stavroulakis, E. Christou, S. Yiannopoulos, "Lead, cadmium and mercury determination and human health risk assessment in foods from Cyprus", *Journal Food Composition and Analysis*, 2024, 128, Article 106007.