



Aggregate consumer exposure assessment

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Consumer exposure to chemicals



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Source



Dose



Pathway

Consumer exposure: Intake routes

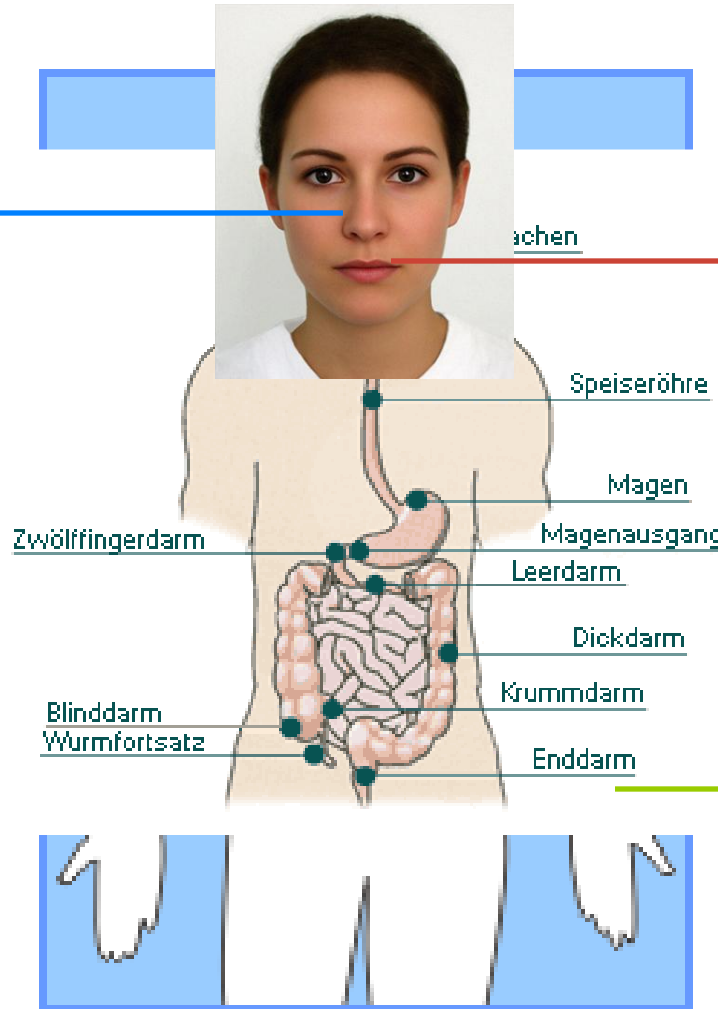


Inhalation

- Air (Aerosols, vapour, gas)
- Dust

Ingestion

- Food
- Drugs
- Dust
- Cosmetics
- Personal care products



Dermal uptake

- Cosmetics
- Personal care products
- Textiles

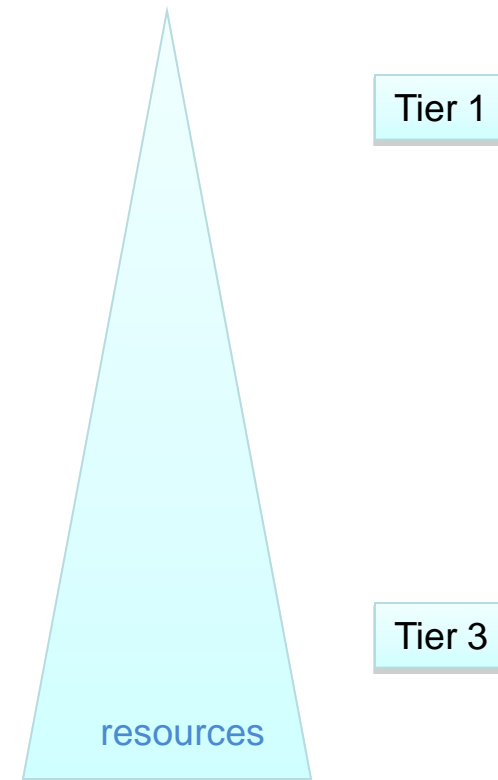
Key questions for risk assessment



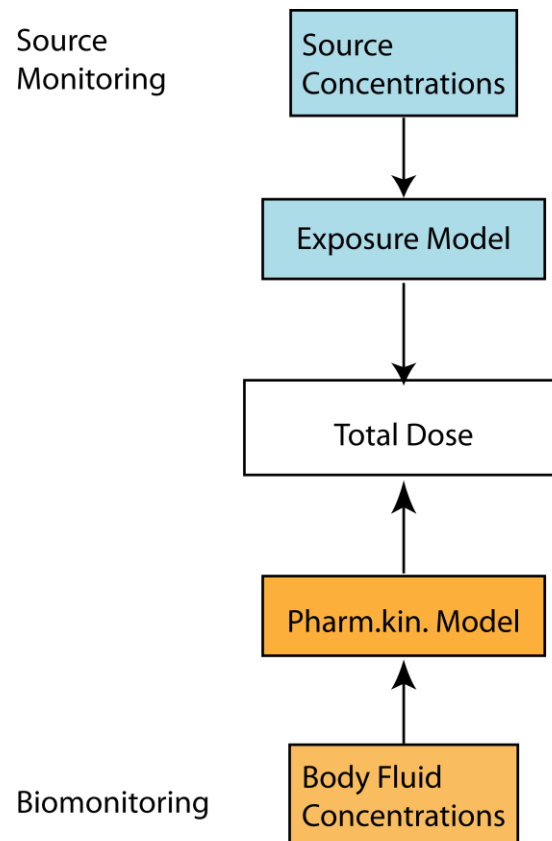
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Effect  **Risk**  Exposure

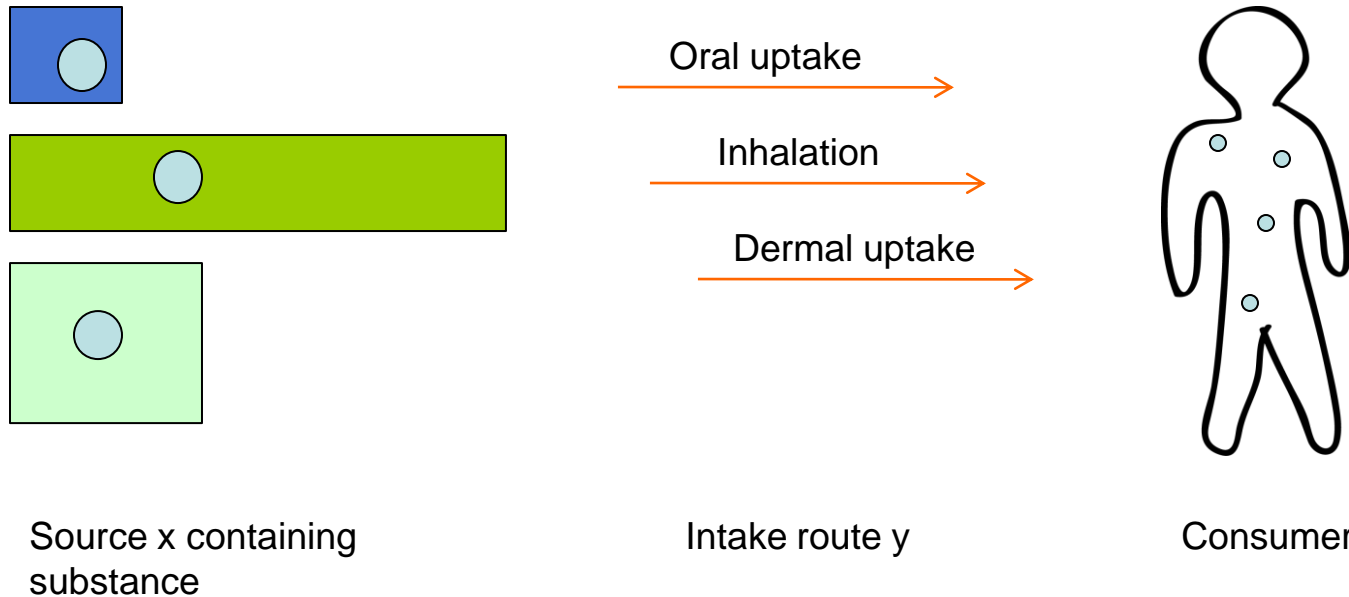
- Worst case exposure?
- Realistic case exposure?
- Most exposed consumer groups?
- Main pathways of exposure?
- Percentage of the population exposed (at risk)?



Assessment of total exposure



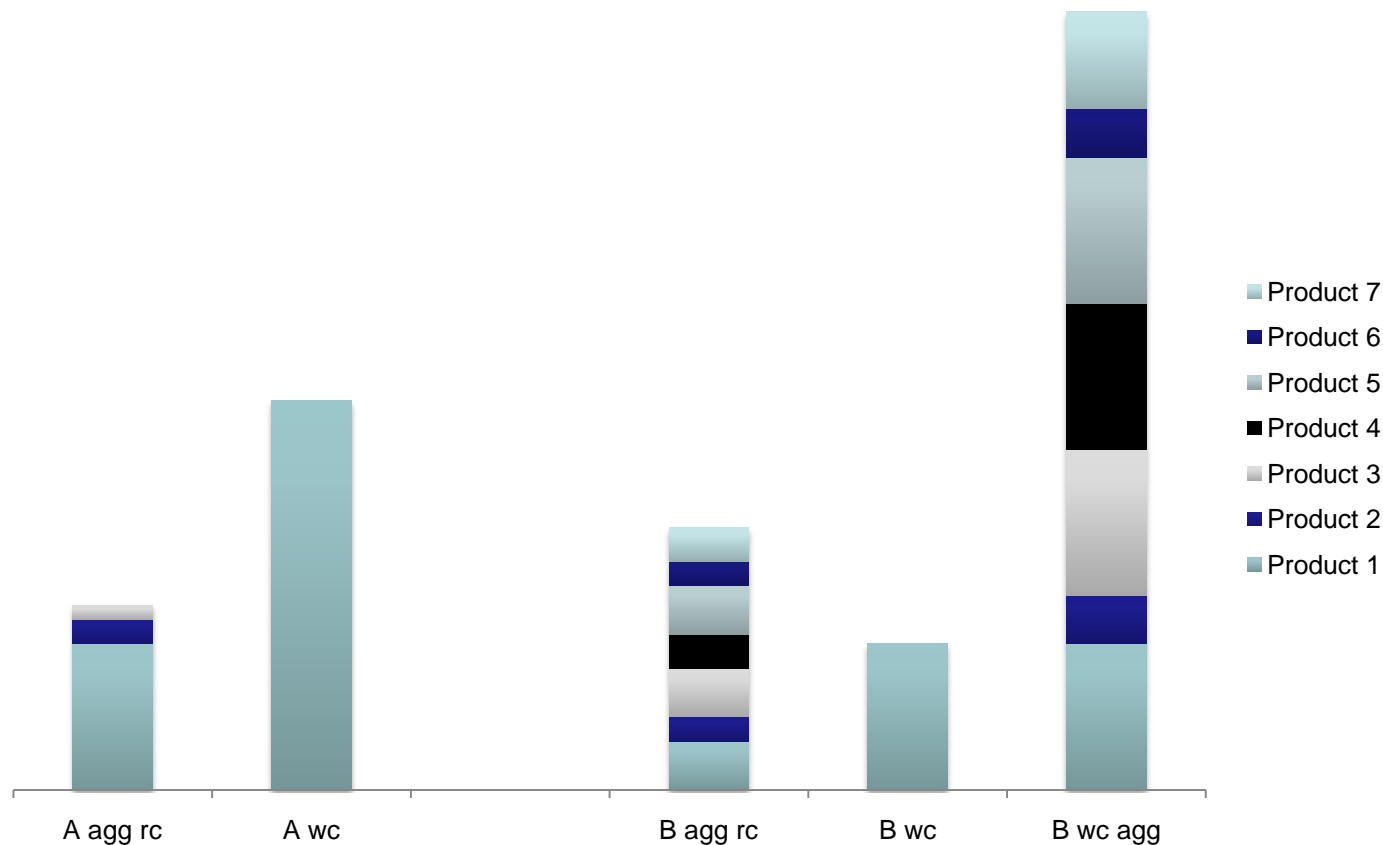
Modeling aggregate/total consumer exposure to substances



$$D_{xy} = \frac{C_x * q_{xy}}{bodyweight} * r_{uptake}$$

$$D_{agg} = \sum_{x=1}^n \sum_{y=1}^m D_{xy}$$

Aggregate exposure needed?

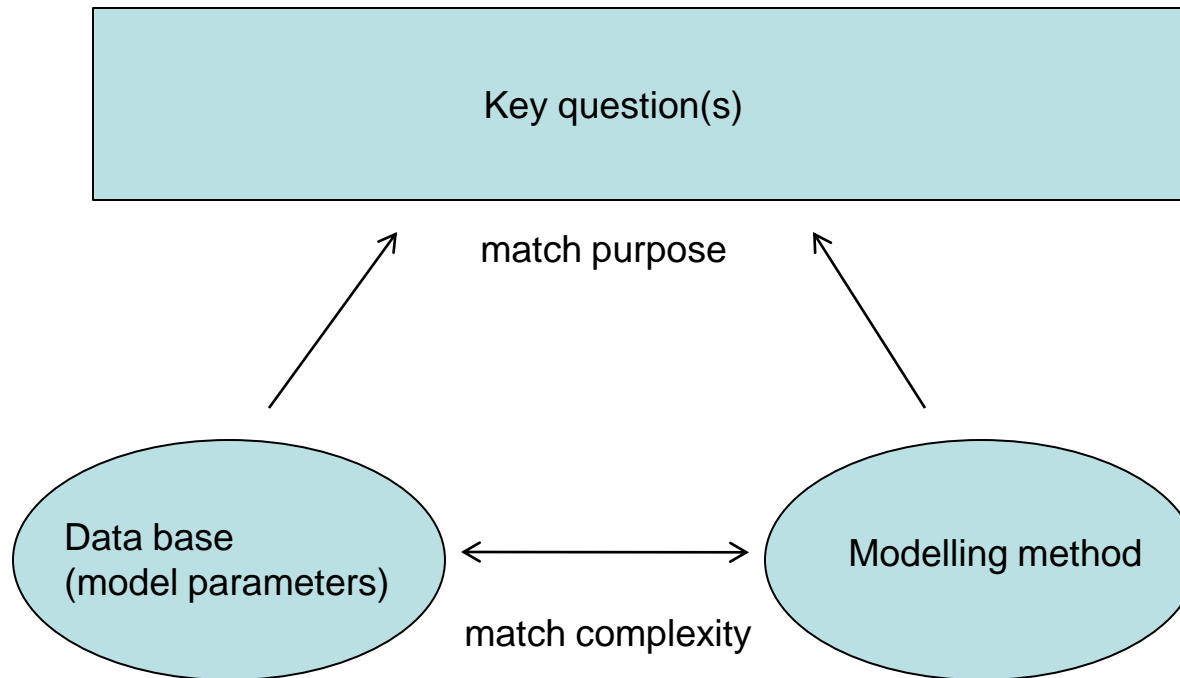


Substance A: used in large amounts in one product

Substance B: used in small amounts in many products

→ importance of realistic cases!!

Choice of method in modelling

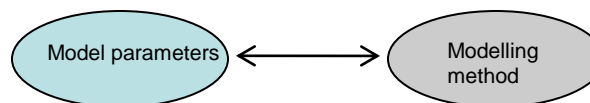


Parameters for exposure modelling



Source  Dose

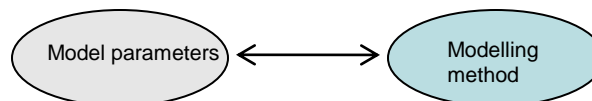
Substance	Source	Use	Co-use	Body char.
uptake rates	amount of substance	amount	<i>individual based</i>	bodyweight
partition coefficients	release of substance	frequency	<i>distribution based</i>	age
		non-use		gender
				race



Methods to calculate realistic exposures



characteristics	Deterministic	Probabilistic	
		distribution based	individual based
input (parameters) and output (exposure values)	mean, lower and upper boundary	distribution	distribution
co-use data	additional conditions	additional conditions	directly
case studies	Bisphenol A	PBDEs	Nanoparticles



Deterministic assessment: Bisphenol A



Mean values for

Source	C (ng/g)	q (g/day) adult-m
Canned fish	15	4.8
Canned meat	24.5	10.0
Canned vegetables	26	31.5
Canned fruit	6.6	18.5
Canned soup	18	10.0
Canned noodles	9	10.0
Breakfast Cereals	3.5	5.0
Cookies	3.5	10.0
Canned Softdrinks	0.4	161.1
Canned alcoholic drinks	0.4	156.3
Tea, hot drinks	0.6	600.0
Mw food (no babies)	0.9	12.6
pc baby bottle (incl. Mw)	6.7	0.0
Breastmilk	0.6	0.0
infant food	0	0.0
Dust	3300	0.2
Air (ng/m ³ ; m ³ /day)	1500	60.0
Saliva (Dent. Seal.)	300	0.7

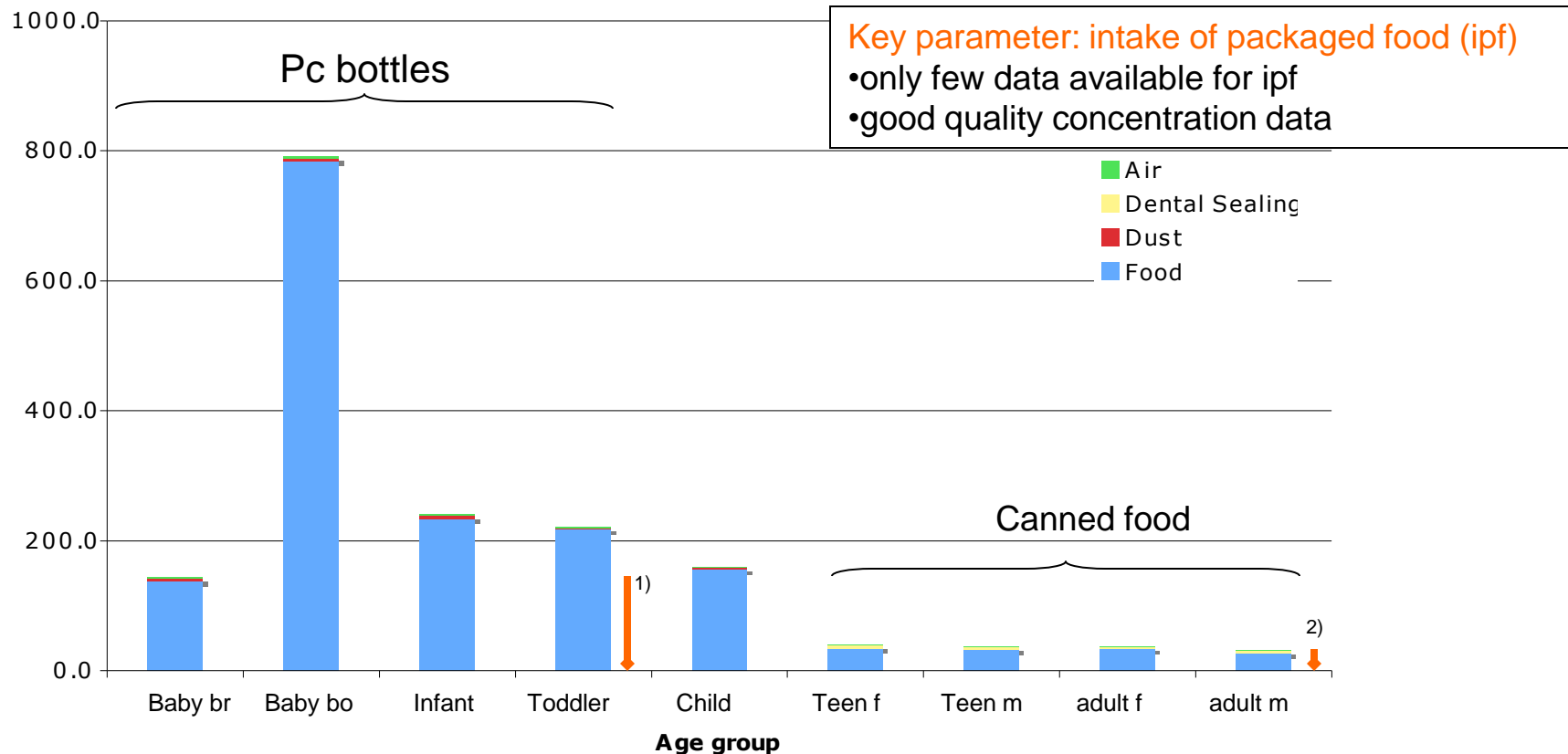
$$D_{xy} = \frac{C_x * q_{xy}}{bw} * r_{xy}$$

C_x BPA concentration in xx
 q_{xy} uptake rate for xx

Von Goetz et al., 2010, Risk Analysis, 30 (3), 473-487



Total BPA-doses for German age Groups (realistic mean)



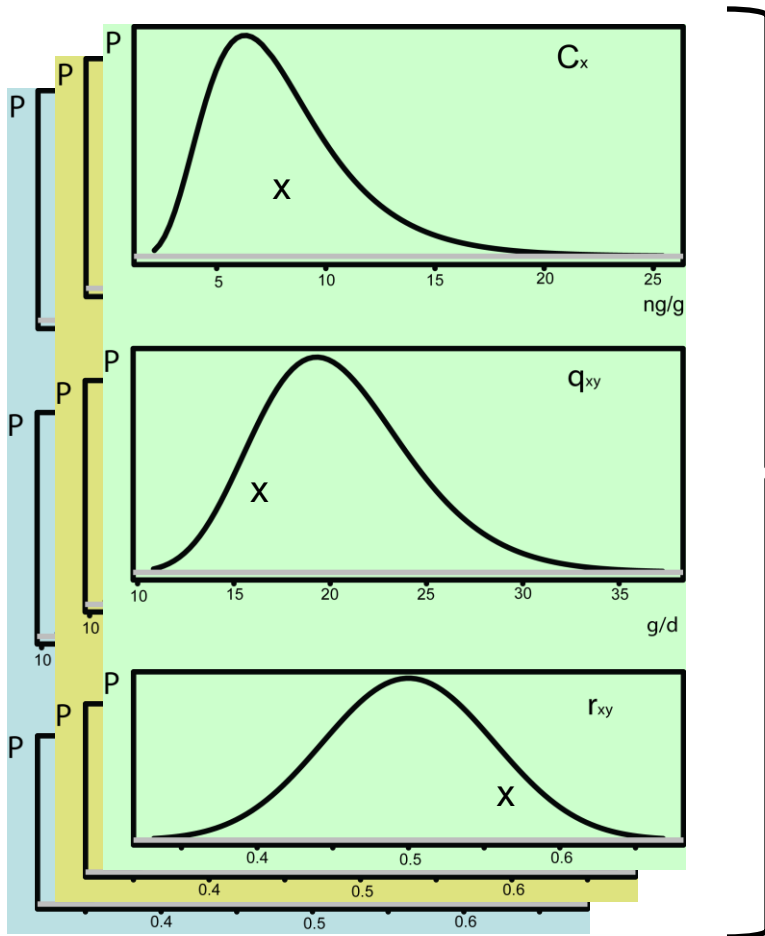
Von Goetz et al., 2010, Risk Analysis, 30 (3), 473-487

1) Becker et al, 2009, Int. J. Hyg. Environ. Health 212, 685-692

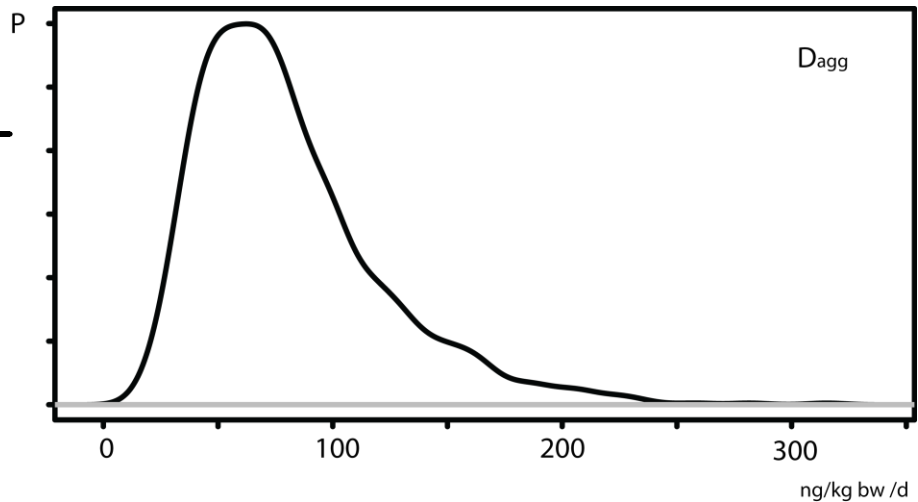
2) Völkel et al, 2008, Toxicol. Letters, 179, 155-162



Distribution based probabilistic assessment: PBDEs



$$D_{xy} = \frac{C_x \cdot q_{xy}}{bw} \cdot r_{xy} \quad D_{agg} = \sum D_{xy}$$



PBDE: Pathways for age groups



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Key parameters: dust ingestion rates, dust conc.



Individual based probabilistic assessment: NP in cosmetics



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One combination = one exposure profile

(one subpopulation sharing the same co use pattern)

Decorative cosmetics

	several times/day	once per day	1-2 times per week
Lip stick	x			
mascara		x		
eye make-up	x			
make-up			x	

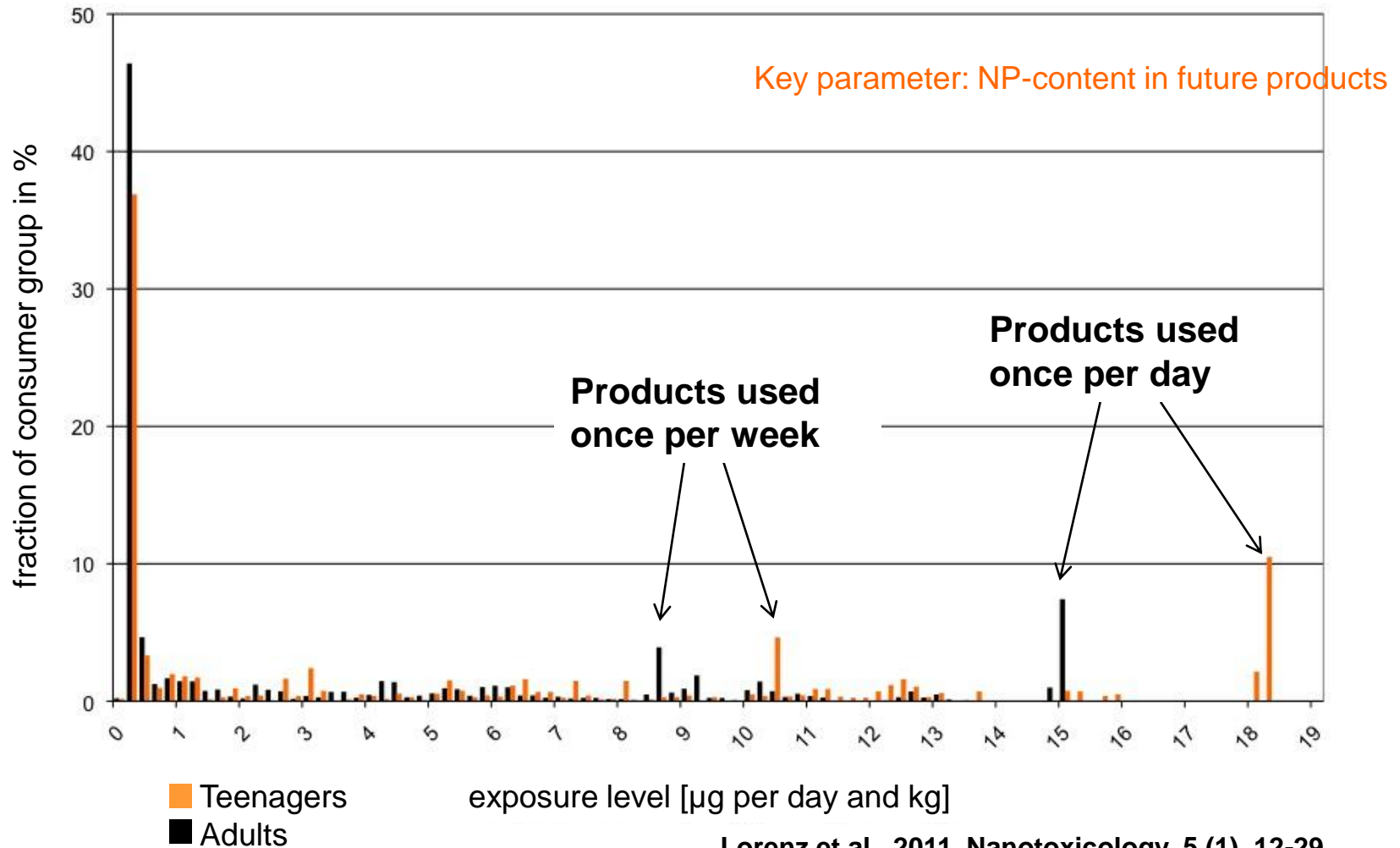
Source: MDS database, a representative database for consumers in Germany



Consumer exposure to nanoparticles



Cosmetics- female consumers



Lorenz et al., 2011, *Nanotoxicology*, 5 (1), 12-29

Matching methods to key parameters...and key questions



Case studies

Key parameters

Methods/ assumptions

Key questions

Bisphenol A

intake of packaged food

combination of intake rates with per capita data for canned food

relative contributions of packaged food

PBDEs

dust ingestion rates, dust concentrations

emphasis on parameter uncertainty

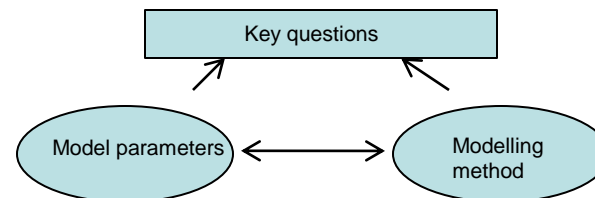
comparison of regions

Nanoparticles

NP content in products

placeholder scenarios

prospective assessment, methodology for REACH



Acknowledgement



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