



National Institute for Public Health  
and the Environment  
*Ministry of Health, Welfare and Sport*

# Aggregate exposure to parabens in personal care products and toys

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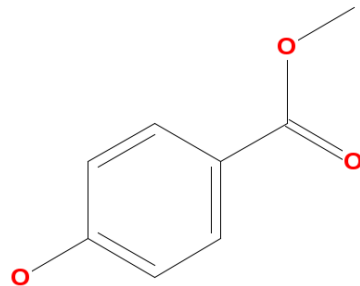
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- > Aim of the study
- > Approach
- > Discussion
- > Outlook

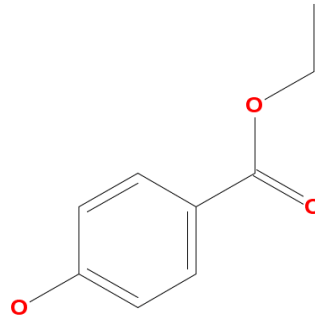


# Background

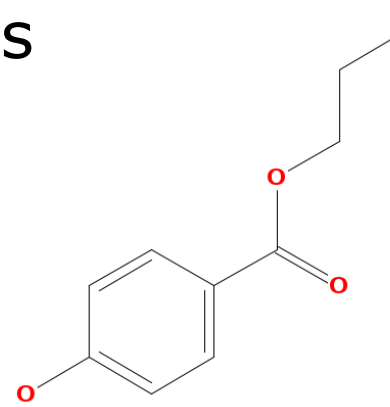
- > Preservatives
- > Personal care products and aqueous toys
- > Exposure possible via different products
- > Focus:



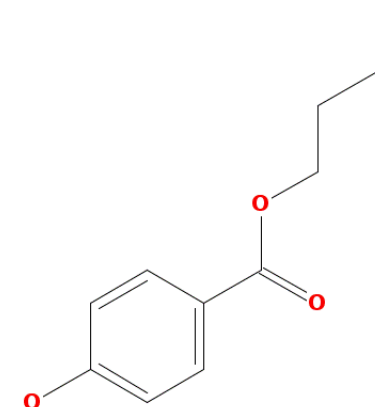
Methylparaben



Ethylparaben



Propylparaben

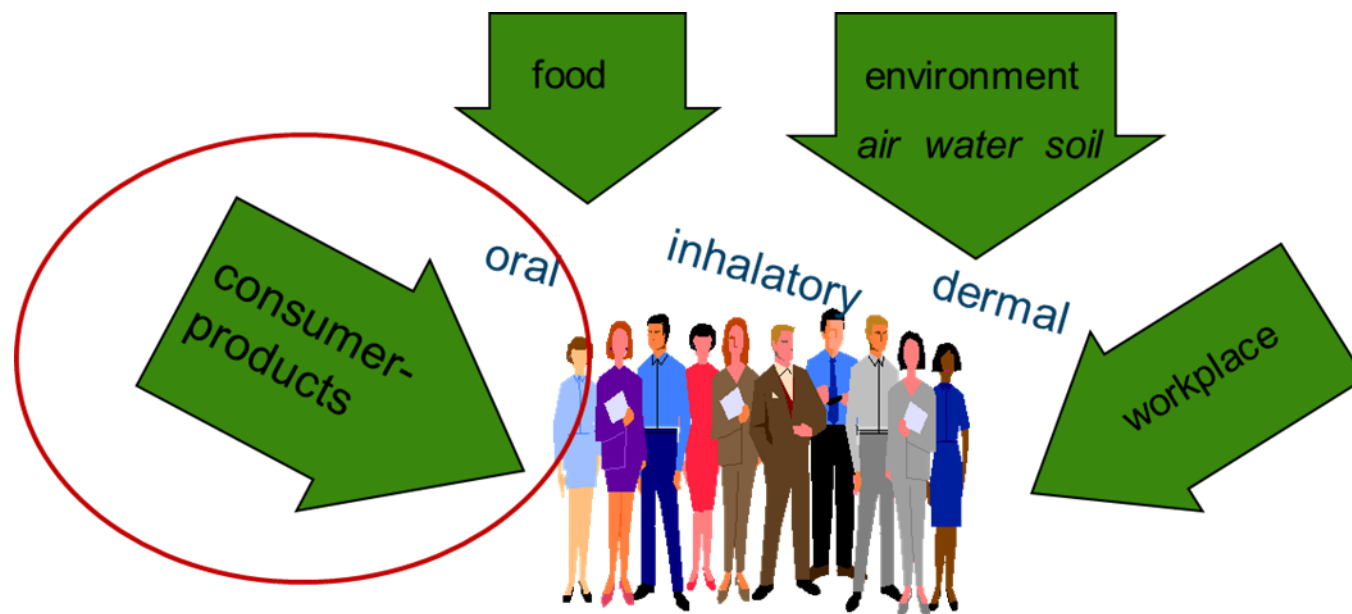


Butylparaben



# Aim of the study

Estimate the aggregate (internal) exposure to four parabens via various consumer products and multiple routes of exposure for both adults and children.





# Approach

- > Identification of relevant consumer products
- > Gathering concentration data of parabens in those products
- > Defining exposure scenarios
- > Exposure assessment with PACEM, ConsExpo and ad hoc methods

PACEMweb

**ConsExpo**  
consumer | exposure



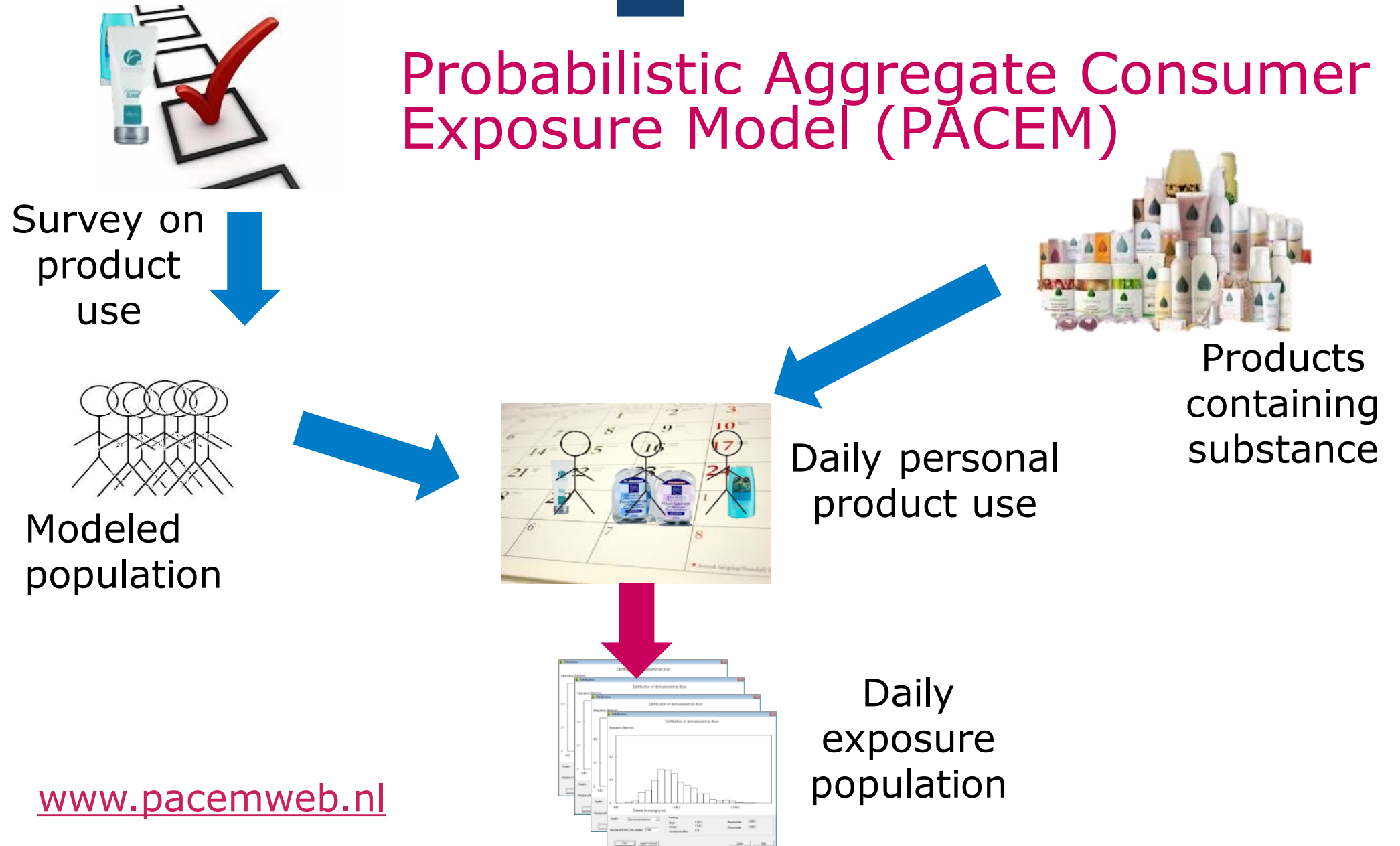
# Identify products and concentration data

- > Measurement data NVWA (Personal communication, 2021):
  - Personal care products (PCP) and toys (2015-2020; n=112)
  - Frequently used PCP (2018; n= 414)
  - Natural PCP (2020; n=65)
  - Toys (slime and putty) (2019; n=51)
- > Literature:
  - Van der Schyff et al., 2022 (n=52)
- > Exclusion criteria:
  - Measurements taken before 2015
  - Measurements outside Europe
  - Concentrations below 100 mg/kg





# Probabilistic Aggregate Consumer Exposure Model (PACEM)



[www.pacemweb.nl](http://www.pacemweb.nl)



# ConsExpo

- > Tool for safety assessment of chemicals in consumer products
- > Assess the exposure for:
  - Single product
  - Single substance
  - One population
  - Multiple exposure scenarios

[www.consexpoweb.nl](http://www.consexpoweb.nl)







# Exposure assessment

	<b>PCP</b>	<b>Body paint, face paint, facial mask, eye contour cream</b>	<b>Toys (slime/putty)</b>	<b>Toys (finger paint)</b>
<b>Adults</b>	PACEM	ConsExpo	-	-
<b>Children</b>	ConsExpo <sup>#</sup>	ConsExpo, if relevant for children	Other*	ConsExpo

# Shampoo, shower gel/foam/scrub, toothpaste

\* Calculated according to:

Dermal:  $E_d = ((A_{Fd} \times [N] \times t \times H_t \times H_{area})/BW) \times F$

Oral:  $E_o = ((A_{Fo} \times [N] \times I)/BW) \times F$



# Exposure assessment with PACEM (adults)

Product groups	n (occurrence (%))			
	MeP	EtP	PrP	BuP
Soaps*	446 (4.9)	441 (1.6)	442 (0.7)	441 (0.23)
Lotion & creams*	70 (63)	39 (26)	61 (51)	36 (22)
Hair styling*	5 (80)	3 (67)	3 (33)	-
Lipstick	5 (20)	-	6 (33)	-
Liquid foundation	4 (100)	-	3 (100)	-
Eye pencil	2 (100)	1 (100)	1 (100)	1 (100)
Eye shadow	5 (100)	2 (100)	5 (100)	1 (100)
Make up remover	2 (100)	2 (100)	2 (100)	-
Mascara	9 (78)	5 (20)	8 (63)	3 (33)
Toothpaste	7 (14)	-	-	-

\* Product were pooled based on assumed similar function of parabens in these products



# Exposure assessment with ConsExpo (adults and children)

Product groups	n (occurrence (%))			
	MeP	EtP	PrP	BuP
Body paint	1 (100)	-	1 (100)	-
Facial mask pack	7 (86)	3 (67)	5 (80)	3 (67)
Face paint	2 (100)	-	-	-
Eye contour cream	2 (100)	-	2 (100)	-
Shampoo	446 (4.9)	441 (1.6)	442 (0.68)	441 (0.23)
Shower gel/foam/scrub	446 (4.9)	441 (1.6)	442 (0.68)	441 (0.23)
Toothpaste	7 (14)	-	-	-
Finger paint	5 (60)	-	3 (33)	-



# Products estimated with ad hoc method

Children

- Putty
- Toy-slime



Dermal exposure:

$$E_d = \frac{AF_d \times [N] \times t \times H_t \times H_{area}}{BW} \times F$$

with:

$E_d$	dermal exposure (mg/kg bw/day)
$AF_d$	dermal absorption fraction (-)
$[N]$	concentration of substance (mg/kg)
$t$	exposure time (min/event)
$H_t$	skin adhesion rate (kg/min/cm <sup>2</sup> )
$H_{area}$	skin contact area (cm <sup>2</sup> )
$BW$	body weight (kg)
$F$	frequency (events/day)

Oral exposure:

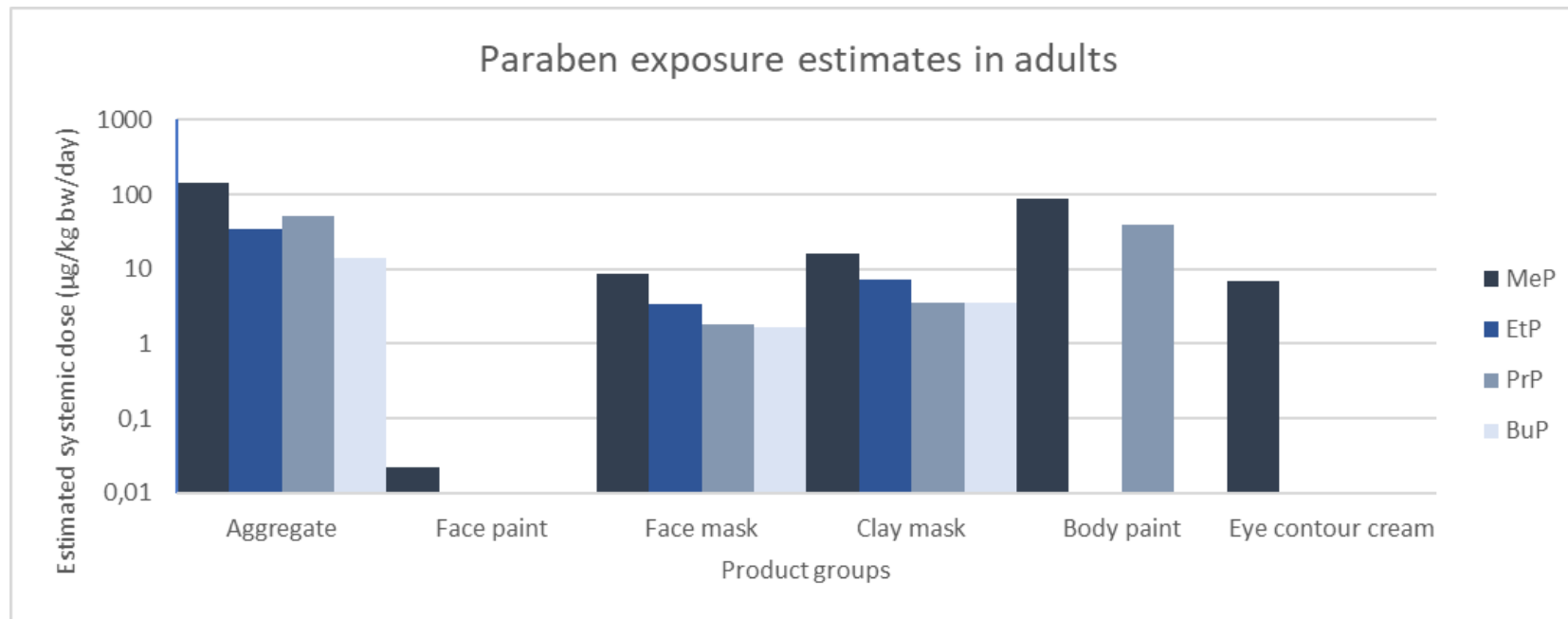
$$E_o = \frac{AF_o \times [N] \times I}{BW} \times F$$

with:

$E_o$	oral exposure (mg/kg bw/day)
$AF_o$	oral absorption fraction (-)
$[N]$	concentration of substance (mg/kg)
$I$	intake (kg/day)
$BW$	body weight (kg)
$F$	frequency (events/day)



# Result (adults)

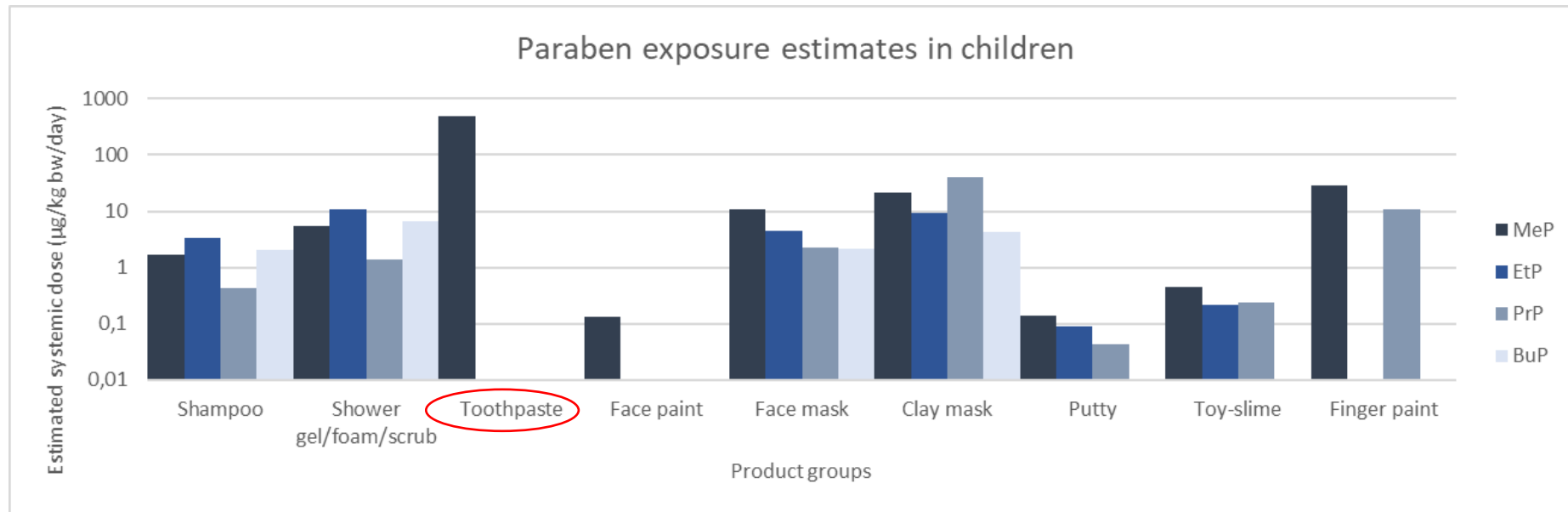


MeP > EtP, PrP and BuP

Visualization of the exposure estimations (95<sup>th</sup> percentiles) for adults expressed as total average systemic exposure ( $\mu\text{g}/\text{kg bw}/\text{day}$ ) via various product groups.



# Result (children)



Visualization of the exposure estimations (95<sup>th</sup> percentiles) for children expressed as total average systemic exposure ( $\mu\text{g}/\text{kg bw}/\text{day}$ ) via various product groups.



# Discussion

- > Adults
  - Aggregate exposure (PACEM):  $MeP > EtP, PrP$  and BuP
  - Single products (ConsExpo): Body paint highest exposure
  - Contribution of the single products is likely to have a relatively minor contribution to the aggregate exposure
- > Children
  - Toothpaste highest exposure
- > Comparison with literature
  - Lower exposure than previous estimations





# Discussion

## Uncertainty in input parameters

- > The occurrence and concentration of parabens in products
- > Exposure and absorption fraction
- > Frequency and amount of the product used
- > Cumulative exposure to multiple parabens



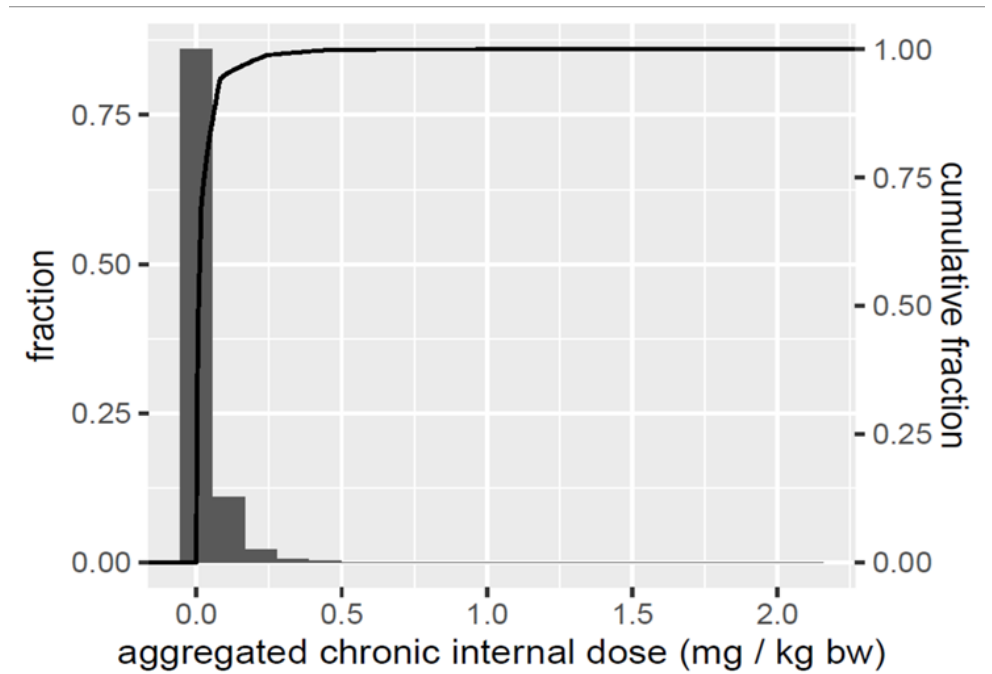
shampoo





# Next steps

- > Combine the output of different exposure models (PACEM/ConsExpo)
- > Survey on PCP use among children




*Distribution of the year averaged aggregated dermal dose in mg/kg bw per day for exposed women*



# Thank you for your attention!

[www.pacemweb.nl](http://www.pacemweb.nl)

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 National Institute for Public Health and the Environment  
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PACEMweb About ↗ Help ↗

## PACEMweb

### Assessment settings

<b>Product group</b> <input checked="" type="checkbox"/> Personal care <input type="checkbox"/> House hold	<b>Country</b> Country <input type="text" value="Select a country"/>
<b>Exposure metric</b> <input checked="" type="radio"/> Systemic dose <input type="radio"/> Dermal load	<b>Absorption fractions</b> Inhalation <input type="text" value="1"/> Dermal <input type="text" value="1"/> Oral <input type="text" value="1"/>