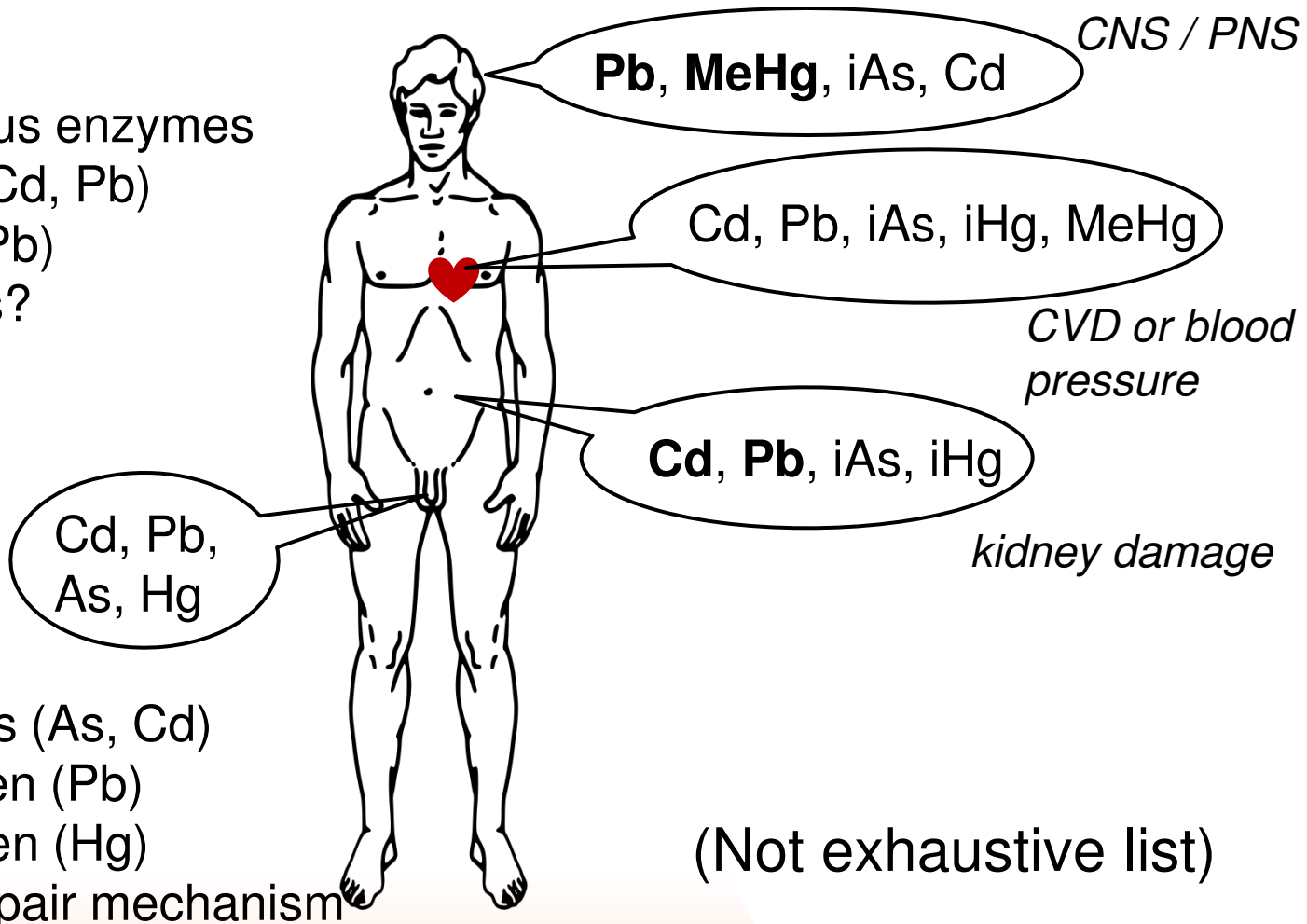
Cumulative risk assessment on the dietary exposure of Finnish children to heavy metals

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Effects of heavy metals

Oxidative stress
Function of various enzymes
Ca metabolism (Cd, Pb)
Fe metabolism (Pb)
Metallohormones?



Type I carcinogens (As, Cd)
Type IIA carcinogen (Pb)
Type IIB carcinogen (Hg)
Effects on DNA repair mechanism

(Not exhaustive list)

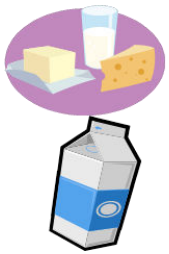
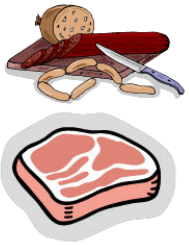
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Figure of man: Wikimedia Commons/OldakQuill (modified from NASA Pioneer picture)

Data used for exposure assessment

- Individual consumption data on 1Y, 3Y, 6Y Finnish children
  - Collected in national DIPP study
    http://dipp.utu.fi/index.php?mid=2&language=en
  - 3 days food diary

- Concentration data on the main food groups
  - Mainly Finnish monitoring data
  - Food produced in Finland or imported to Finland

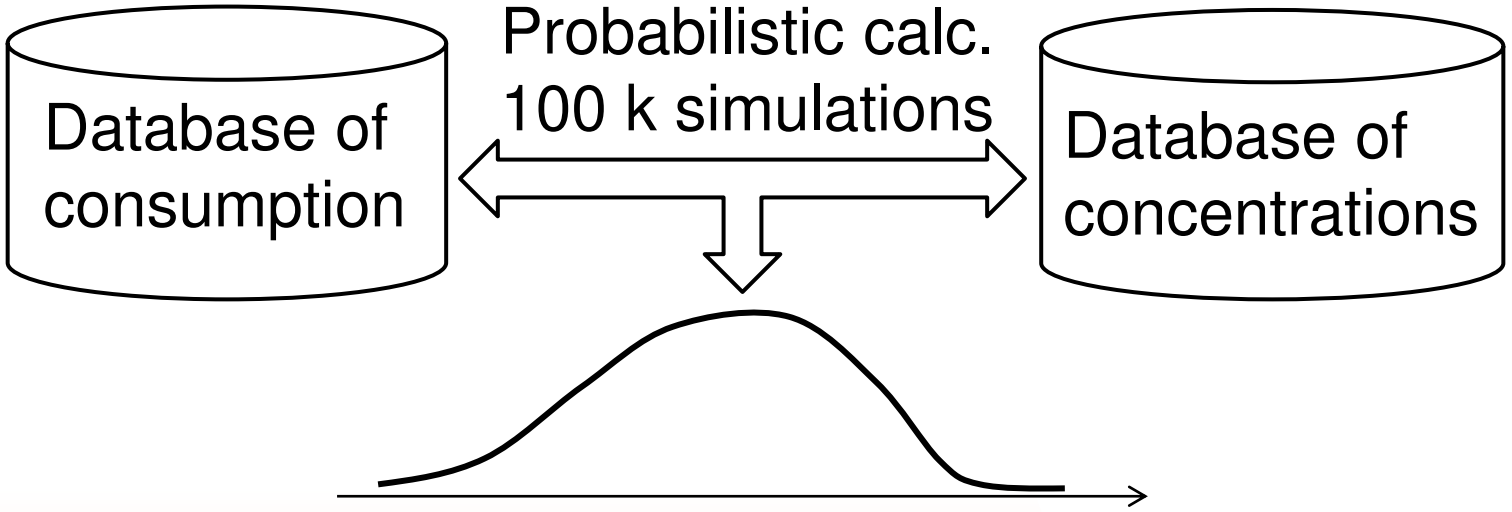



+ ready-made foods for children

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Exposure assessment

- MCRA (Monte Carlo Risk Assessment) https://mcra8.rivm.nl/
- Exposure of each age group (1Y, 3Y, 6Y) assessed separately
  - For each heavy metal
  - As well as cumulative exposure to all heavy metals



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EFSA assessments of exposure to heavy metals (one at a time)

Finnish results to be published this autumn!

Unit µg/kg body weight /day

Age group and level	i As	MeHg	i Hg	Cd	Pb
1–2 years, mean	0,7	0,04	0,2	0,7	1,3
1–2 years, P95	1,4	0,2 / 0,7*	0,2	0,9	1,7
3–10 years, mean	0,5	0,05	0,1	0,6	1,0
3–10 years, P95	0,8	0,2 / 0,6*	0,2	0,9	1,6
Adults, mean	0,2	0,03	0,06	0,3	0,5
Adults, P95	0,4	0,2 / 0,3*	0,1	0,5	0,8
EFSA assessment year	2014	2012	2012	2012	2012
TDI or BMDL	0,3 – 8 3 (2 – 7)	**0,19**	**0,57**	**0,36**	0,5

Values are EU member state median values (middle bound)
(* consumers only

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From exposure to single compounds to cumulative risk

Synergism?
Antagonism?

- Assumed additive (1+1=2) effect on:
  - Nervous system damage (Pb, MeHg, iAs, Cd)
  - Kidney damage (Cd, Pb, iAs, iHg)
- Literature data on dose-response
- Cumulative effect:
  - A*Cd + B*Pb + C*iAs + D*Hg (iHg or MeHg)
  - Factors A to D may be very different depending on toxicity of chemical to this tissue
- Consumption * cumulative concentration (on MCRA)
- Compare: CRA on pesticides
  - TEF's for each compound → Total risk for mixture

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Cumulative risk of heavy metals

- Cumulative risk with neurotoxic endpoint
  - Dose-response values Pb < MeHg < Cd < iAs
  - Total cumulative exposure mainly from Pb
  - Contribution of Cd 16 – 21% and of iAs 6 – 8%
  - Contribution of MeHg 1 – 3% for age group median, for high users contribution of MeHg increases

- For kidney damage endpoint, dose-response values varied more. Main contributor to total cumulative exposure was Cd.



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Cumulative risk of heavy metals: problems

- Toxicological data on chosen endpoints from literature
  PROBLEM: lack of comparable quantitative data
  → e.g. level of enzyme in urine vs. kidney weight change
  → source of error in the estimation

- More toxicological research needed to confirm results!



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- Finnish Environment Institute
- Natural Resources Institute Finland
- Ministry of Agriculture and Forestry
- National Institute for Health and Welfare

Risk assessment report on the project to be published in September/October 2015 (www.evira.fi)
- Finnish, with extended English summary

Thank you for your kind attention!



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