science and policy
for a healthy future

HBM4EU project

Concepts and principles of HBM

Paul T.J. Scheepers PhD

1st HBM4EU Training School 2018

1. Concepts and principles

Definition

Types of biomarkers

Applications of HBM data

2. HBM in practice - merits

3. HBM in practice - limitations

Definition of human biomonitoring (HBM)

Measurement of concentrations of chemicals or their metabolites in human body fluids and tissues, mainly in blood, urine, and serum, but also in saliva, breast milk, sweat, faeces, hair, teeth, and nails

Source: HBM4EU project proposal

Biomarkers of exposure

Biomarkers of exposure identify and measure chemical residues in tissues or body fluids, metabolites of xenobiotic compounds, or physiological outcomes that occur as a result of exposure

Source: HBM4EU project proposal

Biomarkers of susceptibility

Biomarkers of susceptibility reflect the intrinsic characteristics of an organism that make it more susceptible to the adverse effects of an exposure to a specific chemical substance

Source: HBM4EU project proposal

Biomarkers for research and discovery

During the last decade a combination of advanced techniques clustered under the name “omics” has offered new opportunities for enhanced understanding of the exposure-response continuum and deregulations in physiological networks, rather than single biomarkers in health risk assessment.

Omics are high throughput techniques that permit the observation and measurement of response modulation at different biological scales (e.g. [epi]genome, transcriptome, proteome, metabolome) in humans

Source: HBM4EU project proposal

Applications of HBM data

[…] reflect internal exposure to the chemical of interest

[…] important tool in epidemiology and health sciences

[…] HBM data can improve chemical risk assessment, through a methodology based on robust and realistic human internal exposure data

Source: HBM4EU project proposal

Biomarkers integrate of exposure over

time

Hours, days, months, years, depending on the biomarker

routes

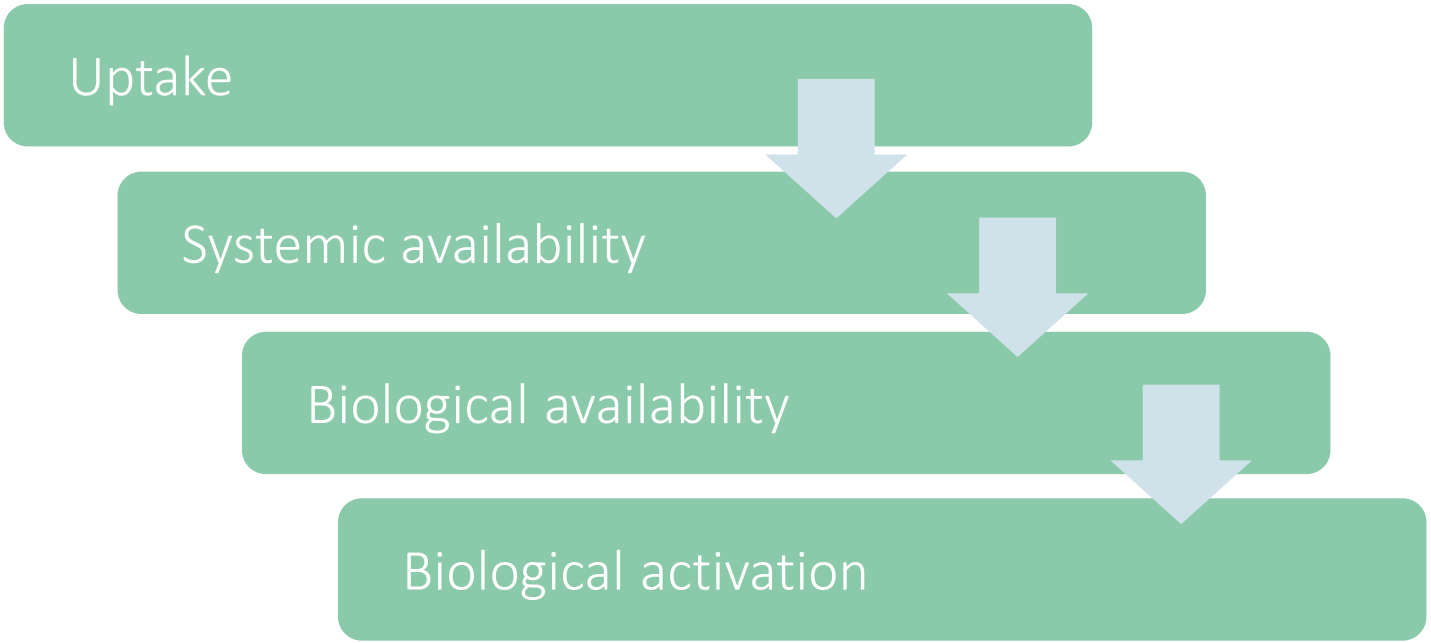
Oral, skin or inhalation

sources

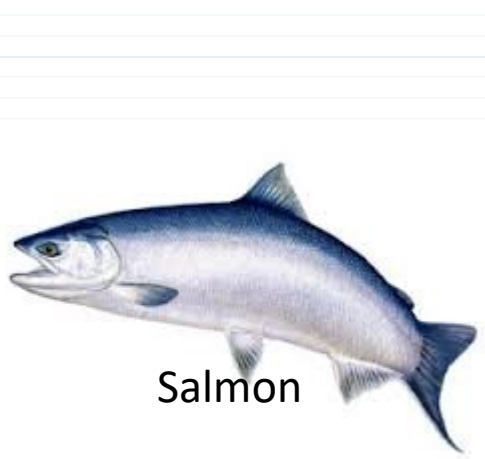
Diet, home, work environment, outdoor air pollution

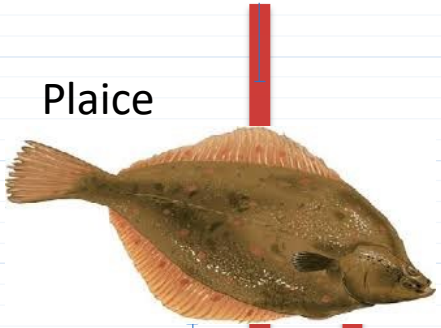
HBM in practice merits

Compared to environmental monitoring



HBM in practicen – limitations





µg As/mMol creatinine

90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0

	Salmon					Schol (plaice)						Burgers/eggs			
Before exposure (As/Creatinine)	0,001	0,002	0,001	0,001	0,001	0,001	0,001	0,001	0,001	0,002	0,001	0,001	0,001	0,001	0,001
After exposure (18h)	0,006	0,008	0,004	0,005	0,002	0,007	0,045	0,020	0,034	0,095	0,072	0,038	0,002	0,001	0,001
After exposure (midnight)	0,008	0,004	0,004	0,004	0,002	0,003	0,026	0,043	0,059	0,037	0,056	0,017	0,001	0,001	0,003

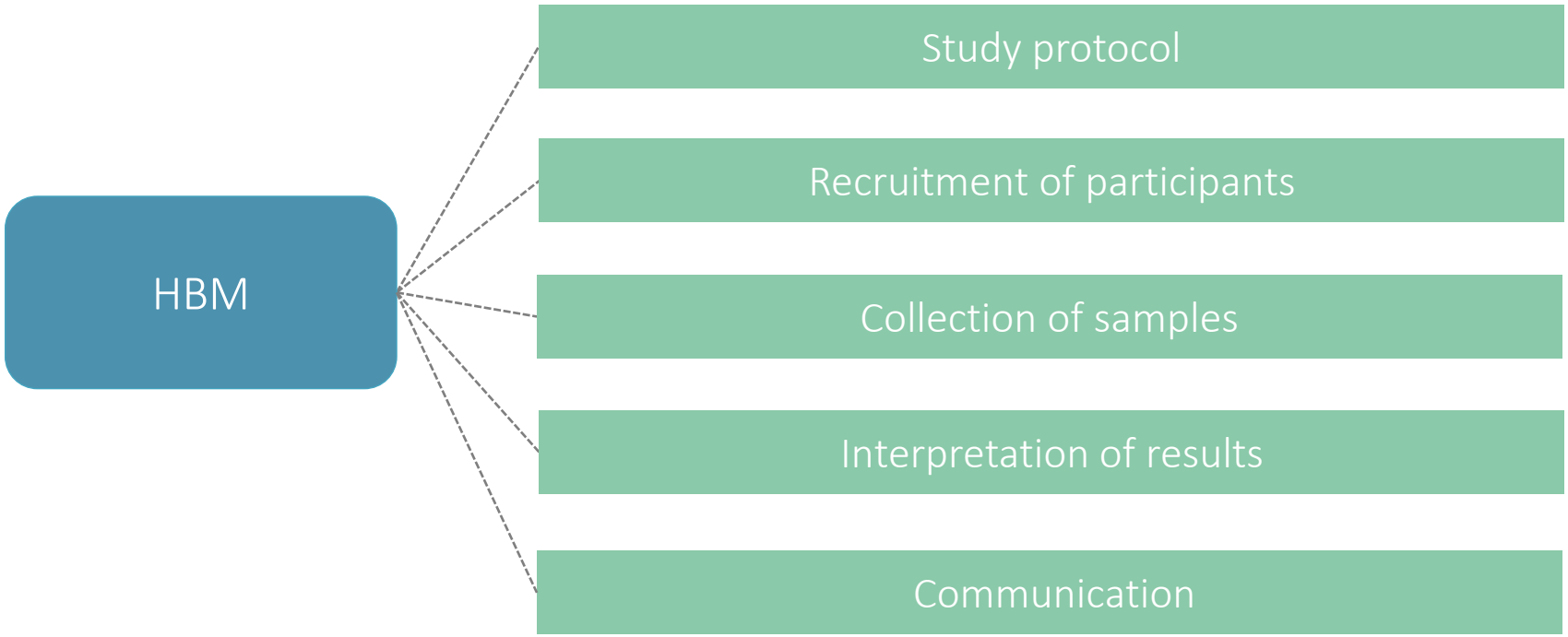
HBM in practice - limitations

HBM data by themselves do not contain information on

- Exact time or duration of exposure
- Source of exposure
- Route of uptake

For interpretation you often need contextual data (e.g. retrieved by questionnaire) and/or additional modelling (e.g. PBPK modelling)

HBM is more than the analysis of biomarkers …



Take home

Biomarkers can be classified for exposure, susceptibility and for research and discovery.

Depending on the choice of a biomarker, HBM often integrates information on bioavailability and bioactivation over time and are suitable to study aggregate exposure.

Radboudumc
university medical center

Contacts

paul.scheepers@radboudumc.nl

HBM4EUtraining.hev@radboudumc.nl

Speaker's information

Paul T.J. Scheepers PhD works as associate professor at the Radboudumc, Nijmegen, The Netherlands. He received training in toxicology and occupational hygiene. In HBM4EU he is responsible for training activities as task leader in WP2. He is a member of the ethics board in WP1.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 733032.