Public Health England

Protecting and improving the nation's health

Human Biomonitoring (HBM) considerations for human health

Ovnair Sepai

Biomonitoring – human and environmental perspectives

Why are you here?

Google Human Biomonitoring
1,650,00 results (0.33 seconds)

Human Biomonitoring — COPHES
www.eu-hbm.info › COPHES
Human Biomonitoring (HBM) is a scientific technique that allows us to assess ... fat, and bone), biomonitoring can provide valuable information on environmental ...

Human biomonitoring | Umweltbundesamt
www.umweltbundesamt.de/en/topics/health/assessing...risks/human-biomonitoring
5 Feb 2016 - **Human biomonitoring** (HBM) is a tool of health-related environmental monitoring with which populations are examined for their exposure to pollutants from the environment. ... **Human biomonitoring** (HBM) is a tool of health-related environmental monitoring. ... **Human biomonitoring** plays an ...

[PDF]
Human biomonitoring: facts and figures - WHO/Europe - World Health ...
www.euro.who.int/__data/assets/pdf.../Human-biomonitoring-facts-figures-en.pdf
This report summarizes the available **human biomonitoring** (HBM) data in the ... and rational approach to **human biomonitoring** as a complementary tool to assist.

The role of human biomonitoring in assessing and managing chemical ...
https://www.eea.europa.eu/themes/human/human-biomonitoring/introduction
Human biomonitoring allows us to measure our exposure to chemicals by measuring either the substances themselves, their metabolites or markers of ...

HBM4EU - science and policy for a healthy future
https://www.hbm4eu.eu/
COORDINATING AND ADVANCING **HUMAN BIOMONITORING** IN EUROPE TO PROVIDE EVIDENCE FOR CHEMICAL POLICY MAKING ...

Higher or lower?

Environmental biomonitoring
2,230,000 results (0.47 seconds)

Biomonitoring
2,260,000 results (0.47 seconds)

Biomarker
36,500,000 (0.42 seconds)

Novel Biomarkers
22,200,000 (0.32 seconds)

Source: intheskies / Fotolia.com

Overview

- **Human biomonitoring**
- **Past UK Experience/ Studies some data.**

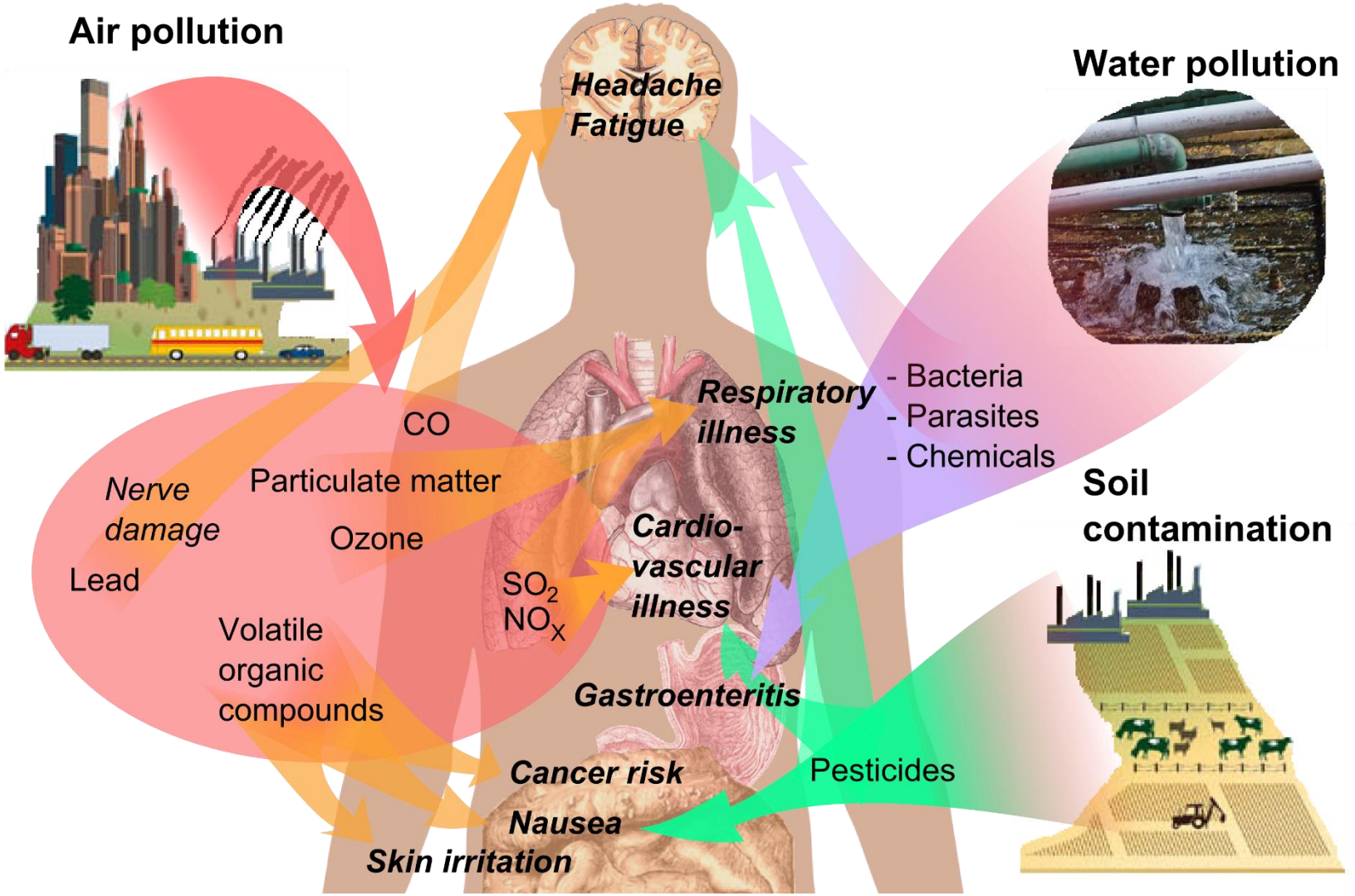
- **Current Work - HBM4EU - brief overview of objectives and policy relevance (will discuss how the UK National activities are linked and enhanced by HBM4EU)**

- **Future Vision** **Link HBM to Health Examination Survey**
  The UK 25 Year Environment Plan
  The Chief Medical Officers reference to HBM

- **Challenges in HBM for Human Health Risk assessment – what is needed to overcome these obstacles.**

➢ **Discuss - Link or integration of human health and ecological risks and strategies to evaluate these risks**

Health effects of pollution



Häggström, Mikael (2014).

The Continuum….

Exposure Guidance Values
TDIs, ADIs, MoE, BMD

Biomarkers

Lifestyle,
Occupation,
Environment

Internal Dose → Effective Dose → Early Biological Effects → Altered Structure & Function

Disease,
Birth Outcomes,

Individual Susceptibility

Consortium to Perform Human Biomonitoring on a European scale

Reference Values or background exposures

Used to compare XYZ to ABC

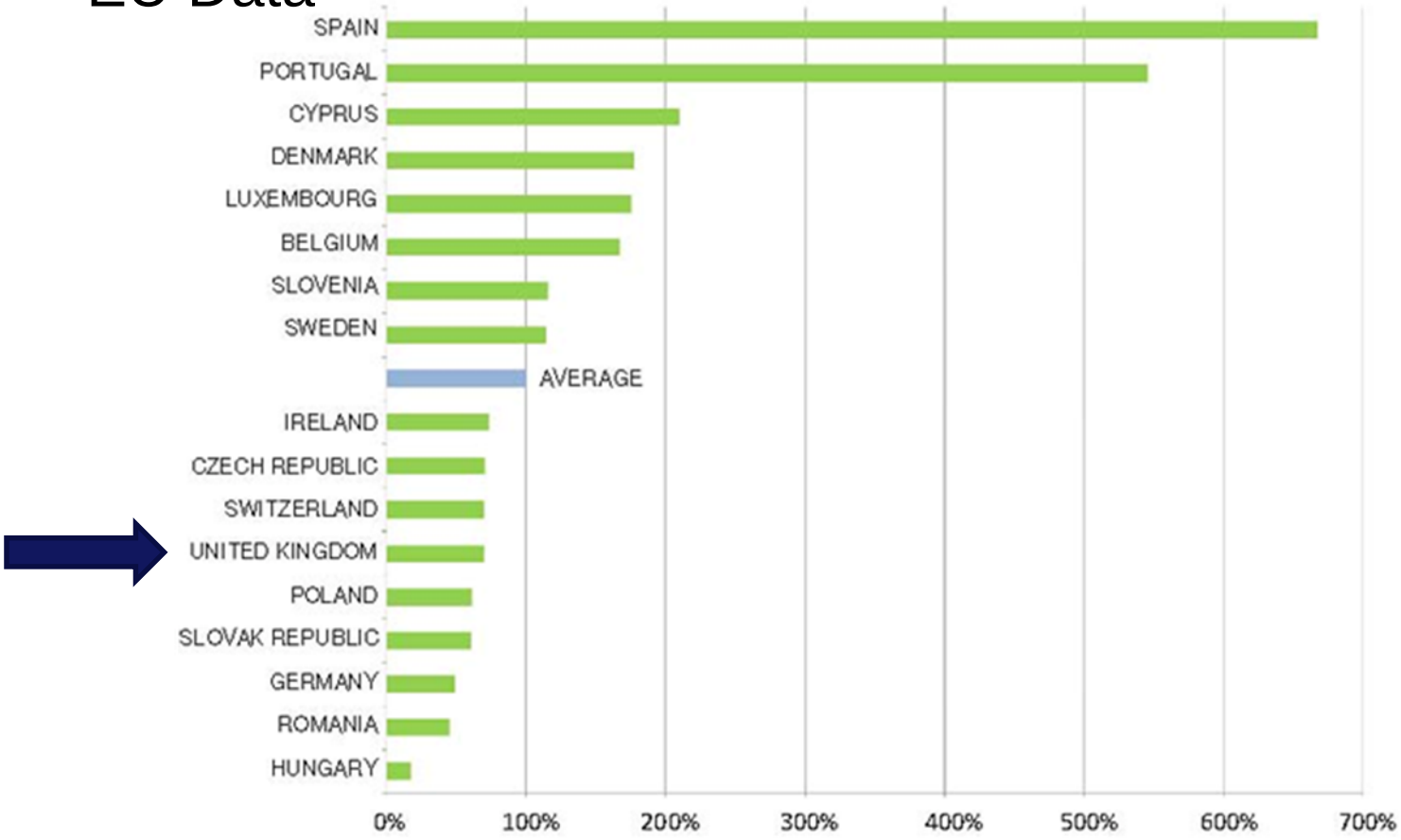
For HBM these are population based statistical values

95th %ile

>1800 mother child pairs, 17 European Countries
Harmonised protocols across Europe – to allow Comparison and quality control

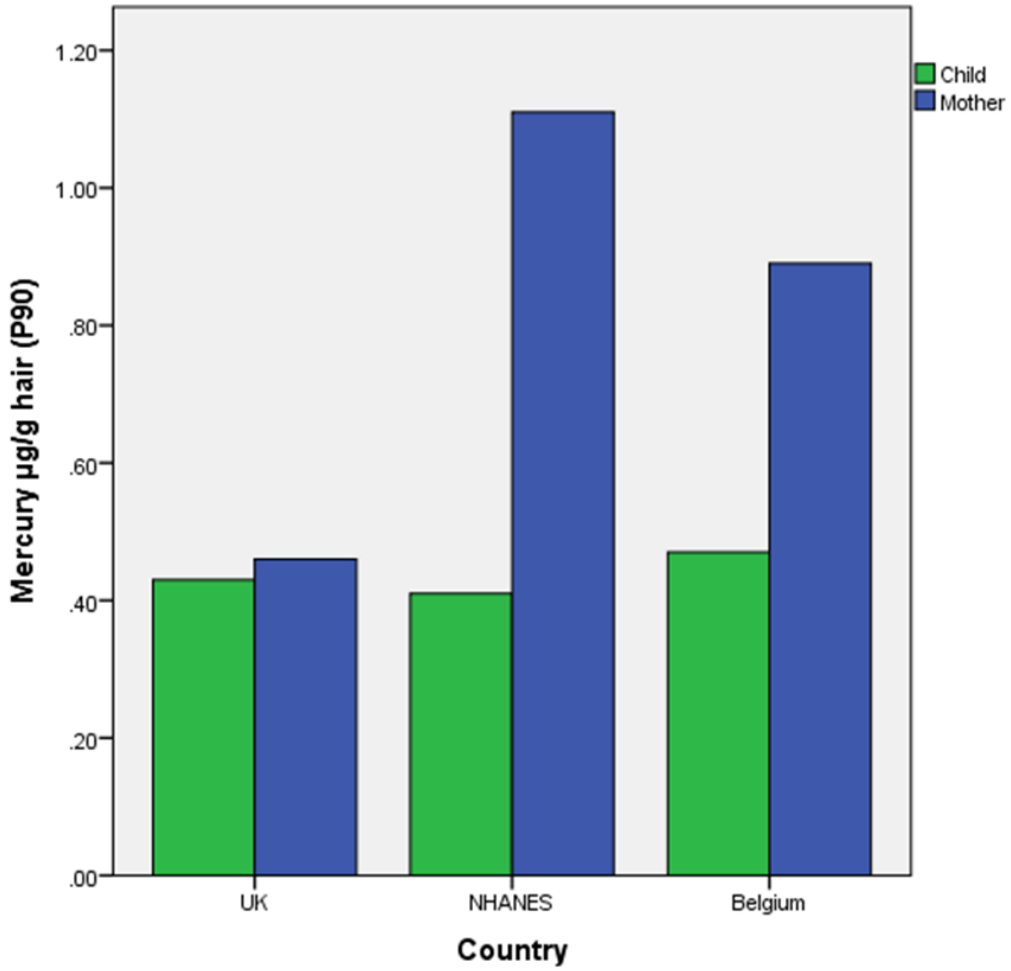
Mercury in hair

EU Data



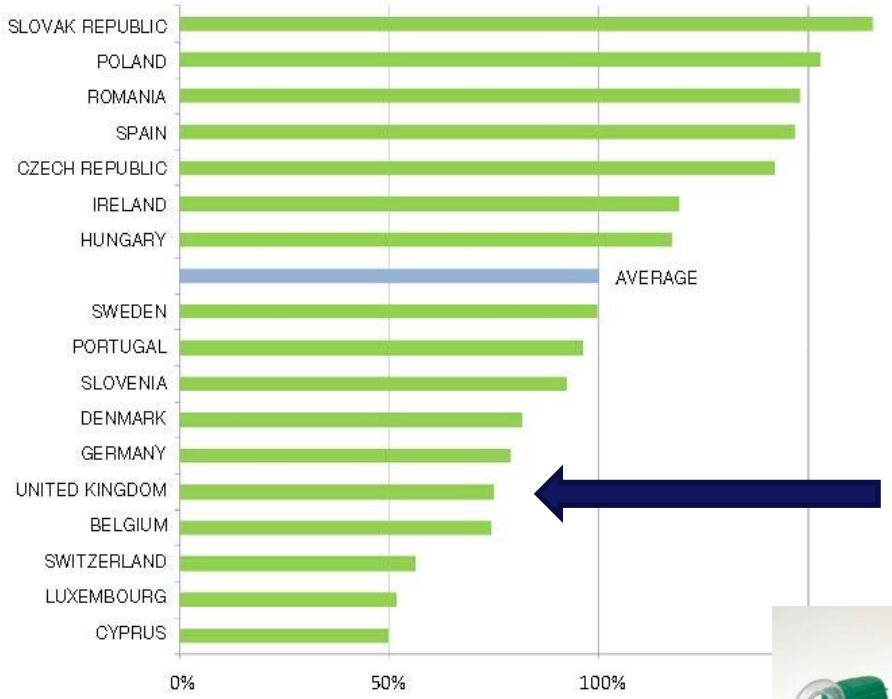
FOOD

Mercury in Hair: UK Data



Urinary phthalate metabolites

Phthalate metabolites – most are higher in children than mothers



Sum of DEHP (Bis(2-ethylhexyl) phthalate) metabolites in urine of children, % of the DEMOCOPHES countries average, adjusted for urinary creatinine, age and gender

CONSUMER PRODUCTS

Public Health England

HBM and REACH

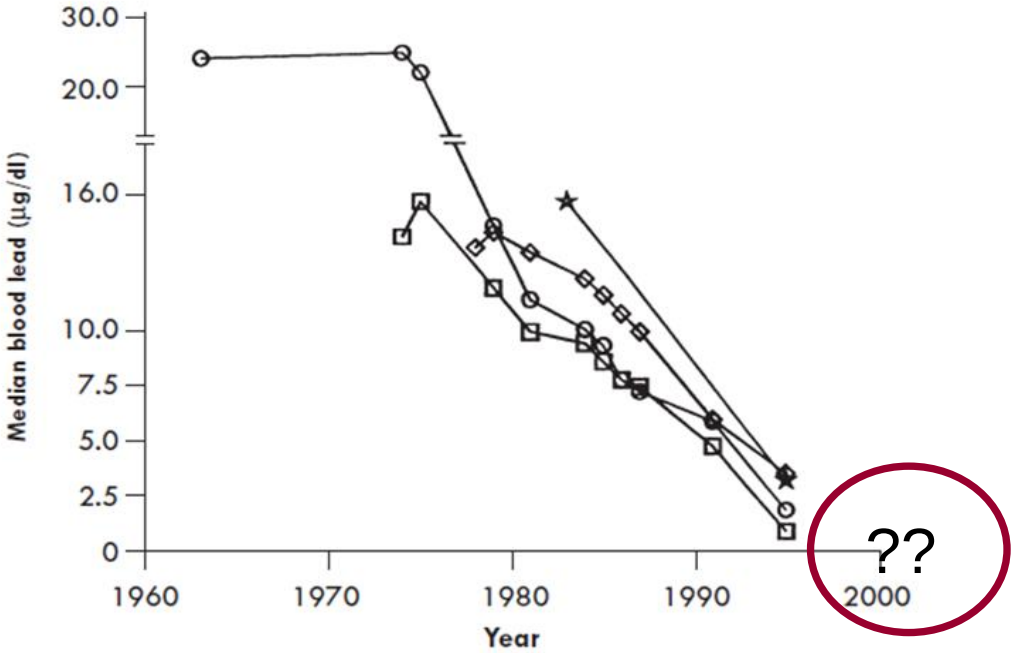
- Biomonitoring data provides valuable information for exposure assessment in REACH
- DEHP data generated by COPHES/DEMOCOPHES were used in REACH evaluations.
- HBM data from DEMOCOPHES provided an understanding of actual exposure – not modelled or derived.

DEMOCOPHES

♄ Lead

Time trends -

Figure 2.3.1 Biological monitoring of environmental lead in UK: changes in median blood lead levels 1964–1995



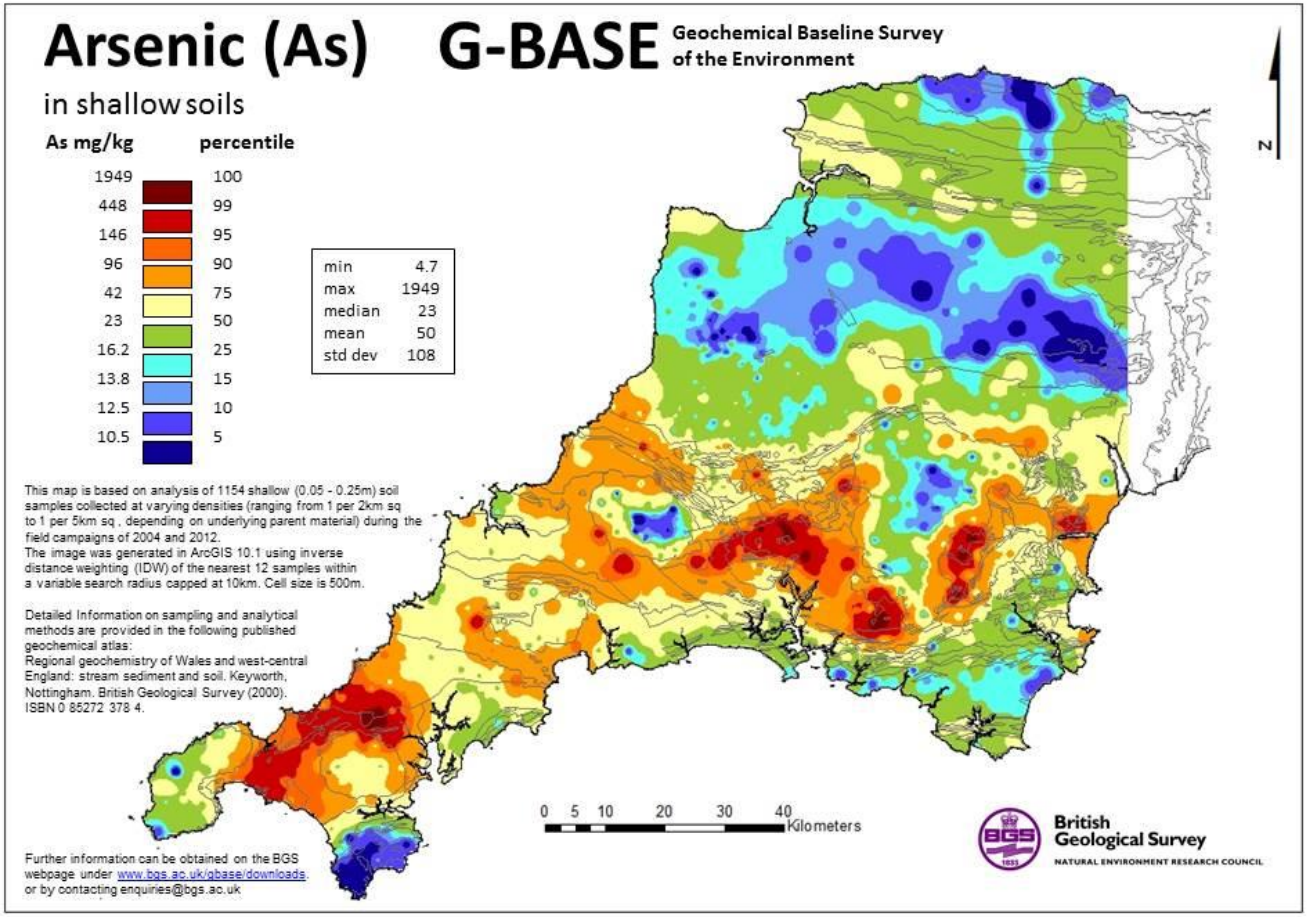
AIR

Children, ○ <16years; ★ <3 years; □ Adult females; ◇ Adult males

All analyses conducted by Great Ormond Street Hospital (1964–78) and Southampton General Hospital (1979–95). From Moncrieff *et al.* (1964); Elwood *et al.* (1977); Pocock *et al.* (1983); DoE (1981, 1983); Harvey *et al.* (1984); DoE (1990); Delves *et al.* (1996); and from the ALSPAC study (*Blood Lead Levels at Two and a Half Years,* Report to the DoE) and a study at a contaminated land site at Portsmouth, 1991

Hot Spot Assessment

British Geological Survey

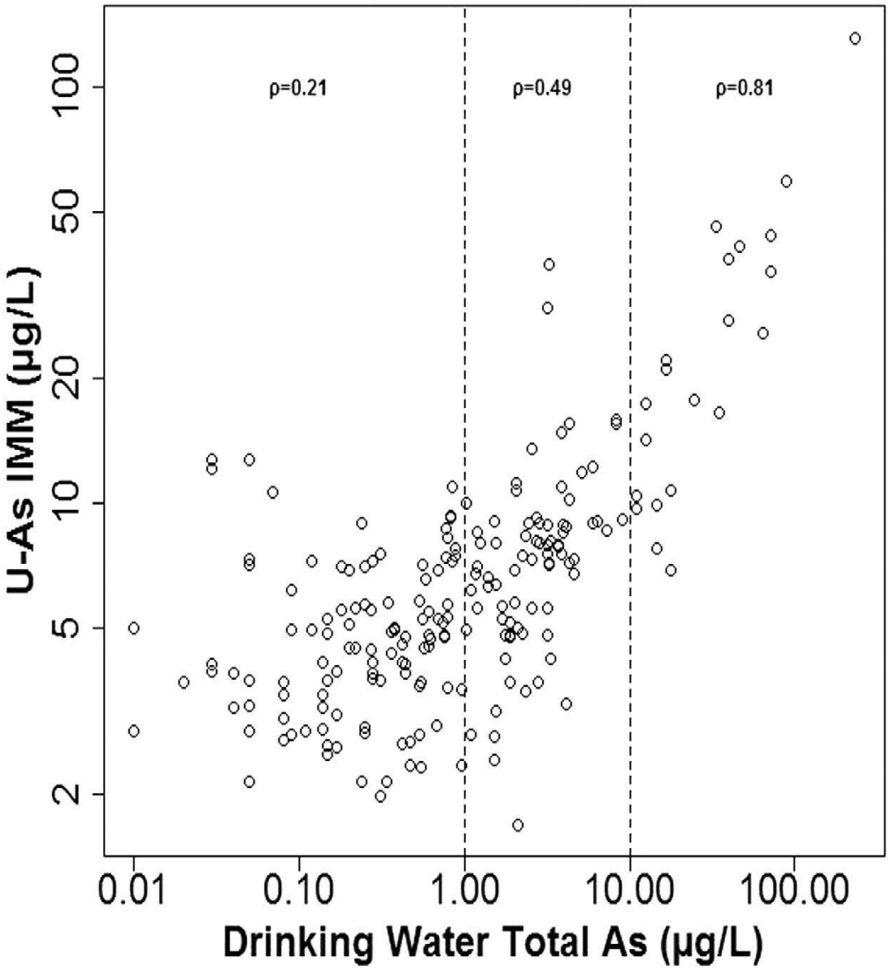


HBM Reference Value
for As UK 15.8 ug/L
(Leese et al 2014)

IMM- Inorganic plus
organic methylated metabolites

Arithmetic Mean of 9 ug/L
Range 0.9 -124 ug/L

WATER



D.R.S. Middleton 2016

The Continuum….

Exposure Guidance Values
TDIs, ADIs, MoE, BMD

Lifestyle,
Occupation,
Environment

Internal Dose

Effective Dose

Biomarkers

Early Biological Effects

Altered Structure & Function

Disease,
Birth Outcomes,

Individual Susceptibility

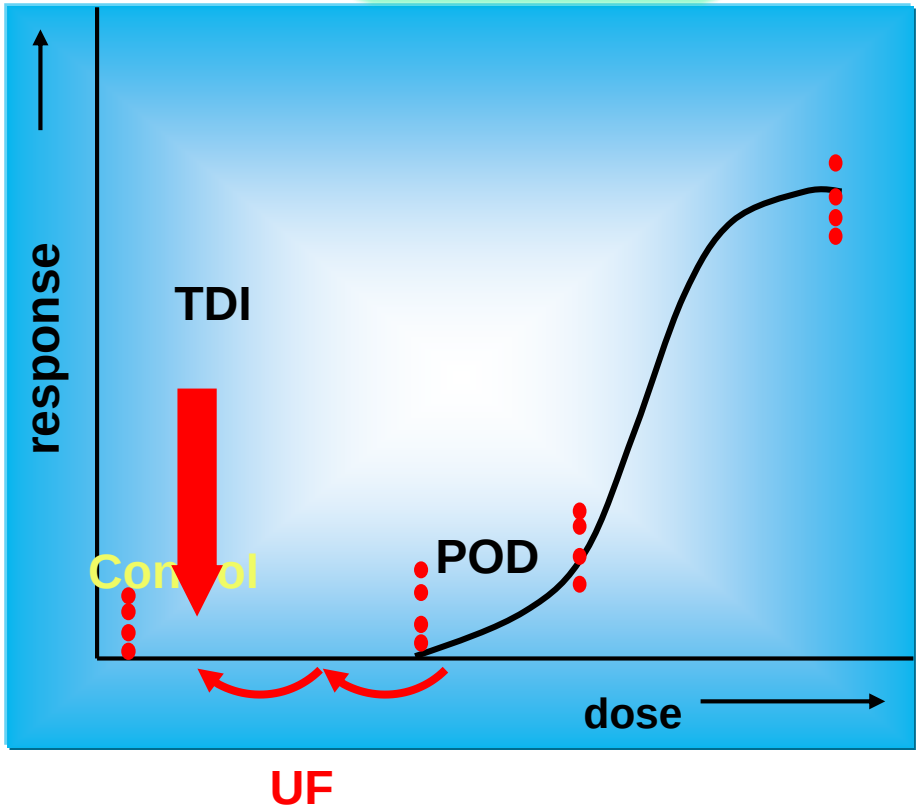
HHRA: TDIs or ADIs

$$TDI = \frac{PoD}{UF}$$

Animal Studies
High dose
Generic Response

Derive a TDI
Values based on
Environmental exposure

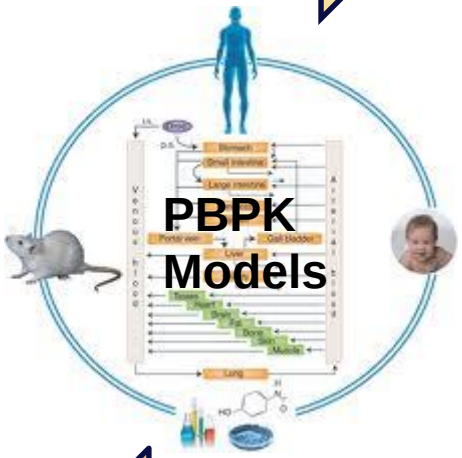
Exposure Assessment
Compare to the TDI



HBM and Risk Assessment

Forward Dosimetry

Exposure
Sources, routes, duration, frequency intensity



Biomarker
Chemicals in blood, urine, hair etc

Reverse Dosimetry

Integration of test methods with biomarker discovery

Public Health England

CHALLENGES

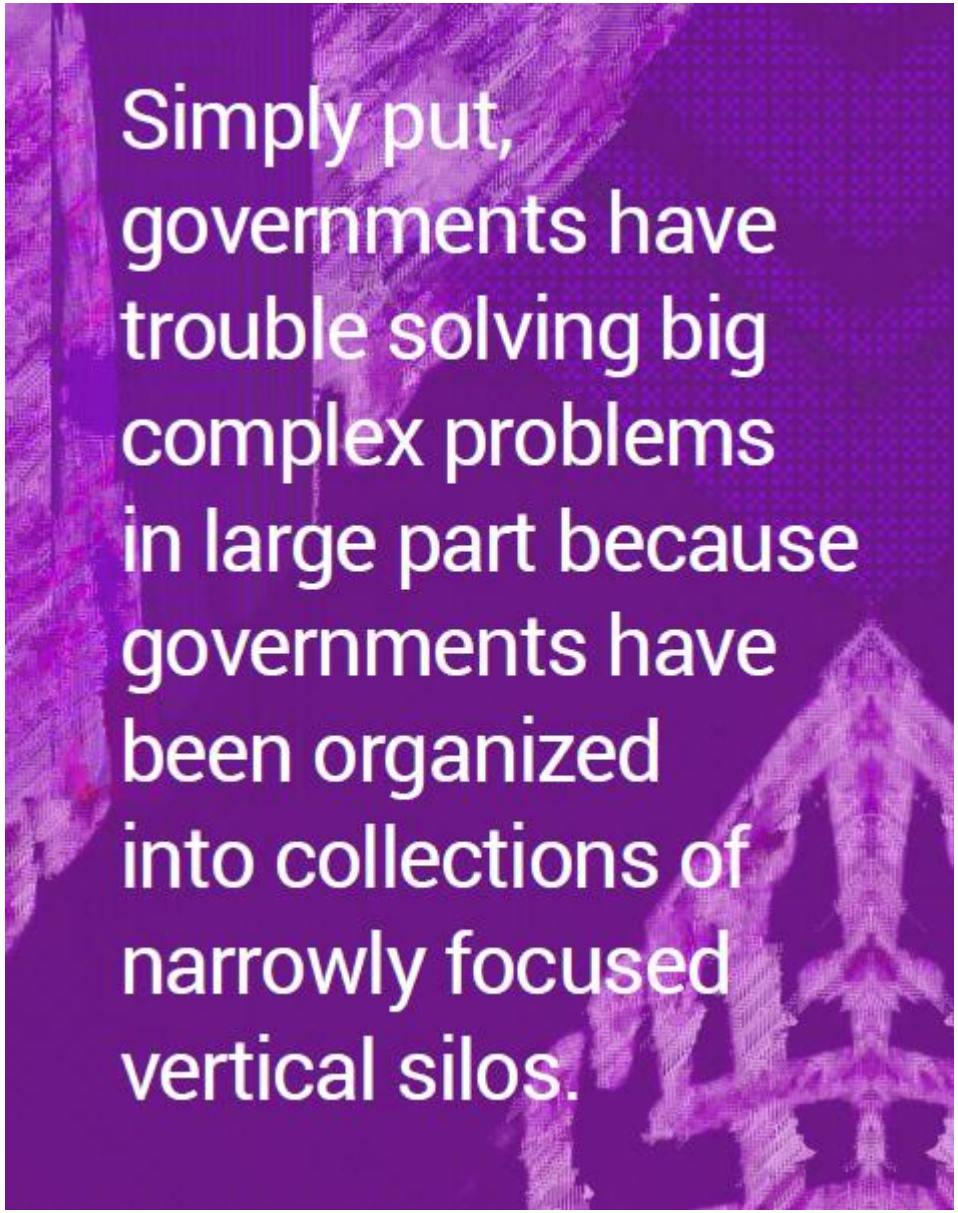
1. Use environmental metrics to determine human risk
2. Extrapolation from animal models – PBPK models
3. Chemical testing and biomarker development
4. Mixtures!!! A challenge for HHRA and ERA
5. Biomarkers as predictors of risk

Abandoning Silos

How innovative governments are collaborating horizontally to solve complex problems, published on Dec 11 by the Mowat Centre, in Toronto

focuses on **case studies from the UK,** Estonia, and New Zealand.

Governments in these countries, it says, have all introduced initiatives that are succeeding in **creatively** tackling complex issues.



(https://mowatcentre.ca/)

UK and HBM….

Public servants do not need another report aimed at convincing them that horizontal problem-solving is good; what we need are case studies that describe how to do it effectively.

Many public sector organizations were designed in and for the industrial age and are functioning less well now that the digital age has dawned.

Today – we are in a room which has overcome silos….

Public Health England

HBM and Risk Assessment

Diet and Nutrition Data	PHE, FSA
Soil contamination data	Local Authorities, BGS
Water Quality Data	DWI, Water Companies
Air Quality Data	EA, LA

We do not have a gauge of actual Human exposure and uptake,
Do we know more about sentinel species?

HBM in Risk Assessment/ Management

European Union's 7th Environmental Action Programme sets the goal of assessing and minimising risks to the environment and health associated with the use of hazardous substances by 2020.

HBM4EU

science and policy
for a healthy future

UK National Hub

PHE, Defra, EA, FSA, HSE/L
IOM, UniBrun, HSL, and BGS- UKRI

Public Health England

Health Survey for England

Monitors trends in the nations health ad care
Adult s- 16 and above
Children 0 -15

Interviews and Nurse visits

Ca. 8000 adults and 1200 children

2017 Report
Cardiovascular Disease
Diabetes
Alcohol and tobacco consumption

25 Year Environment Plan –Defra Consultation

GOAL 10. Changes in exposure to people and wildlife to harmful chemicals

Goal: Managing exposure to chemicals

Questions: Are emissions of harmful chemicals to the environment decreasing? Is the exposure of wildlife on land, in freshwater environments and at sea to harmful chemicals decreasing? **Is exposure to harmful chemicals decreasing in man?** Are wildlife populations affected by harmful chemicals?

Indictors

1) Mercury and POPs to air and water.
2) Pesticides, in terrestrial, marine and freshwater environments.
3) Measure of the consequences and effects for wildlife **(and humans)** of changes in chemical concentrations in the environment.

DEADLINE FOR COMMENT 25TH JANUARY

Public Health England

Annual Report of the Chief Medical Officer 2017

Health Impacts of All Pollution – what do we know?

Bring political, policy and health system attention to pollution as a threat to the public's health

https://www.gov.uk/government/publications/chief-medical-officer-annual-report-2017-health-impacts-of-all-pollution-what-do-we-know

Public Health England

CMO Report 2017: Chapter 3

21st century chemicals

Chapter 3

Authors

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Recommendation 20

I (CMO) recommend Public Health England explore the creation of an English health

bio-monitoring data set, which includes human exposure to pollutant and health outcomes, and report publicly on their findings.

Recommendation 2

I (CMO) recommend that the UK Government fulfils its promise to publish a chemicals strategy, and that this strategy takes full account of the human health impacts of chemicals, including chemical mixtures.

Tobacco Smoke

Exposure

nicotine, cotinine, exhaled CO, PAHs and their metabolites

potential changes in gene expression, chromosomal aberrations

metabolic phenotypes, extensive study of genetic polymorphism in smoking related cancer risk

Internal Dose → Effective Dose → Early Biological Effects → Altered Structure & Function

carcinogen
DNA adducts

Disease,
Birth Outcomes,

Individual Susceptibility

And yet – we can not as yet use BIOMARKERS to predict clinical outcome/ risk.

Summary

- Determine reference or background levels
- Determine trends in exposure
- Assess exposure in hot-spots
- Exposure assessment in chemical management /regulation. REACH
- 25YEP, CMO/Gov.uk Support for HBM
- HBM data in Human Health Risk Assessment (HHRA)
- Future of HBM in Public Health Risk Assessment

Acknowledgements:-

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EA
HSE
FSA
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UniBrunel.

PHE Colleagues
Lorrain Stewart
Dorothy Ubong
David J Roberts
Tony Fletcher
Karen Exley
Helen Crabbe

HBM4EU

COPHES
Consortium to Perform Human Biomonitoring on a European Scale

DEMOCOPHES
Demonstration of a study to coordinate and perform human biomonitoring on a European Scale

Project no: 244237 COPHES ; Project runs from 1 Dec 2009 until 30 Nov 2012
Project : LIFE09/ENV/BE/000410 DEMOCOPHES; Project runs from 1 Sept 2010 until 30 Nov 2012

Public Health England

Key Messages

- HBM is a powerful tool in HHRA
- Can be used to develop and monitor policy/ risk management
- Toxicokinetic models: convert external guidance values to internal biomarker conc. And vice versa
- Need environmental assessment to determine source of exposure

Questions

- Can HBM and E – BM be better integrated to support chemical regulation and management
- Can sentinel species be integrated into Human exposure assessments?
- What are the scientific needs for the future of integrated risk assessment?
- The future of IGHRC…..

- NOT NOVEL QUESTIONS