



UNITED NATIONS
ENVIRONMENT PROGRAMME

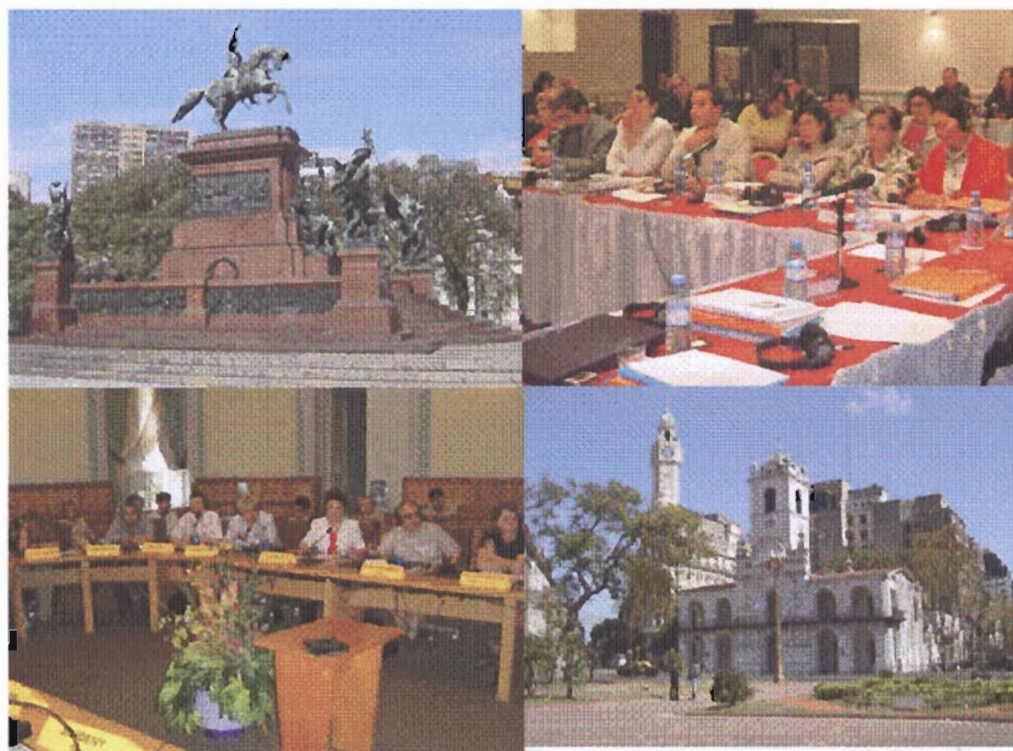
CHEMICALS



REGIONAL AWARENESS-RAISING
WORKSHOP ON MERCURY POLLUTION

A global problem that needs to be addressed

Buenos Aires, Argentina,
13 – 16 September 2004



IOMC

INTER-ORGANIZATION PROGRAMME FOR THE SOUND MANAGEMENT OF CHEMICALS

A cooperative agreement among UNEP, ILO, FAO, WHO, UNIDO, UNITAR and OECD

Overview of approaches that can be used to assess exposures and risks for a population,
by *Roberto Lucchini, resource person*

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Approaches for Assessing Population Exposures

**Mercury Awareness Raising Workshop
Buenos Aires, Argentina
September 13-16, 2004**

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Compartments used for Hg exposure biomarkers

- Blood (plasma, serum, erythrocytes)
- Hair
- Urine
- Saliva
- Sweat
- Nails
- Skin
- Exhaled air
- Biopsy

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Outline for presentation

Exposure biomarkers
Estimating Hg human exposure
Measuring
Modeling

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Measuring mercury levels in human tissues

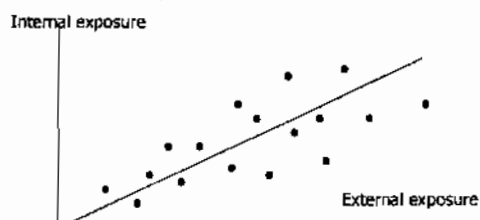
- Hair: Most commonly monitored tissue.**
- Wet digestion (acid/base) measured by cold vapour atomic absorption
 - Each cm of hair represents one month exposure (short history of exposure)
 - Conversion from hair level to blood level is established (between 250/300:1)
- Caution: hair must be washed carefully prior to analysis using 'standard protocol'**

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Exposure Bio-markers

Purpose:

To replace external dose with internal dose on an individual basis

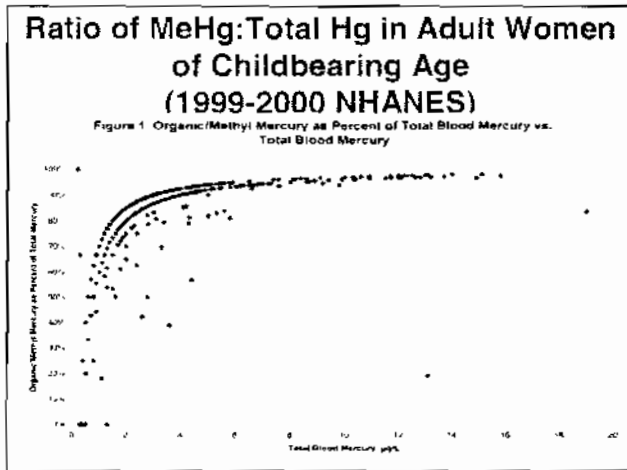


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Measuring mercury levels in human tissues

- Blood: Commonly measured**
- Total Hg measured in whole blood using Cold Vapour Atomic Absorption
 - Organic mercury removed with solvents and blood reanalysed to determine ratio of inorganic to organic forms
 - Cord blood levels are related to maternal blood levels (2:1)
 - Ratio of MeHg to total Hg varies

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Can model estimate exposure from other measurements ?

- Example – MeHg exposure from fish in US
 - EPA Mercury Study Report to Congress
 - FDA Exposure assessments in support of fish advice
- Exposure is a function of amount of fish consumed and Hg level in fish

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Measuring mercury levels in human tissues

Urine:

- Used for biological monitoring in industrial exposures and to measure elemental and inorganic Hg
- Measures excreted mercury
- Useful for establishing elimination rates
- Method: CVAA


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Estimating exposure through modeling

- Calculation of exposure using available info on:
 - Hg levels in food and the environment;
 - Types and amounts of food consumed;
 - Key groups likely to be at risk
- Purpose of modeling exercise (emission regulation, public health advice)
- Quality of data used in model

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Caution: Population sampling issues



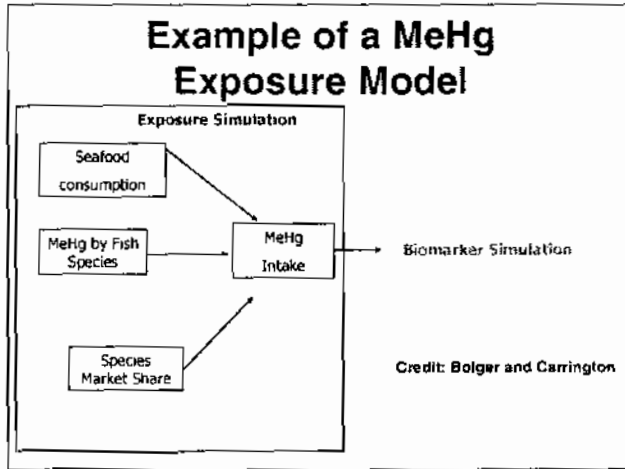
- Social issues (acceptability of hair, blood, cord blood sampling ?)
- Ethical issues (participant consent, reporting to participants, who owns data?).
- When to sample (seasonal and daily variation)
- Confounding factors (hair treatment, other exposures)
- Whom to sample (gender and life stage, cross-section or exposed subpopulation)

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Cautions - modeling

- Regarding models: "All models are wrong; some are useful"
- Regarding data quality for input to models: "Garbage in, garbage out"

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Mercury Data in Fish and Shellfish U.S. Food and Drug Administration

	Before 20003			NEW DATA (2003)			
	MEAN	RANGE	n	MEAN	RANGE	n	
Bluefish	0.30	0.20-0.40	2	0.318	0.139-0.479	21	
Croaker*	0.28	0.18-0.41	15	0.054	0.013-0.096	21	
Crabs*	0.27	0.19-0.33	4	0.569	0.072-1.205	20	
Crawfish/crayfish	NA	NA	NA	0.028	0.014-0.047	20	
Trout Freshwater	0.42	1.22 (max)		NA	NA	NA	
Farm Raised Trout	NA	NA	NA	0.033	0.015-0.110	15	
Orange Roughy	0.58	0.42-0.76	9	0.485	0.013-0.762	20	
Red Snapper	0.60	0.07-1.46	10	0.154	0.077-0.395	12	
Trout Seawater	0.27	ND-1.19	4	0.328	0.022-0.744	20	
Tilapia*	1.45	0.65-3.73	60	NA	NA	NA	
Golden Tieshr	NA	NA	NA	0.208	0.055-1.123	20	
Whitfish*	0.16	ND-0.31		2	0.068	0.027-0.137	14
Black Sea Bass	NA	NA	NA	0.127	0.058-0.352	20	
Sardine	NA	NA	NA	0.016	0.004-0.035	21	

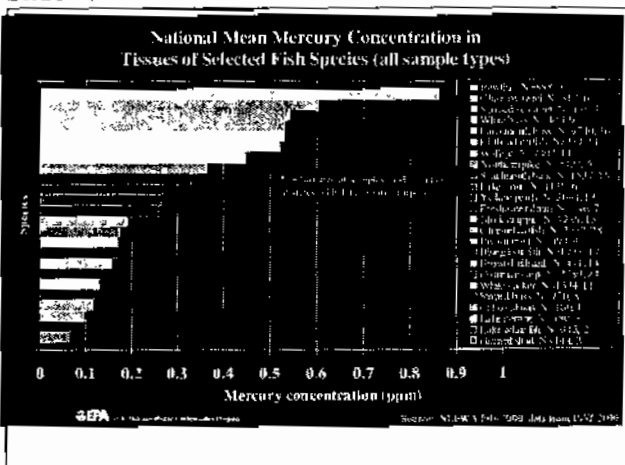
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- ### Measurements of Hg in fish
- Current data for large oceanic fish species is useful for all countries (shark, tuna, swordfish, etc.)
 - Specific measurements may be needed for fish species caught along marine shore or in inland lakes and rivers (possible influence of local sources of pollution)
 - Top of the food chain species are the key species to measure

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- ### Caution: what to measure
- High cost of analyzing food items
 - Possibility of unusual exposures via food items (e.g., vegetables) grown in contaminated soils
 - Measurement of cooked or raw food
 - Other sources beyond food (water, products, jewellery, cooking utensils, dust, occupation, amalgams, etc.)

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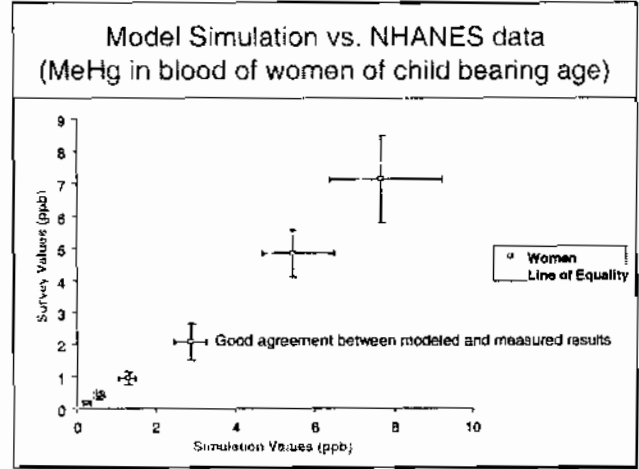
- ### Caution: how to measure
- Whole fish or part of a fish.... comparing results with others
 - Measuring cooked (as prepared for consumption) or uncooked fish tissue
 - Quality Assurance/Quality Control (QA/QC) programs are available

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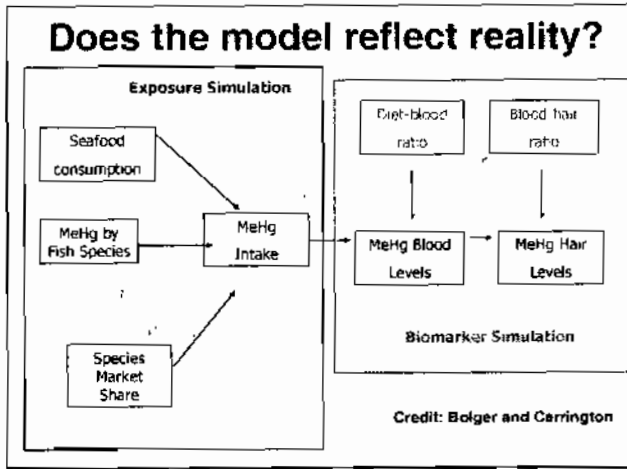
Dietary assessment

1. Dietary surveys (24 hour recall survey, monthly food diary)
2. Measure key food items in the diet and multiply by amounts consumed
3. Measure what is in total meals (duplicate food plate analyses of meals as they are served)
4. Measure what is sold in an area (market basket)

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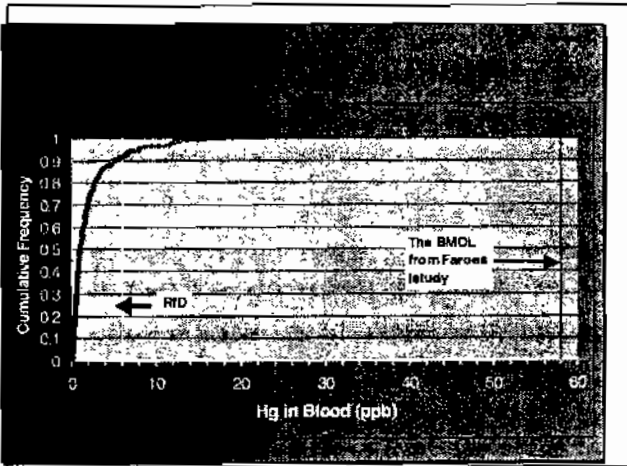


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Guidance from UNEP

- UNEP will prepare a guidance on assessing human exposure to MeHg by
 - Bio-monitoring
 - Dietary survey
 - Modeling techniques
- Available in 2005

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- International Commission on Occupational Health (ICOH)
- Scientific Committee on Neurotoxicology and Psychophysiology
- Triennial International Symposia on Neurobehavioral methods and effects:
 - Italy, 2002
 - Korea, 2005
 - **Costarica, 2008**