Korean National Environmental Health Survey (KoNEHS)

The past, Present and Future of Human Bio-monitoring in Korea

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Contents

Korean National Environmental Health Survey (KoNEHS)

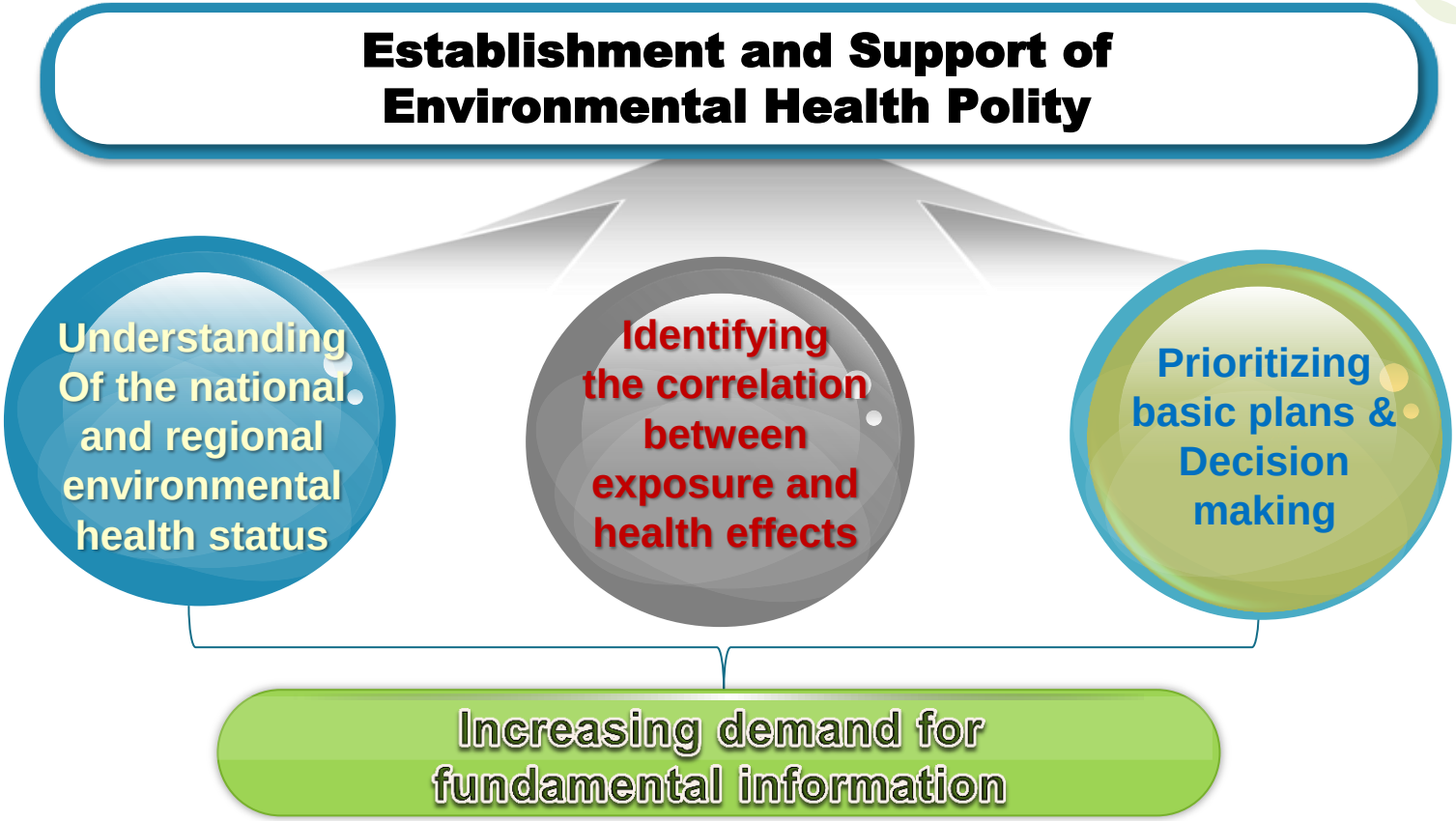
@ Introduction and Background

Environmental Policy Paradigm shift
- towards " Receptor " and " Health "

- Limitation of environmental policy focused on pollution sources and media
  - Increased environmental diseases : Atopic, Asthma, itai-itai disease and etc.
  - Emerging health risk factors : Asbestos, Radon, Climate change, Microorganism

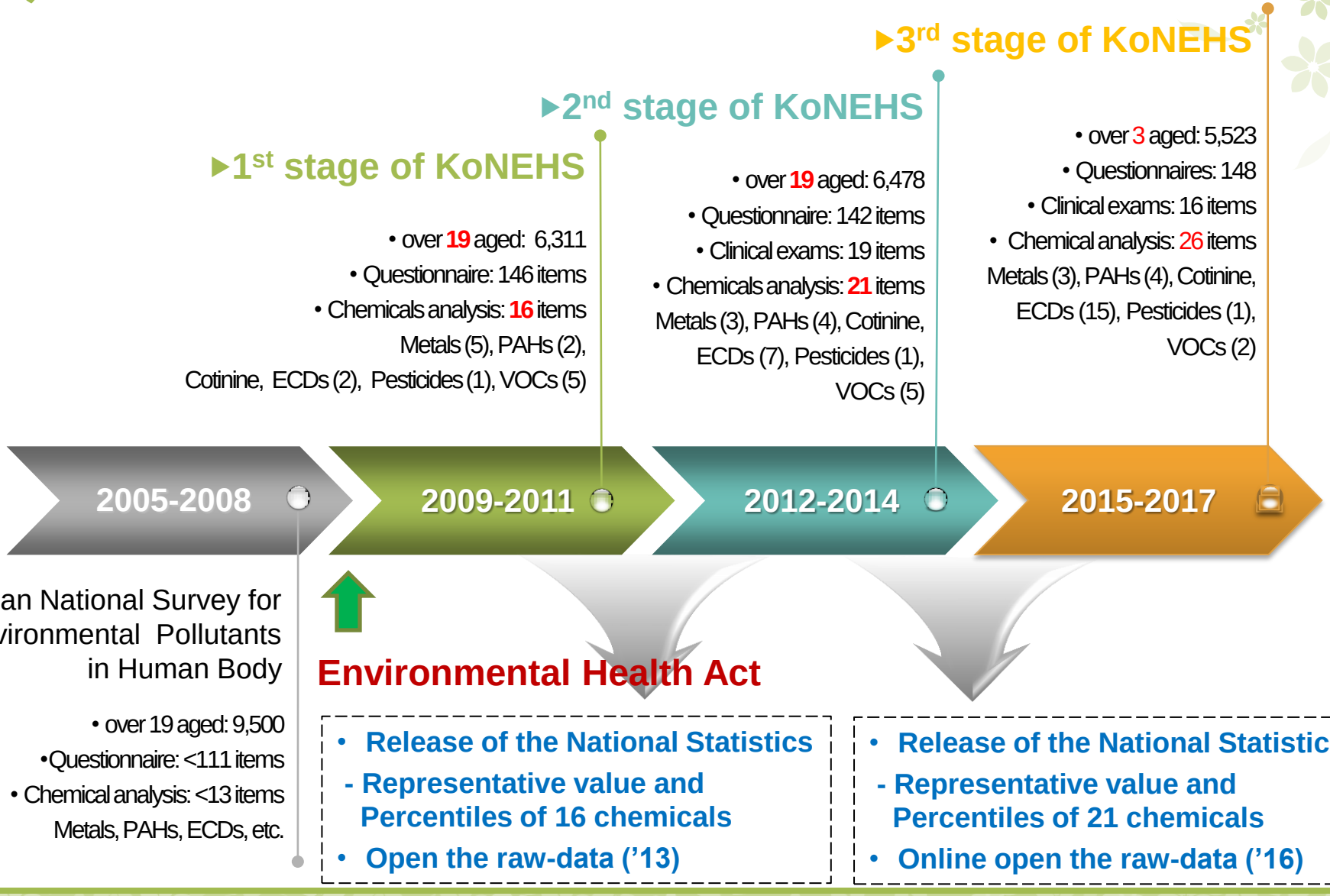
- Increased Public Awareness and public expectation of environmental policy
  - Wide spread of LOHAS (Lifestyles of Health and Sustainability)

Environmental Health Polity & DATA



- Human exposure levels of contaminants
- Exposure factors and pathway
- Status of disease occurrence due to environmental hazardous factors
- Risk assessment, etc

History of Human Bio-monitoring in Korea



Korean National Environmental Health Survey (KoNEHS)

@ Survey Contents (1st and 2nd)

Survey Process

Survey sampling

NIER

Field Survey

Biological sample analysis

Clinical analysis

Sampling Design

1st STAGE (2009-2011)

* Frame: Population & Housing Census (2005)
* Sampling Site: 350 Collection Sites
•Sample size: 6,000 (> 20 years old), 18 persons/ site

2nd STAGE (2012-2014)

* Frame: Population & Housing Census (2010)
* Sampling Site: 400 Collection Sites
•Sample size: 6,000 (> 20 years old), 15 persons / site

3rd STAGE (2015-2017)

"only adult " ⇨ expanded to "over 3 age"

- 3 to 18 age : *n* = about 2,000

- over 19 age : *n* = about 3,500

Sampling Design

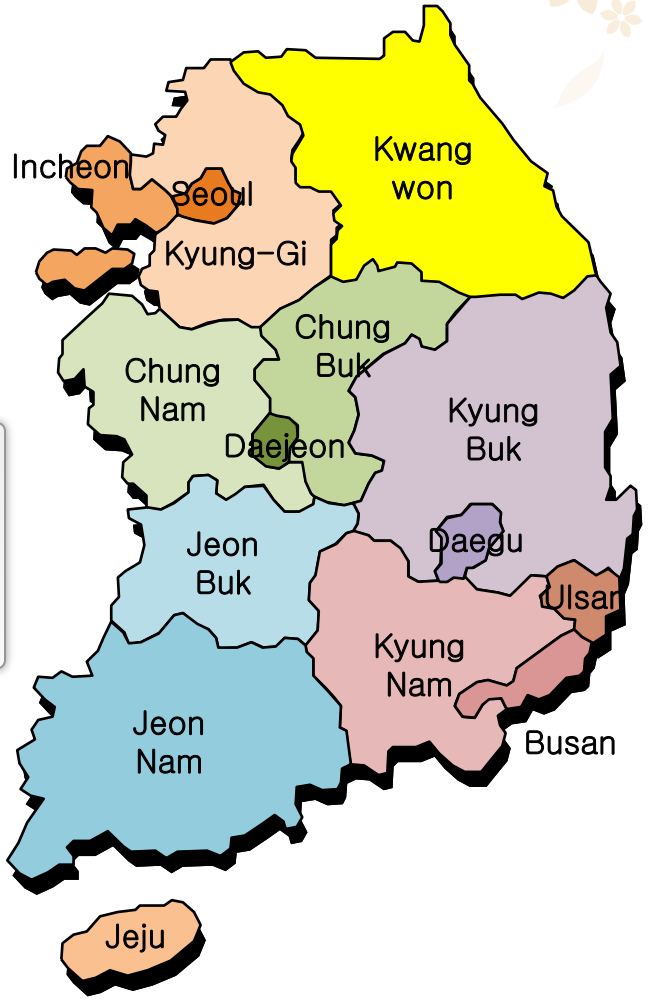
1st : Regional stratification

- 7 metropolitan cities (including the capital)
- 9 provinces
- 1 Coastal Area (West/South/East sea area)
- 1 urban air monitoring station

2nd : Socio-economic stratification

- House type (Apartment, general house….)
- Urban housing/ Rural (farming, fishing, etc)

Total
60 Layers



Questionnaires

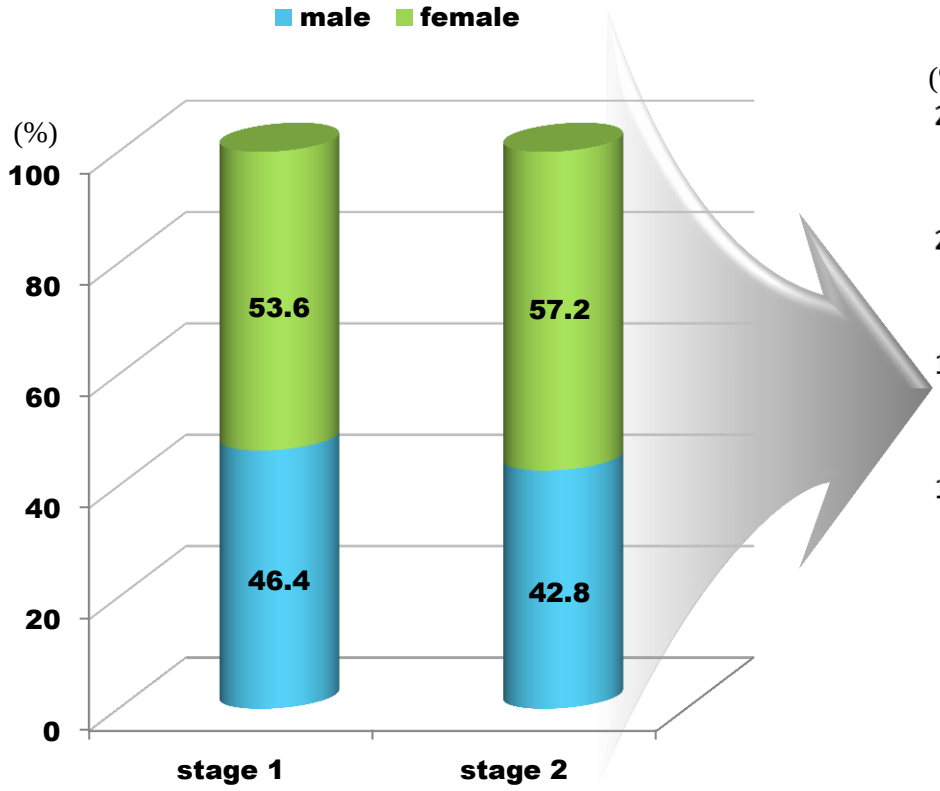
Section		Contents
Household information (20)	Housing characteristics [3]	Distance from road / traffic information
	Indoor environment [13]	Type of housing / construction year / type of air conditioning / ventilation method / drug use for vermin control
	Food security [3]	Storage container / purchasing route
	Socioeconomic characteristics [1]	Household monthly income
Individual information (122)	Personal information [11]	Name / gender / date of birth / number of family
	Transportation [8]	Public transportation use / type of transportation used / average time to using transportation
	Indoor environment [15]	Living duration / type of air conditioning(except house), ventilation methods / remodeling status of living place
	Health behavior [32]	Smoking habits / smoking history / passive smoking / alcohol consumption drinking history, frequencies and amount / exercise / cosmetics / time activities on week day and weekend
	Food security [26]	Type of drinking water / intake of certain food
	Dietary supplement & medicine use [5]	Medicine use / oriental medicine use
	Socioeconomic & demographic [6]	Level of education / marital status / economic status / occupation
	Reproductive health [3]	Pregnancy history / delivery history / menopause
	Dietary behavior [16]	Recent dietary behavior/height, weight / health tonic & digestive medicine use

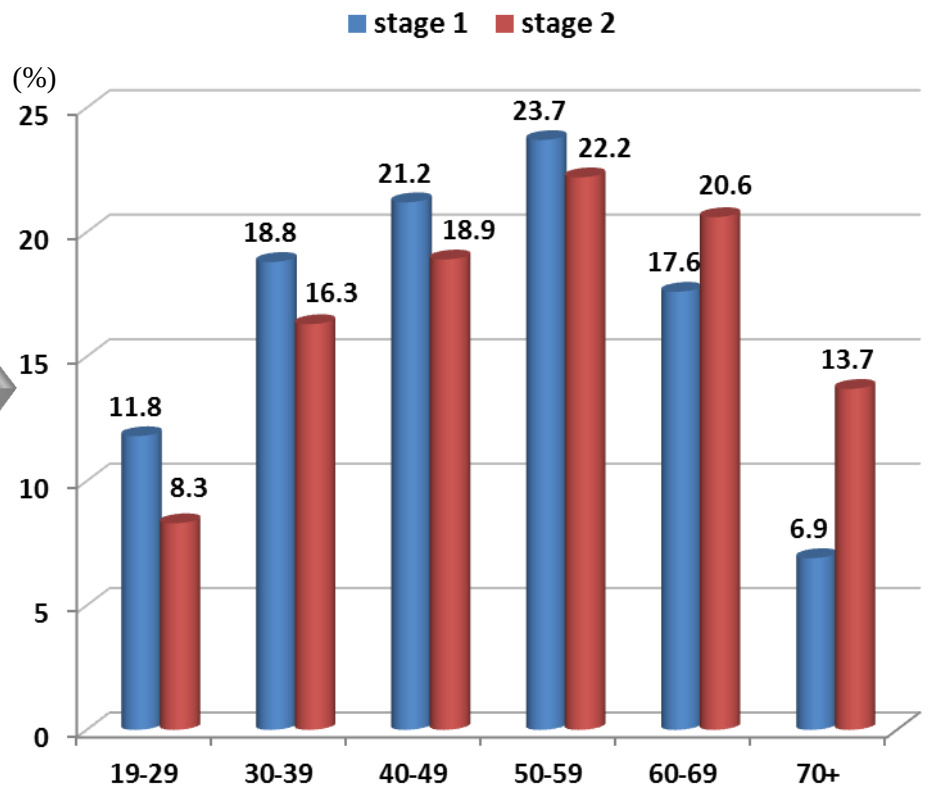
Korean National Environmental Health Survey (KoNEHS)

@ Results from the KoNEHS

Participant Characteristic

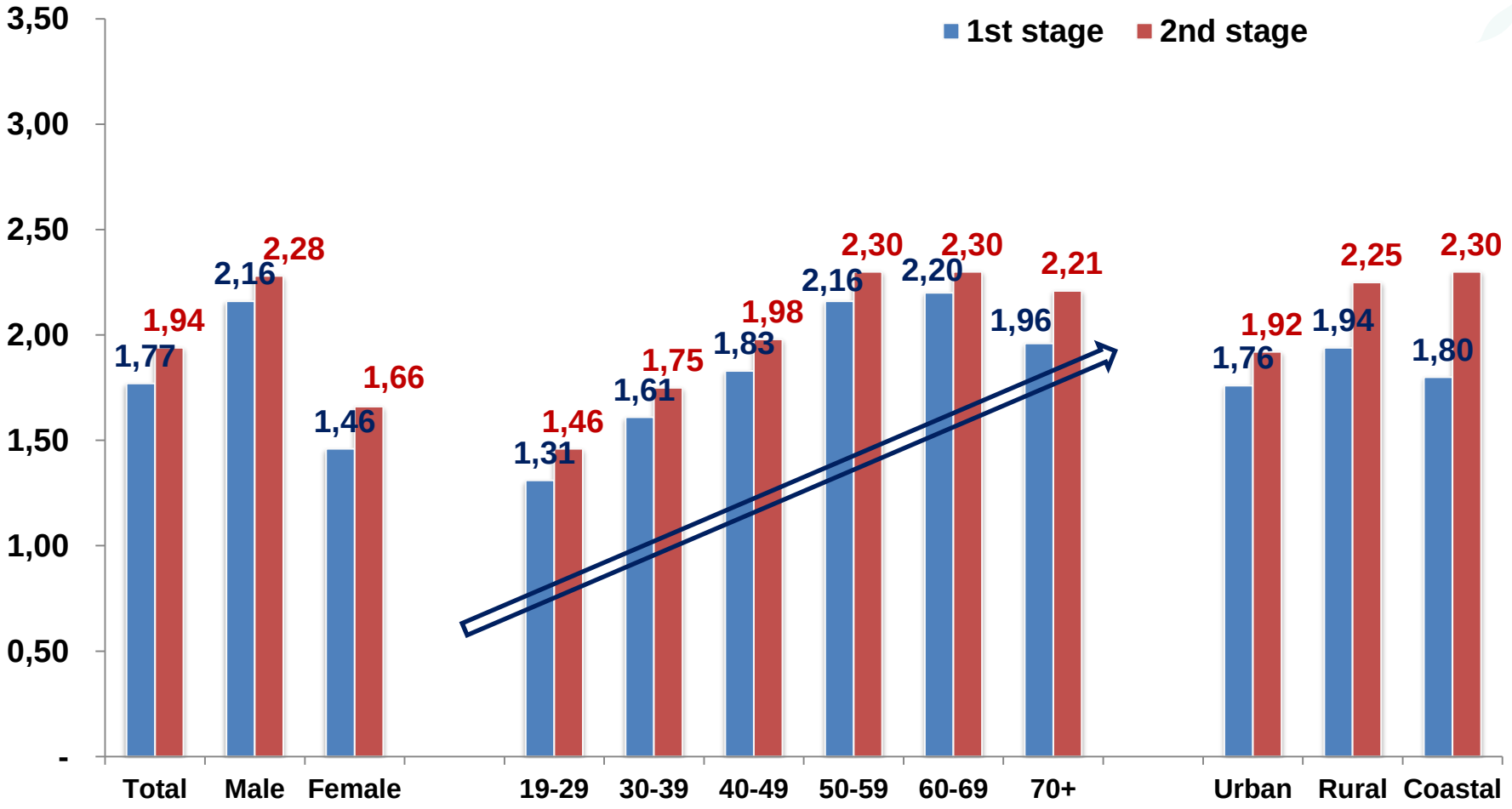
- Stage 1 : Persons aged 19 years and older (n=6,311, male=2,928, female=3,383)
- Stage 2 : Persons aged 19 years and older (n=6,478, male=2,774, female=3,704)





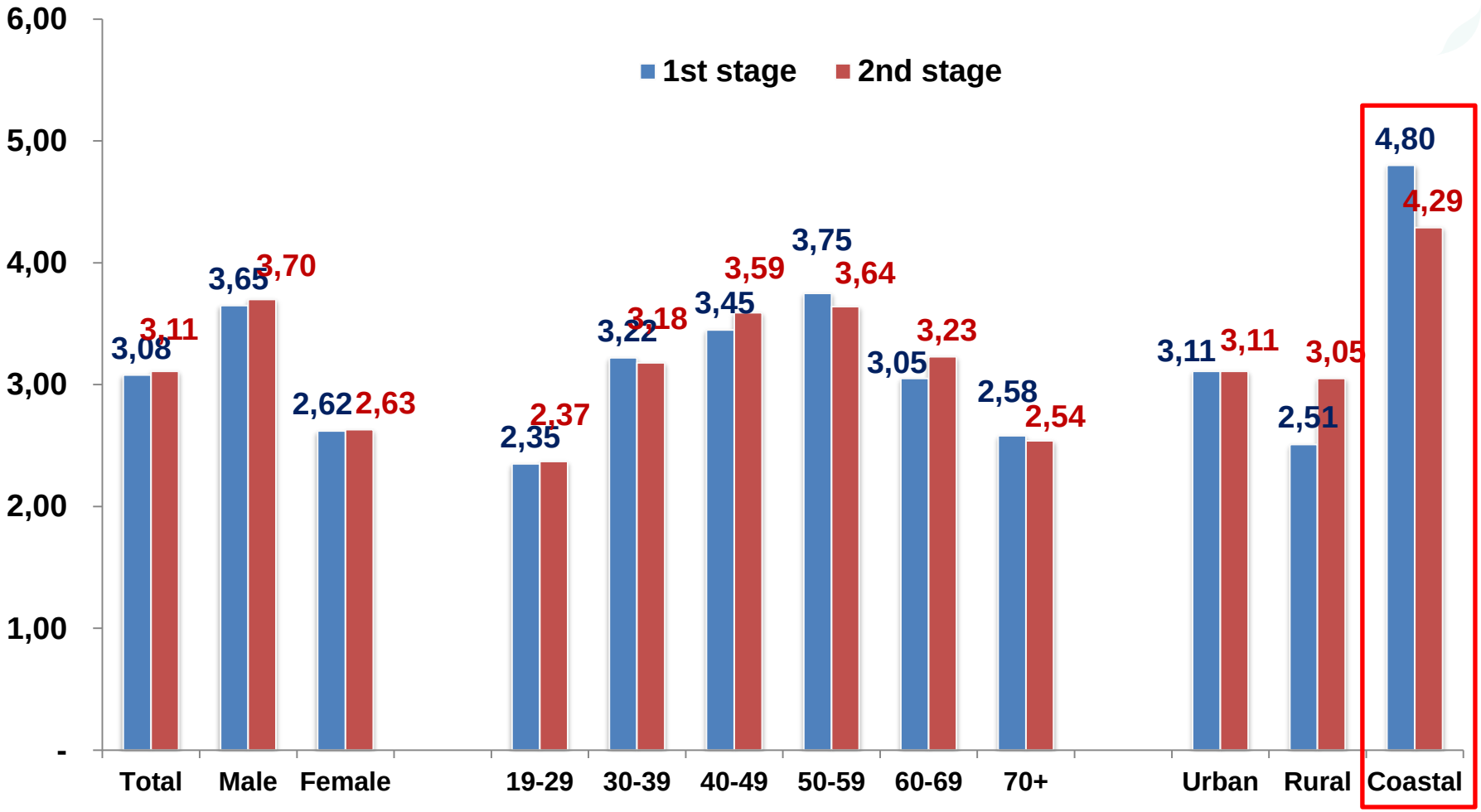
Concentrations of Heavy metals

- Blood Lead Levels (μg/dL)



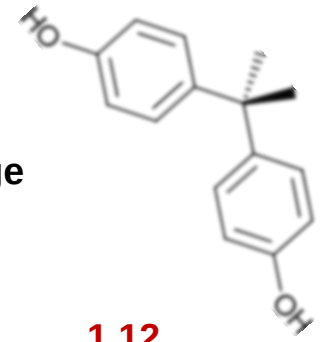
Concentrations of Heavy metals

- Blood Mercury Levels (µg/L)



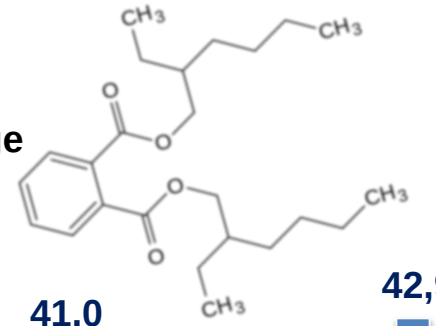
Concentrations of Environmental Phenols

- Urinary Bisphenol-A Levels (μg/L)



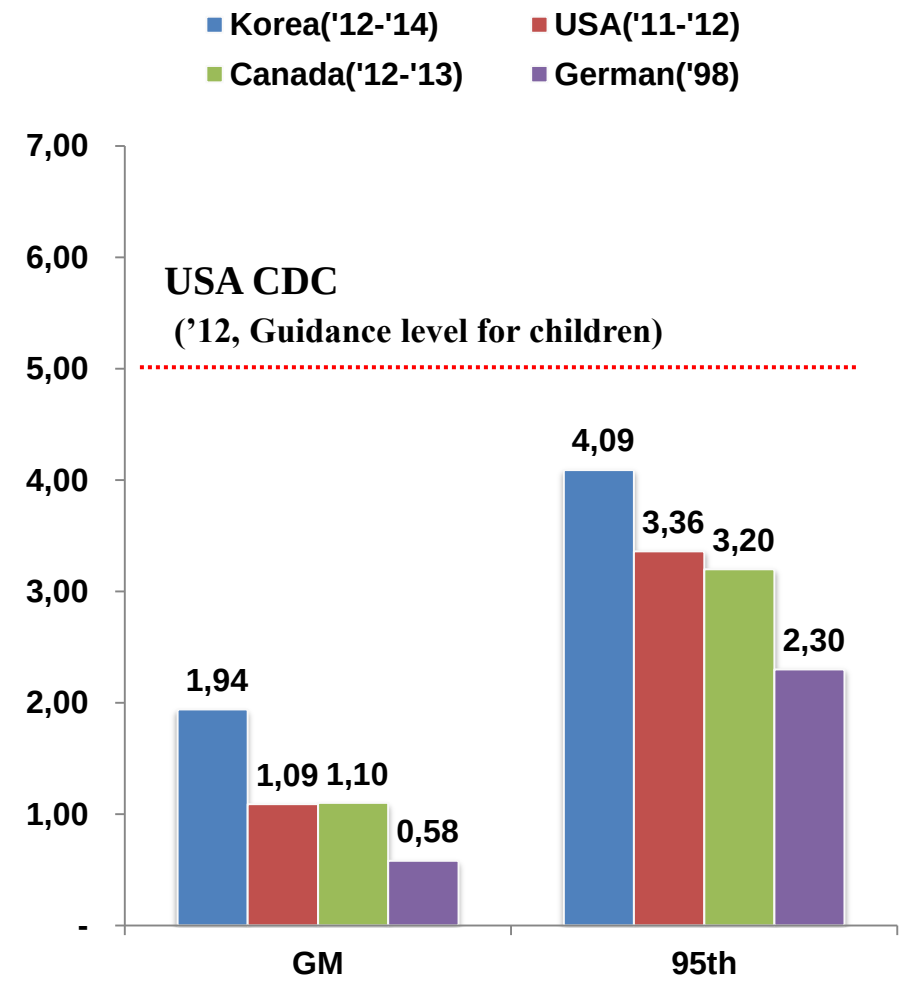
Concentrations of Phthalate

- Urinary DEHP (MEHHP+MEOHP) metabolites Levels (μg/L)

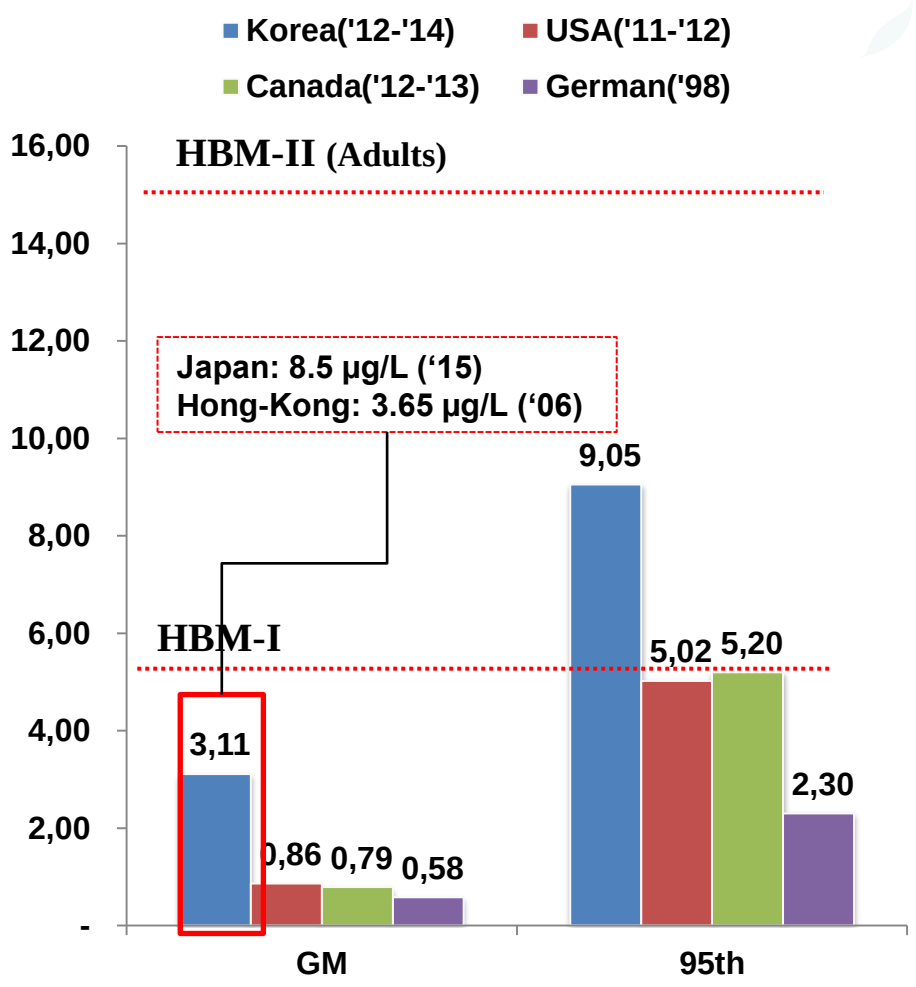


Data Comparison (HBM & Other Countries)

Blood Lead (μg/dL)

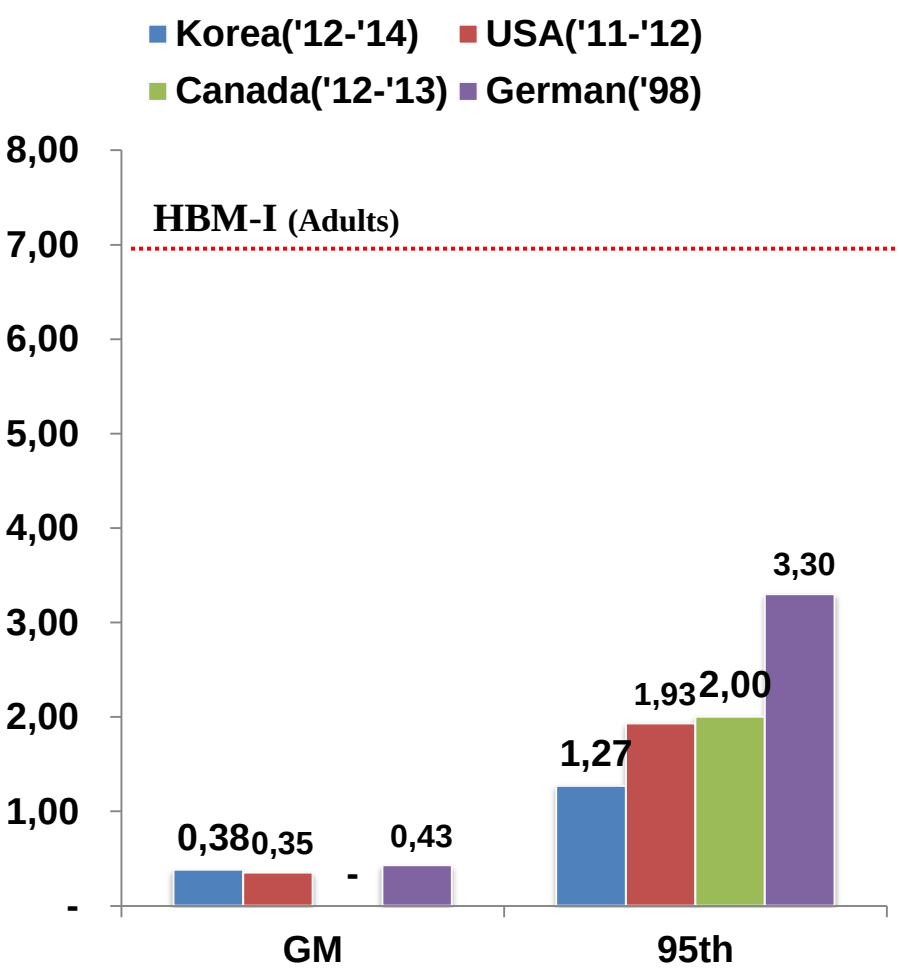


Blood Mercury (μg/L)

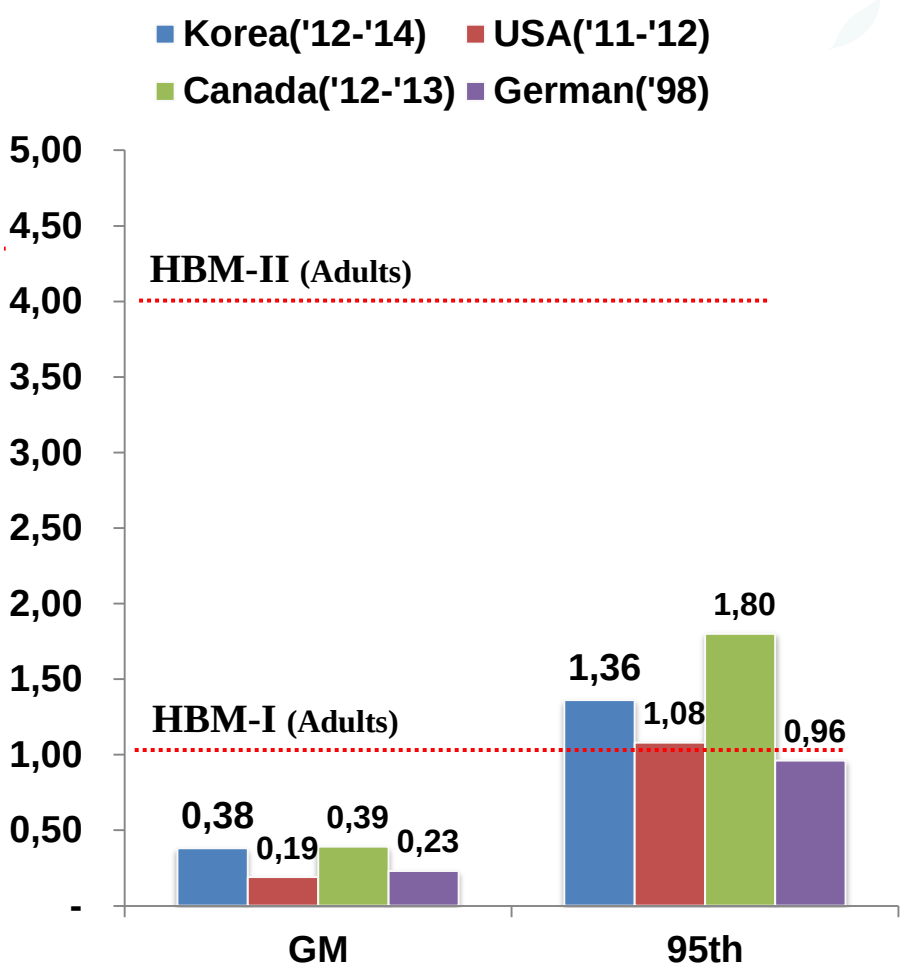


Data Comparison (HBM & Other Countries)

Urinary Mercury (μg/L)

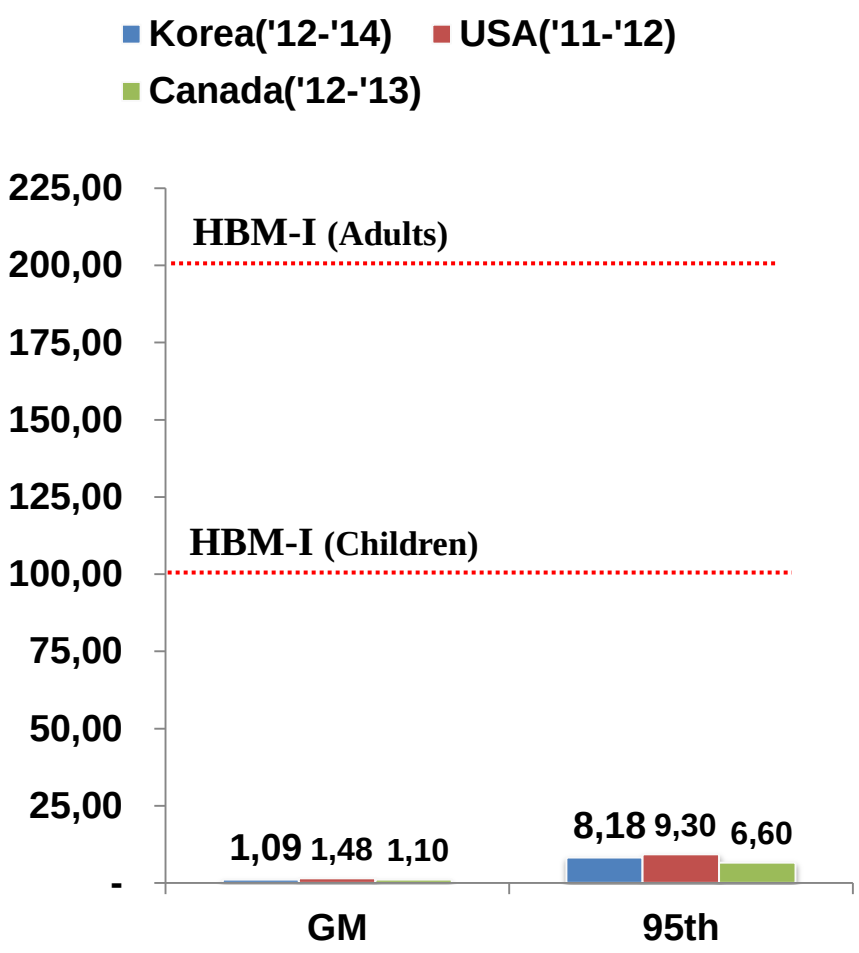


Urinary Cadmium (μg/L)

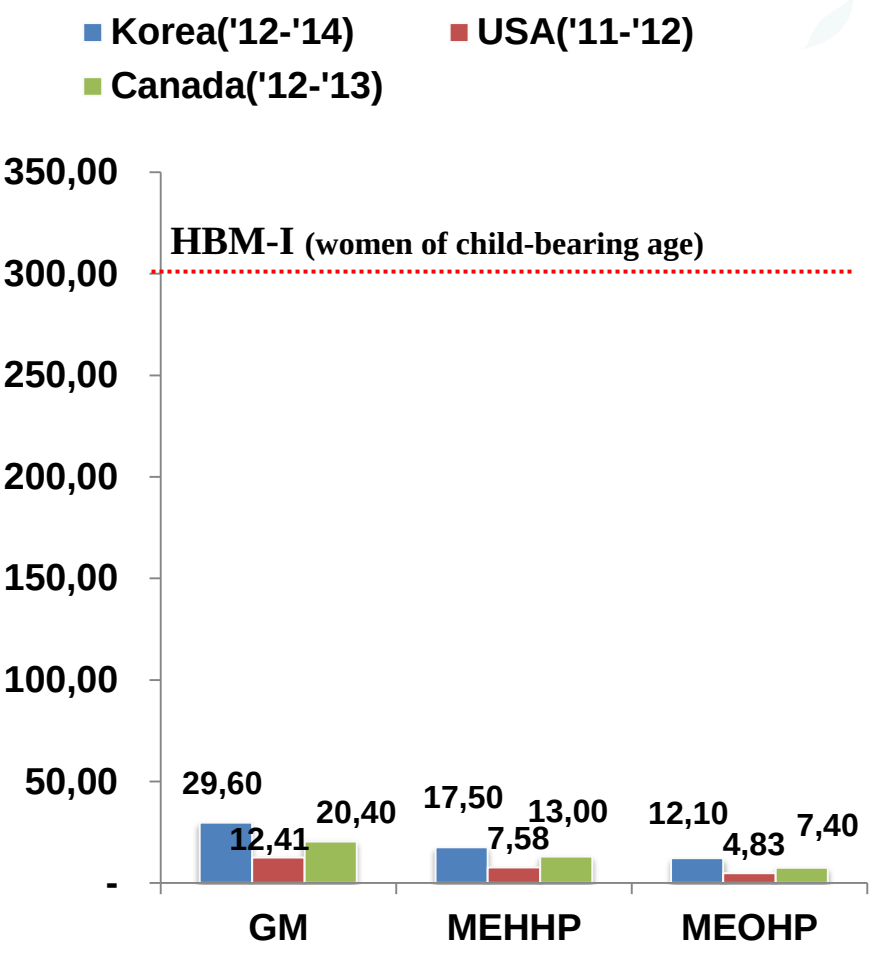


Data Comparison (HBM & Other Countries)

Urinary Bisphenol-A (μg/L)

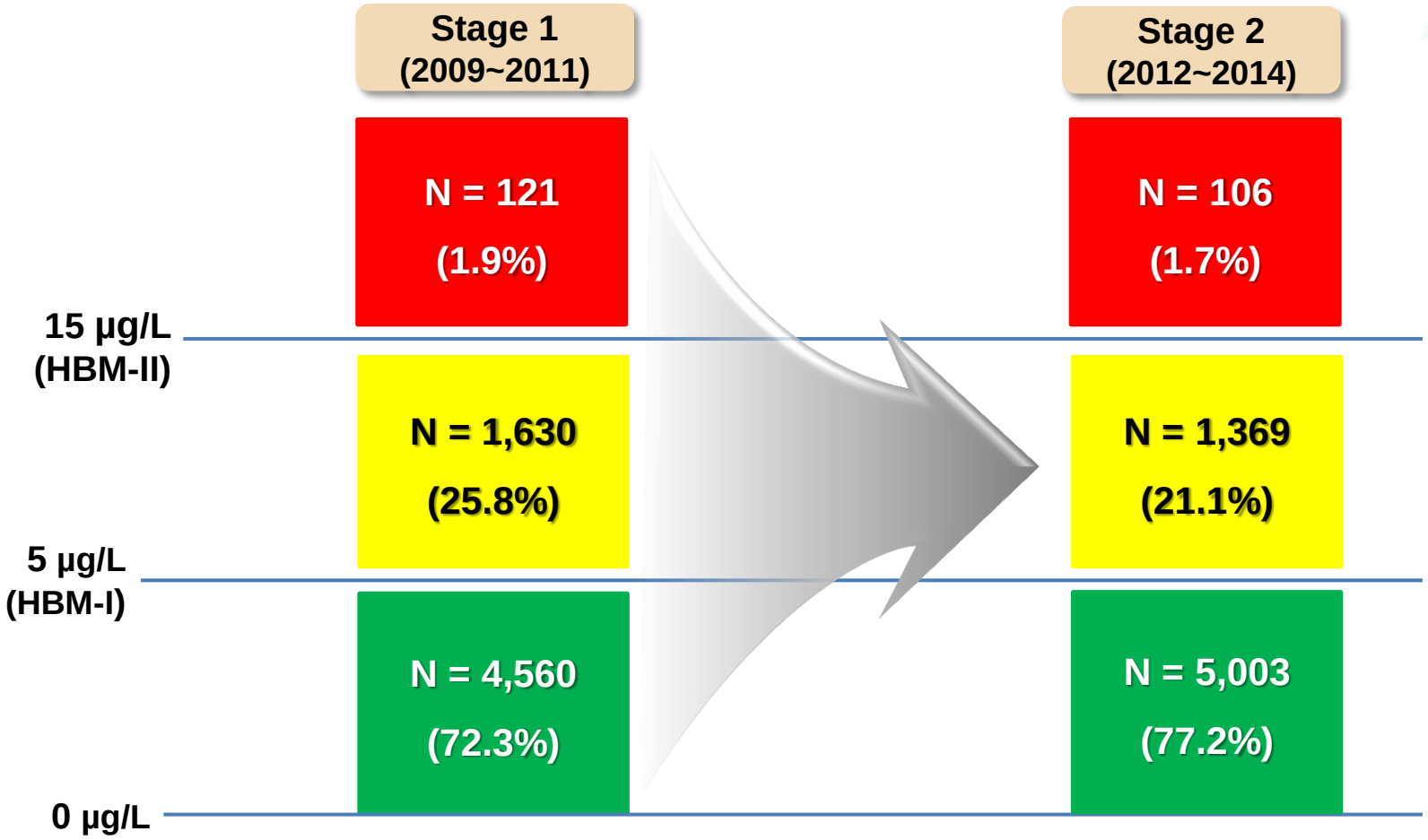


Urinary DEHP metabolites (μg/L)



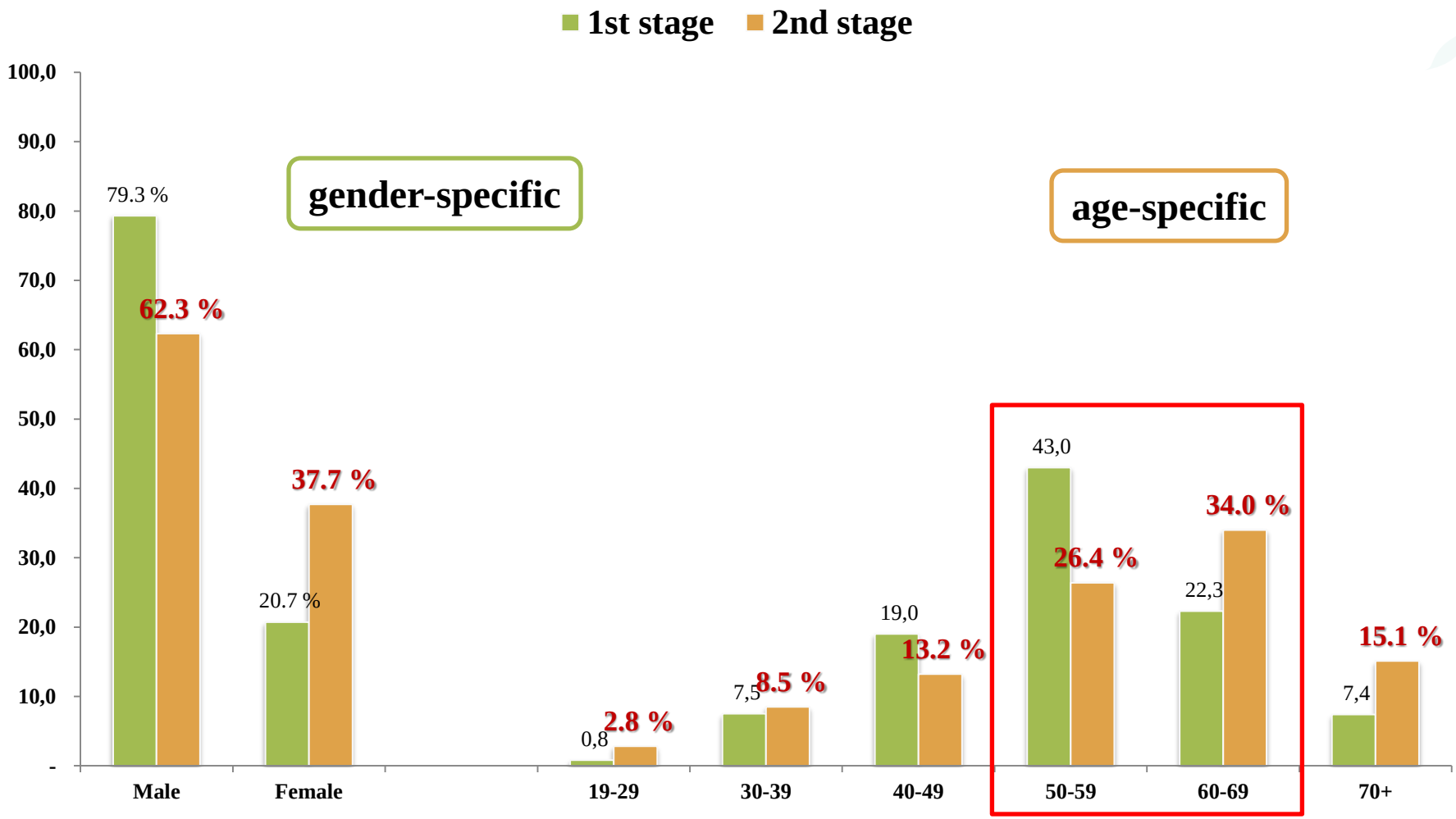
The Risk of Mercury Exposure

- Exceed the HBM-I / II Levels



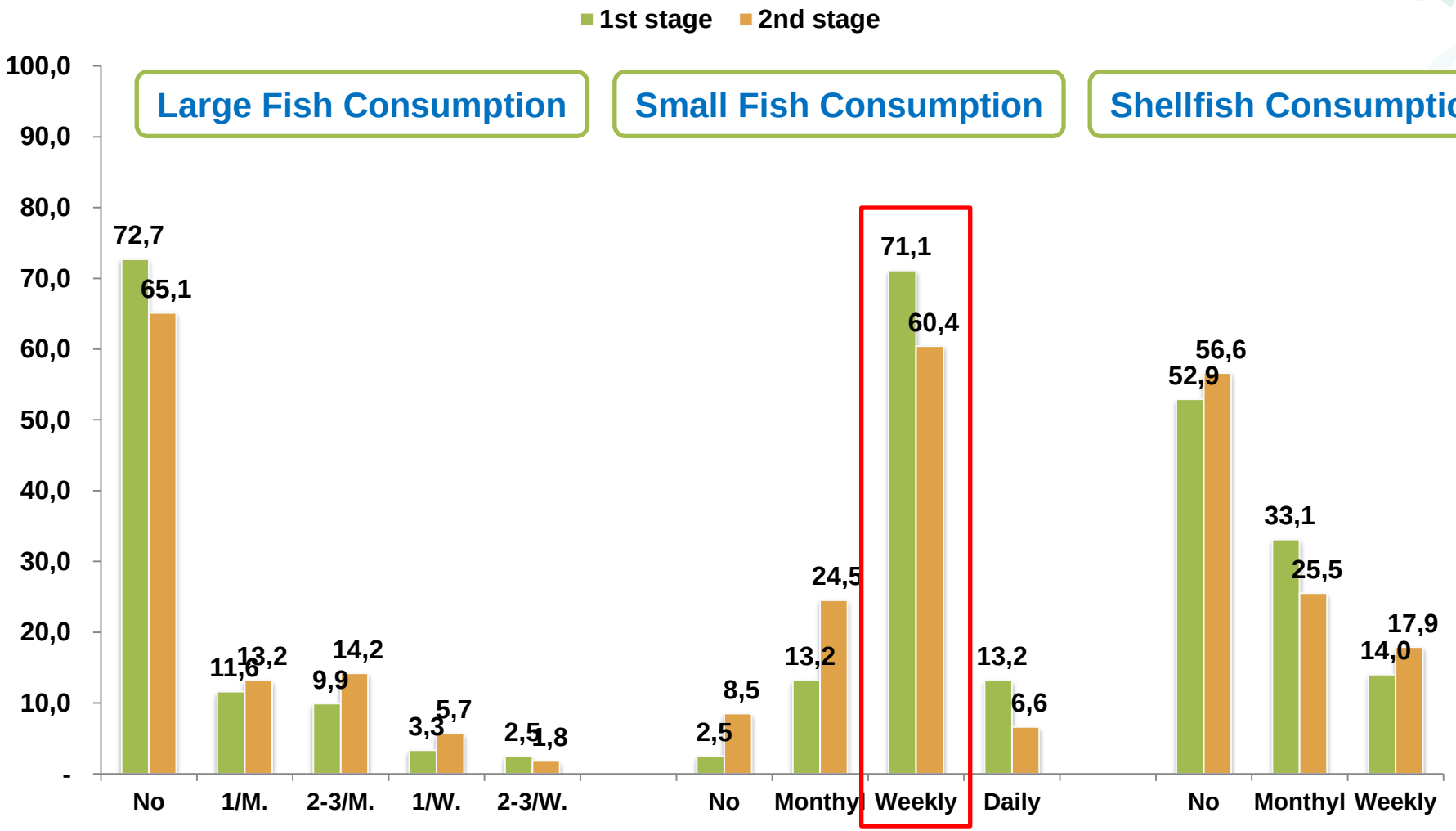
The Risk of Mercury Exposure

- Excess rate of HBM-II Level



The Risk of Mercury Exposure

- Fish Consumption from Excess HBM-II Level participant



Korean National Environmental Health Survey (KoNEHS)

@ Start-up 3rd stage of KoNEHS

Pilot Study

- Korean Environmental Health Survey in Children & Adolescent

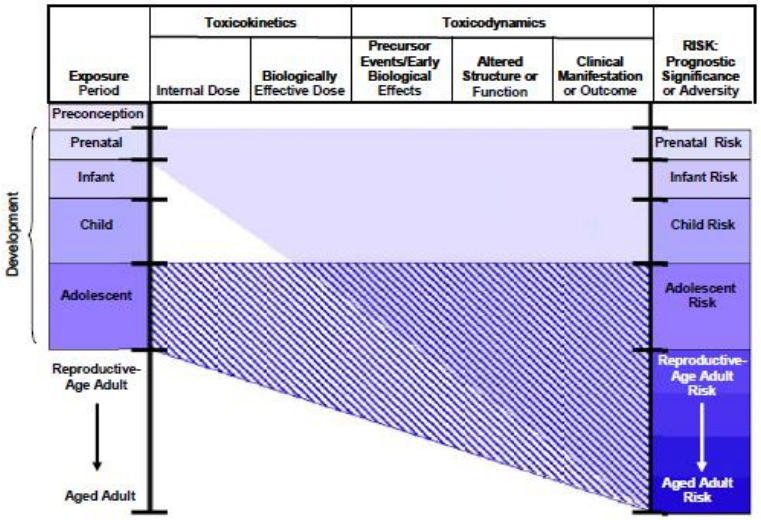


Figure 2-3. Life stages of outcomes after developmental exposure. This figure illustrates the different life stages during which developmental exposures may occur (before conception through adolescence). Exposure (shown on the left side of the figure) during a given life stage may result in outcomes observed during that same stage or later in life (shown on the right side of the figure). For illustrative purposes, the outcomes associated with exposure during two periods, prenatal and adolescence, correspond to the highlighted and hatched regions, respectively. Broad exposure intervals, e.g., "child," are shown here for illustration; divisions between all life stages are not precise. There is some reproductive age overlap between the adolescent and the adult periods.

A Framework for assessing Health Risks of Env. Exposures to Children. EPA. 2006.

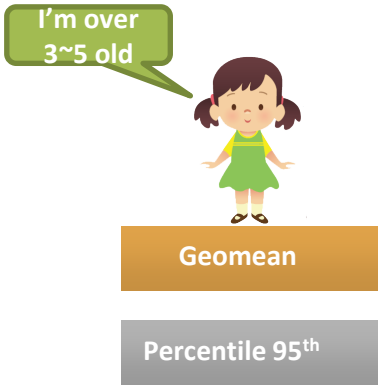
Taeget : over 3 to 18 aged
(*n*= about 2,400)
9 Chemicals analysis

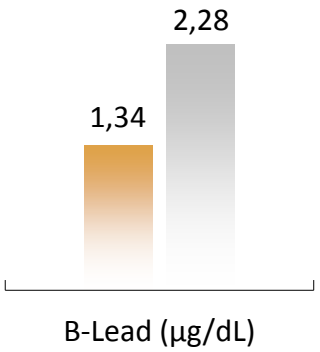
<u>Study Goal</u>: Design and Feasibility of the Children/Adolescent's Env. Health Survey of National scale

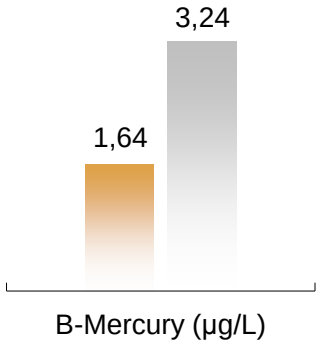
Prepared 3rd stage of KoNEHS

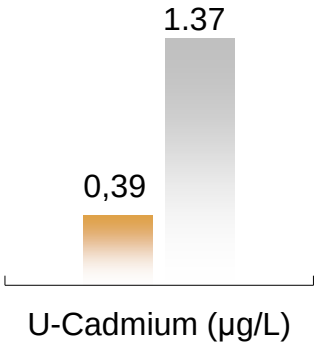
Pilot Study

- Korean Environmental Health Survey in Children & Adolescent





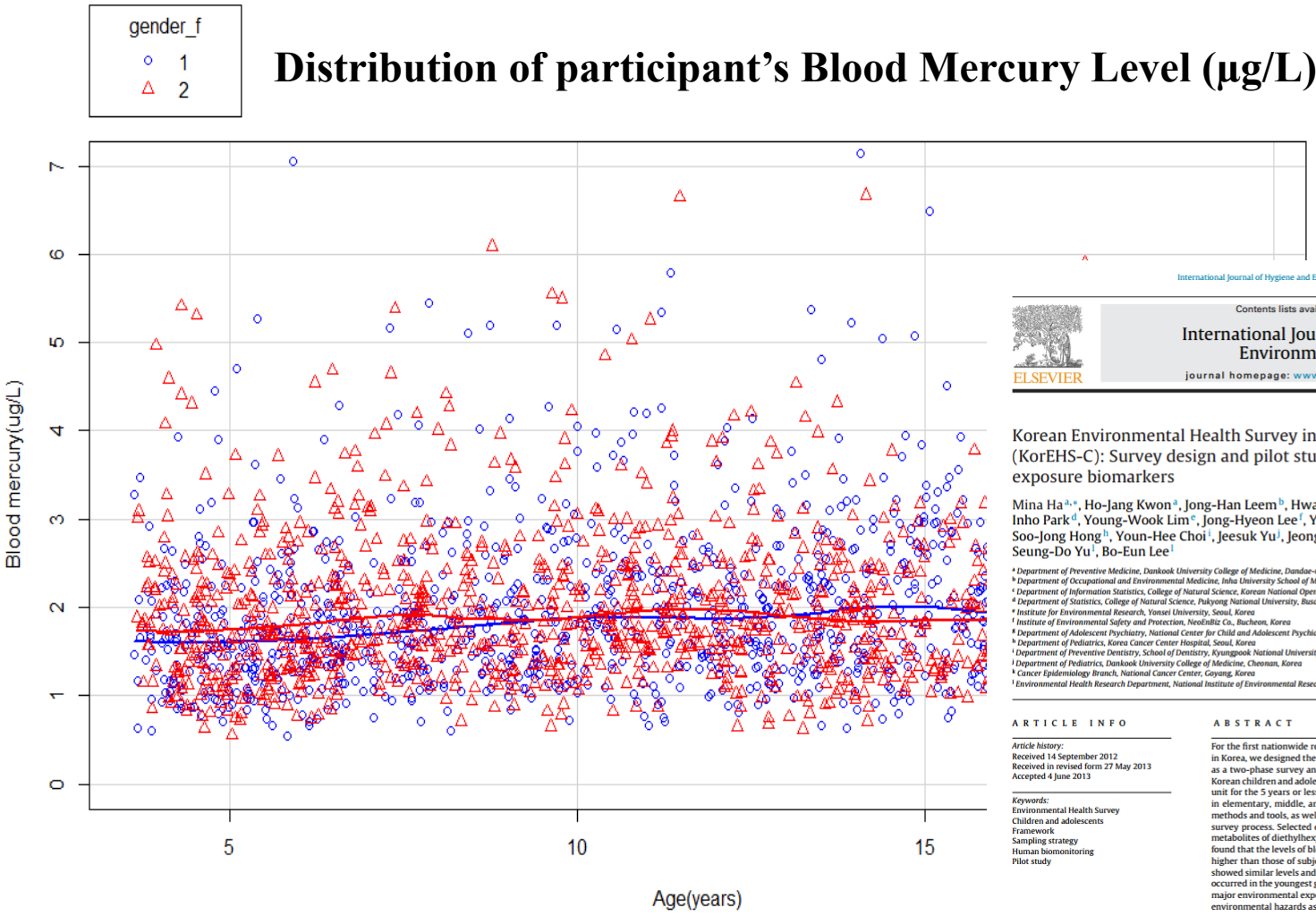




	Year	Age	B-Pb (μg/dL)	B-Hg (μg/L)	U-Cd (μg/L)	U-BPA (μg/L)	Metabolites of Phthalate (μg/L)					
							MEHHP +MEOHP	DEHP			DBP	BBP
								MEHHP	MEOHP	MECPP	MnBP	MBzP
KorEHS-C (Korea)	2014	Over 3-5	1.34	1.64	0.39	2.33	77.77	43.49	34.28	65.47	55.50	7.46
	2012 2013	Over 6-12	1.26	1.93	0.31	1.50	64.29	34.47	29.82	59.39	68.26	7.58
		Over 12-18	1.11	1.90	0.23	1.31	48.66	28.28	20.38	41.15	55.87	6.82
NHANES 4th (USA)	2009 2010	1-5	1.17	-	-	-		-	-	-	-	
		6-11	0.84	-	0.06	1.81	24.78	15.0	9.78	27.7	21.7	11.6
		12-19	0.68	0.53	0.08	2.11	25.3	15.3	10.0	26.2	18.9	10.6
CHMS (Canada)	2009 2011	3-5	0.93	0.27	0.23	1.4	44	27	17	-	32	17
		6-11	0.79	0.28	0.25	1.4	39	24	15	-	36	19
		12-19	0.71	0.27	0.27	1.3	26	16	10	-	28	12
HBM	2015	I	-	5	0.5	100	500	-	-	-	-	-
		II		15	2	-	-	-	-	-	-	-

Pilot Study

- Korean Environmental Health Survey in Children & Adolescent



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Korean Environmental Health Survey in Children and Adolescents (KorEHS-C): Survey design and pilot study results on selected exposure biomarkers

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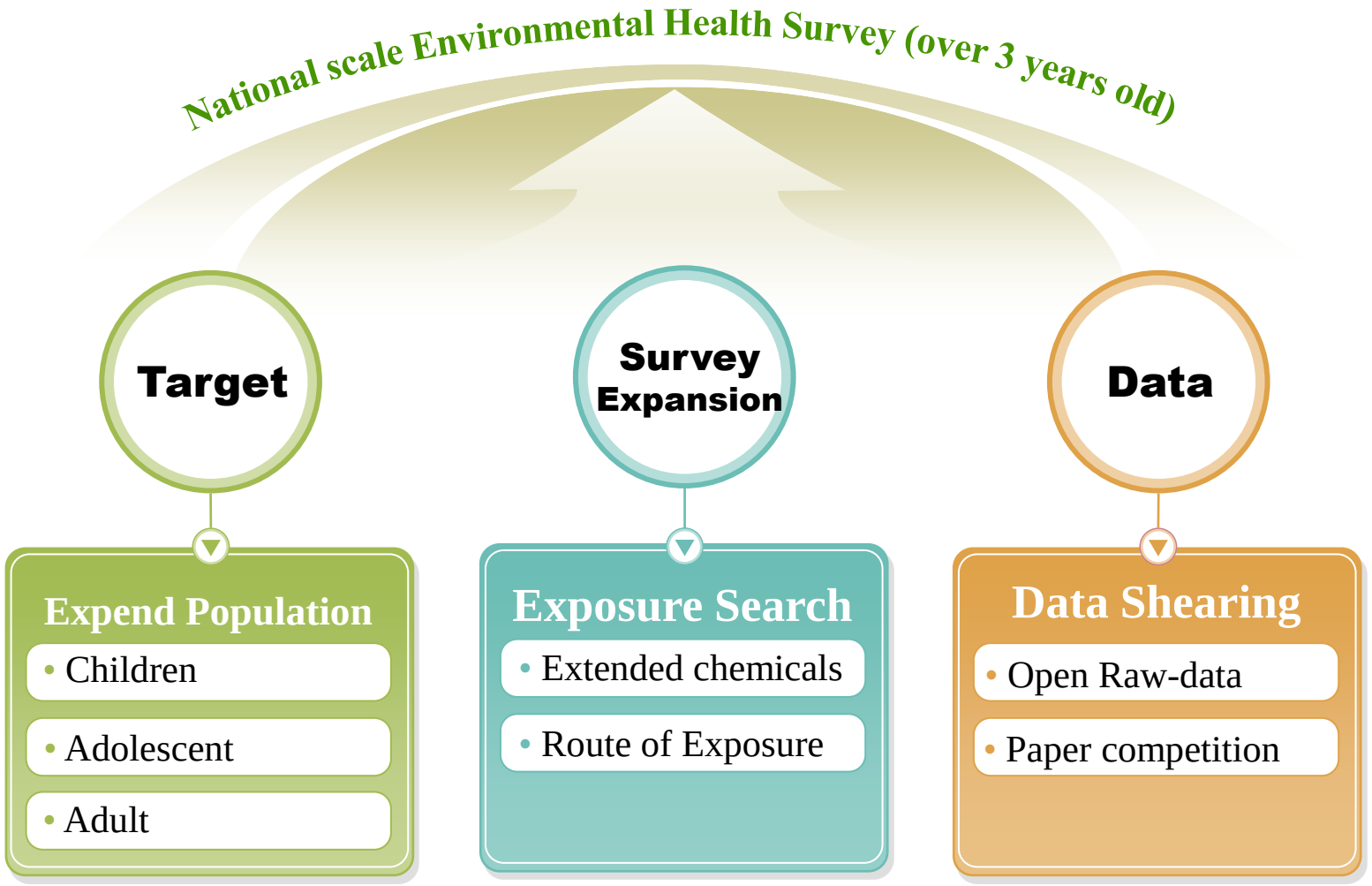
ABSTRACT

For the first nationwide representative survey on the environmental health of children and adolescents in Korea, we designed the Korean Environmental Health Survey in Children and Adolescents (KorEHS-C) as a two-phase survey and planned a sampling strategy that would represent the whole population of Korean children and adolescents, based on the school unit for the 6-19 years age group and the household unit for the 5 years or less age group. A pilot study for 351 children and adolescents aged 6 to 19 years in elementary, middle, and high school of two cities was performed to validate several measurement methods and tools, as well as to test their feasibility, and to elaborate the protocols used throughout the survey process. Selected exposure biomarkers, i.e., lead, mercury, cadmium in blood, and bisphenol A, metabolites of diethylhexyl phthalate and di-n-butyl phthalate and cotinine in urine were analyzed. We found that the levels of blood mercury (Median: 1.7 ug/L) and cadmium (Median: 0.30 ug/L) were much higher than those of subjects in Germany and the US, while metabolites of phthalates and bisphenol A showed similar levels and tendencies by age; the highest levels of phthalate metabolites and bisphenol A occurred in the youngest group of children. Specific investigations to elucidate the exposure pathways of major environmental exposure need to be conducted, and the KorEHS-C should cover as many potential environmental hazards as possible.

Need More data? - http://www.sciencedirect.com/science/article/pii/S1438463913000771

3rd stage of KoNEHS (2015-2017)

- Concept & Plan of 3rd stage



3rd stage of KoNEHS (2015-2017)

- Sampling Design of 3 type populations

Population / Sampling Frame

- Population: Over 3 years old
- Sex: male / female

Error Range & Sample Size

- Error Range: Within 5%
- Total population: **5,500 people**
  - (Children) about 500 people
  - (Adol.) about 1,500 people
  - (Adult) about 3,500 people

(Children) Multi-stratified sampling
Stratification : 16 Regional
1st : Kindergarten, Day-care center
2nd : Infant (over 3years old)

(Adolescent) Multi-stratified sampling
Stratification : 16 Regional
1st : School
2nd : Class

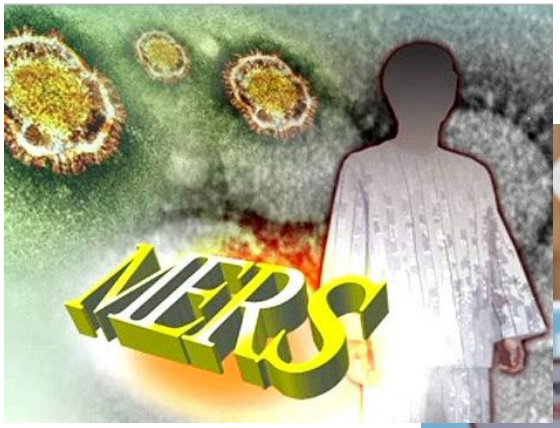
(Adult) Multi-stratified sampling
Stratification : 16 Regional
1st : Sample of Enumeration district
2nd : House

※ The number of children using [**Kindergarten**] and [**Day-care Center**] comparison to '14 demographic statistics (Autumn): 91%

※ The number of [**Elementary / Middle / High school's students**] comparison to '14 demographic statistics (Autumn): 99%

3rd stage of KoNEHS (2015-2017)
- Chemical Selection

- Reflect **Public Interest** & Including **substitute of bisphenol-A**
  - **Considering [Life environment]** & **[Amount of chemicals in circulation]**
  - Substances which could be **harmful depending on exposure level to human body**



- **Necessary for selecting chemicals to deal with health issues**

→ **Using of hand disinfectants increased due to expand of MERS**

→ **3 types of Paraben (*methyl-*, *ethyl-* and *propyl-*)**

위생

Sales growth(%)

품목	증감률
황사 마스크	
Nonmedical Hand Washes	**2,373 %**
거품형 손세정제	1044%
물비누	199%
Hand disinfectants	**66,583 %**
Liquid hand soap	**1,727 %**

Group	Target Chemical or Metabolite	Specimen	1st	2nd	3rd
Metals (3)	Lead	Blood	○	○	○
	Mercury	Blood/Urine	○	○	○
	Cadmium	Urine	○	○	○
PAHs (4)	1-Hydroxypyrene	Urine	○	○	○
	2-Napthol		○	○	○
	1-Hydroxyphenanthrene		×	○	○
	2-Hydroxyfluorene		×	○	○
Environmental Tobacco (1)	Cotinine	Urine	○	○	○
Environmental Phenols (7)	Bisphenol-A	Urine	○	○	○
	Bisphenol-F		×	×	●
	Bisphenol-S		×	×	●
	methyl-Paraben		×	×	●
	ehtyl-Paraben		×	×	●
	propyl-Paraben		×	×	●
	Triclosan		×	○	○
Phthalate (8)	mono(2-ethyl-5-hydroxyhexyl) phthalate	Urine	○	○	○
	mono(2-ethyl-5-oxohexyl) phthalate		○	○	○
	mono(2-ethyl-5-carboxypentyl) phthalate		×	○	○
	mono-n-butyl phthalate		○	○	○
	mono-benzyl phthalate		×	○	○
	mono(2,6-methyl-6-carboxyhexyl) phthalate		×	×	●
	mono(2,7-methyl-7-carboxyheptyl) phthalate		×	×	●
	Mono(3-carboxypropyl) phthalate		×	×	●
Pyrethoid (1)	3-Phenoxybenzoic acid	Urine	○	○	○
VOCs (2)	t,t-Muconic acid	Urine	○	○	○
	N-Acetyl-S-(benzyl)-L-cystein		×	×	●

3rd stage of KoNEHS (2015-2017)

- Poster & Leaflet (Ver. KOR)

당신은 우리나라 국민 10,000명을 대표 합니다

국민환경보건 기초조사

조사기간

2015.8~2017.12

조사대상

전 국민 대표로
표본선정된
어린이·청소년·성인
총 5,500명

조사내용

환경노출관련 설문조사
신체계측 및 16종 임상검사
환경오염물질 26종 농도 분석

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환경부·국립환경과학원

3rd stage of KoNEHS (2015-2017)

- Questionnaire (Ver. KOR)

전 국민 환경오염물질 노출 수준 조사

국민환경보건 기초조사

BABY

[영유아용 설문지]

환경부·국립환경과학원

전 국민 환경오염물질 노출 수준 조사

국민환경보건 기초조사

CHILDREN

[초등학생용 설문지]

환경부·국립환경과학원

전 국민 환경오염물질 노출 수준 조사

국민환경보건 기초조사

TEENAGER

[중 · 고등학생용 설문지]

환경부·국립환경과학원

전 국민 환경오염물질 노출 수준 조사

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ADULT

[성인용 설문지]

환경부·국립환경과학원

가 구 공 통 설 문 (성인용)

거주지 특성

1. 현재 살고 계신 집에서 **가장 가까운 도로**(시내버스가 다니는 정도의 도로)와의 거리는 어느 정도 입니까?

[1] 50 m 미만(걸어서 1분 이내) [2] 50 m~100 m 미만(걸어서 2분 이내)
[3] 100 m~500 m 미만(걸어서 8분 이내) [4] 500 m 이상(걸어서 8분 이상)

1-1. 몇 차선 도로입니까?

[1] 왕복 2차선(편도 1차선) [2] 왕복 4차선(편도 2차선)
[3] 왕복 6차선(편도 3차선) [4] 왕복 8차선 이상(편도 4차선 이상)

2. 도로의 **통행량**은 어느 정도라고 생각하십니까?

[1] 매우 많다 [2] 많은 편이다 [3] 보통이다 [4] 적은 편이다 [5] 매우 적다

실내환경

3. 현재 살고 계신 **집은 어떤 형태**입니까?

[1] 단독주택 [2] 연립주택/다세대주택
[3] 아파트 □□층 [4] 기타( )

4. 현재 살고 계신 **집은 언제 지어졌습니까?** □□□□ 년도

5. 현재 살고 계신 **집의 주요 난방 형태와 사용 연료**는 무엇입니까? (각 하나만 선택)

5-1. 난방	5-2. 난방연료	5-3. 취사연료
[1] 중앙	[1] 가스(LPG, LNG)	[1] 가스(LPG, LNG)
[2] 단독(개별)	[2] 석유	[2] 석유
[3] 없음 (5-3번 문항으로)	[3] 석탄, 연탄	[3] 석탄, 연탄
	[4] 나무	[4] 나무
	[5] 태양열	[5] 태양열
	[6] 전기	[6] 전기
	[7] 기타 ( )	[7] 기타 ( )

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국민환경보건기초조사

선택

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[1] 있음
[2] 있음
[3] 있음
[4] 있음
[5] 있음

[1] 유리 그릇 [2] 금속 그릇(스테인리스) [3] 플라스틱 그릇
[4] 지퍼 백, 비닐봉지 [5] 사기 그릇(자기 그릇) [6] 기타 ( )

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43-3. 현재 알레르기 비염으로 치료받고 있습니까?

[1] 아니오 [2] 예

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Korean National Environmental Health Survey (KoNEHS)

@ Further study

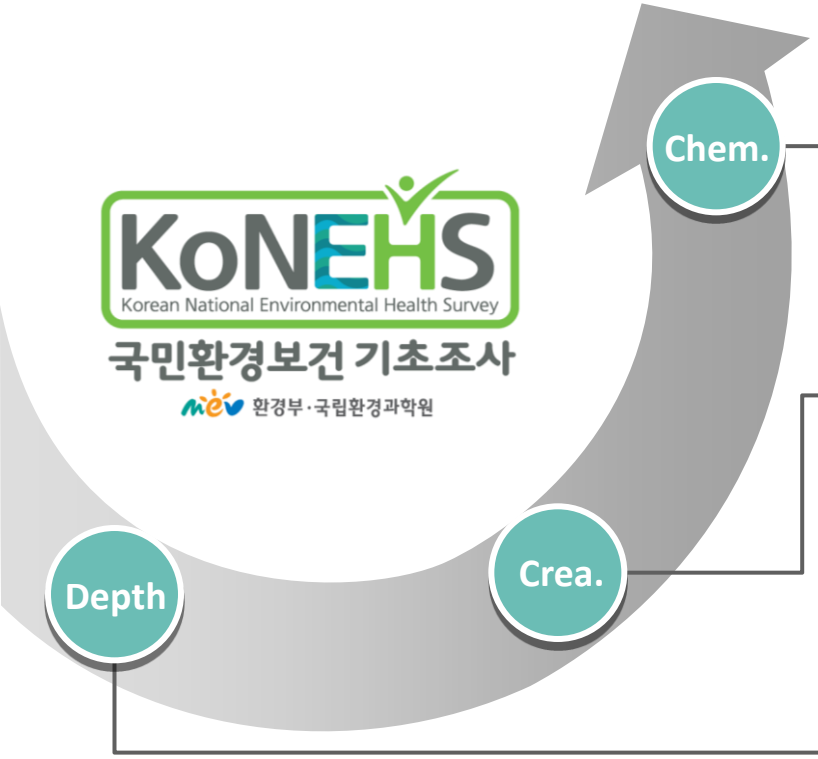
Further Study
- Thinking about Next Human Bio-monitoring

Guideline for chemical concentration levels in body

Necessary for establishing standard guideline of environmental harmful chemicals considering characteristics

☞ Considering health impact of people who participated KoNEHS & standard of communication

☞ Considering necessary of site-specific environmental health survey when group size influence factors found



KoNEHS
Korean National Environmental Health Survey
국민환경보건 기초조사
환경부·국립환경과학원

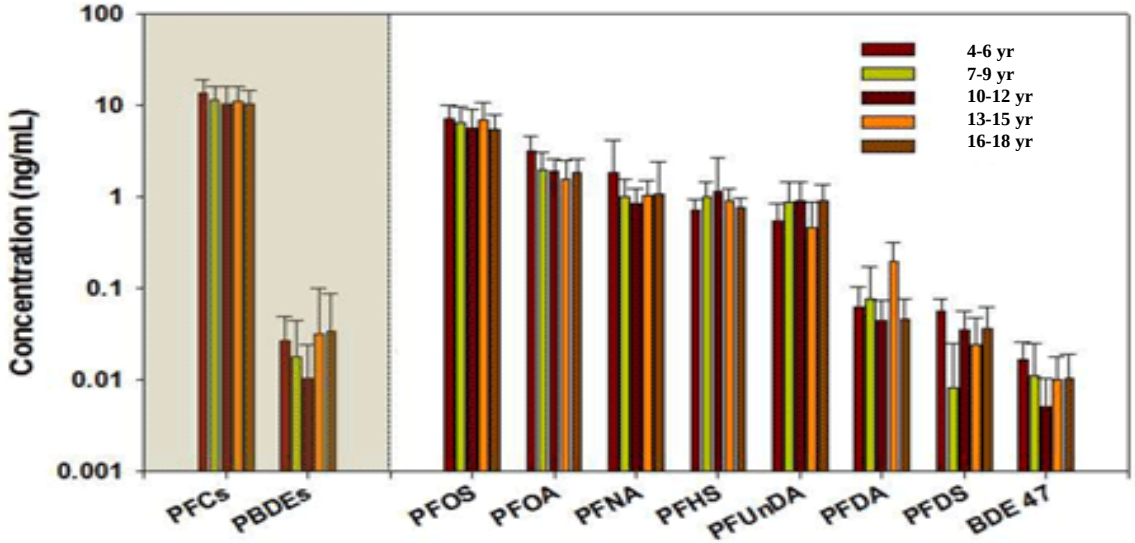
Pilot study for non research chemicals using household item
- POPs, Chlorophenols, Benzophenol and etc.
- Consider simultaneous determination & using little sample
- Develop SOP, QA/QC, Specimen management manuals

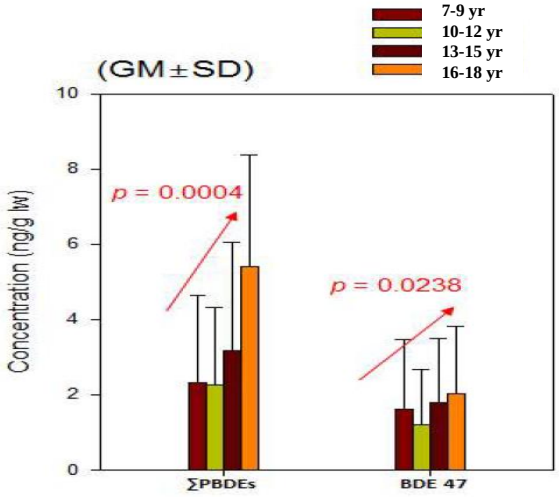
Korean Reference value of Creatinine
- 1st & 2nd participant's creatinine levels analysis (*n*= 12,789)
- Calculate geometric mean value and percentile 95
- Using the correction of chemical concentrations in urine

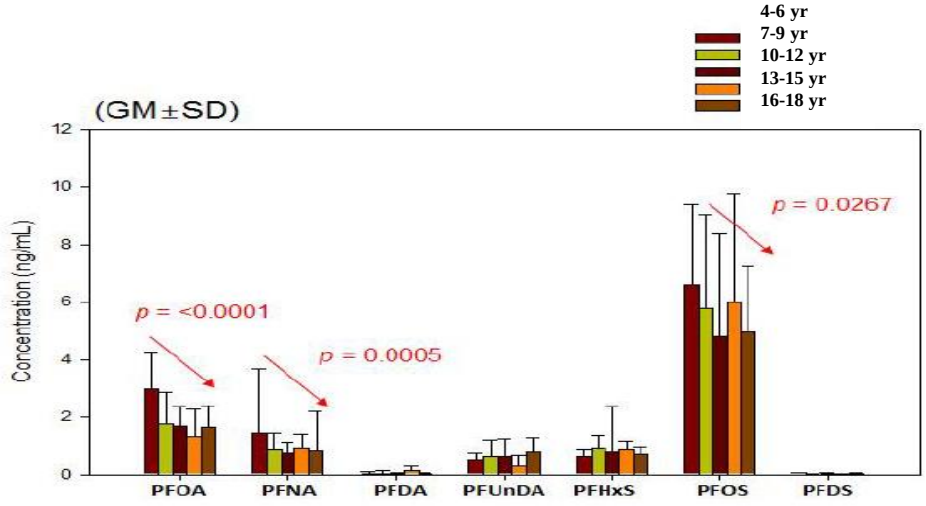
Intergraded analysis of the 2nd stage survey results
- Conducting an in-depth study on the identification of exposure pathways and related variables

Further Study

- Prepare next survey, Evaluate POPs levels in our body







감사합니다

“ 감사합니다 ” means “ Thank you ” / “ Vielen Dank ”

Ministry of Environment