

National Health and Nutrition Examination Survey 2003-2004

Documentation, Codebook, and Frequencies

MEC Laboratory Component:
Blood Lead, Cadmium and
Mercury

Survey Years:
2003 to 2004

SAS Export File:
L06BMT_C.XPT



First Published: May 2006
Last Revised: N/A

NHANES 2003–2004 Data Documentation

Laboratory Assessment: Lab 6 – Blood Lead and Cadmium, Blood Total Mercury, and Blood Inorganic Mercury

Years of Coverage: 2003–2004

First Published: May 2006

Last Revised: N/A

Component Description

Lead

Lead is a known environmental toxin that has been shown to deleteriously affect the nervous, hematopoietic, endocrine, renal, and reproductive systems. In young children, lead exposure is a particular hazard because children more readily absorb lead than do adults, and children's developing nervous systems also make them more susceptible to the effects of lead. The primary sources of exposure for children are lead-laden paint chips and dust as a result of deteriorating lead-based paint. The risk for lead exposure is disproportionately higher for children who are poor, non-Hispanic black, living in large metropolitan areas, or living in older housing. Among adults, the most common high exposure sources are occupational. Blood lead levels measured in previous NHANES programs have been the cornerstone of lead exposure surveillance in the U.S. The data have been used to document the burden and dramatic decline of elevated blood lead levels, to promote the reduction of lead use, and to help to redefine national lead poisoning prevention guidelines, standards, and abatement activities.

Cadmium

A cadmium assay is performed to identify cases of cadmium toxicity. Occupational exposure is the most common cause of elevated cadmium levels.

Total Blood Mercury, Inorganic Mercury

Uncertainties exist regarding levels of exposure to methyl mercury from fish consumption and potential health effects resulting from this exposure. Past estimates of exposure to methyl mercury have been obtained from results of food consumption surveys and measures of methyl mercury in fish. Measures of a biomarker of exposure are needed for improved exposure assessments. Blood mercury levels will be assessed in two subpopulations particularly vulnerable to the health effects from mercury exposure: children 1–5 years old and women of childbearing age.

Blood measures of total and inorganic mercury will be important for evaluation of exposure from exposure to mercury in interior latex paints.

Eligible Sample**Blood Lead, Cadmium, Total Blood Mercury and Inorganic Mercury**

Participants aged 1 year and older who do not meet any of the exclusion criteria are eligible.

Description of Laboratory Methodology**Blood Lead, Cadmium, and Total Mercury**

Whole blood Hg, Pb, and Cd concentrations are determined using inductively coupled plasma mass spectrometry. This multi-element analytical technique is based on quadrupole ICP-MS technology. Coupling radio frequency power into a flowing argon stream seeded with electrons creates the plasma. Predominate species in the plasma are positive argon ions and electrons. Diluted whole blood samples are converted into an aerosol using a nebulizer inserted within a spray chamber. A portion of the aerosol is transported through the spray chamber and then through the central channel of the plasma, where it experiences temperatures of 6000–8000 K. This thermal energy atomizes and ionizes the sample. The ions, along with the argon, enter the mass spectrometer through an interface that separates the ICP, operating at atmospheric pressure (approximately 760 torr), from the mass spectrometer, operating at approximately 10^{-5} torr. The mass spectrometer permits detection of ions at each mass-to-charge ratio in rapid sequence, allowing individual isotopes of an element to be determined. Once inside the mass spectrometer, the ions first pass through the ion optics, then the mass analyzing quadrupole before being detected as they strike the surface of the detector. The ion optics focuses the ion beam using an electrical field. Electrical signals resulting from the detection of the ions are processed into digital information that is used to indicate the intensity of the ions and subsequently the concentration of the element. In this method, blood samples are diluted with 18 Mega-ohm water and with diluent, containing 1% v/v tetramethylammonium hydroxide (TMAH), 0.5% disodium ethylenediamine tetraacetate (EDTA), 10% ethyl alcohol, 0.05% Triton X-100. Au is added to reduce intrinsic Hg memory effects, Rh for internal standardization of Cd, and Bi for internal standardization of Hg and Pb. The samples were prepared with the following ratio:

Sample:Water:Diluent = 1:1:48 correspondingly.

Inorganic Mercury

Inorganic mercury in blood is measured using stannous chloride as a reductant, also utilizing microwave digestion. Mercury vapor (reduced

from inorganic mercury compounds) is measured via the same quartz cell at 253.7 nm.

The difference between total and inorganic mercury represents the organic mercury in blood. Mercury analysis identifies cases of mercury toxicity. The main organs affected by mercury are the brain and kidneys. Psychic and emotional disturbances are the initial signs of chronic intoxication by elemental mercury vapor or salts. Parasthesia and neuralgia may develop. Renal disease, digestive disturbances, and ocular lesions can also develop. Kidney toxicity is an important consequence of exposure to mercury salts.

There were no changes to the equipment or lab site from the previous 2 years.

Laboratory Quality Control and Monitoring

The NHANES quality assurance and quality control (QA/QC) protocols meet the 1988 Clinical Laboratory Improvement Act mandates. Detailed QA/QC instructions are discussed in the NHANES Laboratory/Medical Technologists Procedures Manual (LPM). Read the LABDOC file for detailed QA/QC protocols.

A detailed description of the quality assurance and quality control procedures can be found on the NHANES website.

Data Processing and Editing

Whole blood specimens are processed, stored, and shipped to the Division of Laboratory Sciences, National Center for Environmental Health, and Centers for Disease Control and Prevention for analysis.

Detailed specimen collection and processing instructions are discussed in the NHANES LPM. Vials are stored under appropriate frozen (-20°C) conditions until they are shipped to National Center for Environmental Health for testing.

This file contains no top coding. The below detection limit "fill values" for total mercury and inorganic mercury changed from 2001-2002. For inorganic mercury the "fill value" was .28 in 2001-2002 and .3 in 2003-2004. For total mercury the "fill value" was .07 in 2001-2002 and .1 and .14 in 2003-2004.

Four derived variables were created in this data file. The formula for their derivation is as follows:

The cadmium in $\mu\text{g/L}$ was converted to $\mu\text{mol/L}$ by multiplying by 8.897.

The lead in $\mu\text{g/L}$ was converted to $\mu\text{mol/L}$ by multiplying by 0.0483.

The total mercury in $\mu\text{g/L}$ was converted to nmol/L by multiplying by 4.99.

The inorganic mercury in $\mu\text{g/L}$ was converted to nmol/L by multiplying by 4.99.

Detailed instructions on specimen collection and processing can be found on the NHANES website.

Analytic Notes The analysis of NHANES 2003–2004 laboratory data must be conducted with the key survey design and basic demographic variables. The NHANES 2003–2004 Household Questionnaire Data Files contain demographic data, health indicators, and other related information collected during household interviews. The Household Questionnaire Data Files also contain all survey design variables and sample weights required to analyze these data. The Phlebotomy Examination file includes auxiliary information on duration of fasting, the time of day of the venipuncture, and the conditions precluding venipuncture. The Household Questionnaire and Phlebotomy Exam files may be linked to the laboratory data file using the unique survey participant identifier SEQN.

References N/A

Locator Fields

Title: Blood Lead and Cadmium, Blood Total Mercury and Blood Inorganic Mercury

Contact Number: 1-866-441-NCHS

Years of Content: 2003–2004

First Published: May 2006

Revised: N/A

Access Constraints: None

Use Constraints: None

Geographic Coverage: National

Subject: Blood Lead and Cadmium, Blood Total Mercury and Blood Inorganic Mercury

Record Source: NHANES 2003–2004

Survey Methodology: NHANES 2003–2004 is a stratified multistage probability sample of the civilian non-institutionalized population of the U.S.

Medium: NHANES Web site; SAS transport files

**National Health and Nutrition Examination Survey
Codebook for Data Production (2003-2004)**

**Blood Lead, Cadmium and Mercury (L06BMT_C)
Person Level Data**

First Publish: May 2006

Last Revised: N/A



SEQN	Target
Hard Edits	B(1 Yrs. to 150 Yrs.)
	SAS Label
	Respondent sequence number
English Text: Respondent sequence number.	
English Instructions:	

LBXBCD	Target			
	B(1 Yrs. to 150 Yrs.)			
Hard Edits	SAS Label			
0 to 99.9	Cadmium (ug/L)			
English Text: Cadmium (ug/L)				
English Instructions:				
Code or Value	Description	Count	Cumulative	Skip to Item
0.2 to 7.4	Range of Values	5616	5616	
0.1	Below Limit of Detection	2756	8372	
.	Missing	807	9179	

LBDBCDSI		Target		
		B(1 Yrs. to 150 Yrs.)		
Hard Edits		SAS Label		
		Cadmium (nmol/L)		
English Text: Cadmium (nmol/L)				
English Instructions:				
Code or Value	Description	Count	Cumulative	Skip to Item
1.78 to 65.84	Range of Values	5616	5616	
0.89	Below Limit of Detection	2756	8372	
.	Missing	807	9179	

LBXBPB		Target		
		B(1 Yrs. to 150 Yrs.)		
Hard Edits		SAS Label		
0 to 99.9		Lead (ug/dL)		
English Text: Lead (ug/dL)				
English Instructions:				
Code or Value	Description	Count	Cumulative	Skip to Item
0.3 to 68.9	Range of Values	8349	8349	
0.2	Below Limit of Detection	24	8373	
.	Missing	806	9179	

LBDBPBSI		Target		
		B(1 Yrs. to 150 Yrs.)		
Hard Edits		SAS Label		
		Lead (umol/L)		
English Text: Lead (umol/L)				
English Instructions:				
Code or Value	Description	Count	Cumulative	Skip to Item
0.014 to 3.328	Range of Values	8349	8349	
0.01	Below Limit of Detection	24	8373	
.	Missing	806	9179	

LBXTHG		Target		
		B(1 Yrs. to 150 Yrs.)		
Hard Edits		SAS Label		
0 to 99.9		Mercury, total (ug/L)		
English Text: Mercury, total (ug/L)				
English Instructions:				
Code or Value	Description	Count	Cumulative	Skip to Item
0.2 to 32.8	Range of Values	7356	7356	
0.1	Below First Limit of Detection	372	7728	
0.14	Below Second Limit of Detection	645	8373	
.	Missing	806	9179	

LBDTHGSI		Target		
		B(1 Yrs. to 150 Yrs.)		
Hard Edits		SAS Label		
		Mercury, total (umoL/L)		
English Text: Mercury, total (umoL/L)				
English Instructions:				
Code or Value	Description	Count	Cumulative	Skip to Item
1 to 163.67	Range of Values	7356	7356	
0.5	Below First Limit of Detection	372	7728	
0.7	Below Second Limit of Detection	645	8373	
.	Missing	806	9179	

LBXIHG	Target
	B(1 Yrs. to 150 Yrs.)
Hard Edits	SAS Label
0 to 99.9	Mercury, inorganic (ug/L)
English Text: Mercury, inorganic (ug/L)	
English Instructions:	

Code or Value	Description	Count	Cumulative	Skip to Item
0.4 to 40.2	Range of Values	1854	1854	
0.3	Below Limit of Detection	6293	8147	
.	Missing	1032	9179	

LBDIHGSI	Target
	B(1 Yrs. to 150 Yrs.)
Hard Edits	SAS Label
	Mercury, inorganic (umoL/L)
English Text: Mercury, inorganic (umoL/L)	
English Instructions:	

Code or Value	Description	Count	Cumulative	Skip to Item
2 to 200.6	Range of Values	1854	1854	
1.5	Below Limit of Detection	6293	8147	
.	Missing	1032	9179	