National Health and Nutrition Examination Survey

2015-2016 Data Documentation, Codebook, and Frequencies

Speciated Arsenics - Urine (UAS_I)

Data File: UAS_I.xpt

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Component Description

Arsenic is widely distributed in the earth's crust and is found most often in ground water rather than surface water. People encounter arsenic in many chemical forms that vary greatly in toxicity. The most toxic of the naturally occurring arsenic compounds are inorganic forms of arsenic and their methylated metabolites. Less toxic are the organic arsenic compounds.

Eligible Sample

All examined participants aged 3 to 5 years were eligible and participants aged 6 years and older from a one-third subsample were eligible.

Description of Laboratory Methodology

Arsenobetaine, arsenocholine, monomethylarsonic acid, dimethylarsinic acid, arsenous (III) acid, arsenic (V) acid

The concentration of speciated arsenics is determined by using high performance liquid chromatography (HPLC) to separate the species coupled to an ICP-DRC-MS to detect the arsenic species. This analytical technique is based on separation by anion-exchange chromatography (IC), followed by detection using quadrupole ICP-MS technology, and includes DRC™ technology (Baranov VI et al., 1999), which minimizes or eliminates many argon-based polyatomic interferences (Tanner S et al., 2000) will require 0.5 mL of urine. Arsenic species column separation is largely achieved due to differences in charge-charge interactions of each negatively charged arsenic component in the mobile phase, with the positively-charged quaternary ammonium groups bound at the column's solid-liquid interface. Upon exit from the column, the chromatographic eluent goes through a nebulizer, where it is converted into an aerosol upon entering the spray chamber.

Carried by a stream of argon gas, a portion of the aerosol is transported through the spray chamber and then through the central channel of the plasma, where it is heated to temperatures of 6000-8000° K. This thermal energy atomizes and ionizes the sample. The ions and the argon enter the mass spectrometer through an interface that separates the ICP, which is operating at atmospheric pressure (approximately 760 torr), from the mass spectrometer, which is operating at approximately 10^{-5} torr.

The mass spectrometer permits detection of ions at each mass-to-charge ratio in rapid sequence, which allows the determination of individual isotopes of an element. Once inside the mass spectrometer, the ions pass through the ion optics, then through the DRC™, and finally through the mass-analyzing quadrupole before being detected as they strike the surface of the detector. The ion optics uses an electrical field to focus the ion beam into the DRC™.

The DRC™ component is pressurized with an appropriate reaction gas and contains a

quadrupole. In the DRC™, elimination or reduction of argon-based polyatomic interferences takes place through the interaction of the reaction gas with the interfering polyatomic species in the incoming ion beam. The quadrupole in the DRC™ allows elimination of unwanted reaction by-products that would otherwise react to form new interferences.

Refer to the Laboratory Method Files section for a detailed description of the laboratory methods used.

There were no changes to the lab method, lab equipment, or lab site for this component in the NHANES 2015-2016 cycle.

Laboratory Method Files

Arsenics - Speciated - Urine Laboratory Procedure Manual (June 2018)

Laboratory Quality Assurance and Monitoring

Urine samples are processed, stored, and shipped to the Division of Laboratory Sciences, National Center for Environmental Health, Centers for Disease Control and Prevention, Atlanta, GA for analysis.

Detailed instructions on specimen collection and processing are discussed in the NHANES LPM Vials are stored under appropriate frozen (–30°C) conditions until they are shipped to National Center for Environmental Health for testing.

The NHANES quality assurance and quality control (QA/QC) protocols meet the 1988 Clinical Laboratory Improvement Amendment mandates. Detailed QA/QC instructions are discussed in the NHANES Laboratory Procedures Manual (LPM).

Mobile Examination Centers (MECs)

Laboratory team performance is monitored using several techniques. NCHS and contract consultants use a structured competency assessment evaluation during visits to evaluate both the quality of the laboratory work and the quality-control procedures. Each laboratory staff member is observed for equipment operation, specimen collection and preparation; testing procedures and constructive feedback are given to each staff member. Formal retraining sessions are conducted annually to ensure that required skill levels were maintained.

Analytical Laboratories

NHANES uses several methods to monitor the quality of the analyses performed by the contract laboratories. In the MEC, these methods include performing blind split samples collected on “dry run” sessions. In addition, contract laboratories randomly perform repeat testing on 2% of all specimens.

NCHS developed and distributed a quality control protocol for all CDC and contract laboratories, which outlined the use of Westgard rules (Westgard et al, 1981) when running NHANES specimens. Progress reports containing any problems encountered during shipping or receipt of specimens, summary statistics for each control pool, QC graphs, instrument calibration, reagents, and any special considerations are submitted to NCHS quarterly. The reports are reviewed for trends or shifts in the data. The laboratories are required to explain any identified areas of concern.

All QC procedures recommended by the manufacturers were followed. Reported results for all assays meet the Division of Laboratory Sciences’ quality control and quality assurance performance criteria for accuracy and precision, similar to the Westgard rules (Caudill et al, 2008).

Data Processing and Editing

The data were reviewed. Incomplete data or improbable values were sent to the performing

laboratory for confirmation.

Analytic Notes

Refer to the 2015-2016 Laboratory Data Overview for general information on NHANES laboratory data.

Subsample Weights

Urinary speciated arsenics were measured in a full sample of participants ages 3-5 and a one-third subsample of persons 6 years and older. Special sample weights are required to analyze these data properly. Specific sample weights for this subsample are included in this data file and should be used when analyzing these data.

Demographic and Other Related Variables

The analysis of NHANES laboratory data must be conducted the appropriate survey design and demographic variables. The NHANES 2015-2016 Demographics File contains demographic data, health indicators, and other related information collected during household interviews as well as the sample design variables. The recommended procedure for variance estimation requires use of stratum and PSU variables (SDMVSTRA and SDMVPSU, respectively) in the demographic data file.

Starting in the 2015-2016 NHANES cycle, the variable URXUCR (urine creatinine) will not be reported in this file. URXUCR can be found in the data file titled Albumin & Creatinine – Urine.

This laboratory data file can be linked to the other NHANES data files using the unique survey participant identifier (i.e., SEQN).

Detection Limits

The detection limits were constant for all of the analytes in the data set. Two variables are provided for each of these analytes. The variable name ending in “LC” (ex., URDUASLC) indicates whether the result was below the limit of detection: the value “0” means that the result was at or above the limit of detection, “1” indicates that the result was below the limit of detection. For analytes with analytic results below the lower limit of detection (ex., URDUASLC=1), an imputed fill value was placed in the analyte results field. This value is the lower limit of detection divided by square root of 2 (LLOD/sqrt [2]). The other variable prefixed URX (ex., URXUAS) provides the analytic result for the analyte.

The lower limit of detection (LLOD, in µg/L) for the speciated arsenics is:

Variable Name	SAS Label	LLOD
URXUAS3	Urinary Arsenous Acid	0.12
URXUAS5	Urinary Arsenic acid	0.79
URXUAB	Urinary Arsenobetaine	1.16
URXUAC	Urinary Arsenocholine	0.11
URXUDMA	Urinary Dimethylarsinic Acid	1.91
URXUMMA	Urinary Monomethylarsonic Acid	0.20

Please refer to the NHANES Analytic Guidelines and the on-line NHANES Tutorial for further details on the use of sample weights and other analytic issues.

References

- Baranov VI, Tanner SD. A dynamic reaction cell for inductively coupled plasma mass spectrometry (ICP-DRC-MS). Part 1. The rf-field energy contribution in thermodynamics of ion-molecule reactions. J. Anal. At. Spectrom. 1999;14:1133-1142.
- Caudill S.P., Schleicher R.L., Pirkle J.L. Multi-rule quality control for the age-related eye disease study. Statist. Med. (2008) 27(20:4094-40106.
- Tanner S, Baranov VI, Vollkopf U. A dynamic reaction cell for inductively coupled plasma mass spectroscopy (ICP-DRC-MS). Part III. Optimization and analytical performance. J. Anal. At. Spectrom. 2000;15:1261-1269.
- Westgard J.O., Barry P.L., Hunt M.R., Groth T. A multi-rule Shewhart chart for quality control in clinical chemistry. Clin Chem (1981) 27:493-501.

Codebook and Frequencies

SEQN - Respondent sequence number

Variable Name:	SEQN
SAS Label:	Respondent sequence number
English Text:	Respondent sequence number.
Target:	Both males and females 3 YEARS - 150 YEARS

WTSA2YR - Subsample A weights

Variable Name: WTSA2YR

SAS Label: Subsample A weights

English Text: Subsample A weights

Target: Both males and females 3 YEARS - 150 YEARS

Code or Value	Value Description	Count	Cumulative	Skip to Item
6552.119284 to 708844.24678	Range of Values	3231	3231	
0	Participants 6+ years with no lab specimen	48	3279	
.	Missing	0	3279	

URXUAS3 - Urinary Arsenous acid (ug/L)

Variable Name: URXUAS3

SAS Label: Urinary Arsenous acid (ug/L)

English Text: Urinary Arsenous acid (ug/L)

Target: Both males and females 3 YEARS - 150 YEARS

Code or Value	Value Description	Count	Cumulative	Skip to Item
0.08 to 8.82	Range of Values	3094	3094	
.	Missing	185	3279	

URDUA3LC - Urinary Arsenous acid comment code

Variable Name: URDUA3LC

SAS Label: Urinary Arsenous acid comment code

English Text: Urinary Arsenous acid comment code

Target: Both males and females 3 YEARS - 150 YEARS

Code or Value	Value Description	Count	Cumulative	Skip to Item
0	At or above the detection limit	1640	1640	
1	Below lower detection limit	1454	3094	
.	Missing	185	3279	

URXUAS5 - Urinary Arsenic acid (ug/L)

Variable Name: URXUAS5

SAS Label: Urinary Arsenic acid (ug/L)

English Text: Urinary Arsenic acid (ug/L)

Target: Both males and females 3 YEARS - 150 YEARS

Code or Value	Value Description	Count	Cumulative	Skip to Item
0.56 to 4.54	Range of Values	3094	3094	
.	Missing	185	3279	

URDUA5LC - Urinary Arsenic acid comment code

Variable Name: URDUA5LC

SAS Label: Urinary Arsenic acid comment code

English Text: Urinary Arsenic acid comment code

Target: Both males and females 3 YEARS - 150 YEARS

Code or Value	Value Description	Count	Cumulative	Skip to Item
0	At or above the detection limit	97	97	
1	Below lower detection limit	2997	3094	
.	Missing	185	3279	

URXUAB - Urinary Arsenobetaine (ug/L)

Variable Name: URXUAB

SAS Label: Urinary Arsenobetaine (ug/L)

English Text: Urinary Arsenobetaine (ug/L)

Target: Both males and females 3 YEARS - 150 YEARS

Code or Value	Value Description	Count	Cumulative	Skip to Item
0.82 to 662.24	Range of Values	3094	3094	
.	Missing	185	3279	

URDUABLC - Urinary Arsenobetaine comment code

Variable Name: URDUABLC

SAS Label: Urinary Arsenobetaine comment code

English Text: Urinary Arsenobetaine comment code

Target: Both males and females 3 YEARS - 150 YEARS

Code or Value	Value Description	Count	Cumulative	Skip to Item
0	At or above the detection limit	1230	1230	
1	Below lower detection limit	1864	3094	
.	Missing	185	3279	

URXUAC - Urinary Arsenocholine (ug/L)

Variable Name: URXUAC

SAS Label: Urinary Arsenocholine (ug/L)

English Text: Urinary Arsenocholine (ug/L)

Target: Both males and females 3 YEARS - 150 YEARS

Code or Value	Value Description	Count	Cumulative	Skip to Item
0.08 to 10.98	Range of Values	3094	3094	
.	Missing	185	3279	

URDUACLC - Urinary Arsenocholine comment code

Variable Name: URDUACLC

SAS Label: Urinary Arsenocholine comment code

English Text: Urinary Arsenocholine comment code

Target: Both males and females 3 YEARS - 150 YEARS

Code or Value	Value Description	Count	Cumulative	Skip to Item
0	At or above the detection limit	534	534	
1	Below lower detection limit	2560	3094	
.	Missing	185	3279	

URXUDMA - Urinary Dimethylarsinic acid (ug/L)

Variable Name: URXUDMA

SAS Label: Urinary Dimethylarsinic acid (ug/L)

English Text: Urinary Dimethylarsinic acid (ug/L)

Target: Both males and females 3 YEARS - 150 YEARS

Code or Value	Value Description	Count	Cumulative	Skip to Item
1.35 to 149.62	Range of Values	3094	3094	
.	Missing	185	3279	

URDUDALC - Urinary Dimethylarsonic acid comment

Variable Name: URDUDALC

SAS Label: Urinary Dimethylarsonic acid comment

English Text: Urinary Dimethylarsinic acid comment code

Target: Both males and females 3 YEARS - 150 YEARS

Code or Value	Value Description	Count	Cumulative	Skip to Item
0	At or above the detection limIt	2208	2208	
1	Below lower detection limit	886	3094	
.	Missing	185	3279	

URXUMMA - Urinary Monomethylacrsonic acid (ug/L)

Variable Name: URXUMMA

SAS Label: Urinary Monomethylacrsonic acid (ug/L)

English Text: Urinary Monomethylacrsonic acid (ug/L)

Target: Both males and females 3 YEARS - 150 YEARS

Code or Value	Value Description	Count	Cumulative	Skip to Item
0.14 to 12.09	Range of Values	3094	3094	
.	Missing	185	3279	

URDUMMAL - Urinary Monomethylacrsonic acid comment

Variable Name: URDUMMAL

SAS Label: Urinary Monomethylacrsonic acid comment

English Text: Urinary Monomethylacrsonic acid comment code

Target: Both males and females 3 YEARS - 150 YEARS

Code or Value	Value Description	Count	Cumulative	Skip to Item
0	At or above the detection limit	1724	1724	
1	below lower detection limit	1370	3094	
.	Missing	185	3279	