National Health and Nutrition Examination Survey

2017-March 2020 Data Documentation, Codebook, and Frequencies

Organophosphate Insecticides - Dialkyl Phosphate Metabolites - Urine (P_OPD)

Data File: P_OPD.xpt

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Component Description

The NHANES program suspended field operation in March 2020 due to the coronavirus disease 2019 (COVID-19) pandemic. As a result, data collection for the NHANES 2019-2020 cycle was not completed and the collected data are not nationally representative. Therefore, data collected from 2019 to March 2020 were combined with data from the NHANES 2017-2018 cycle to form a nationally representative sample of NHANES 2017-March 2020 pre-pandemic data. These data are available to the public. Please refer to the Analytic Notes section for more details on the use of the data.

Organophosphate (OP) pesticides are used in both residential and agricultural settings in the United States. OP pesticides include malathion, diazinon, chlorpyrifos, Guthion® (azinphosmethyl), parathion, and many others. All OP pesticides have a common mode of toxicity because they are competitive inhibitors of acetylcholinesterase, the enzyme responsible for deacetylation of the neurotransmitter acetylcholine (Koelle G.B., 1994; Gompertz D., 1996). Unfortunately, the toxic effects of OP pesticides are not unique to insects; high doses can similarly affect wildlife and people.

OP pesticides were among the first of the U.S. Environmental Protection Agency (EPA)-registered pesticides whose food tolerances were reassessed (EPA, 2017), due to their common mode of toxicity and potential adverse effects in vulnerable populations, such as children.

Most of the organophosphate pesticides registered for use in the United States by the EPA are O, O-dimethyl, or O-diethyl substituted, which metabolize to dialkylphosphate (DAP) metabolites. The six common DAP metabolites (Dimethylphosphate, Diethylphosphate, Dimethylthiophosphate, Dimethyldithiophosphate, Diethylthiophosphate, and Diethyldithiophosphate) do not retain any of the structure unique to the pesticides from which they were derived, so it is impossible to identify individual pesticides from these metabolites. However, because these metabolites are common to the majority of OP pesticides, they can provide invaluable information about cumulative exposure to the OP class.

Eligible Sample

All examined participants aged 3 to 5 years and a one-third subsample of examined participants aged 6 years and older were eligible in the NHANES 2017-March 2020 pre-pandemic sample.

Description of Laboratory Methodology

This method uses solid phase extraction (SPE) coupled with isotope dilution-ultrahigh performance liquid chromatography (UHPLC)-tandem mass spectrometry (Jayatilaka N.K., et. al., 2017). The method relies on an enzymatic hydrolysis of urinary conjugates, automated off-line SPE to pre-concentrate the target compounds while minimizing urine matrix potential interferences to increase the overall sensitivity and specificity. The deconjugated target analytes in the urine extract are separated on an UHPLC system with reversed phase chromatography and quantified by isotope dilution tandem mass spectrometry.

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, and lab site for this component in the NHANES 2017-2018 or 2019-2020 cycles.

Laboratory Method Files

Organophosphate Insecticides- Dialkyl Phosphate Metabolites (OPD) (March 2022)

Organophosphate Insecticides - Dialkyl Phosphate Metabolites - Urine (November 2023)

Laboratory Quality Assurance and Monitoring

Urine specimens 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 2017-2018 and 2019-2020 NHANES Laboratory Procedures Manual (LPM). Vials were stored under appropriate frozen (–30°C) conditions until they were shipped to the Division of Laboratory Sciences for testing.

The NHANES quality control and quality assurance protocols (QA/QC) meet the 1988 Clinical Laboratory Improvement Amendments mandates. Detailed QA/QC instructions are discussed in the NHANES 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 during “dry run” sessions. In addition, contract laboratories randomly perform repeat testing on 2% of all specimens.

NCHS developed and distributed a QC 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’ QA/QC 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

The COVID-19 pandemic required suspension of NHANES 2019-2020 field operations in March 2020 after data were collected in 18 of the 30 survey locations in the 2019-2020 sample. Data collection was cancelled for the remaining 12 locations. Because the collected data from 18 locations were not nationally representative, these data were combined with data from the previous cycle (2017-2018) to create a 2017-March 2020 pre-pandemic data file. A special weighting process was applied to the 2017-March 2020 pre-pandemic data file. The resulting sample weights in the present file should be used to calculate estimates from the combined cycles. These sample weights are not appropriate for independent analyses of the 2019-2020 data and will not yield nationally representative results for either the 2017-2018 data alone or the 2019-March 2020 data alone. Please refer to the NHANES website for additional information for the NHANES 2017-March 2020 pre-pandemic data, and for the previous 2017-2018 public use data file with specific weights for that 2-year cycle.

Refer to the 2017-2018 and 2019-2020 Laboratory Data Overview for general information on NHANES laboratory data.

There are over 800 laboratory tests performed on NHANES participants. However, not all participants provided biospecimens or enough volume for all the tests to be performed. The specimen availability can also vary by age or other population characteristics. Analysts should evaluate the extent of missing data in the dataset related to the outcome of interest as well as any predictor variables used in the analyses to determine whether additional re-weighting for item non-response is necessary.

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.

Subsample Weights

Organophosphate Pesticides - Dialkyl Phosphate Metabolites were measured in a one-third subsample of participants 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.

For participants aged 3-5, their sample weights in this dataset (i.e., WTSBPRP) are equivalent to their MEC exam sample weights. These participants have completed at least one physical exam component in the MEC; therefore, they all have an exam sample weight larger than “0,” regardless of their lab test results. For participants 6 years and older in the dataset, special sample weights were created for the subsample and encoded in variable WTSBPRP. These special weights accounted for the additional probability of selection into the subsample, as well as the additional nonresponse to these lab tests. Therefore, if participants 6 years and older were selected as part of the one-third subsample, but did not provide a urine specimen, they would have the sample weight value assigned as “0” in their records.

Demographic and Other Related Variables

The analysis of NHANES laboratory data must be conducted using the appropriate survey design and demographic variables. The NHANES 2017- March 2020 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.

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 limit was constant for the analyte in the data set. Two variables are provided for this analyte. The variable name ending in “LC” (ex., URDOP1LC) 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 the analyte with analytic results below the lower limit of detection (URDOP1LC=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 variable prefixed URX (ex., URXOP1) provides the analytic result for that analyte.

The lower limit of detection (LLOD, in ng/mL) for Organophosphate Pesticides - Dialkyl Phosphate Metabolites:

Variable Name	Analyte Description	LLOD
URXOP1	Dimethylphosphate (ng/mL)	0.1
URXOP2	Diethylphosphate (ng/mL)	0.1
URXOP3	Dimethylthiophosphate (ng/mL)	0.1
URXOP4	Diethylthiophosphate (ng/mL)	0.1
URXOP5	Dimethyldithiophosphate (ng/mL)	0.1
URXOP6	Diethyldithiophosphate (ng/mL)	0.1

References

- 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.
- Gompertz D. Biological monitoring of chemical exposure in the Workplace: Guidelines. Vol. 1. Geneva (CH): World Health Organization; 1996. p. 237-42.
- Jayatilaka NK, Restrepo P, Williams L, Ospina M, Valentin-Blasini L, Calafat AM. Quantification of three chlorinated dialkyl phosphates, diphenyl phosphate, 2,3,4,5-tetrabromobenzoic acid, and four other organophosphates in human urine by solid phase extraction-high performance liquid chromatography-tandem mass spectrometry. Anal Bioanal Chem (2017) 409:1323–1332.
- Koelle G B. Pharmacology of organophosphates. J Appl Toxicol 1994; 14:105-9.
- U.S Environmental Protection Agency (EPA). Pesticides Industry Sales and Usage 2008-2012. 2017. https://www.epa.gov/sites/production/files/2017-01/documents/pesticides-industry-sales-usage-2016_0.pdf.
- 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

WTSBPRP - Subsample B Weights Pre-Pandemic

Variable Name: WTSBPRP

SAS Label: Subsample B Weights Pre-Pandemic

English Text: Subsample B Weights Pre-Pandemic

Target: Both males and females 3 YEARS - 150 YEARS

Code or Value	Value Description	Count	Cumulative	Skip to Item
2462.026927 to 981259.61533	Range of Values	4646	4646	
0	Participants 6+ years with no lab specimen	283	4929	
.	Missing	0	4929	

URXOP1 - Dimethylphosphate (ng/mL)

Variable Name: URXOP1

SAS Label: Dimethylphosphate (ng/mL)

English Text: Dimethylphosphate (ng/mL)

Target: Both males and females 3 YEARS - 150 YEARS

Code or Value	Value Description	Count	Cumulative	Skip to Item
0.0707 to 622	Range of Values	4618	4618	
.	Missing	311	4929	

URDOP1LC - Dimethylphosphate Comment Code

Variable Name: URDOP1LC

SAS Label: Dimethylphosphate Comment Code

English Text: Dimethylphosphate 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	4383	4383	
1	Below lower detection limit	235	4618	
.	Missing	311	4929	

URXOP2 - Diethylphosphate (ng/mL)

Variable Name: URXOP2

SAS Label: Diethylphosphate (ng/mL)

English Text: Diethylphosphate (ng/mL)

Target: Both males and females 3 YEARS - 150 YEARS

Code or Value	Value Description	Count	Cumulative	Skip to Item
0.0707 to 252	Range of Values	4607	4607	
.	Missing	322	4929	

URDOP2LC - Diethylphosphate Comment Code

Variable Name: URDOP2LC

SAS Label: Diethylphosphate Comment Code

English Text: Diethylphosphate 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	4585	4585	
1	Below lower detection limit	22	4607	
.	Missing	322	4929	

URXOP3 - Dimethylthiophosphate (ng/mL)

Variable Name: URXOP3

SAS Label: Dimethylthiophosphate (ng/mL)

English Text: Dimethylthiophosphate (ng/mL)

Target: Both males and females 3 YEARS - 150 YEARS

Code or Value	Value Description	Count	Cumulative	Skip to Item
0.0707 to 454	Range of Values	4604	4604	
.	Missing	325	4929	

URDOP3LC - Dimethylthiophosphate Comment Code

Variable Name: URDOP3LC

SAS Label: Dimethylthiophosphate Comment Code

English Text: Dimethylthiophosphate 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	4075	4075	
1	Below lower detection limit	529	4604	
.	Missing	325	4929	

URXOP4 - Diethylthiophosphate (ng/mL)

Variable Name: URXOP4

SAS Label: Diethylthiophosphate (ng/mL)

English Text: Diethylthiophosphate (ng/mL)

Target: Both males and females 3 YEARS - 150 YEARS

Code or Value	Value Description	Count	Cumulative	Skip to Item
0.0707 to 34	Range of Values	4611	4611	
.	Missing	318	4929	

URDOP4LC - Diethylthiophosphate Comment Code

Variable Name: URDOP4LC

SAS Label: Diethylthiophosphate Comment Code

English Text: Diethylthiophosphate 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	2674	2674	
1	Below lower detection limit	1937	4611	
.	Missing	318	4929	

URXOP5 - Dimethyldithiophosphate (ng/mL)

Variable Name: URXOP5

SAS Label: Dimethyldithiophosphate (ng/mL)

English Text: Dimethyldithiophosphate (ng/mL)

Target: Both males and females 3 YEARS - 150 YEARS

Code or Value	Value Description	Count	Cumulative	Skip to Item
0.0707 to 175	Range of Values	4621	4621	
.	Missing	308	4929	

URDOP5LC - Dimethyldithiophosphate Comment Code

Variable Name: URDOP5LC

SAS Label: Dimethyldithiophosphate Comment Code

English Text: Dimethyldithiophosphate 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	2192	2192	
1	Below lower detection limit	2429	4621	
.	Missing	308	4929	

URXOP6 - Diethyldithiophosphate (ng/mL)

Variable Name: URXOP6

SAS Label: Diethyldithiophosphate (ng/mL)

English Text: Diethyldithiophosphate (ng/mL)

Target: Both males and females 3 YEARS - 150 YEARS

Code or Value	Value Description	Count	Cumulative	Skip to Item
0.0707 to 1.27	Range of Values	4620	4620	
.	Missing	309	4929	

URDOP6LC - Diethyldithiophosphate Comment Code

Variable Name: URDOP6LC

SAS Label: Diethyldithiophosphate Comment Code

English Text: Diethyldithiophosphate 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	156	156	
1	Below lower detection limit	4464	4620	
.	Missing	309	4929	