National Health and Nutrition Examination Survey

2017-March 2020 Data Documentation, Codebook, and Frequencies

Flame Retardants - Urine (Surplus) (P_SSFR)

Data File: P_SSFR.xpt

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Component Description

The NHANES program suspended field operations 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.

Flame retardants (FRs) are either additive or reactive ingredients applied to household and consumer products to reduce the products flammability and to meet state and federal fire safety standards and regulations. Until recently, a dominant class of FR additives used for household products was polybrominated diphenyl ethers (PBDEs), which are persistent and can accumulate in the environment (de Wit, 2002; Law et. al., 2006; Stapleton et. al., 2012). Flame retardant formulations containing chlorinated and non-chlorinated organophosphates and non-PBDE brominated chemicals have entered consumers' markets as PBDEs have been phased-out in many countries (van der Veen and de Boer, 2012). Several organophosphate aryl ester technical mixtures have been increasingly used in residential applications. These mixtures contain isomers of isopropylated and tert-butylated triarylphosphate esters, such as isopropylphenyl diphenyl phosphate and tert-butylphenyl diphenyl phosphate (Phillips et. al., 2017). Additionally, human exposure to these mixtures has been demonstrated to be widespread in several studies (Hammel et. al., 2016; Phillips et. al., 2018). Biomarkers of exposure of several flame retardants are quantified here, including 2-((isopropyl)phenyl)phenyl phosphate (iPPPP) and 4-((tert-butyl)phenyl)phenyl phosphate (tBPPP), two metabolites of isopropylphenyl diphenyl phosphates and tert-butylphenyl diphenyl phosphates, respectively.

Eligible Sample

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

Description of Laboratory Methodology

The method uses 0.2 mL urine and is based on enzymatic hydrolysis of urinary conjugates of the target analytes, automated off-line solid phase extraction, reversed phase high-performance liquid chromatography separation, and isotope dilution-electrospray ionization tandem mass spectrometry detection (Jayatilaka et. al., 2019).

There were no changes to the lab method, lab equipment, or lab site for this component in the NHANES 2017-March 2020 cycle.

Laboratory Quality Assurance and Monitoring

The analytical measurements were conducted following strict quality control/quality assurance CLIA guidelines. Along with the study samples, each analytical run included high- and low-concentration quality

control materials (QCMs) and reagent blanks to assure the accuracy and reliability of the data. The concentrations of the high-concentration QCMs and the low-concentration QCMs, averaged to obtain one measurement of high-concentration QCM and low-concentration QCM for each run, were evaluated using standard statistical probability rules (Caudill et. al., 2008).

Data Processing and Editing

Data were received after all analyses were complete. The data were not edited. 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 surplus specimens 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 Overviews 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. Additionally, availability of specimens for surplus projects is lower than for other laboratory tests performed on NHANES participants. 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 details on the use of sample weights and analytic issues.

Subsample Weights

The analytes included in this dataset were measured in all examined participants aged 3-5 years, and 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, WTSSBPP, are included in this data file and should be used when analyzing these data. The sample weights created for this file used the examination sample weight, i.e., WTMECPRP, as the base weight. The base weight was adjusted for additional nonresponse to these lab tests and re-poststratified to the population total using sex, age, and race/Hispanic origin. Participants who were part of the eligible population but did not provide a urine specimen, or did not have sufficient volume of biospecimens, or who did not give consent for their specimens to be used for future research are included in the file; however, they have a sample weight assigned “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 Pre-Pandemic 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).

The variable URXUCR (urine creatinine) will not be reported in this file. URXUCR can be found in the data file titled “Albumin & Creatinine – Urine”.

Detection Limits

The detection limit was constant for all of the analytes in the data set. Two variables are provided for each of these analytes. The variable name ending in “L” (ex., SSIPPPL) 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. The other variable (ex., SSIPPP) provides the analytic result for that analyte. For analytes with analytic results below the lower limit of detection (ex., SSIPPPL=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]). All data are rounded to three significant figures or three decimal places, whichever is less precise.

The lower limits of detection (LLOD, in µg/mL) for SSIPPP and SSBPPP:

Variable Name	Analyte Description	LLOD
SSIPPP	2-((isopropyl)phenyl)phenyl phosphate (µg/L)	0.05
SSBPPP	4-((tert-butyl)phenyl)phenyl phosphate (µg/L)	0.05

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): 4094-4106.
- de Wit C.A. An overview of brominated flame retardants in the environment. Chemosphere. (2002) 46(5): 583-624.
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- Phillips A.L., Hammel S.C., Hoffman K., et. al. Children’s residential exposure to organophosphate ester flame retardants and plasticizers: Investigating exposure pathways in the TESIE study. Environ. Int. (2018) 116:176–185.
- Phillips A.L., Hammel S.C., Konstantinov A., Stapleton H.M. Characterization of individual isopropylated and tert-butylated triarylphosphate (ITP and TBPP) isomers in several commercial flame retardant mixtures and house dust standard reference material SRM 2585. Environ Sci Technol. (2017) 51(22):13443-13449.
- Stapleton H.M., Sharma S., Getzinger G., et. al. Novel and high volume use flame retardants in US couches reflective of the 2005 PentaBDE phase out. Environ Sci Technol. (2012) 46(24): 13432-13439.
- van der Veen I., de Boer J. Phosphorus flame retardants: Properties, production, environmental occurrence, toxicity and analysis. Chemosphere. (2012) 88(10): 1119-1153.

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

WTSSBPP - Surplus specimen B weights pre-pandemic

Variable Name: WTSSBPP

SAS Label: Surplus specimen B weights pre-pandemic

English Text: Surplus specimen B weights pre-pandemic

Target: Both males and females 3 YEARS - 150 YEARS

Code or Value	Value Description	Count	Cumulative	Skip to Item
0 to 1018359.9145	Range of Values	4929	4929	
.	Missing	0	4929	

SSIPPP - 2(isopropyl)phenyl)phenyl phosphateug/L

Variable Name: SSIPPP

SAS Label: 2(isopropyl)phenyl)phenyl phosphateug/L

English Text: 2-((isopropyl)phenyl)phenyl phosphate (µg/L)

Target: Both males and females 3 YEARS - 150 YEARS

Code or Value	Value Description	Count	Cumulative	Skip to Item
0.035 to 4.19	Range of Values	3913	3913	
.	Missing	1016	4929	

SSIPPPL - 2(isopropyl)phenyl)phenyl phosphate cd

Variable Name: SSIPPPL

SAS Label: 2(isopropyl)phenyl)phenyl phosphate cd

English Text: 2-((isopropyl)phenyl)phenyl phosphate (µg/L) 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	654	654	
1	Below lower detection limit	3259	3913	
.	Missing	1016	4929	

SSBPPP - 4(tert-butyl)phenyl)phenyl phosphateug/L

Variable Name: SSBPPP

SAS Label: 4(tert-butyl)phenyl)phenyl phosphateug/L

English Text: 4-((tert-butyl)phenyl)phenyl phosphate (µg/L)

Target: Both males and females 3 YEARS - 150 YEARS

Code or Value	Value Description	Count	Cumulative	Skip to Item
0.035 to 6.38	Range of Values	3923	3923	
.	Missing	1006	4929	

SSBPPPL - 4(tert-butyl)phenyl)phenyl phosphate cd

Variable Name: SSBPPPL

SAS Label: 4(tert-butyl)phenyl)phenyl phosphate cd

English Text: 4-((tert-butyl)phenyl)phenyl phosphate (µg/L) 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	964	964	
1	Below lower detection limit	2959	3923	
.	Missing	1006	4929	