**Exposure to Organophosphate Flame Retardant Chemicals in the U.S. General Population: Data from the 2013-2014 National Health and Nutrition Examination Survey**

Authors: Maria Ospina, Nayana K. Jayatilaka, Lee-Yang Wong, Paula Restrepo, Antonia M. Calafat

Division of Laboratory Sciences, National Center for Environmental Health, Centers for Disease Control and Prevention, 4770 Buford Hwy, MS F17, Atlanta, GA 30341, USA

**SUPPLEMENTAL INFORMATION**

Table S1. Geometric mean and selected percentiles of dibenzyl phosphate (DBzP) concentrations in urine (in µg/L first row and in µg/g creatinine second row) for the U.S. population six years of age and older. Data from the National Health and Nutrition Examination Survey 2013-2014.

|  | |  | | |  | | | | | | | | | | | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | ***Geometric mean*** | | | ***Selected percentile (95% CI)*** | | | | | | | | | | | | | | | | | | ***N*** | | |
|  | ***(95% CI)*** | | | ***50th*** | | | | ***75th*** | | | | ***90th*** | | | | | ***95th*** | | | | |  | | |
| ***Total*** | ***\**** |  | | ***< LOD*** | | |  | ***< LOD*** | | |  | | ***< LOD*** | | |  | | ***< LOD*** | | |  | | *2666* | | |
|  | ***\**** |  | | ***< LOD*** | | |  | ***< LOD*** | | |  | | ***< LOD*** | | |  | | ***< LOD*** | | |  | | *2666* | | |
|  |  |  | |  | | |  |  | | |  | |  | | |  | |  | | |  | |  | | |
| ***Age group*** |  |  | |  | | |  |  | | |  | |  | | |  | |  | | |  | |  | | |
|  |  |  | |  | | |  |  | | |  | |  | | |  | |  | | |  | |  | | |
| *6-11 years* | ***\**** |  | | ***< LOD*** | | |  | ***< LOD*** | | |  | | ***< LOD*** | | |  | | ***< LOD*** | | |  | | *421* | | |
|  | ***\**** |  | | ***< LOD*** | | |  | ***< LOD*** | | |  | | ***< LOD*** | | |  | | ***< LOD*** | | |  | | *421* | | |
|  |  |  | |  | | |  |  | | |  | |  | | |  | |  | | |  | |  | | |
| *12-19 years* | ***\**** |  | | ***< LOD*** | | |  | ***< LOD*** | | |  | | ***< LOD*** | | |  | | ***< LOD*** | | |  | | *427* | | |
|  | ***\**** |  | | ***< LOD*** | | |  | ***< LOD*** | | |  | | ***< LOD*** | | |  | | ***< LOD*** | | |  | | *427* | | |
|  |  |  | |  | | |  |  | | |  | |  | | |  | |  | | |  | |  | | |
| *20-59 years* | ***\**** |  | | ***< LOD*** | | |  | ***< LOD*** | | |  | | ***< LOD*** | | |  | | ***< LOD*** | | |  | | *1266* | | |
|  | ***\**** |  | | ***< LOD*** | | |  | ***< LOD*** | | |  | | ***< LOD*** | | |  | | ***< LOD*** | | |  | | *1266* | | |
|  |  |  | |  | | |  |  | | |  | |  | | |  | |  | | |  | |  | | |
| *60 years and older* | ***\**** |  | | ***< LOD*** | | |  | ***< LOD*** | | |  | | ***< LOD*** | | |  | | ***< LOD*** | | |  | | *552* | | |
|  | ***\**** |  | | ***< LOD*** | | |  | ***< LOD*** | | |  | | ***< LOD*** | | |  | | ***< LOD*** | | |  | | *552* | | |
| ***Gender*** |  |  | |  | | |  |  | | |  | |  | | |  | |  | | |  | |  | | |
|  |  |  | |  | | |  |  | | |  | |  | | |  | |  | | |  | |  | | |
| *Males* | ***\**** |  | | ***< LOD*** | | |  | ***< LOD*** | | |  | | ***< LOD*** | | |  | | ***< LOD*** | | |  | | *1344* | | |
|  | ***\**** |  | | ***< LOD*** | | |  | ***< LOD*** | | |  | | ***< LOD*** | | |  | | ***< LOD*** | | |  | | *1344* | | |
|  |  |  | |  | | |  |  | | |  | |  | | |  | |  | | |  | |  | | |
| *Females* | ***\**** |  | | ***< LOD*** | | |  | ***< LOD*** | | |  | | ***< LOD*** | | |  | | ***< LOD*** | | |  | | *1322* | | |
|  | ***\**** |  | | ***< LOD*** | | |  | ***< LOD*** | | |  | | ***< LOD*** | | |  | | ***< LOD*** | | |  | | *1322* | | |
| ***Race/ethnicity*** |  |  | |  | | |  |  | | |  | |  | | |  | |  | | |  | |  | | |
|  |  |  | |  | | |  |  | | |  | |  | | |  | |  | | |  | |  | | |
| *All Hispanic* | ***\**** |  | | ***< LOD*** | | |  | ***< LOD*** | | |  | | ***< LOD*** | | |  | | ***< LOD*** | | |  | | *671* | | |
|  | ***\**** |  | | ***< LOD*** | | |  | ***< LOD*** | | |  | | ***< LOD*** | | |  | | ***< LOD*** | | |  | | *671* | | |
|  |  |  | |  | | |  |  | | |  | |  | | |  | |  | | |  | |  | | |
| *Non-Hispanic Blacks* | ***\**** |  | | ***< LOD*** | | |  | ***< LOD*** | | |  | | ***< LOD*** | | |  | | ***< LOD*** | | |  | | *587* | | |
|  | ***\**** |  | | ***< LOD*** | | |  | ***< LOD*** | | |  | | ***< LOD*** | | |  | | ***< LOD*** | | |  | | *587* | | |
|  |  |  | |  | | |  |  | | |  | |  | | |  | |  | | |  | |  | | |
| *Non-Hispanic Whites* | ***\**** |  | | ***< LOD*** | | |  | ***< LOD*** | | |  | | ***< LOD*** | | |  | | ***< LOD*** | | |  | | *1015* | | |
|  | ***\**** |  | | ***< LOD*** | | |  | ***< LOD*** | | |  | | ***< LOD*** | | |  | | ***< LOD*** | | |  | | *1015* | | |
|  |  |  | |  | | |  |  | | |  | |  | | |  | |  | | |  | |  | | |
| *Others* | ***\**** |  | | ***< LOD*** | | |  | ***< LOD*** | | |  | | ***< LOD*** | | |  | | ***< LOD*** | | |  | | *393* | | |
|  | ***\**** |  | | ***< LOD*** | | |  | ***< LOD*** | | |  | | ***< LOD*** | | |  | | ***< LOD*** | | |  | | *393* | | |
|  |  |  |  | |  |  | | |  |  | | | |  |  | | | |  |  | | | |  | | |  |
| *CI, confidence interval; N, sample size; %, detection frequency < LOD means less than the limit of detection* (LOD= 0.05 µg/L)*. \* Not calculated. Proportion of results below limit of detection was too high to provide a valid result.* | | | | | | | | | | | | | | | | | | | | | | | | | | | |

Table S2. Geometric mean and selected percentiles of di-o-cresyl phosphate (DoCP) concentrations in urine (in µg/L first row and in µg/g creatinine second row) for the U.S. population six years of age and older. Data from the National Health and Nutrition Examination Survey 2013-2014.

|  | |  | | |  | | | | | | | | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Geometric mean** | | | **Selected percentile (95% CI)** | | | | | | | | | | | | | | | | **N** | |
|  | **(95% CI)** | | | **50th** | | | | **75th** | | | | **90th** | | | | **95th** | | | |  | |
| **Total** | **\*** |  | | **< LOD** | |  | | **< LOD** | |  | | **< LOD** | |  | | **< LOD** | |  | | 2666 | |
|  | **\*** |  | | **< LOD** | |  | | **< LOD** | |  | | **< LOD** | |  | | **< LOD** | |  | | 2666 | |
|  |  |  | |  | |  | |  | |  | |  | |  | |  | |  | |  | |
| **Age group** |  |  | |  | |  | |  | |  | |  | |  | |  | |  | |  | |
|  |  |  | |  | |  | |  | |  | |  | |  | |  | |  | |  | |
| 6-11 years | **\*** |  | | **< LOD** | |  | | **< LOD** | |  | | **< LOD** | |  | | **< LOD** | |  | | 421 | |
|  | **\*** |  | | **< LOD** | |  | | **< LOD** | |  | | **< LOD** | |  | | **< LOD** | |  | | 421 | |
|  |  |  | |  | |  | |  | |  | |  | |  | |  | |  | |  | |
| 12-19 years | **\*** |  | | **< LOD** | |  | | **< LOD** | |  | | **< LOD** | |  | | **< LOD** | |  | | 427 | |
|  | **\*** |  | | **< LOD** | |  | | **< LOD** | |  | | **< LOD** | |  | | **< LOD** | |  | | 427 | |
|  |  |  | |  | |  | |  | |  | |  | |  | |  | |  | |  | |
| 20-59 years | **\*** |  | | **< LOD** | |  | | **< LOD** | |  | | **< LOD** | |  | | **< LOD** | |  | | 1266 | |
|  | **\*** |  | | **< LOD** | |  | | **< LOD** | |  | | **< LOD** | |  | | **< LOD** | |  | | 1266 | |
|  |  |  | |  | |  | |  | |  | |  | |  | |  | |  | |  | |
| 60 years and older | **\*** |  | | **< LOD** | |  | | **< LOD** | |  | | **< LOD** | |  | | **< LOD** | |  | | 552 | |
|  | **\*** |  | | **< LOD** | |  | | **< LOD** | |  | | **< LOD** | |  | | **< LOD** | |  | | 552 | |
| **Gender** |  |  | |  | |  | |  | |  | |  | |  | |  | |  | |  | |
|  |  |  | |  | |  | |  | |  | |  | |  | |  | |  | |  | |
| Males | **\*** |  | | **< LOD** | |  | | **< LOD** | |  | | **< LOD** | |  | | **< LOD** | |  | | 1344 | |
|  | **\*** |  | | **< LOD** | |  | | **< LOD** | |  | | **< LOD** | |  | | **< LOD** | |  | | 1344 | |
|  |  |  | |  | |  | |  | |  | |  | |  | |  | |  | |  | |
| Females | **\*** |  | | **< LOD** | |  | | **< LOD** | |  | | **< LOD** | |  | | **< LOD** | |  | | 1322 | |
|  | **\*** |  | | **< LOD** | |  | | **< LOD** | |  | | **< LOD** | |  | | **< LOD** | |  | | 1322 | |
| **Race/ethnicity** |  |  | |  | |  | |  | |  | |  | |  | |  | |  | |  | |
|  |  |  | |  | |  | |  | |  | |  | |  | |  | |  | |  | |
| All Hispanic | **\*** |  | | **< LOD** | |  | | **< LOD** | |  | | **< LOD** | |  | | **< LOD** | |  | | 671 | |
|  | **\*** |  | | **< LOD** | |  | | **< LOD** | |  | | **< LOD** | |  | | **< LOD** | |  | | 671 | |
|  |  |  | |  | |  | |  | |  | |  | |  | |  | |  | |  | |
| Non-Hispanic Blacks | **\*** |  | | **< LOD** | |  | | **< LOD** | |  | | **< LOD** | |  | | **< LOD** | |  | | 587 | |
|  | **\*** |  | | **< LOD** | |  | | **< LOD** | |  | | **< LOD** | |  | | **< LOD** | |  | | 587 | |
|  |  |  | |  | |  | |  | |  | |  | |  | |  | |  | |  | |
| Non-Hispanic Whites | **\*** |  | | **< LOD** | |  | | **< LOD** | |  | | **< LOD** | |  | | **< LOD** | |  | | 1015 | |
|  | **\*** |  | | **< LOD** | |  | | **< LOD** | |  | | **< LOD** | |  | | **< LOD** | |  | | 1015 | |
|  |  |  | |  | |  | |  | |  | |  | |  | |  | |  | |  | |
| Others | **\*** |  | | **< LOD** | |  | | **< LOD** | |  | | **< LOD** | |  | | **< LOD** | |  | | 393 | |
|  | **\*** |  | | **< LOD** | |  | | **< LOD** | |  | | **< LOD** | |  | | **< LOD** | |  | | 393 | |
|  |  |  |  | |  | |  | |  | |  | |  | |  | |  | |  | |  | |  | |
| CI, confidence interval; N, sample size; %, detection frequency < LOD means less than the limit of detection (LOD= 0.05 µg/L). \* Not calculated. Proportion of results below limit of detection was too high to provide a valid result. | | | | | | | | | | | | | | | | | | | | | | | |

Table S3. Geometric mean and selected percentiles of 2.3.4.5-tetrabromobenzoic acid (TBBA) concentrations in urine (in µg/L first row and in µg/g creatinine second row) for the U.S. population six years of age and older. Data from the National Health and Nutrition Examination Survey 2013-2014

|  | |  | | |  | | | | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Geometric mean** | | | **Selected percentile (95% CI)** | | | | | | | | | | | | **N** | |
|  | **(95% CI)** | | | **50th** | | | **75th** | | | **90th** | | | **95th** | | |  | |
| **Total** | **\*** |  | | **< LOD** |  | | **< LOD** |  | | **< LOD** |  | | **.050** | (<LOD-.060) | | 2666 | |
|  | **\*** |  | | **< LOD** |  | | **< LOD** |  | | **< LOD** |  | | **.174** | (<LOD-.190) | | 2666 | |
|  |  |  | |  |  | |  |  | |  |  | |  |  | |  | |
| **Age group** |  |  | |  |  | |  |  | |  |  | |  |  | |  | |
|  |  |  | |  |  | |  |  | |  |  | |  |  | |  | |
| 6-11 years | **\*** |  | | **< LOD** |  | | **< LOD** |  | | **< LOD** |  | | **.070** | (.050-.090) | | 421 | |
|  | **\*** |  | | **< LOD** |  | | **< LOD** |  | | **< LOD** |  | | **.235** | (.167-.286) | | 421 | |
|  |  |  | |  |  | |  |  | |  |  | |  |  | |  | |
| 12-19 years | **\*** |  | | **< LOD** |  | | **< LOD** |  | | **< LOD** |  | | **< LOD** |  | | 427 | |
|  | **\*** |  | | **< LOD** |  | | **< LOD** |  | | **< LOD** |  | | **< LOD** |  | | 427 | |
|  |  |  | |  |  | |  |  | |  |  | |  |  | |  | |
| 20-59 years | **\*** |  | | **< LOD** |  | | **< LOD** |  | | **< LOD** |  | | **< LOD** |  | | 1266 | |
|  | **\*** |  | | **< LOD** |  | | **< LOD** |  | | **< LOD** |  | | **< LOD** |  | | 1266 | |
|  |  |  | |  |  | |  |  | |  |  | |  |  | |  | |
| 60 years and older | **\*** |  | | **< LOD** |  | | **< LOD** |  | | **< LOD** |  | | **< LOD** |  | | 552 | |
|  | **\*** |  | | **< LOD** |  | | **< LOD** |  | | **< LOD** |  | | **< LOD** |  | | 552 | |
| **Gender** |  |  | |  |  | |  |  | |  |  | |  |  | |  | |
|  |  |  | |  |  | |  |  | |  |  | |  |  | |  | |
| Males | **\*** |  | | **< LOD** |  | | **< LOD** |  | | **< LOD** |  | | **.060** | (<LOD-.070) | | 1344 | |
|  | **\*** |  | | **< LOD** |  | | **< LOD** |  | | **< LOD** |  | | **.143** | (<LOD-.182) | | 1344 | |
|  |  |  | |  |  | |  |  | |  |  | |  |  | |  | |
| Females | **\*** |  | | **< LOD** |  | | **< LOD** |  | | **< LOD** |  | | **< LOD** |  | | 1322 | |
|  | **\*** |  | | **< LOD** |  | | **< LOD** |  | | **< LOD** |  | | **< LOD** |  | | 1322 | |
| **Race/ethnicity** |  |  | |  |  | |  |  | |  |  | |  |  | |  | |
|  |  |  | |  |  | |  |  | |  |  | |  |  | |  | |
| All Hispanic | **\*** |  | | **< LOD** |  | | **< LOD** |  | | **< LOD** |  | | **< LOD** |  | | 671 | |
|  | **\*** |  | | **< LOD** |  | | **< LOD** |  | | **< LOD** |  | | **< LOD** |  | | 671 | |
|  |  |  | |  |  | |  |  | |  |  | |  |  | |  | |
| Non-Hispanic Blacks | **\*** |  | | **< LOD** |  | | **< LOD** |  | | **< LOD** |  | | **.060** | (<LOD-.090) | | 587 | |
|  | **\*** |  | | **< LOD** |  | | **< LOD** |  | | **< LOD** |  | | **.122** | (<LOD-.154) | | 587 | |
|  |  |  | |  |  | |  |  | |  |  | |  |  | |  | |
| Non-Hispanic Whites | **\*** |  | | **< LOD** |  | | **< LOD** |  | | **< LOD** |  | | **.050** | (<LOD-.070) | | 1015 | |
|  | **\*** |  | | **< LOD** |  | | **< LOD** |  | | **< LOD** |  | | **.182** | (<LOD-.200) | | 1015 | |
|  |  |  | |  |  | |  |  | |  |  | |  |  | |  | |
| Others | **\*** |  | | **< LOD** |  | | **< LOD** |  | | **< LOD** |  | | **.070** | (<LOD-.110) | | 393 | |
|  | **\*** |  | | **< LOD** |  | | **< LOD** |  | | **< LOD** |  | | **.190** | (<LOD-.265) | | 393 | |
|  |  |  |  | |  |  | |  |  | |  |  | |  |  | |  | |  | |
| CI, confidence interval; N, sample size; %, detection frequency < LOD means less than the limit of detection (LOD= 0.05 µg/L) . \* Not calculated. Proportion of results below limit of detection was too high to provide a valid result. | | | | | | | | | | | | | | | | | | | |

Table S4. Geometric mean and selected percentiles of di-p-cresyl phosphate (DpCP) concentrations in urine (in µg/L first row and in µg/g creatinine second row) for the U.S. population six years of age and older. Data from the National Health and Nutrition Examination Survey 2013-2014.

|  | |  | |  | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Geometric mean** | | **Selected percentile (95% CI)** | | | | | | | | | **N** | |
|  | **(95% CI)** | | **50th** | | **75th** | | | **90th** | | **95th** | |  | |
| **Total** | **\*** |  | **< LOD** |  | **< LOD** |  | | **.070** | (.060-.080) | **.110** | (.090-.160) | 2666 | |
|  | **\*** |  | **< LOD** |  | **< LOD** |  | | **.133** | (.125-.152) | **.200** | (.182-.219) | 2666 | |
|  |  |  |  |  |  |  | |  |  |  |  |  | |
| **Age group** |  |  |  |  |  |  | |  |  |  |  |  | |
|  |  |  |  |  |  |  | |  |  |  |  |  | |
| 6-11 years | **\*** |  | **< LOD** |  | **.060** | (<LOD-.080) | | **.150** | (.090-.210) | **.240** | (.160-.490) | 421 | |
|  | **\*** |  | **< LOD** |  | **.125** | (<LOD-.174) | | **.247** | (.182-.361) | **.361** | (.222-.500) | 421 | |
|  |  |  |  |  |  |  | |  |  |  |  |  | |
| 12-19 years | **\*** |  | **< LOD** |  | **< LOD** |  | | **.090** | (.060-.130) | **.140** | (.080-.270) | 427 | |
|  | **\*** |  | **< LOD** |  | **< LOD** |  | | **.108** | (.085-.174) | **.200** | (.108-.267) | 427 | |
|  |  |  |  |  |  |  | |  |  |  |  |  | |
| 20-59 years | **\*** |  | **< LOD** |  | **< LOD** |  | | **.050** | (<LOD-.070) | **.100** | (.070-.200) | 1266 | |
|  | **\*** |  | **< LOD** |  | **< LOD** |  | | **.129** | (<LOD-.135) | **.182** | (.146-.192) | 1266 | |
|  |  |  |  |  |  |  | |  |  |  |  |  | |
| 60 years and older | **\*** |  | **< LOD** |  | **< LOD** |  | | **< LOD** |  | **.090** | (.050-.120) | 552 | |
|  | **\*** |  | **< LOD** |  | **< LOD** |  | | **< LOD** |  | **.200** | (.160-.235) | 552 | |
| **Gender** |  |  |  |  |  |  | |  |  |  |  |  | |
|  |  |  |  |  |  |  | |  |  |  |  |  | |
| Males | **\*** |  | **< LOD** |  | **< LOD** |  | | **.070** | (.050-.090) | **.130** | (.100-.200) | 1344 | |
|  | **\*** |  | **< LOD** |  | **< LOD** |  | | **.121** | (.103-.138) | **.174** | (.135-.222) | 1344 | |
|  |  |  |  |  |  |  | |  |  |  |  |  | |
| Females | **\*** |  | **< LOD** |  | **< LOD** |  | | **.070** | (.050-.080) | **.100** | (.080-.140) | 1322 | |
|  | **\*** |  | **< LOD** |  | **< LOD** |  | | **.154** | (.133-.182) | **.211** | (.190-.235) | 1322 | |
| **Race/ethnicity** |  |  |  |  |  |  | |  |  |  |  |  | |
|  |  |  |  |  |  |  | |  |  |  |  |  | |
| All Hispanic | **\*** |  | **< LOD** |  | **< LOD** |  | | **.060** | (<LOD-.070) | **.100** | (.070-.150) | 671 | |
|  | **\*** |  | **< LOD** |  | **< LOD** |  | | **.138** | (<LOD-.170) | **.190** | (.174-.222) | 671 | |
|  |  |  |  |  |  |  | |  |  |  |  |  | |
| Non-Hispanic Blacks | **\*** |  | **< LOD** |  | **< LOD** |  | | **.060** | (<LOD-.080) | **.100** | (.080-.160) | 587 | |
|  | **\*** |  | **< LOD** |  | **< LOD** |  | | **.082** | (<LOD-.101) | **.114** | (.093-.143) | 587 | |
|  |  |  |  |  |  |  | |  |  |  |  |  | |
| Non-Hispanic Whites | **\*** |  | **< LOD** |  | **< LOD** |  | | **.070** | (.060-.090) | **.130** | (.090-.190) | 1015 | |
|  | **\*** |  | **< LOD** |  | **< LOD** |  | | **.138** | (.125-.167) | **.211** | (.182-.235) | 1015 | |
|  |  |  |  |  |  |  | |  |  |  |  |  | |
| Others | **\*** |  | **< LOD** |  | **< LOD** |  | | **.060** | (<LOD-.080) | **.100** | (.050-.210) | 393 | |
|  | **\*** |  | **< LOD** |  | **< LOD** |  | | **.154** | (<LOD-.175) | **.200** | (.174-.333) | 393 | |
|  |  |  |  |  |  | |  |  |  |  |  |  | |
| CI, confidence interval; N, sample size; %, detection frequency < LOD means less than the limit of detection (LOD= 0.05 µg/L). \* Not calculated. Proportion of results below limit of detection was too high to provide a valid result. | | | | | | | | | | | | | | |

Table S5. Observed statistical significance values (p-value) for differences between least squares geometric mean concentrations of contemporary FRs for various demographic groupsa.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **DIFFERENCE** | **BIOMARKER** | | | | |
| **BDCIPP** | **DPHP** | **BCEP** | **DNBP** | **BCIPP** |
| Male vs Female | 0.0004 |  |  | 0.0005 | 0.0563 |
| HIispanic vs Non-Hispanic white |  |  |  | 0.2979 | 0.0057 |
| HIispanic vs Non-Hispanic black |  |  |  | 0.9624 | 0.2520 |
| HIispanic vs Other race/ethnicity |  |  |  | 0.0173 | 0.0169 |
| Non-Hispanic white vs Non-Hispanic black |  |  |  | 0.1785 | 0.0003 |
| Non-Hispanic white vs Other race/ethnicity |  |  |  | 0.0003 | 0.4226 |
| Non-Hispanic black vs Other race/ethnicity |  |  |  | <0.0001 | 0.0005 |
| 6-11 years vs 12-19 years |  |  |  | 0.0001 | <0.0001 |
| 6-11 years vs 20-59 years |  |  |  | <0.0001 | <0.0001 |
| 6-11 years vs ≥60 years |  |  |  | 0.0118 | <0.0001 |
| 12-19 years vs 20-59 years |  |  |  | 0.2324 | 0.2212 |
| 12-19 years vs ≥60 years |  |  |  | 0.0078 | 0.9491 |
| 20-59 years vs ≥60 years |  |  |  | 0.0012 | 0.1510 |
| Male: HIispanic - Non-Hispanic white |  | 0.0335 |  |  |  |
| Male: HIispanic - Non-Hispanic black |  | 0.3860 |  |  |  |
| Male: HIispanic - Other race/ethnicity |  | 0.7226 |  |  |  |
| Male: Non-Hispanic white - Other race/ethnicity |  | 0.0575 |  |  |  |
| Male: Non-Hispanic white - Non-Hispanic black |  | 0.0071 |  |  |  |
| Male: Non-Hispanic black - Other race/ethnicity |  | 0.3114 |  |  |  |
| Female: HIispanic - Non-Hispanic white |  | 0.5733 |  |  |  |
| Female: HIispanic - Non-Hispanic black |  | 0.4286 |  |  |  |
| Female: HIispanic - Other race/ethnicity |  | 0.0025 |  |  |  |
| Female: Non-Hispanic white - Other race/ethnicity |  | 0.0004 |  |  |  |
| Female: Non-Hispanic white - Non-Hispanic black |  | 0.2788 |  |  |  |
| Female: Non-Hispanic black - Other race/ethnicity |  | 0.1823 |  |  |  |
| Male, 6-11 years vs 12-19 years |  | <0.0001 | 0.2035 |  |  |
| Male, 6-11 years vs 20-59 years |  | <0.0001 | 0.0001 |  |  |
| Male, 6-11 years vs ≥60 years |  | <0.0001 | 0.3210 |  |  |
| Male, 12-19 years vs 20-59 years |  | 0.0002 | 0.0007 |  |  |
| Male, 12-19 years vs ≥60 years |  | 0.0023 | 0.7254 |  |  |
| Male, 20-59 years vs ≥60 years |  | 0.3786 | 0.1529 |  |  |
| Female, 6-11 years vs 12-19 years |  | 0.0022 | 0.0151 |  |  |
| Female, 6-11 years vs 20-59 years |  | <0.0001 | 0.0027 |  |  |
| Female, 6-11 years vs ≥60 years |  | <0.0001 | 0.1804 |  |  |
| Female, 12-19 years vs 20-59 years |  | <0.0001 | 0.1366 |  |  |
| Female, 12-19 years vs ≥60 years |  | 0.0008 | 0.7979 |  |  |
| Female, 20-59 years vs ≥60 years |  | 0.6448 | 0.2061 |  |  |
| 6-11 years : male vs female |  | 0.9825 | 0.2932 |  |  |
| 12-19 years: male vs female |  | 0.0262 | 0.0637 |  |  |
| 20-59 years: male vs female |  | 0.0002 | 0.0111 |  |  |
| ≥60 years : male vs female |  | 0.0066 | 0.4943 |  |  |
| Hispanic: male vs female |  | <0.0001 |  |  |  |
| Non-Hispanic white: male vs female |  | <0.0001 |  |  |  |
| Non-Hispanic black: male vs female |  | <0.0001 |  |  |  |
| Other race/ethnicity: male vs female |  | 0.0066 |  |  |  |
| Hispanic, 6-11 years vs 12-19 years | <0.0001 |  | 0.0471 |  |  |
| Hispanic, 6-11 years vs 20-59 years | <0.0001 |  | 0.0002 |  |  |
| Hispanic, 6-11 years vs ≥60 years | <0.0001 |  | 0.0008 |  |  |
| Hispanic, 12-19 years vs 20-59 years | 0.6066 |  | 0.4374 |  |  |
| Hispanic, 12-19 years vs ≥60 years | 0.0007 |  | 0.3633 |  |  |
| Hispanic, 20-59 years vs ≥60 years | 0.0003 |  | 0.7677 |  |  |
| Non-Hispanic white, 6-11 years vs 12-19 years | <0.0001 |  | 0.0005 |  |  |
| Non-Hispanic white, 6-11 years vs 20-59 years | <0.0001 |  | <0.0001 |  |  |
| Non-Hispanic white, 6-11 years vs ≥60 years | <0.0001 |  | <0.0001 |  |  |
| Non-Hispanic white, 12-19 years vs 20-59 years | 0.0052 |  | 0.8846 |  |  |
| Non-Hispanic white, 12-19 years vs ≥60 years | 0.0002 |  | 0.1911 |  |  |
| Non-Hispanic white, 20-59 years vs ≥60 years | 0.0047 |  | 0.0914 |  |  |
| Non-Hispanic black, 6-11 years vs 12-19 years | <0.0001 |  | 0.0343 |  |  |
| Non-Hispanic black, 6-11 years vs 20-59 years | <0.0001 |  | 0.0007 |  |  |
| Non-Hispanic black, 6-11 years vs ≥60 years | <0.0001 |  | 0.0101 |  |  |
| Non-Hispanic black, 12-19 years vs 20-59 years | 0.1001 |  | 0.9506 |  |  |
| Non-Hispanic black, 12-19 years vs ≥60 years | 0.0005 |  | 0.7526 |  |  |
| Non-Hispanic black, 20-59 years vs ≥60 years | 0.0103 |  | 0.6907 |  |  |
| Other race/ethnicity, 6-11 years vs 12-19 years | 0.0085 |  | 0.0151 |  |  |
| Other race/ethnicity, 6-11 years vs 20-59 years | <0.0001 |  | 0.0027 |  |  |
| Other race/ethnicity, 6-11 years vs ≥60 years | 0.0007 |  | 0.1804 |  |  |
| Other race/ethnicity, 12-19 years vs 20-59 years | 0.0058 |  | 0.1366 |  |  |
| Other race/ethnicity, 12-19 years vs ≥60 years | 0.0142 |  | 0.7979 |  |  |
| Other race/ethnicity, 20-59 years vs ≥60 years | 0.4215 |  | 0.2061 |  |  |
| 6-11 years: HIispanic vs Non-Hispanic white | 0.0207 |  | 0.8250 |  |  |
| 6-11 years: HIispanic vs Non-Hispanic black | 0.1012 |  | 0.0518 |  |  |
| 6-11 years: HIispanic vs Other race/ethnicity | 0.9218 |  | 0.7923 |  |  |
| 6-11 years: Non-Hispanic white vs Non-Hispanic black | 0.0001 |  | 0.0056 |  |  |
| 6-11 years: Non-Hispanic white vs Other race/ethnicity | 0.1226 |  | 0.4831 |  |  |
| 6-11 years: Non-Hispanic black vs Other race/ethnicity | 0.3767 |  | 0.0411 |  |  |
| 12-19 years: HIispanic vs Non-Hispanic white | 0.0434 |  | 0.5588 |  |  |
| 12-19 years: HIispanic vs Non-Hispanic black | 0.1786 |  | 0.0435 |  |  |
| 12-19 years: HIispanic vs Other race/ethnicity | 0.3778 |  | 0.9732 |  |  |
| 12-19 years: Non-Hispanic white vs Non-Hispanic black | 0.0141 |  | 0.2018 |  |  |
| 12-19 years: Non-Hispanic white vs Other race/ethnicity | 0.6390 |  | 0.3581 |  |  |
| 12-19 years: Non-Hispanic black vs Other race/ethnicity | 0.1105 |  | 0.0629 |  |  |
| 20-59 years: HIispanic vs Non-Hispanic white | 0.8708 |  | 0.8742 |  |  |
| 20-59 years: HIispanic vs Non-Hispanic black | 0.0003 |  | 0.0896 |  |  |
| 20-59 years: HIispanic vs Other race/ethnicity | 0.0015 |  | 0.5659 |  |  |
| 20-59 years: Non-Hispanic white vs Non-Hispanic black | 0.0009 |  | 0.0367 |  |  |
| 20-59 years: Non-Hispanic white vs Other race/ethnicity | 0.0011 |  | 0.5098 |  |  |
| 20-59 years: Non-Hispanic black vs Other race/ethnicity | 0.7466 |  | 0.1261 |  |  |
| ≥60 years: HIispanic vs Non-Hispanic white | 0.9577 |  | 0.2291 |  |  |
| ≥60 years: HIispanic vs Non-Hispanic black | 0.0759 |  | 0.3586 |  |  |
| ≥60 years: HIispanic vs Other race/ethnicity | 0.4417 |  | 0.2121 |  |  |
| ≥60 years: Non-Hispanic white vs Non-Hispanic black | 0.0583 |  | 0.9877 |  |  |
| ≥60 years: Non-Hispanic white vs Other race/ethnicity | 0.3211 |  | 0.0680 |  |  |
| ≥60 years: Non-Hispanic black vs Other race/ethnicity | 0.5501 |  | 0.1129 |  |  |
|  |  |  |  |  |  |

a The final multivariate regression models included: sex, age, race, sex\*age, and sex\*race (DPHP); race, sex, age, age\*race (BDCIPP); race, sex, age, sex\*age, and age\*race (BCEP); race, age, and sex (DNBP); and age and race (BCIPP).

Table S6. Weighted multivariate logistic regression to examine associations of OPFRs concentrations above the 95th percentile by sex, age group and creatinine

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Independent variable** | **BDCIPP** | | **DPHP** | | **BCEP** | | **DNBP** | | **BCIPP** | |
| **Odds ratio** | **p value** | **Odds ratio** | **p value** | **Odds ratio** | **p value** | **Odds ratio** | **p value** | **Odds ratio** | **p value** |
| Log10 creatinine | 9.04 (3.96-20.6) | <0.001 | 55.3 (14.8-207) | <0.001 | 36.6 (18.0-74.4) | <0.001 | 22.7 (7.72-66.7) | <0.001 | 24.2 (8.23-71.4) | <0.0001 |
|  |  |  |  |  |  |  |  |  |  |  |
| **Age group:** |  |  |  |  |  |  |  |  |  |  |
| 6-11 years | 3.57 (1.98-6.45) | <0.003 | 6.56 (2.50-17.2) | <0.001 | 2.05 (1.07-3.93) | <0.02 | 3.59 (1.98-6.52) | 0.001 | 10.7 (4.42-26.1) | <0.0001 |
| 12-19 years | 0.77 (0.27-2.16) |  | 1.88 (0.54-6.52) |  | 0.90 (0.41-1.96) |  | 0.93 (0.50-1.74) |  | 1.67 (0.49-5.71) |  |
| 20-59 years | 1.58 (1.03-2.43) |  | 1.05 (0.38-2.87) |  | 0.76 (0.43-1.34) |  | 0.46 (0.21-1.01) |  | 1.09 (0.42-2.83) |  |
| ≥60 years | ref |  | ref |  | ref |  | ref |  | ref |  |
|  |  |  |  |  |  |  |  |  |  |  |
| **Sex:** |  |  |  |  |  |  |  |  |  |  |
| Male |  |  | ref |  |  |  |  |  |  |  |
| Female |  |  | 3.61 (2.01-6.48) | 0.0003 |  |  |  |  |  |  |